8030993/AE00/V1-4/2013-11



# Technical Information
# GM32

## In-situ Gas Analyzer,
## Measuring Probe Version

Endress+Hauser
People for Process Automation

**Described product**
Product name: GM32
Variants: GM32 Probe (measuring probe)

**Manufacturer**
Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Deutschland

**Legal information**


**Original document**
This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

CE

## Warning Symbols


Hazard (general)


Hazard by voltage


Hazard by unhealthy substances

## 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 material damage.

## Information Symbols


Important technical information for this device


Important information on electric or electronic functions


Supplementary information


Link to information at another place

GM32

# 1 General Information

Responsibility of user

## 1.1 Responsibility of user

### 1.1.1 Designated users

This Technical Information is aimed at qualified persons familiar with the GM32 and 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.

### 1.1.2 Special local conditions

Follow all local laws, regulations and company-internal operating directives applicable at the installation location.

GM32

# 2 Product Description (Details)

Functional principle
Check cycles
Remote operation

## 2.1 Measuring method

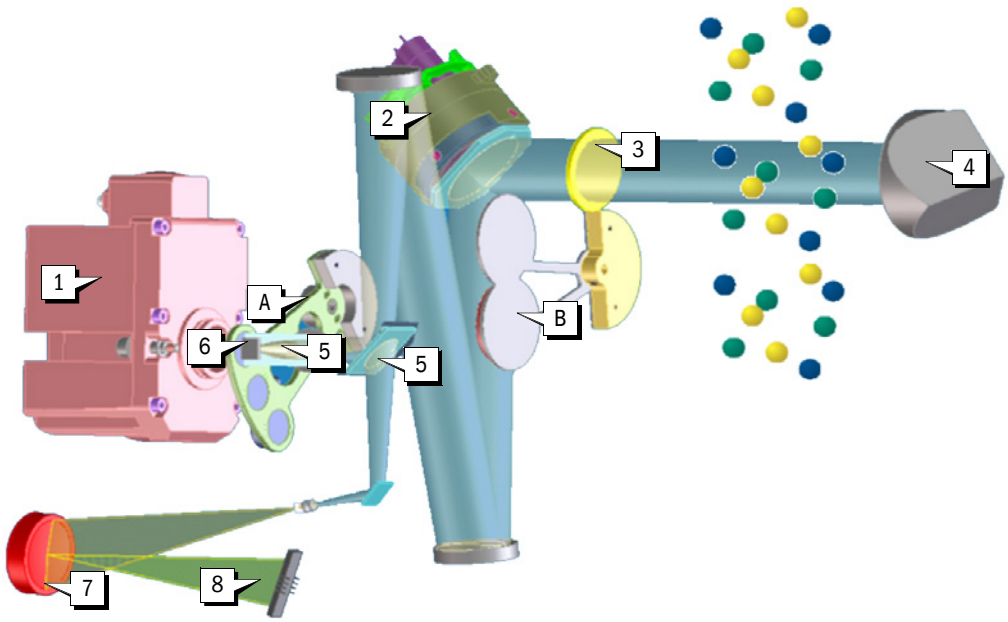
### 2.1.1 Optics layout and functional principle

The GM32 multi-component analyzer is based on in-situ technology with opto-electronic direct measurement. Measured values are recorded without contact directly in the gas flow using a measuring probe protruding into the duct. Depending on the version, this has either an open measuring gap or a gas permeable membrane insert (filter) through which the gas mixture being measured flows - the active measuring path.

The GM32 SR-unit determines the concentration of the respective gases based on wave-length-specific light absorption by the gas mixture in the active measuring path.

Light from the sender/receiver unit (SR-unit) illuminates the active measuring path in the gas duct which is then reflected back again by a triple reflector at the end of the probe. The beam splitter diverts the returning light to the polychromatic subassembly comprising a condenser lens with slit diaphragm, optical grating and receiver element. The optical grating dissects the returning light spectrally and maps it to the receiver element, a highly sensitive diode array.

