OPERATING INSTRUCTIONS

GMS800

Extractive Gas Analyzers

Basic information for all products in the series

SICK
Sensor Intelligence.

Described Product
Product name: GMS800
Variants: All device versions

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Legal information

Original document
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Contents

1 Important Information

1.1 Symbols and document conventions

1.1.1 Warning Symbols

Symbol	Significance
	Hazard (general)
	Hazard by voltage
	Hazard in potentially explosive atmospheres
	Hazard by explosive substances/mixtures
	Hazard by toxic substances
	Hazard by corrosive substances
	Hazard for environment/nature/organisms

1.1.2 Warning levels and signal words

WARNING: Risk or hazardous situation which *could* result in severe personal injury or death.
CAUTION: Hazard or unsafe practice which *could* result in less severe or minor injuries.
NOTE: Hazard which *could* result in property damage.

1.1.3 Information Symbols

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

1.2 Main hazards

Dangerous sample gases

WARNING: Hazards through explosive or combustible gases

- ▶ Do not use the gas analyzer
  - to measure explosive or combustible gases/gas mixtures
  - to measure gases/gas mixtures that can create an explosive gas mixture together with air.

  Apart from when the device version is specified for such use.

WARNING: Hazards through dangerous sample gases

- *If the sample gas can be dangerous to health:* Escaping sample gas can be a danger for persons.
- *If the sample gas is combustible:* Sample gas escaping during a defect together with the ambient air can create a flammable gas mixture. A risk of explosion can occur.

- ▶ Meticulously observe the safety information and application limitations for the sample gases:
  - General measures for health protection (see “Responsibility of user”, page 11);
  - Safety information on installation (see page 21);
  - Safety information on the use of the enclosure version (see Supplementary Operating Instructions for the Enclosure).

Otherwise operation is not safe.

WARNING: Health hazards through dangerous gases

Before maintenance and repair work:

- ▶ Observe Safety information on disassembly of parts (see page 44).

Operation in potentially explosive atmospheres

WARNING: Risk of explosion in potentially explosive atmospheres

- ▶ Only use the gas analyzer in potentially explosive atmospheres when the device version is specified for this purpose.

WARNING: Risk of explosion when disregarding the operating conditions

When the GMS800 is operated with enclosure purging or enclosure pressurization:

- ▶ Observe the stipulated start-up procedure.[1]
- ▶ Maintain the stipulated operating conditions.[1]
- ▶ Do not open the enclosure during operation.

[1] See Supplementary Operating Instructions for Enclosure.

Protection from liquids

NOTE: Risk of damage

- ▶ Prevent condensation in the sample gas path of the gas analyzer.

Otherwise, the gas analyzer can become unusable, damaged or defective.

1.3 Main operating information

Start-up:

- Ensure leak tightness of gas paths (e.g. filters, valves).
  If leaks are suspected: Carry out a leak tightness check (see “Leak tightness check of sample gas path”, page 46).
- Prevent condensation in the sample gas path of the gas analyzer.
- Make an adjustment after each start-up (see “Adjustment”, page 33).

Additionally in potentially explosive atmospheres:

- Make sure the enclosure is tightly closed.
- *When theGMS800 is fitted with enclosure purging or enclosure pressurization*: Pre-purge the enclosure when stipulated in the device specifications (see Supplementary Operating Instructions for Enclosure or Operating Instructions for Enclosure Pressurization System).

Operating state:

- Pay attention to status and malfunction fields (see Operating Instructions for Control Unit).
- Make adjustments at regular intervals (see “Adjustment”, page 33).

If an “Alarm” message is displayed:

- Check the current measured values. Consider the situation.
- Perform the measures planned at your site for the particular situation.
- When necessary: Switch the alarm message off (“acknowledge”).

In hazardous situations:

- Switch-off the emergency switch or main switch of the host system.

Shutting down:

- *Before shutting down:* Purge the sample gas path with a dry neutral gas to prevent condensation in the measuring system.

1.4 General safety information

Sensitive electronics

Before signal connections are established (also with plug connections):

- Disconnect the GMS800 and all connected devices from the power supply (switch off).

Otherwise the internal electronics could be damaged.

Hazards during maintenance work

- *If it is necessary to open the device for setting or repair:* Disconnect the device from all power sources before starting work.
- *If the open device must be live during work:* This work must be performed by skilled persons who are familiar with potential hazards. If it is necessary to remove or open internal components, live parts could be exposed.
- Never interrupt protective conductor connections.

Hazards due to unsafe state

- *If severe damage is visible on or in the device:* Shut device down and secure against unauthorized start-up.
- *If liquids or particles have penetrated the enclosure:* Shut device down immediately and disconnect power voltage at external source.

1.5 Intended use

1.5.1 Purpose of the device

GMS800 Series gas analyzers measure simultaneously the concentration of one or several gases in a gas mixture.

Sample gas is extracted at a sampling point and flows from there through the internal measuring system of the gas analyzer (extractive gas analysis principle).

1.5.2 Installation location

- Only use the GMS800 indoors.
- Do not use the GMS800
  - in potentially explosive atmospheres
  - to measure combustible or explosive gases

  unless the device version is specified for such use or additional safety precautions are taken.

1.5.3 Application limitations

Sample gas properties

- Do not feed sample gas to the GMS800
  - which contains substances that can chemically attack components carrying sample gas
  - which contains particles that could deposit in the measuring system
  - which contains gas components that could condense in the measuring system.

Combustible sample gases

A defect in an internal gas path (leak) can create an explosion risk when the GMS800 is used to measure combustible gases or gases that can create a flammable gas mixture when mixed with air. *For such applications:*

- Check whether the device version is suitable for the application (check the manufacturer's specifications).
- Check which regulations and laws are valid for the installation site in this case.
- Check whether additional, suitable safety devices must be installed (e.g. pressurization and enclosure purging with inert gas).

Adverse effects on physical measuring properties

In some applications, certain gas components could interfere with measurement – e.g. because they create a similar measuring effect which cannot be prevented due to the laws of nature or technical limitations. Consequence: The measured values could be modified when the sample gas composition changes even when the concentration of the measured gas component remains the same.

- *If the sample gas composition has changed in such cases:* Carry out an adjustment with new test gases that correspond to the changed conditions.

This may not be necessary when the GMS800 automatically compensates such effects.

1.6 Responsibility of user

Intended users

- The GMS800 may only be installed, started and maintained by skilled technicians who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

Correct use

- Only use the GMS800 as described in the Operating Instructions. The manufacturer is not responsible for any other use.
- Carry out the specified maintenance work.
- Do not remove, add, or change any components in 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 Type Examination Certificate becomes invalid (only for ATEX versions).

WARNING: Hazard through incorrect use
Equipment-internal protection devices can be impaired when the device is not used as defined.
- Read these Operating Instructions and the associated Supplementary Operating Instructions before installation, start-up, operation and maintenance and observe all information on using the equipment.

Special local requirements

- In addition to these Operating Instructions, observe all local laws, technical rules and company-internal instructions valid at the site where the device is installed.

Health protection

WARNING: Health hazards through sample gas
If the sample gas can be dangerous to health:
Escaping sample gas can be an acute danger for persons. The concept of the measuring system must include the appropriate safety measures for health protection. [1]
- *During installation:* Make sure the safety instructions for installation are observed (see "Safety information on installation", page 21).
- *After installation/in operation:*
  - Make sure that all persons involved are informed about the sample gas composition, and know and observe the appropriate safety measures for health protection.
  - *If the leak tightness of the gas paths is doubtful:* Carry out a leak tightness check (see "Leak tightness check of sample gas path", page 46).

[1] The operating company is responsible for the composition of sample gas and the relevant safety measures.

Keeping documents

- Keep these Operating Instructions and all associated documents available for reference.
- Pass the documents on to a new owner.

1.7 Additional documents

Additional instructions and information

These Operating Instructions include further documents specifying the technical properties of the GMS800. You need the appropriate additional documents for each device component of your GMS800.

Device component	Title	Document type
Complete device	GMS800 Series	Operating Instructions
Control unit	BCU	Supplementary Operating Instructions
	BCU – Operation with SOPAS ET	Technical Information
Enclosures	GMS810	Supplementary Operating Instructions
	GMS811	
	GMS815P	Supplementary Operating Instructions
	GMS815P-3G	
	GMS815P-PS-3G	Supplementary Operating Instructions
	GMS815P-PS-2G	
	GMS820P	Supplementary Operating Instructions
	GMS840	Supplementary Operating Instructions
	GMS841	
	GMS842	
I/O module	I/O module	Supplementary Operating Instructions
Gas module	Gas module	Supplementary Operating Instructions
Analyzer module	Analyzer Module DEFOR	Supplementary Operating Instructions
	Analyzer Module OXOR-E	Supplementary Operating Instructions
	Analyzer Module OXOR-P	Supplementary Operating Instructions
	Analyzer Module THERMOR	Supplementary Operating Instructions
	Analyzer Module UNOR-MULTOR	Supplementary Operating Instructions

Table 1: User documents for the GMS800 (overview)

The respective required documents are included in the scope of delivery.

Individual product information

If necessary, the GMS800 will be delivered with additional individual information:

- Product configuration (e.g. modules, system configuration)
- Recommended test gases for adjustment and factory settings
- Individual specifications where necessary.

NOTE:

▶ Pay primary attention to the individual information and specifications delivered with the device.

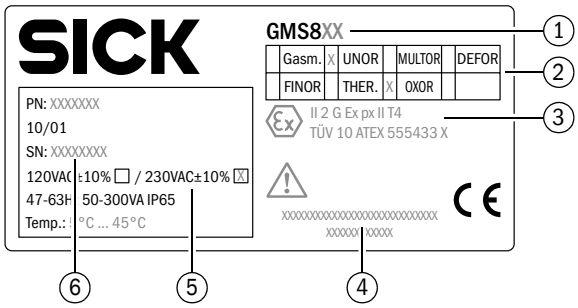
If the GMS800 is delivered as part of a measuring system:
Refer to the separate documents delivered for further information.