Fig. 1 Measuring principle



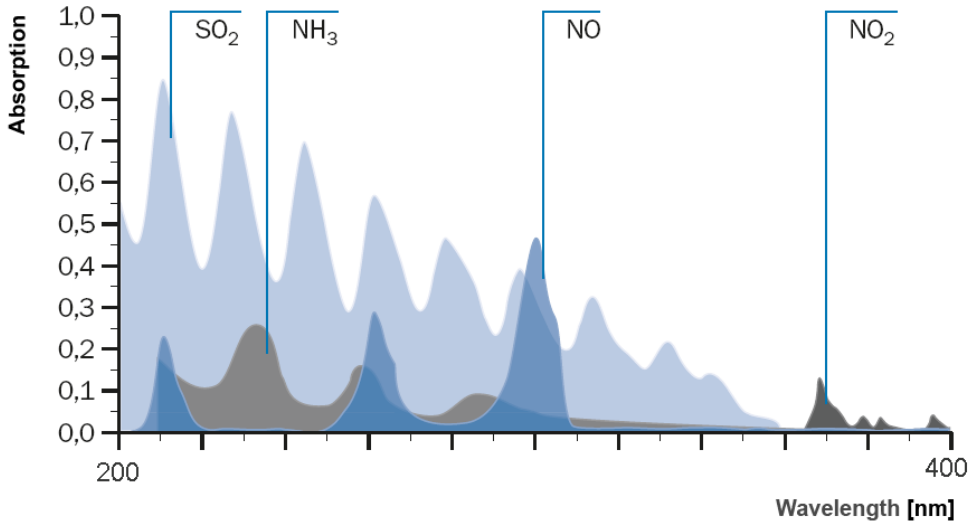

1 Emitter
2 Tracking mirror
3 Window
4 Reflector
5 Beam splitter
6 4-quadrants detector
7 Optical grating
8 Detector

A Swivel segment with filter and cell for check cycles
B Swivel segment with zero point reflector and blanking diaphragm

## 2.2 Signal evaluation

The optimized algorithms of the GM32 evaluation electronics process the measurement signal of the receiver element together with the associated parameters according to the DOAS (Differential Optical Absorption Spectroscopy) method.

Fig. 2 Absorption spectra from sample gases (schematic)




The method is based on the physical capability of gas molecules to absorb light energy in the typical wavelength ranges for the respective types of gas. Spectral dissection in the receiver element captures the absorption of gas molecules at characteristic points of the spectrum in the IR wavelength range 200 to 400 nm. Corresponding sections within this range are evaluated depending on the device type. The optimized algorithms used here ensure concentrations of gas components searched for are determined without cross-sensitivity to other gases. To do this, the respective evaluation IR range for the components to be measured is defined so that no “foreign gases” disturb the spectrum structure.

## 2.3 Zero adjust (description)

Zero adjust basically fulfills two tasks:

- Adjustment of the device in the measuring path
- Determination of reference values for check cycles
- Zero adjust is started manually (→ p. 66, § 5.1)

## 2.4 Reference cycle (description)

The reference cycle serves to compensate changes in lamp intensity (e.g. through aging) and contamination effects in the SR-unit.

The measured concentration values are retained (e.g. on analog outputs) during the reference cycle.

The reference cycle interval is adjustable (→ p. 34, § 4.2.3.1).

### 2.4.1 Reference cycle sequence

1 Determining the spectrometer offset
2 Setting the lamp parameters
3 Determining the aperture signal (dark signal)
4 Determining the reference spectrum
5 Determining the 4Q offset

## 2.5 Check cycle (description)

The check cycle serves to check the zero and reference point for each component without using test gases.

The check cycle meets the requirements of EN14181 and obviates “drift monitoring with test gases” according to QAL3.

The check cycle interval is adjustable (→ p. 34, § 4.2.3.1).

### 2.5.1 Control elements

Control elements that can be swiveled in are used for measuring during the check:

- 2 grating filters:
  - Grating filter 1: Finely woven grating with 51% transmission and 0.3 absorption
  - Grating filter 2: Finely woven grating with 6.3% transmission and 1.2 absorption
- NO cell:
  - Active length 5 mm
  - Filling 20% NO in $N_2$
  - Single beam path

  Relative to the double beam path used in measuring operation, this gives a C x L of approx. 500 ppm x m or 600 mg/m³ x m
- 1 zero point reflector

### 2.5.2 Check cycle (function)

The following influencing factors are the main cause of drifts in concentration measurement:

- Wavelength scale drift
- Spectral resolution drift
- Absorption drift

Methods to monitor these influencing factors are described in the following.

#### 2.5.2.1 Wavelength scale monitoring

The grating spectrometer used in the GM32 shows, due to the design, wavelength scale drifts caused by mechanical effects (e.g. length changes caused by temperature fluctuations). Compensation is realized through continuous determination of this drift during measuring operation and calculation back to the original state through numeric interpolation.

Wavelength drift is monitored in two stages during the check cycle:

1 Determining the position of an NO absorption line ensures correct functioning of wavelength drift compensation.
To do this, a spectrum is examined with the NO cell swiveled in and the line position deviation calculated as compared against the original device state.
A maintenance request is signaled when this deviation exceeds a limit value (normally 0.046 nm)

2 The overall wavelength drift is checked relative to the original device state. A maintenance request is also signaled here when a limit value (normally 1 mm) is exceeded.

These measures ensure wavelength drift is compensated correctly and therefore has no influence on measured values.

#### 2.5.2.2 Resolution drift monitoring

Spectral resolution of the grating spectrometer used can change during operation due to mechanical changes or contamination (scattered light). Resolution deterioration normally leads to a reduction in sensitivity and the device displays values that are too low.

This is why the spectral resolution is examined during the check cycle.

To do this, the half-width of an NO absorption line is calculated from the NO cell spectrum (see above).

A maintenance request is signaled when this deviation exceeds a limit value (normally 0.035 nm) as compared against the original state.

This check ensures resolution changes are detected *before* device sensitivity changes significantly.

#### 2.5.2.3 Absorption drift monitoring

Measured values output by the device have, to a large extent, a linear association with the measured absorption. The consequence is that errors during absorption measurement have a direct effect on measured values. Possible error sources for absorption determination are fluctuating scattered light intensities in the device as well as erroneous determination of the dark current of the detector array.

Two grating filters that serve as standard are used to check absorption determination. The absorption for each of the two filters is determined during the check cycle and compared against the values in original state. The deviations for both filters are averaged and this value checked against a limit value (normally 2% of the measured value). A maintenance request is signaled when the limit value is exceeded.

#### 2.5.2.4 Determining the zero and reference point

The zero point is determined by creating a zero spectrum by swiveling in a zero point reflector during the check cycle. This spectrum corresponds to measurement with a measuring path free from gas.

Based on this zero spectrum and using the device calibration function, the associated measured concentration values for individual components are determined and output.

A maintenance request is signaled when one of these zero values exceeds a limit value (normally 2% of the FS).

The absorption measurement deviation determined above is used to calculate the reference value. The value

$$\mathrm{rp} = (70\% + [\text{Absorption deviation in \%}]) \times \mathrm{FS}$$

is output as reference value for all components.

As described above, there are three causes for reference point drift:

- Wavelength scale drift
- Resolution drift
- Absorption drift

The measures described in → §2.5.2.1 and → §2.5.2.2 keep the first two drift causes within very strict limits. This is why the value *rp* gained from absorption measurement is representative for reference point drift for all measuring components.

#### 2.5.2.5 Monitoring the cell NO filling

The check cycle only runs correctly when the NO cell filling is sufficient.

Determining a value for an NO absorption line serves to monitor the cell concentration.

A maintenance request is signaled when the value sinks below 0.1 absorption units.

#### 2.5.2.6 Summary

Table 1 Evaluation of data determined during the check cycle

| | Purpose | Data used | Evaluation | Resulting action |
|---|---|---|---|---|
| 1 | Check wavelength scale overall drift | Current wavelength scale | Determine shift of wavelength scale against scaling | Maintenance request signal when shift above limit |
| 2 | Check wavelength drift compensation | NO spectrum | Determine NO peak position | Maintenance request signal when deviation from value against scaling over limit |
| 3 | Check resolution | NO spectrum | Determine NO peak width | Maintenance request signal when deviation from value against scaling over limit |
| 4 | Check absorption scale | Grating filter spectra | Grating filter absorption change relative to scaling | Control value[1] output for individual components.<br>Maintenance request signal when deviation from nominal value over limit |
| 5 | Check zero point | Zero spectrum | Evaluate zero spectrum with calibration function | Zero value output for individual components<br>Maintenance request signal when deviation from zero over limit |
| 6 | Check cell filling | NO spectrum | Determine NO peak height | Maintenance request signal when peak height under 0.1 absorption units |

[1] Control value calculated as (70%+ grating absorption deviation in %) x FS

### 2.5.3 Events and signals output

#### 2.5.3.1 Check cycle signals

The *Not_measuring* signal is active during the check cycle.

This signal can be sent via a digital output or read out via the OPC interface.