2 Product Description

2.1 Product identification

Product name:	GMS800
Product variants:	See list of additional documents (see “Additional documents”, page 12)
Manufacturer:	See type plate (“Type plate (schematic)”)

Fig. 1: Type plate (schematic)



1 Product name of enclosure
2 Installed modules
3 Explosion protection specification[1]
4 Manufacturer
5 Power voltage
6 Serial number

[1] Only for corresponding device version.

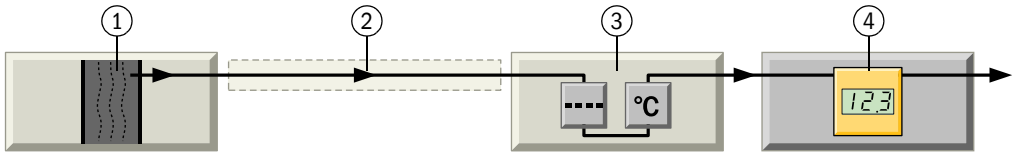
2.2 Functional principle/application principle

GMS800 is an extractive gas analyzer with continuous measuring operation:

- Extractive gas analysis means that a certain quantity of the gas to be analyzed is extracted from the original quantity of the gas (“sample gas” from the “sampling point”) and then fed to the gas analyzer via a gas line.
- Continuous measurement means that a continuous sample gas volume flow to the gas analyzer is maintained and the gas analyzer continuously delivers measured values.
- Sample gas conditioning is required for most applications. Depending on the individual application, suitable devices can be:

Particle filters	To protect the gas analyzer’s measuring system against contamination
Heated sample gas lines	To prevent condensation and ice blockages inside the sample gas path
Liquid separators	To separate any liquids or condensable components from the sample gas
Safety devices	To protect the gas analyzer and the peripheral system against each other (e.g. flame blocks in the gas path)

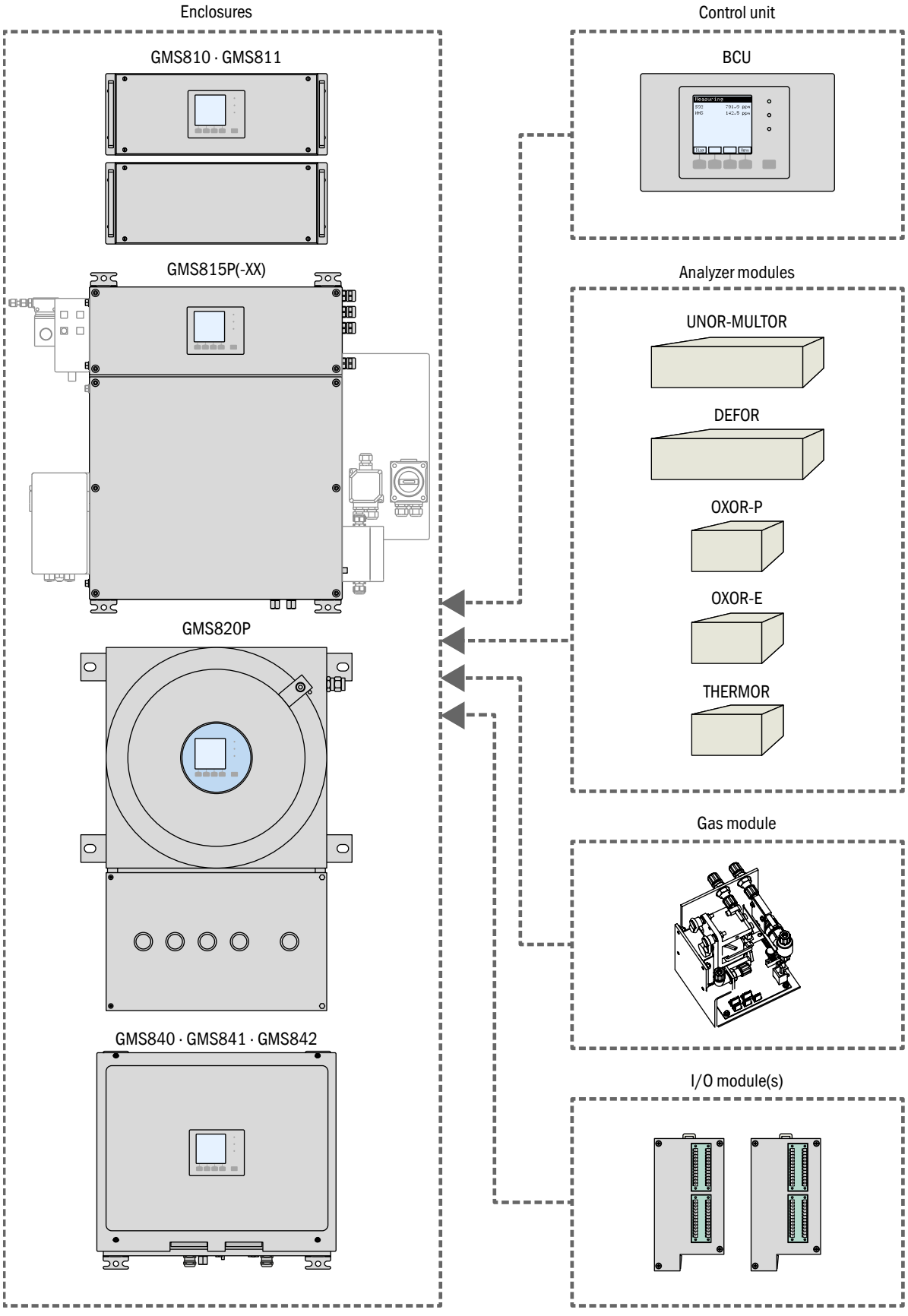
Fig. 2: Extractive gas analysis principle



1 Sampling point
2 Extracted sample gas
3 Sample gas conditioning
4 Gas analyzer

Operating conditions for sample gas feed, see Supplementary Operating Instructions for the Analyzer Modules fitted

Fig. 3: Product components



2.3 Product components

2.3.1 Enclosures

Type	Intended use
GMS810	Installation in 19" rack or corresponding outer enclosure.[1]
GMS811 [2]	Supplementation of a system with control unit. Otherwise as GMS810. [1]
GMS815P	Wall assembly in industrial environment, standard version. [1]
GMS815P-3G	As GMS815P, however “vapor-proof” for potentially explosive atmospheres of category “3 G”.
GMS815P-PS-3G	As GMS815P, however with an enclosure pressurization system for potentially explosive atmospheres of category “3 G”.
GMS815P-PS-2G	As GMS815P, however with an enclosure pressurization system for potentially explosive atmospheres of category “2 G”.
GMS820P	Potentially explosive atmospheres zone 1.
GMS840	Wall enclosures for safe area. [1]
GMS841	Wall enclosures for potentially explosive atmospheres zone 2 (ATEX).
GMS842	Wall enclosures for potentially explosive atmospheres zone 2 (NEC 500/ NEC 505).

[1] Not suitable for potentially explosive atmospheres
[2] In preparation

Detailed information and specifications, see Supplementary Operating Instructions for Enclosure concerned

2.3.2 Control unit

Constructive version

- Control unit integrated in enclosure.

Electronic function

- Runs as independent electronic module.
- Collects and displays measured values from other modules.
- Includes the operating and display functions.
- Controls I/O module outputs (see “I/O module”, page 16).
- Controls internal processes (e.g. adjustment procedure).

Detailed information, see Operating Instructions for Control Unit

2.3.3 Analyzer modules

Analyzer module types

Analyzer module	Measuring principle	Measuring components, application
DEFOR	UVRAS[1] / UV-IFC	1 to 3 UV measuring components
OXOR-E	Electrochemical cell	O_2, standard requirements
OXOR-P	Paramagnetism	O_2, high requirements
THERMOR	Thermal conductivity	H_2, CO_2, He and others
UNOR-MULTOR	NDIR	1 to 4 IR measuring components

[1] For measuring component NO.

2.3.4 Gas module

Possible components

- Gas pump
- Pressure sensor
- Flow sensor
- Moisture sensor

Electronics

The Gas module delivers measured values and status signals of the sensors in the same manner as an Analyzer module.

Detailed information, see Supplementary Operating Instructions “Gas Module”

2.3.5 I/O module

An I/O module makes the GMS800 signal connections available. The enclosure can hold 1 or 2 I/O modules (depending on device configuration).

Detailed information, see Supplementary Operating Instructions “I/O Module”

2.3.6 Possible product configurations

Minimum configuration

- 1 power supply unit (provides operating voltage for internal modules)
- 1 control unit
- 1 Analyzer module with 1 measuring component

Maximum configuration

- 1 power supply unit
- 1 control unit
- 1 large Analyzer module (UNOR-MULTOR, DEFOR)
- 2 small Analyzer modules (OXOR-E, OXOR-P, THERMOR)
- 1 Gas module (gas pump, sensors)
- 1 or 2 I/O modules (per device configuration)
- Monitoring and controlling with PC + PC software “SOPAS ET”

The maximum configuration may be restricted for some enclosure types.

2.4 Information concerning the measured values

2.4.1 Physical measuring range

The “physical measuring range” corresponds to the measurement signals span created selectively by the measuring system for a gas component. These measurement signals are corrected metrologically (linearized), converted to physical units and then displayed as measured value. Further output ranges can be calculated from the physical measuring range.

The metrological specifications are valid for the respective physical measuring range. Higher measuring precision (option) can be created in the 0 ... 20% range of the physical measuring range – using additional, separate linearization of this range (option).

Specification of measuring components and measuring ranges for the individual device version → order records, delivery documents

2.4.2 Calculated measuring ranges and virtual measuring components

Several “virtual measuring components” can be set up at the factory for a single measured gas component (measuring component). Each virtual measuring component has its own measured value processing (linearization) and adjustment.

Usage

- Different measuring ranges for a measuring component are generated by setting up an own virtual measuring component for each measuring range.
- Individual measuring components can be measured with several different computations – e.g. with and without cross-sensitivity compensation. This is also performed with virtual measuring components.

Consequences

- The Measuring screens and menu functions can have several measuring components originating from the same gas component.
- Every displayed measuring component and every measuring range must be individually adjusted.

NOTE:

To obtain a complete adjustment:

▶ Make a zero point and reference point adjustment individually for *each* displayed measuring component – even if the measured values originate from the same physical gas component.

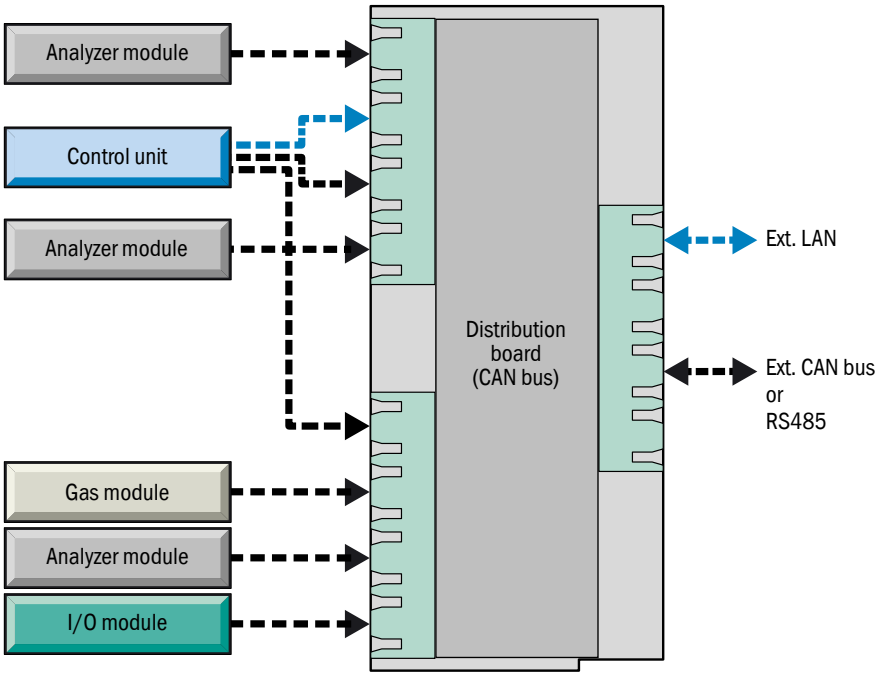
2.5 Digital interfaces

2.5.1 CAN bus

GMS800 Module data are transferred internally via a CANopen bus. Each module has an own name or module number (bus address). The control unit or PC software “SOPAS ET” communicate with each individual module.

The Analyzer modules	The control unit
• store their individual operating parameters internally (e.g. operating hours) • automatically send their current measured values to the control unit.	• generates a status message that classifies the current measured value • computes the measured values – as required and with appropriate programming (with other measured variables and parameters) • displays the measured values and passes them to the outputs and interfaces.

Fig. 4: Internal connections (schematic)



Additional separator couplers must be fitted to the CAN bus when the modules are installed physically separated (e.g. in system cabinets).

2.5.2 RS485

In addition to the CANopen bus, all GMS800 modules are connected with an RS485 bus.

Each GMS800 enclosure provides two RS485 connections with identical function. Several GMS800 enclosures can be interconnected to one system via the RS485 connections so that the modules of all enclosures are controlled and evaluated by one control unit.

The Basic Control Unit (BCU) uses the RS485 interface also for the Modbus (see Supplementary Operating Instructions of the Basic Control Unit (BCU)).

3 Installation

3.1 Scope of delivery

Item	Scope of delivery
Device	Gas analyzer, complete
	Further device components - depending on scope of order
Documentation	Operating Instructions
	Further documents - depending on device version (see “Additional documents”, page 12)
Accessories	See Supplementary Operating Instructions for Enclosure

NOTE:

- Always pay primary attention to the individual information provided.

Gas connections are sealed off with plugs to protect the internal gas path from contamination, liquids and condensation.

- *Recommendation:* First remove these plugs when connecting the gas lines.

3.2 Installation/project planning guideline

Proper installation meeting application requirements is the prerequisite for correct device functions and measuring results.
▶ *Recommendation:* Allow qualified skilled persons to plan and carry out installation.

NOTE: Responsibility for the safety of a system
The safety of the system in which the equipment is integrated is the responsibility of the person setting up the system.

Basics

Prerequisites at the installation location	see Supplementary Operating Instructions for Enclosure
Ambient conditions	
Gas connection details	

Required installation work

▶ Assemble/fit enclosure	see Supplementary Operating Instructions for Enclosure
▶ Prepare power connection	see “Power connection”, page 25
▶ Connect power connection	see Supplementary Operating Instructions for Enclosure
▶ Make gas connections.	see “Gas connections function”, page 22

Additional installations as required

▶ Setting up automatic test gas feed	see “Providing installations for test gases (when required)”, page 24
▶ Using signal connections	see “Signal connections”, page 27

Protection against dangerous sample gases

WARNING: Health hazards through sample gas
If the sample gas can be dangerous to health:
The concept of the measuring system must include the appropriate safety measures for health protection.
▶ Observe “Safety measures against dangerous gases” (see page 21).

3.3 Safety information on installation

3.3.1 Safety in potentially explosive atmospheres

WARNING: Hazard in potentially explosive atmospheres

- Use a GMSxxx in a potentially explosive atmosphere only when the enclosure is suitable for it (see “Enclosures”, page 15).
- Meticulously observe the relevant information on the enclosure (see Supplementary Operating Instructions for Enclosure).

Otherwise operation is not safe.

3.3.2 Safety measures against dangerous gases

If the sample gases or auxiliary gases can be dangerous to health:

Protection against dangerous sample gases

WARNING: Health hazards through sample gas

If the sample gas can be dangerous to health:

Escaping sample gas can be an acute danger for persons. The concept of the measuring system must include the required safety measures for health protection.These safety measures must be installed and observed. [1]

- Make sure that all affected persons are informed about the sample gas composition, and know and observe the appropriate safety measures for health protection.
- Make sure that a leak in the gas path is detected as operational malfunction and the mandatory safety measures are then initiated.
- *If leaks are suspected:* Carry out a leak tightness check (see “Leak tightness check of sample gas path”, page 46).
- *Before maintenance work:* Flush gas paths with a neutral gas until the dangerous gases have been completely purged.
- *If it is possible that sample gas escaped:* Take breathing protection precautions.

[1] The operating company is responsible for the composition of the sample gas. The operating company must take the appropriate safety measures.

Constructive safety measures (examples)

- *Closed enclosures:* Purge the enclosure with a neutral gas; discharge the purge gas at a safe location.
- *Other enclosures:* Enclose the enclosure in a gas-tight outer housing. Purge the outer housing with a neutral gas; discharge the purge gas at a safe location.

Further safety measures (examples)

- Attach warning signs to the gas analyzer.
- Attach warning signs at the access to the operating area.
- Inform persons who could possibly enter there about the dangers and required safety measures.

3.4 Gas connections function

- Gas connections type and position, see Supplementary Operating Instructions for Enclosure
- Physical conditions for the sample gas, see Supplementary Operating Instructions for the Analyzer Modules fitted

3.4.1 General criteria for sample gas feed

- In most applications, peripheral components for sample gas conditioning are required in addition to the gas analyzer (e.g. dust filter, gas dryer).
- In some applications, disturbing physical effects that can falsify measured values must be considered (cross-sensitivities, absorption, adsorption, diffusion).
- The complete analysis system must be planned and installed carefully to ensure trouble-free measuring operation with low maintenance effort and excellent measuring results. This is just as decisive for measurement quality as the gas analyzer itself.

Detailed information on analysis system design, see Technical Information for “Extractive Gas Analysis” *(in preparation)*

WARNING: Mortal/health danger as a result of gas path leakage

When the unit measures toxic gases: Leaks in the gas path can be an acute danger for persons.

- Set up appropriate safety precautions (see “Responsibility of user”, page 11).

3.4.2 Feeding sample gas (sample gas inlet)

- Feed sample gas via the “sample gas inlet” of the enclosure.

NOTE:

- Always install a fine dust filter in the sample gas feed to protect the gas analyzer against contamination.[1]
- Prevent liquids penetrating the sample gas path in the gas analyzer.
- Prevent condensation in the sample gas path of the gas analyzer. If the sample gas contains condensable components, then only operate the gas analyzer in conjunction with a sample gas conditioning system
  See Technical Information for “Extractive Gas Analysis“[2]
- *Before feeding sample gas:* Check whether the sample gas can chemically attack the sample gas path materials.
  See Supplementary Operating Instructions for the fitted Analyzer modules

[1] *Even when the sample gas is free from particles:* Fit a dust filter as safety filter so that the gas analyzer is protected during operational malfunctions or defects.
[2] In preparation.

WARNING: Hazards from noxious sample gases

- *When the sample gas contains substances dangerous to health:* Check whether additional safety precautions are necessary (see “Responsibility of user”, page 11).

3.4.3 Channeling off exhaust gas (sample gas outlet)

▶ Connect the “sample gas outlet” to a suitable collection point (e. g. exhaust duct).

CAUTION: Risk of health risks/damage
If the exhaust gas can create condensate: It is possible that acid is created in the exhaust gas line. Acid could be noxious and corrosive.
▶ Safely collect and dispose of condensate.
▶ Prevent condensate penetrating the gas analyzer.

CAUTION: Risk of erroneous measurements
The sample gas must not penetrate the enclosure.
▶ Channel the sample gas off safely from the sample gas outlet.
Otherwise significant measurement errors could occur.

If the GMS800 is not fitted with the “sample gas pressure compensation” option:

CAUTION: Risk of erroneous measurements
- Sample gas outlet must not be throttled.
- No significant counterpressure at the sample gas outlet.
- No strong pressure fluctuations may occur at the sample gas outlet.