#### 2.5.3.2 Maintenance request signal

The *Maintenance_request* signal is activated when an unallowed drift is determined or the NO cell is empty → p. 13, § 2.5.2) and, at the same time, an appropriate message entered in the Logbook. The *Maintenance_request* signal can be sent via a digital output or read out via the OPC interface.

#### 2.5.3.3 Zero and reference point level output

The zero and reference point values determined can be output via the analog outputs. This is done - depending on the parameter settings - directly after the check cycle or on demand (via a digital input). The *Output_control_value*s signal is active during output and can also be sent via a digital output. The zero values are first output for 90 s and then the reference values for 90 s. The *Not_measuring* signal is *not* active during the output.

As an alternative, the zero and reference values of the last check cycle can be read out using SOPAS ET menu */Diagnosis/Check cycle*.

## 2.6 Contamination compensation

During the reference cycle, the zero point reflector serves to compensate contamination occurring in the SR-unit. Contamination of the front window or measurement reflector cannot be compensated in this manner. Light absorption also occurs during measuring operation through dust in the flue gas. Both of these effects cannot be determined separately due to the principle used and are compensated together using a basic line correction during spectrum evaluation (→ p. 11, §2.2).

### 2.6.1 Monitoring contamination

As described above, contamination outside the SR-unit cannot be differentiated from dust effects. However, both effects are monitored together by continuous control of the maximum absorption measured in the spectral range of the evaluation. A *maintenance request* is signaled when this absorption rises above a warning value that can be set as a parameter (standard: absorption 1.8). *Failure* is signaled when a limit value is exceeded (standard absorption 2.0).

## 2.7 Automatic adjustment with alignment

Swivel movements of the reflector relative to the SR-unit can occur during measuring operation. This can be caused, for example, when the probe bends due to varying gas temperatures. These swivel movements are compensated continually on the GM32 by the built-in tracking mirror. Motors tilt this mirror in two directions and can thereby compensate occurring swivel movements.

## 2.8 Measuring probe in detail

Fig. 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 transmitted via the CAN bus interface of the measuring probe.

### EPA conformity

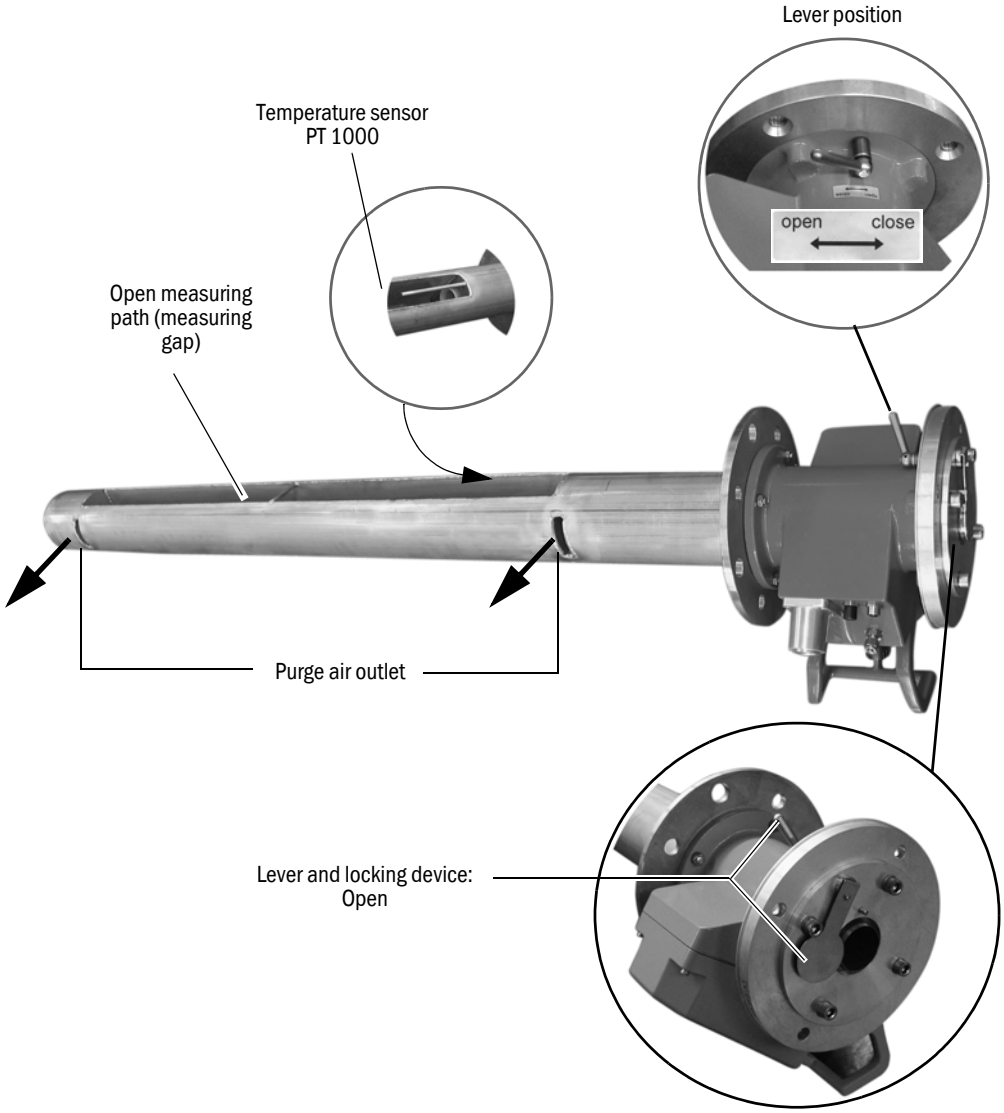
When using a GPP probe/EPA probe, an audit measurement conforming to EPA CFR 40 Part 60 and/or Part 75 can be carried out with the device fitted.