▶ Make sure the sample gas can flow out “freely”.
▶ Install regulating valves to adjust the volume flow only before the sample gas inlet.

3.4.4 Feeding span gas (option)

Only applicable for device versions with “flowing span gas”

Devices with span gas connections have a second internal gas path through which the span gas should flow.

▶ Feed span gas via the span gas inlet. Maintain the same operating conditions as on the sample gas inlet.
▶ Channel the span gas outlet off to a suitable collection point. Maintain the same operating conditions as on the sample gas outlet.

The span gas must be used as “zero gas” during adjustment so it can be advantageous to install a connecting line from the span gas inlet to the sample gas inlet.

3.4.5 Providing special gas connections

– Only for special versions–

Special versions of the GMSxxx may possibly be fitted with individual gas connections (e.g. for a second sample gas path).

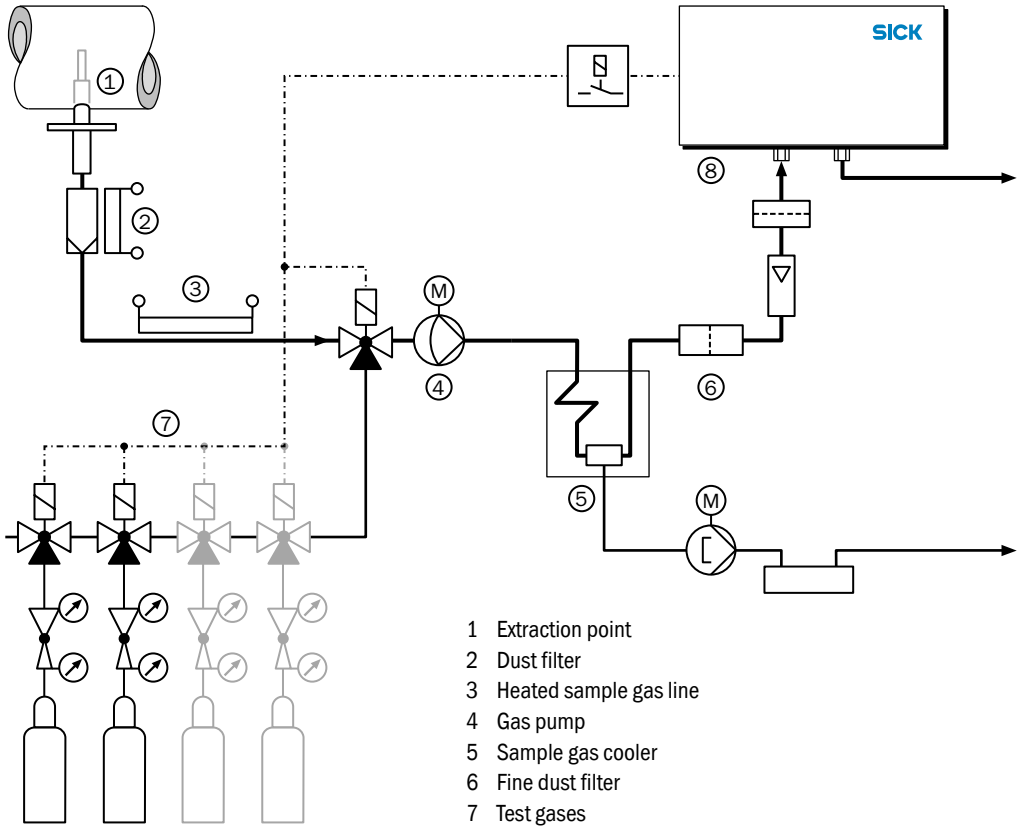
▶ Observe the individual information provided.

3.4.6 Providing installations for test gases (when required)

When cyclic adjustments are to be setup or when the test gases are to be fed automatically during adjustments:

- Make the required test gases (see “Test gases”, page 36) available in pressure cylinders or from pressure lines.
- Install suitable pressure reducers to provide the correct feed pressure (see Supplementary Operating Instructions for the Analyzer Modules fitted).
- Install solenoid valves or similar devices for electric control of the test gas feed.
- Configure the GMSxxx digital outputs to control the solenoid valves (see Supplementary Operating Instructions for “I/O Module”).
- Connect the solenoid valves to the digital outputs.
- Assign the test gases to the suitable digital output in the Test Gas Table (see Technical Information for Control Unit).

Fig. 5: Installations for gas feed (example for emission measurement)



1 Extraction point
2 Dust filter
3 Heated sample gas line
4 Gas pump
5 Sample gas cooler
6 Fine dust filter
7 Test gases
8 Gas analyzer

3.5 Power connection

3.5.1 Safety information for power connection

Electrical safety through lines with correct rating

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

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

- *When a removable power cable must be replaced:* Observe the exact specifications (see Supplementary Operating Instructions for Enclosure).

Grounding the equipment

CAUTION: Device damage through incorrect or missing grounding

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

CAUTION: Health risk

- Only connect the device to a main power supply with a functional protective conductor (protective earth, PE).
- Only start the device when a correct protective conductor is installed.
- Never interrupt a protective conductor connection (yellow-green cable) inside or outside the enclosure.

Otherwise electric safety is not ensured.

Correct power voltage

NOTE: Check power voltage at the installation location

- Make sure the available power voltage matches the type plate specifications.

Electrical safety through power isolating switches

see “Install an external power isolating switch”, page 26

3.5.2 Install an external power fuse

▶ Install a power fuse in the main power supply. Recommended fuse value for an external device: T 16 A.

The GMS800 needs more power (“inrush current”) than the rated current temporarily when switched on. Reference value: 30 A at 230 VAC power voltage (60 A at 115 VAC).
▶ Use fuses with slow trigger characteristic.

Internal power fuses:
- *Primary:* Fuse in internal power supply unit (6.3 A). – *If this fuse triggers:* Replace the complete power supply unit.
- *Secondary:* Fusible cutout on the internal “distribution board” (on CANopen connections). – *if this fuse triggers:* Clear the malfunction cause and renew the fusible cut-out[1].

[1] Fuse element F10A 250V D5x20, Part No. 6044838.

3.5.3 Install an external power isolating switch

WARNING: Endangerment of electrical safety during installation and maintenance work when the power supply is not switched off
An electrical accident can occur during installation and maintenance work when the power supply to the device and/or lines is not switched off using a power isolating switch/circuit breaker.
▶ Before starting the work on the device, ensure the power supply can be switched off using a power isolating switch/circuit breaker in accordance with DIN EN 61010.
▶ Make sure the power isolating switch is easily accessible.
▶ *If the power isolating switch cannot be accessed or only with difficulty after installation of the device connection:* Install an additional disconnecting device.
▶ The power supply may only be activated again by personnel carrying out the work (after the end of the installation work or for test purposes). The valid safety regulations must be observed.

The built-in main power switch can be useful during service work. The built-in main power switch should not be used during operation.

3.5.4 Connect power connection

See Supplementary Operating Instructions for Enclosure.

3.6 Signal connections

3.6.1 Safety information for signal connections

Safe input signals

NOTE:
Signals connected to interfaces shall be low voltage (Max. 30 V AC or 60 V DC), derived from: a secondary circuit, double or reinforced insulated from power voltage, e.g. a "SELV" circuit per IEC 60950-1.

Install disconnected from the power supply

NOTE: Sensitive electronics
Before signal connections are established (also with plug connections):
- ▶ Disconnect the GMS800 and all connected devices from the power supply (switch off).

Otherwise the internal electronics could be damaged.

Adjustment procedure safeguard

While an adjustment procedure is running, status “Functional control” is activated and the test gas measured values output as measured values.

CAUTION: Risk during adjustments
Test gas values are output as measured values during an adjustment procedure.
- ▶ Check whether the “Function control” digital output must be processed or displayed at external stations.
- ▶ Install the “Function control” digital output accordingly when necessary.

Otherwise the measured values output from the test gases could possibly create dangerous or undesired situations.

3.6.2 Suitable signal cables

All exterior power circuits only conduct signal low voltages <50V DC.

- ▶ Only use cable material for all signal lines which meets the following requirements:
  - AWG22 (or better)
  - Insulating strength> 520 V
- ▶ Use shielded cables for all signal connections. The high-frequency impedance of the shield must be low.
- ▶ Only connect the ground on one cable end with GND/enclosure. Whenever possible, ensure a short connection with broad contact.
- ▶ Observe the shielding concept of the host system (if existing).

NOTE:
- ▶ Use suitable cables only. Install all cables properly.

Otherwise the specified EMC stability will not be maintained, and sudden and inexplicable functional problems might occur.

WARNING: Endangerment of electrical safety by incorrect cables
If external heating lines are operated with power voltage:
- ▶ Use cable material with a minimum conductor cross-section of 3 x 1 mm^2 .

3.6.3 Information in other documents (notice)

Signal connections ...	See for information
On an internal I/O module	See Supplementary Operating Instructions for “I/O Module”
On other external components	See relevant separate information

3.7 Interfaces

Position of interface connections, see Supplementary Operating Instructions for Enclosure

NOTE:
Signals connected to interfaces shall be low voltage (Max. 30 V AC or 60 V DC), derived from: a secondary circuit, double or reinforced insulated from power voltage, e.g. a "SELV" circuit per IEC 60950-1.

Ethernet

A PC can be connected to the Ethernet interface (network connection). The “SOPAS ET” application program supports digital communication with the GMS800.

Application options with “SOPAS ET”:

- Measured value and status inquiries
- Remote control
- Parameter setting
- Diagnosis
- Setting the internal configuration

CAN bus

External System modules can be connected to the CANopen interfaces. One of the CANopen connections is reserved for the CAN bus terminator (terminating resistor).

RS485

Several GMS800 enclosures can be interconnected to one system via the RS485 connections.

▶ *When the delivered GMS800 configuration has several enclosures:* Observe the individual information provided.

The Basic Control Unit (BCU) uses the RS485 interface also for the Modbus (see Supplementary Operating Instructions of the Basic Control Unit (BCU)).

4 Start-up

4.1 Safety information on start-up

NOTE: Risk of damage

Liquids and particles (dust) must not penetrate the gas analyzer measuring system. The gas analyzer is normally unusable when liquids or particles have penetrated the measuring system.

Before activating sample gas feed to the gas analyzer:

- ▶ Make sure no liquids (e.g. condensate) or particles can penetrate the gas analyzer.
- ▶ Check whether sample gas feed to the gas analyzer functions correctly (e.g. dust filter, valves).

Possible single measures:

- ▶ Wait until system components that remove condensable substances out of the sample gas [1] are in the operating state (e.g. sample gas cooler).
- ▶ Wait until heated system components [1] have reached operating temperature (e.g. heated sample gas line).

[1] If fitted.

4.2 Start-up procedure

Before GMS800 start-up

1 *Wall enclosures and Ex-d enclosures* [1] *in potentially explosive atmospheres:* Close the enclosure and check the enclosure for leak tightness.
2 Check gas feed condition and leak tightness.

When corresponding devices are fitted:

1 Put devices for sample gas conditioning into operation (e.g. gas cooler) and/or check their condition (e.g. filter).
2 Check pressure reserves in test gas cylinders.
3 Put protection devices into operation (e.g. enclosure purging).
4 Wait until all devices are ready for operation.

Start-up the GMS800

- ▶ Switch power supply on (see Supplementary Operating Instructions for Enclosure).

Wait until ready for operation

1 Wait until the control unit is ready for operation (see Operating Instructions for Control Unit).
2 Wait until the GMS800 is ready for operation. This is the case when no malfunctions are displayed after the heating up phase.
3 Start sample gas feed (e.g. open valve).

- Heating up time: ≈ 0,7 ... 2 hours (depending on ambient temperature)
- Each module has a function in the Menu system which shows the module state with LED symbols.

4.3 Measures after start-up

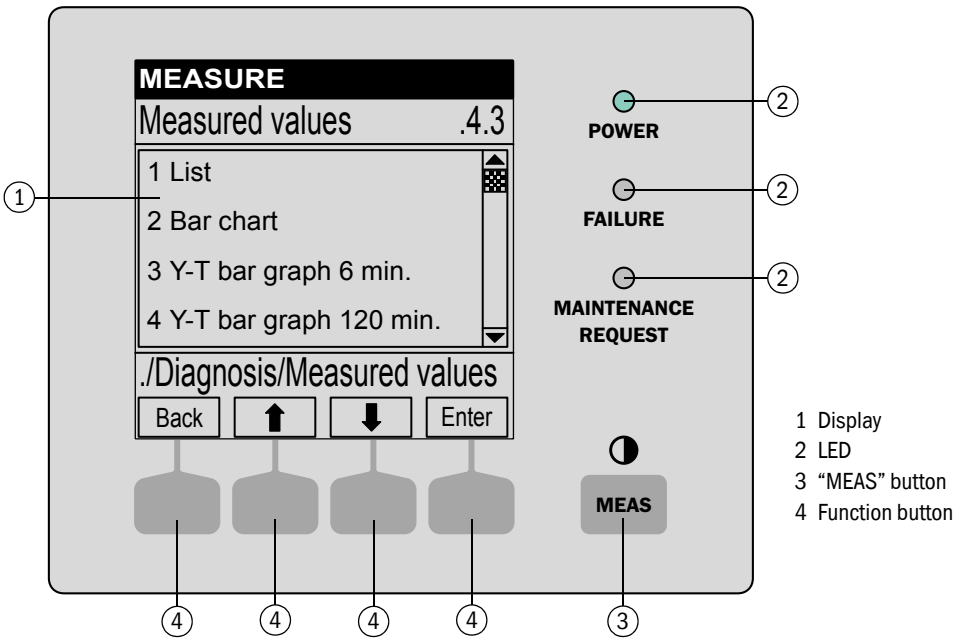
- ▶ Carry out an adjustment (see “Adjustment”, page 33).

[1] In preparation.

5 Operation

5.1 Operating and display elements (quick guide)

Fig. 6: Basic Control Unit (BCU) operating and display elements



1 Display
2 LED
3 “MEAS” button
4 Function button

- Function of LEDS, see Supplementary Operating Instructions “BCU”
- The “MEAS” button starts the measured value display immediately.
- The respective function of the function buttons is shown on the display.

Detailed instructions, see Supplementary Operating Instructions “BCU”

The display lighting can possibly switch off automatically after a certain time (see Supplementary Operating Instructions “BCU”).
▶ To reactivate the display lighting: Touch the left or right function button.

5.2 Menu system

5.2.1 Variants of the menu system

The menu functions of the Analyzer modules and of the Gas module are available in two variants:

- Menu system in the Basic Control Unit (BCU)
- Menu system in the PC software “SOPAS ET”

The PC software “SOPAS ET” has more complex menu functions than the Basic Control Unit (BCU).

5.2.2 User levels

Certain menu functions are only available when user level “Authorized operator” is active.

Trained and authorized skilled persons can make advanced parameter settings at “Service” level.

5.3 Checking the operating state (visual check)

5.3.1 Recognizing a safe operating state

Control unit of gas analyzer

- Operation display of control unit is on
- No malfunction messages on display
- Measured value display with normal background color
- Measured values in normal (expected) range

Gas analyzer peripherals

- Gas feed functioning correctly (e.g. pump, filter)
- Peripheral devices functioning correctly (e.g. fan, heater)

5.3.2 Recognizing an unsafe operating state

Complete device

- Unusual smell (gas, smoke, heat)
- Heavy damage or deformation of enclosure
- Defective or damaged connections or connection lines
- Unusual noises

Some Analyzer modules create rhythmic operating noises.

Control unit

- Operation display not on
- Malfunction message on display

- A malfunction message appears on the display during the heating up phase after switching on. The GMS800 is not ready for operation in this state. This is however not an unsafe operating state.
- An “Alarm” message is not an indication for an unsafe operating state.

An “Alarm” message signals that the measured value has exceeded a programmed limit value.

▶ *When the GMS800 reports an “Alarm”:* Check whether the current measured value requires an operational reaction.

Peripherals

- Leak in a gas line
- Incorrect operating conditions (e.g. ambient temperature, gas pressure)
- Heat build-up (ambient temperature too high)
- Moisture condensation/moisture on enclosure
- Peripheral device down (e.g. fan, heating)

CAUTION: Danger caused by unsafe operating state

When the GMS800 is or could be in an unsafe state:

▶ Put the GMS800 out of operation, disconnect from the power voltage and signal voltage and secure against unallowed or accidental start-up.

WARNING: Hazards through a gas leak

▶ *When gas escapes uncontrolled:* Immediately check whether the gas can be dangerous to health or combustible.
If this is the case: Immediately follow the local Operating Instructions that govern behavior during uncontrolled escape of gas.

5.4 Behavior in an emergency

Fire:

1 Stop gas feed to the GMS800.
2 Disconnect the GMS800 from the power voltage (main power switch or emergency switch).
3 Switch off possible peripheral devices (e.g. heater).
4 Trigger an alarm/make an emergency call.
5 Follow the local Operating Instructions governing behavior when fire breaks out.
6 Inform the fire brigade about dangerous gases when necessary.

Unsafe operating state:

1 Stop gas feed to device.
2 Disconnect the device from the power voltage (main power switch or emergency switch).
3 Prevent unauthorized or unintentional start-up.
4 Protect the measuring system against condensation and penetration by liquids.

Recognizing an unsafe operating state see page 31.

If a protection device is defective (when fitted):

1 Disconnect the GMS800 from the power voltage (main power switch or emergency switch).
2 Stop gas feed to the GMS800.
3 Prevent unauthorized or unintentional start-up.
4 Protect the measuring system against condensation and penetration by liquids.

6 Adjustment

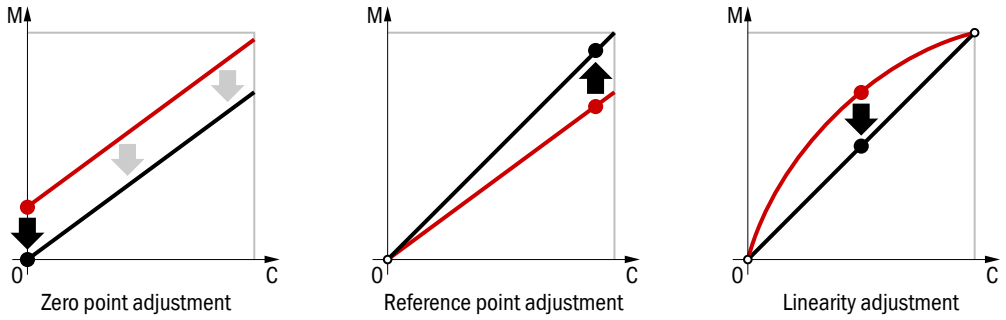
6.1 Adjustment introduction

6.1.1 Adjustment purpose

It is unavoidable that some of the properties of Analyzer modules will change during the operating time. This changes measurement results even when external conditions remain identical. This gradual change in measured results is known as drift. Zero point drift and reference point drift exist. These drifts are measured during adjustment and the relation between real concentration and measured value (characteristic curve) is corrected accordingly (see Fig. 7).

The linearity of the characteristic curve (proportional relation between real value and measured value) can also be corrected afterwards .

Fig. 7: Adjustment functions (schematic)



6.1.2 Principle adjustment procedure

1 A test gas is fed in.
2 A measured value (actual value) is determined with this test gas.
3 This actual value is then compared against the programmed nominal value.
4 The internal adjustment parameters are then corrected mathematically so that the actual value then corresponds to the nominal value.