### 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. The air outlet runs in the duct offset 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.

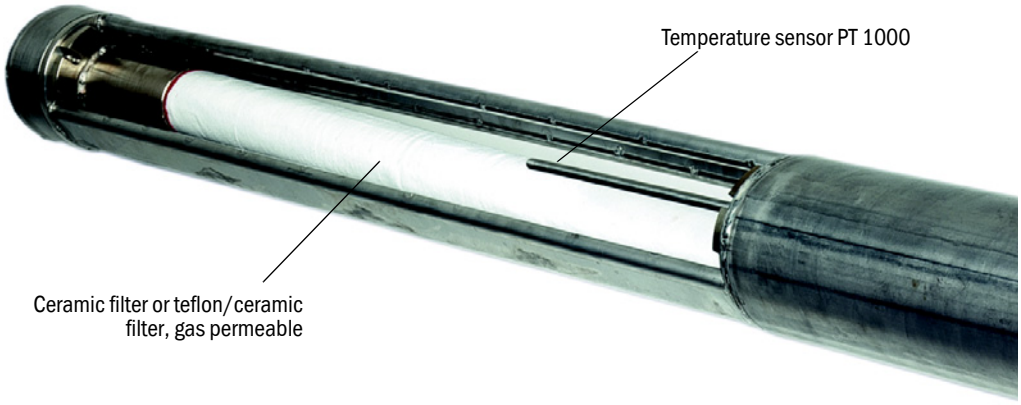
Fig. 4 GMP measuring probe (with open measuring gap)



**GPP – gas diffusion probe in dry or wet version**

This version is more suitable for higher dust contents because, on GPP probes, dust particles are separated on the filter element and therefore kept away from the measuring path. To allow an EPA-conform audit measurement as well as with low flow speeds or irregular flow profiles, the GPP (***G***as ***P***ermeable ***P***robe) should also be chosen.

Fig. 5 Measuring gap of the GPP measuring probe




Both variants of the GPP differ in the respective filter which provides suitability for different application areas.

They are fitted with an automatically controlled heater to reliably prevent condensate on the optical interfaces.

The heating control is located between the assembly and device flange in a housing connected firmly with the probe. The electronics for heating control and temperature and pressure measurement are protected safely in a stable cast housing that forms the section of the measuring probe between the duct flange and SR-unit. Both the electrical connections for CAN bus and power supply as well as the test gas connection and pressure measurement connection are fitted on this housing and serve manual activation of the audit measurement according to EPA Guideline CFR 40, Part 60 or Part 75.