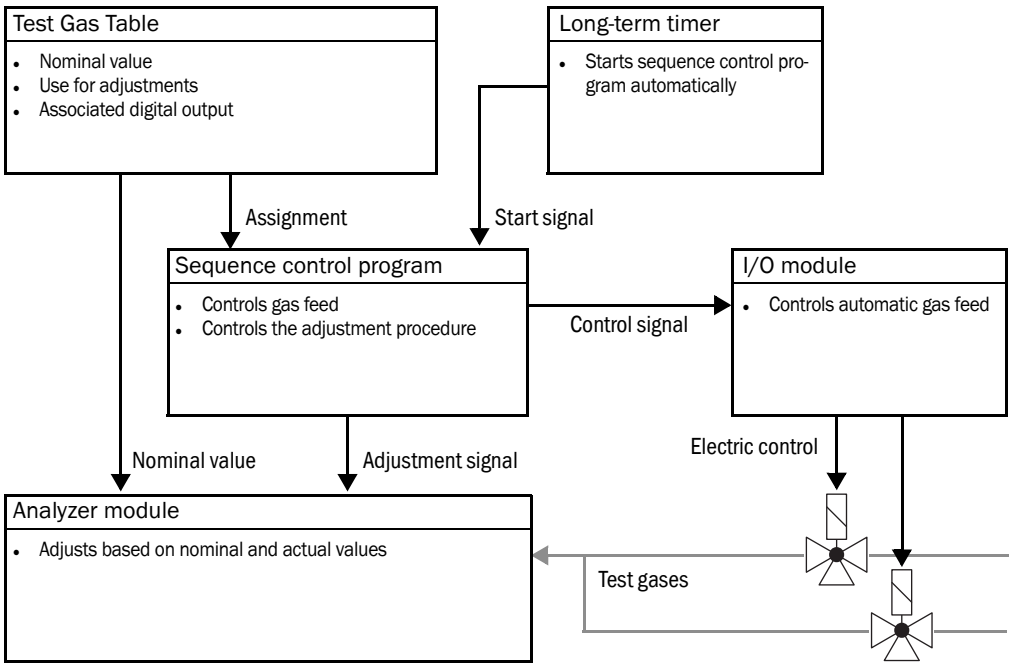
To attain complete adjustment, this procedure must be performed twice for each measuring component – once for the zero point and once for the reference point. Sequence control programs control these procedures (see Technical Information for Control Unit).

6.1.3 Internal organization of adjustment procedures

Three internal instances are decisive for adjustment:

- The Test Gas Table – to program test gas settings
- Sequence control programs for adjustment
- Long-term timer – for time-controlled automatic starts of sequence control programs

Fig. 8: Internal organization of adjustment procedures



6.2 Adjustment guideline

6.2.1 How often do you have to adjust?

The GMS800 should be adjusted

- after start-up
- at regular intervals during operation (weekly to monthly).

▶ Pay primary attention to the adjustment information in the Supplementary Operating Instructions for the Analyzer Modules fitted.

- Choose larger adjustment intervals when possible (e.g. 3 or 6 months) when permitted by the application or when expressly allowed (e.g. in a TÜV approval).
- Specialized measuring systems (e.g. process applications with complex gas conditioning systems) may need a different adjustment concept.

6.2.2 What do I need for an adjustment?

To perform an adjustment, you need:

- For each measuring component of the GMS800
  - suitable zero gas (see “Zero gas”, page 36)
  - suitable reference gas (see “Span gases”, page 37)
- Time in which normal measuring operation may temporarily stop.

Further prerequisites are:

- Correct test gas parameter settings[1]
- Correct runtime settings [1]

The GMS800 can control test gas feed automatically.[1]

6.2.3 How can you perform an adjustment?

You can use the following alternative adjustment procedures:

Alternative adjustment procedures		Requirements	See
A	Single comparisons with manual test gas feed	Suitable test gas settings	See Operating Instructions for Control Unit
B	Single comparisons with automatic test gas feed	As in [A] + installations with automatic test gas feed	see “Providing installations for test gases (when required)”, page 24
C	Automatic adjustment started manually	As in [B] + selection of suitable sequence control program	See Technical Information for Control Unit
D	Fully automatic (cyclic) adjustment	As in [C] + programmed cyclic trigger	

[1] See Technical Information for Control Unit

6.3 Test gases

NOTE:

▶ Pay primary attention to the information and specifications on test gases in the Supplementary Operating Instructions for the Analyzer Modules fitted.

6.3.1 Zero gas

General requirements

Zero gas should not normally cause a measuring effect for the measuring components for which the metrological zero point is adjusted with this gas (nominal value: “0“). A zero gas cannot therefore contain the measuring components.

- The same zero gas can be used for all measuring components in most applications.
- Nitrogen (N_2) is normally used as zero gas with quality “technical” or “top grade” depending on the application.
- Filtered atmospheric fresh air can be used as zero gas for some applications.

Application-specific zero gas

A definite nominal value can also be set for zero gas. This means a zero gas that causes certain measuring effects can be used in special applications. These effects must be known quantitatively and considered appropriately when setting the zero gas nominal value.

▶ Pay primary attention to the individual information provided on zero gas.

6.3.2 Span gases

General requirements

The reference point or the linearity are adjusted with span gases. A span gas is basically a mixture of zero gas and a measuring component whose measurement is to be adjusted.

Span gas mixtures

In many applications, you can also use span gas mixtures with more than one measuring component to adjust the reference point of several measuring components.

However, please note that span gas mixtures should *not* be used in the following applications:

- When the coexistence of the gas components could physically interfere with the gas analysis
- When the gas components could chemically react with each other
- When the mixture components in the GMS800 create cross-sensitivity effects in those measuring components to be adjusted and these cross-sensitivity effects cannot be automatically compensated
- When separate information was delivered with the analyzer which rules out the use of span gas mixtures.

Appropriate nominal values

The nominal value of a span gas is the actual concentration of the measuring component in the span gas.

- *For reference point adjustment:* On the GMS800, the nominal value may amount to 10 ... 120% of the end value of the respective physical measuring range. Adjust the nominal value in the range 65 ... 100% of the physical measuring range for precise adjustment.
- *For linearity adjustment:* The nominal value should be approx. 50% (40 ... 60%) of the end value of the respective physical measuring range.

- ▶ Pay primary attention to the span gas information in the Supplementary Operating Instructions for the Analyzer Modules fitted.
- ▶ Pay primary attention to any individual information provided.

6.3.3 Physical conditions for test gases

Principle

Test gases should be fed into the gas analyzer under the same conditions as the sample gas.

- *When devices are available for sample gas conditioning (e.g. filter):* Let the test gases flow through the sample gas conditioning before reaching the gas analyzer.
- *If a sample gas cooler is used:* Observe see “Test gas feed with sample gas cooler”, page 39.

Volume flow

- Set the volume flow (flow) of the test gases so that it more or less corresponds to the sample gas volume flow.

Feed pressure

- *Without a sample gas pump:* Feed the test gases with the same primary pressure as the sample gas.
- *With a sample gas pump (option in Gas module):* Feed the test gases with low overpressure (+50 ... +100 mbar). Set the overpressure so that the volume flow is as large as the sample gas volume flow during operation.

NOTE:

On devices with a sample gas pump:

- Make sure the feed pressure of the test gases is limited (check pressure regulator).

Otherwise the fitted sample gas pump can be damaged.

6.3.4 Test gas feed with sample gas cooler

Only applicable for applications where a sample gas cooler is used.

Adjustment with “dry” test gases

In the method with “dry” test gases, the test gases flow from the source (pressure cylinder) directly into the gas analyzer without flowing through the sample gas cooler.

Advantages:	• The physical conditions are identical during adjustment. This means the adjustment results can be compared directly. • This method allows following the gas analyzer drift.
Disadvantages:	• The influence of the sample gas cooler is not considered during adjustment. • It may be necessary to quantify the influence of the sample gas cooler.

Possible methods to determine the sample gas cooler influence:

1 Feed a test gas directly into the gas analyzer (as during adjustment). Note the measured value displayed for this test gas.
2 Feed the same test gas again through the sample gas cooler (as with the sample gas) before it reaches the gas analyzer. Note the measured value.
3 Consider the difference between the two measured values during measuring operation.
4 Possibly repeat this comparison measurement regularly.

Adjustment with “wet” test gases

The test gases are subjected to the same influences as the sample gas when the test gases flow through the sample gas cooler before reaching the gas analyzer. The result is “wet” test gases with the same H_2O content as the sample gas.

Advantages:	• The actual influence of the sample gas cooler is recorded physically and considered in the adjustment.
Disadvantages:	• Because the physical conditions in the sample gas cooler are not exactly constant, the results of single adjustments are also not exactly identical. This must be considered when assessing the drift. • Due to the fact that adjustment gases from gas cylinders practically do not contain any H_2O, the sample gas cooler can dry out during the course of a long adjustment procedure. This would neutralize the advantages of this method.

7 Shutdown

7.1 Safety information on shutting down

NOTE:
The Analyzer modules are heated to maintain constant internal temperatures. This also prevents condensation occurring in the measuring system during operation. However, when the gas analyzer is shutdown condensation could occur in the Analyzer modules as they cool down. This can damage the Analyzer modules or make them unusable. – Therefore:

- ▶ Always purge the internal sample gas path thoroughly with a “dry” neutral gas before each shutdown task.

WARNING: Health hazards through dangerous gases
If the GMS800 is used to measure toxic or dangerous gases:

- ▶ Thoroughly purge all sample gas paths with a neutral gas (e.g. nitrogen) before opening sample gas paths or components carrying sample gas.

WARNING: Health hazards through residues

- ▶ Observe Safety information on decontamination (see page 44).

7.2 Preparations for shutdown

7.2.1 Secure connected stations

- Gas analyzer shutdown can affect external stations. GMS800 It may be necessary to take the switching logic used by the switching outputs of the into consideration (see Supplementary Operating Instructions for “I/O Module”).
- If a data processing system is connected, it may be required to manually indicate a planned shutdown, so that the system will not interpret the shutdown as a gas analyzer malfunction.

- ▶ If required, inform connected external stations that a shutdown is planned.
- ▶ Ensure operational safety is not endangered by shutting down, e.g. when the gas analyzer is used to monitor processes or atmospheres.
- ▶ Ensure shutdown does not unintentionally trigger an automatic emergency signal.

7.2.2 Purge sample gas out of the gas analyzer

1. Stop gas feed to the GMS800.
2. Disconnect the GMS800 from external sample gas paths so that no sample gas can flow into the GMS800.
3. Purge all gas paths in the GMS800 for several minutes with a “dry” neutral gas – for example with technical grade nitrogen or with a zero gas. Possibly include peripheral gas paths in this purging operation.
4. Then close off all GMS800 gas connections or close the related valves in the purged gas path.

7.2.3 Deactivate enclosure pressurization (when fitted)

When the enclosure is fitted with an active system for enclosure pressurization (e.g. inert gas purging):

- ▶ Shut the enclosure pressurization system down (see Operating Instructions for the system involved).

7.3 Switch-off procedure

1 Carry out shutdown preparations (see “Preparations for shutdown”, page 40).
2 Disconnect the GMS800 power supply at an external source (external main power switch).

WARNING: Risk of explosion in potentially explosive atmospheres
If the device is installed in a potentially explosive atmosphere:
- Before opening the enclosure: Wait for the prescribed delay times to elapse (see Supplementary Operating Instructions for Enclosure or Operating Instructions for Enclosure Pressurization System).

7.4 Protective measures for long-term storage

- *When the GMS800 has been separated from gas lines:* Close off the GMS800 gas connections (with sealing plugs, if necessary with adhesive tape) to protect against moisture, dust or dirt penetrating the internal gas path.
  When the GMS800 is fitted with the OXOR-E Analyzer module: Keep gas connections gas-tight during storage.

The service life of the OXOR-E Analyzer module will be reduced by contact to oxygen in the air even when the device is switched off.

- Cover open electrical connections dust-tight, e.g. with adhesive tape.
- Protect the keypad and display against sharp-edged objects. If necessary, cover the instrument with protective material (e.g.: Cardboard, styrofoam).
- Select a dry and well-ventilated room for storage whenever possible.
- Pack the device (e.g. in a plastic sack).
- *When high air humidity can be expected:* Include a drying agent (SilicaGel) in the packing.

WARNING: Health hazards through residues
- Observe Safety information on decontamination (see page 44).

7.5 Transport

CAUTION: Risk of injuries and accidents
- Observe the safety information for transport (see Supplementary Operating Instructions for Enclosure).

- Protect the enclosure before transport (see “Protective measures for long-term storage”).
- Use the original packaging for transport whenever possible.
- A transport container with adequate stability can also be used. Protect the device with padding from shocks and vibrations and thoroughly secure the device in place inside the transport container. Make sure there is sufficient clearance from the walls of the container.

Accompanying documents when shipping for repairs see “Shipping for repair”

7.6 Shipping for repair

When the device is being sent to the manufacturer or a Service company for repairs:

Please enclose the following information so that the device can be repaired as quickly as possible:

- An error description, as precise as possible (meaningful keywords suffice).
- *For unclear functional problems*: A short description of the operating conditions and installations (connected devices etc.).
- *If shipping was agreed with the manufacturer:* The contact person at the manufacturer's who is informed about the matter.
- A contact person in the user's company (for possible questions).

Please add the information even if your matter has already been discussed with a manufacturer's employee.

7.7 Disposal

CAUTION: Risk of environmental hazards
- Observe the information in these Operating Instructions.
- Observe local regulations and laws on disposal of industrial waste and electric devices.

WARNING: Health hazards through dangerous gases
If the GMS800 is used to measure toxic or dangerous gases:
- Thoroughly purge all sample gas paths with a neutral gas (e.g. nitrogen) before opening sample gas paths or components carrying sample gas.

WARNING: Health hazards through residues
Observe Safety information on decontamination (see page 44).

These subassemblies could contain materials which may require special disposal:

- *Sample gas paths:* Toxic materials in the sample gas could have been absorbed or trapped in the »soft« gas path material (e.g. hoses, sealing rings).
- *Sample gas filter*: Sample gas filters can be contaminated with pollutants.
- *Electronics:* Electrolyte capacitors, tantalum capacitors
- *Display:* Liquid of the Liquid Crystal Display (LCD)

8 Maintenance

8.1 Maintenance plan

8.1.1 Maintenance by the user

Maintenance interval[1]				Maintenance work	Information	Note
1D	1W	1M	6M			
(□)	□	□	□	▸ Make a visual inspection	see “Visual inspection”, page 45	
	(□)	□	□	▸ Perform adjustment	[2]	a
	(□)	(□)	(□)	▸ Check/clean gas supply and discharge lines [3]		a b
			□	▸ Check operating hours of DEFOR Analyzer module [4]		

[1] D = day(s), W = week(s), M = month(s).
[2] See Operating Instructions for Control Unit
[3] If fitted.
[4] The UV lamp in the DEFOR Analyzer module must be replaced about every 2 years (see “Maintenance by Service technician”). With measuring component NO: The gas filter fitted for NO measurement must be replaced every 2 years approximately.

Note	Explanation
a	Maintenance interval depends on the individual application
b	Only when solids deposit in the gas lines – as required

▸ In addition, observe all official and internal company regulations valid for the individual application.

8.1.2 Maintenance by Service technician

Maintenance interval[1]				Maintenance work	Note
6M	1Y	2Y	10Y		
□	□	□	□	▸ Check/service fitted gas pump [2]	a
□	□	□	□	▸ Check function of flow sensor [3]	a
□	□	□	□	▸ Check important operating functions (e.g. alarm message)	a
(□)	□	□	□	▸ Readjust adjustment unit [4]	
	□	□	□	▸ Adjust H_2O measurement [5]	
	□	□	□	▸ Replace OXOR-E module [6]	a
	□	□	□	▸ Check gas paths for leak tightness	
		□	□	▸ Replace UV lamp [7]	
		□	□	▸ Replace gas filter for NO measurement [8]	
			□	▸ Replace battery in control unit	c

[1] M = month(s), Y = year(s).
[2] Only for devices with Gas module with gas pump.
[3] Only for devices with Gas module with flow sensor.
[4] Only for devices with DEFOR Analyzer module with adjustment unit (option).
[5] Only for devices with H_2O measurement.
[6] Only for devices with OXOR-E Analyzer module.
[7] Only for devices with DEFOR Analyzer module
[8] Only for devices with DEFOR Analyzer module and measuring component NO.

Note	Explanation
a	Maintenance interval depends on the individual application
c	Carry out at the manufacturer's factory or workshop with suitable equipment

8.2 Safety information on disassembly of parts

8.2.1 Safety information on decontamination

WARNING: Health hazards through contact with hazardous gases
Residues of noxious gases can be released when opening parts with sample gas contact.

Before opening parts with sample gas contact:

- *Remove gaseous residues:* Purge all parts in contact with sample gas for two hours with dry N_2.
- *Remove solid/liquid residues:* Carry out a decontamination in accordance with the requirements resulting from this type of contamination (contact SICK Service as required).

Before performing maintenance/repair work on the enclosure:
If the enclosure also has contact with toxic gases during the application, decontaminate the enclosure as well before carrying out maintenance/repairs.

- Decontaminate the enclosure appropriately for the requirements resulting from this type of contamination. Observe all relevant cleaning information.

8.2.2 Potential hazard by gas from internal parts

WARNING: Health hazards through dangerous gas in the enclosure
It is possible that a small amount of a dangerous gas is enclosed in Analyzer modules. If the respective part becomes leaky, this gas amount escapes into the enclosure (possible gases and amounts see Table 2).
To prevent hazards by such gas:

- *Before opening the enclosure (especially when an internal defect is suspected):* Ensure breathing protection (e.g. adequate ventilation/suctioning off).
- When carrying out regular maintenance and service work (see “Maintenance plan”, page 43), check also the condition of the internal parts. Parts that are defective or questionable must be repaired.

Analyzer module	Possibly enclosed gas	Maximum gas amount	Maximum gas concentration in enclosure during a defect
DEFOR UNOR MULTOR SIDOR	$CO \cdot NO \cdot NO_2 \cdot SO_2 \cdot NH_3 \cdot N_2O \cdot$ hydrocarbons · Freon	50 ml	1000 ppm

Table 2: Dangerous gases in Analyzer modules

8.3 Visual inspection

Maintenance interval

Recommendation: Max. 2 days

Procedure

1 Check the GMS800: Inspect the control unit display (no malfunction fields).
2 Check test gas supply (when present):
   – Remaining reserves in pressure cylinders
   – Feed pressure
   – State of gas lines and valves
3 Check peripheral installations (when present), e.g.:
   – Gas sampling probe
   – Sample gas line (state, connections)
   – Particle filter (dust filter)
   – Protective filter (e.g. corrosion inhibitor filter)

8.4 Cleaning of the enclosure

- To clean the enclosure, use a soft cloth.
- If required, wet the cloth with water and a mild cleaning solution.
- Do not use any mechanically or chemically aggressive cleaning agents.
- Do not allow any liquids to penetrate the enclosure.

CAUTION: Hazardous situation if liquids penetrate the enclosure
If liquids have penetrated the device:
- Do not touch the device any more.
- Shut the device down immediately by disconnecting the main power voltage at an *external station* (e.g. pull out the power cable at the socket or switch off the external power fuse).
- Contact the manufacturer's customer service or other trained skilled persons able to repair the device.

8.5 Leak tightness check of sample gas path

8.5.1 Safety information on gas leak tightness

WARNING: Hazards through leaky gas path

- There is a health hazard when the gas path is leaky when using toxic sample gases or sample gases hazardous to health.
- If the sample gas is corrosive or can create corrosive liquids with water (e.g. air moisture), there is a risk of damage to the gas analyzer and neighboring equipment when the sample gas path is leaky.
- If the escaping gas is explosive or can create an explosive gas mixture together with ambient air, there is a *risk of explosions* when the safety measures on explosion protection are not implemented.
- Measured values can be erroneous when the gas path is leaky.