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# 3 CAN Connection

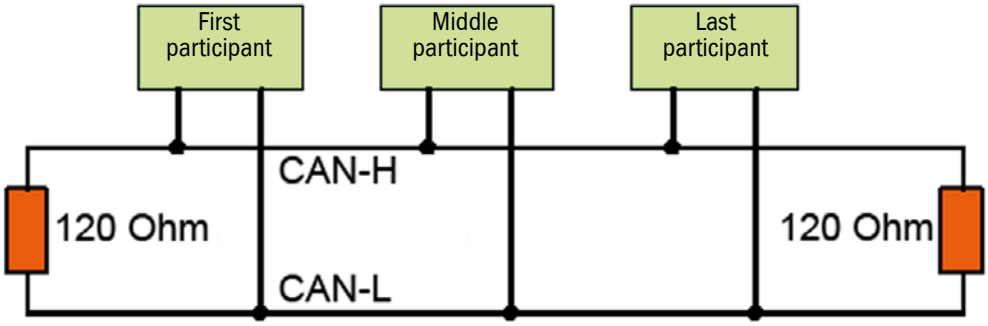
CAN connection
SCU connection

## 3.1 GM32 CAN connection

The CAN bus is a 2-wire bus system to which all bus participants are connected parallel (i.e. with short stub lines).

- Each end of the CAN bus must be closed off with a 120 ±10% Ohm terminating resistor (prevents reflections).
  This is also required for very short line lengths.

Fig. 6 CAN bus principle




Terminating resistors must be activated for first and last bus participants.

The terminating resistor must be deactivated for middle bus participants.

- ► GM32 default value:
  - Probe: Resistor activated (last participant of a stub line)
  - Gateway: Resistor activated (last participant).
    The LED in the gateway is on.
- ► Activating or deactivating terminating resistors → Operating Instructions of bus participants.
  - ► For GM32: → p. 24, §3.3 and → Operating Instructions “Modular System I/O”.

Stub lines lead to reflections on the bus, therefore:

- ► Avoid stub lines whenever possible, otherwise limit these to max. 10 m.

CAN wiring:

- ► Maximum length of the CAN bus: 1000 m
- ► Cable twisted in pairs and shielded
  - Surge impedance: 120 Ohm
  - Capacitance: ≤ 60 pF/m.

  Connect the shield across the complete bus and only ground galvanically at one location (prevents ground loops).

## 3.2 SCU connection (overview)

As an option, the GM32 (and further analyzers) can be operated using an SCU (System Control Unit).

The SCU is an operating unit for comfortable, powerful analyzer control.
The following actions can be performed on the analyzers via the SCU:

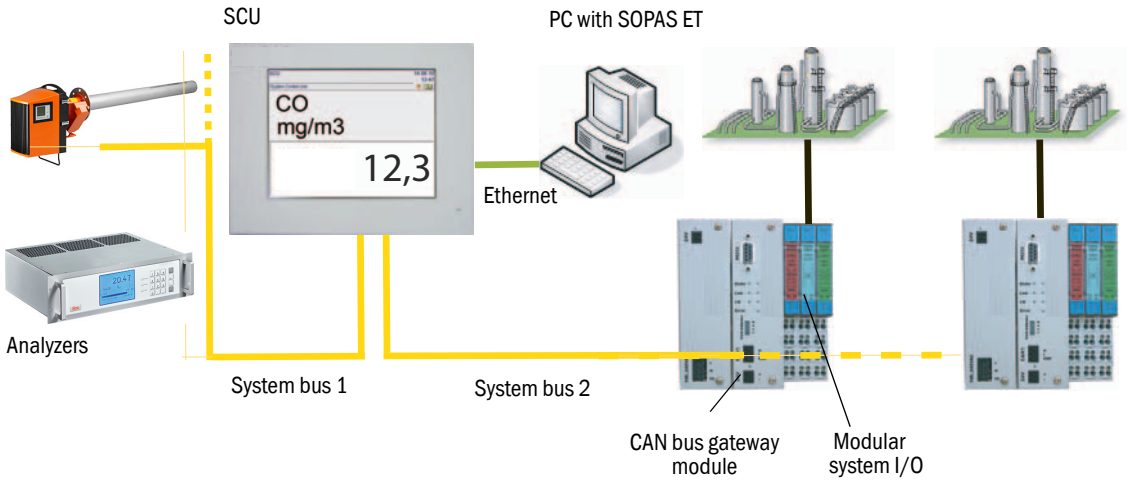
- Control, parameter setting and display.
- Process and save measured values.
- Remote diagnosis.

The SCU is connected with the analyzers via a system bus.

The SCU is operated via a touchscreen or a PC.