If the gas path is determined to be leaky:

- ▶ Shut off gas feed.
- ▶ Put the gas analyzer out of operation.
- ▶ *If the escaping gas can be dangerous to health, corrosive or explosive:* Remove the escaping gas systematically (purge, suction off, vent) whilst maintaining the necessary safety measures, e.g. for
  - explosion protection (e.g. purge enclosure with inert gas)
  - health protection (e.g. use breathing protection)
  - environment protection.

8.5.2 Test criterion for gas leak tightness

- With the specified test pressure (see Table 3), the leak rate of the internal gas path of the gas analyzer must not be higher than $3.75 \cdot 10^{-3}$ mbar · l/s. Otherwise the gas analyzer is considered to be leaky.
- Recommended test interval: Max. 6 months.

Layout of internal gas path	Test pressure
with hoses	450 mbar
with tubes – without Analyzer module “OXOR-E”	1,5 bar
with tubes – with Analyzer module “OXOR-E”	450 mbar

Table 3: Test pressure for leak tightness check of sample gas path

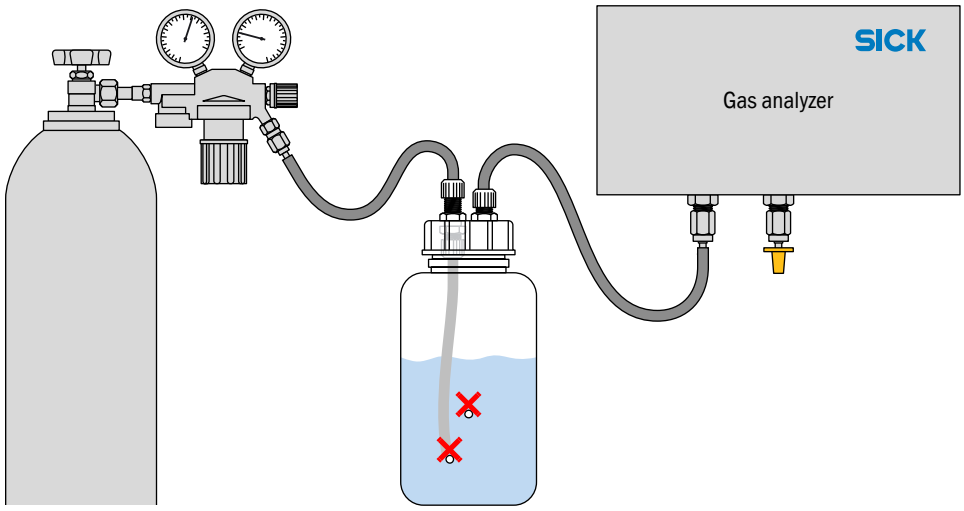
8.5.3 Simple test method for gas leak tightness

Test equipment

For a simple test, you need

- A compressed gas cylinder with adjustable pressure reducer (recommendation: Nitrogen)
- A »washing bottle« with two hose connections (see “Simple test method for leak tightness check (example)”, page 47).
  - The washing bottle must be able to withstand the test pressure (1 bar) and be closable gas-tight.
  - The hose leading (or a suitable tube) into the water should have an inner diameter of 4 mm (outlet opening diameter).
  - Plain water can be used as filling. Only use enough water so that no water can escape via the gas outlet of the washing bottle.

Fig. 9: Simple test method for leak tightness check (example)



Test procedure

When the gas analyzer has several separate internal gas paths:
▶ Perform this procedure individually for each gas path.

1 Put the gas analyzer out of operation. Separate the gas inlet and outlet of the gas analyzer from the installation (when fitted).
2 Connect the gas analyzer gas inlet to the washing bottle gas outlet.
3 Close the gas analyzer gas outlet off gas-tight, e.g. with a sealing plug.
4 Also close off all the other internal gas path connections (as available) in the same manner.
5 Check: The valve on the pressure reducer gas outlet must be closed off. Now open the main valve of the compressed gas cylinder.
6 Adjust the pressure reducer so that the output pressure (secondary pressure) is 150 kPa (1.5 bar).
7 Connect the pressure reducer gas outlet to the washing bottle gas inlet.
8 Open the pressure reducer valve *slowly* (avoid sudden pressure increase).
9 Wait until the pressure ratio is constant (several seconds).
10 Observe the washing bottle for three minutes.
The gas path is classified as tight when no air bubbles rise during this period.
11 To terminate the test procedure:
– Close off the valve on the pressure reducer gas outlet.
– To release the gas pressure: Carefully loosen the connection hose *on the washing bottle gas outlet*.
– Reconnect the gas connection on the gas analyzer as for operating mode - pay careful attention to gas leak tightness.

9 Clearing Malfunctions

9.1 If the GMS800 does not work at all ...

Possible causes	Information
Power cable not connected.	▸ Check power cable and connections.
Main switch off.	▸ Check main switch (external).[1]
Power supply has failed.	▸ Check power supply (e.g. socket, external fuses).
On enclosures with enclosure pressurization system: The enclosure pressurization system has automatically interrupted the power supply (safety switch-off).	▸ Check the status of the enclosure pressurization system.
Internal power fuse defective.	▸ Have internal fuse checked (information see “Install an external power fuse”, page 26).
Internal operating temperatures not correct.	▸ Check whether corresponding malfunction message displays are present.
Sample gas feed not working.	▸ Check (see “Feeding sample gas (sample gas inlet)”, page 22).
Internal software not working.	Can only occur after complex internal malfunctions or after strong external interference (e.g. strong electromagnetic interference impulses). ▸ Switch off the GMS800. Wait for a few seconds, then switch on again.
Internal overheat fuse triggered	Heated Analyzer modules have overheating fuses which are defective after triggering. ▸ Inform the manufacturer's Customer Service to have the defective overheating fuse replaced.

[1] The GMS800 has no own main power switch.

9.2 Malfunction displays

The control unit activates the malfunction field when a module signals an internal malfunction (see Operating Instructions for Control Unit).

▶ *To localize the malfunction cause:* Call up the Diagnosis → State function in the menu branch for each module and check whether one of the LED symbols for “Failure”, “Maintenance” or “Unsafe State” is activated.

If this is the case:

▶ Call up the Diagnosis function “Logbook” and check the current entries.
▶ Inform the skilled person trained and authorized to clear malfunctions or contact the manufacturer's Customer Service.

- The Logbook contains the malfunctions of a module in tabular form with an error code (see Supplementary Operating Instructions for Modules).
- “SOPAS ET” blends in the significance of the error code after clicking the Logbook table once.

9.3 If measured values are obviously incorrect ...

Possible causes	Information	Notes for service
GMS800 not ready for operation.	▸ Check operational readiness (see "Checking the operating state (visual check)", page 31).	–
GMS800 not measuring the sample gas. Sample gas path not switched correctly.	▸ Check sample gas path and all valves (e.g. switching from test gas to sample gas).	▸ Make sure valves are functioning correctly, disassemble if necessary.
GMS800 not correctly adjusted.	▸ Check prerequisites for correct adjustment: – Correct test gases used? – Nominal values set correctly? ▸ Then run an adjustment.	▸ Check test gases used critically (nominal values, manufacturing tolerance, state).
Measuring parameter settings not suitable for the application.	▸ Check corresponding settings (e.g. damping). Try a different setting as test.	–
Sample gas pressure inside the GMS800 too high.	▸ Ensure sample gas pressure in the GMS800 is not greater than 20 kPa (= 200 mbar) against atmospheric pressure.	The gas pressure can influence measured values in most of the measuring principles used.
Sample gas path not gas-tight.	▸ Visually inspect the installation. ▸ *When a defect is suspected:* Inform the manufacturer's Customer Service or trained skilled persons.	▸ Carry out a leak tightness check (see page 46).
When only observed on one measured value output: The load is too high.	▸ Make sure that the internal resistance of the connected devices is not larger than 500 Ω.	▸ Measure including feed line.
Analyzer module is contaminated.	▸ Contact manufacturer's Customer Service or trained skilled persons.	▸ Inspect the measuring cell/ cuvette. ▸ Clean or replace if necessary.
With computation of an analog input (option): External analog signal is erroneous or has failed.	▸ Check external equipment that delivers the analog signal for cross-sensitivity compensation.	– Connection interrupted? – Problem with external measurement? – External analyzer not adjusted?

9.4 If measured values are unstable for no apparent reason ...

Possible causes	Information	Notes for service
Strong pressure fluctuations at the sample gas outlet.	▸ Install separate exhaust gas line for the GMS800 .	–
Strong mechanical vibrations.	▸ Check ambient conditions where the GMS800 is installed.	–

10 Technical Data (Information)

The Technical Data are specified in the following documents:

Technical data for	See
Enclosure specifications	Supplementary Operating Instructions for Enclosure.
Ambient conditions, climate	
Gas connection details	
Power connection	
Electrical safety	
Technical gas requirements	Supplementary Operating Instructions for the fitted Analyzer modules
Metrological data	
Signal connections	Supplementary Operating Instructions for “I/O Module”

11 Glossary

AC	Alternating Current
ATEX	Atmosphères Explosifs: Abbreviation for European Directives that govern safety in potentially explosive atmospheres
CAN	Field bus (Control Area Network) with high data security; especially suitable for safety-relevant applications.
CANopen	Communication protocol for the CAN bus. Standardized as European standard EN 50325-4. (www.can-cia.org).
Ethernet	Cable-based network technology for data networks. Basis for network protocols (e.g. TCP/IP).
IFC	Interference Filter Correlation.
LED	Light emitting diode (small indicator lamp)
PC	Personal Computer.
RS485	Standard for digital serial interfaces.
SELV	Safety/Separated Extra-Low Voltage
SOPAS	SICK Open Portal for Applications and Systems: Family of computer programs to set parameters, capture and calculate data.
SOPAS ET	SOPAS Engineering Tool: PC application program to configure modular system components.
UV	Ultraviolet (ultraviolet light).
UVRAS	UV Resonance Absorption Spectrometry.

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8013025/YL20/2016-02

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