Further information on the SCU → “SCU” Operating Instructions

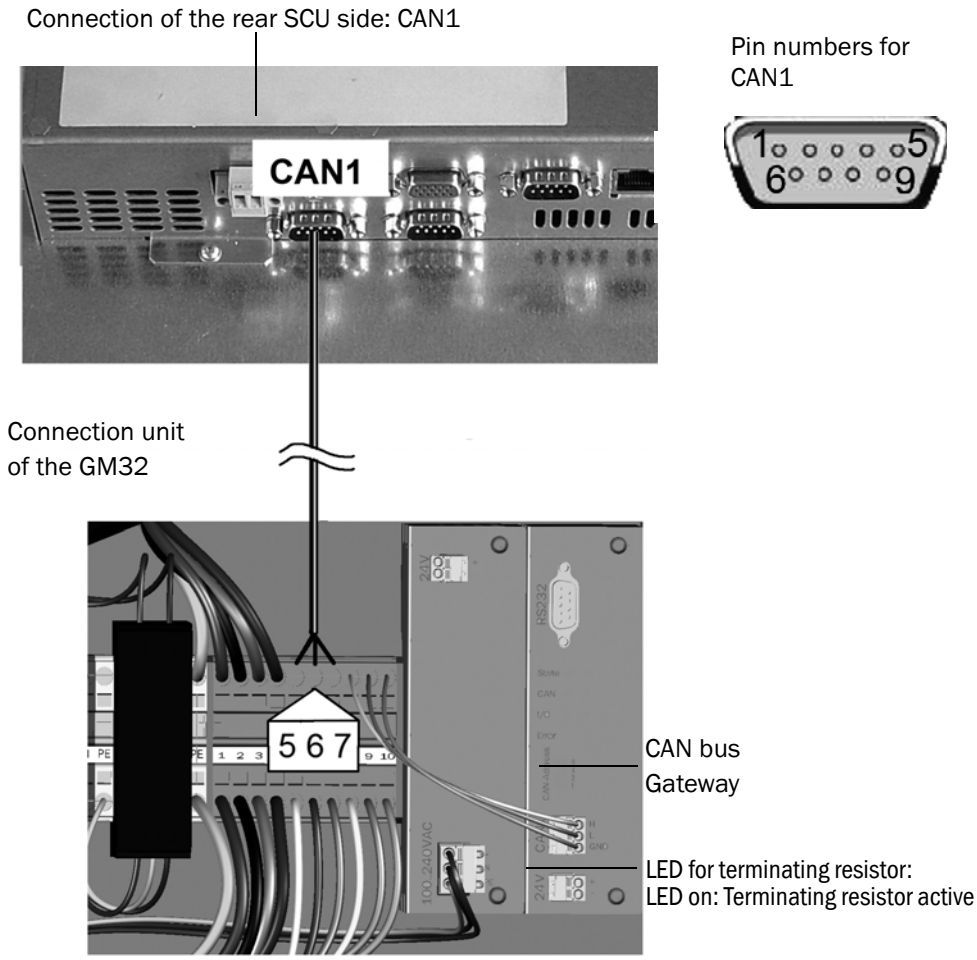
Fig. 7 SCU concept



## 3.3 Connecting the GM32 to the CAN bus and to the SCU

Connection of the GM32 to the CAN bus, here as example to the SCU.

Fig. 8 Example: CAN connection of the SCU to the GM32




- Terminal assignment:

| CAN designation | Terminal in GM32 connection unit | Pin on CAN1 of SCU |
|---|---|---|
| CAN H | 5 | 7 |
| CAN L | 6 | 2 |
| gnd | 7 | 3 |
| Shield on PE | | |

### 3.3.1 Settings in GM32

*Menu: Parameter/Device Parameter* (→ p. 34, §4.2.3.1)

Valid for the CAN interface to SCU.

- Address for SCU interface: 17 (preset for 1 device)
  (range available for further devices: 16, 18, .. 31)
- Baudrate: 125 (preset)

### 3.3.2 Settings in the SCU

- Set in the SCU (→ Operating Instructions of the SCU):
  - Baudrate: Corresponding to the GM32 setting
  - CAN: 1 (always)

## 3.4 Mapping Table

### Measured values on SCU – Measured value (MV)

| Index | Measured value |
|---|---|
| MV01..MV16 | Identifiers are defined during calibration.<br>Maximum 14 gases + temperature and pressure.<br>Physical unit: mg/m$^3$ operation |

| Version | MV01 | MV02 | MV03 | MV04 | MV05 |
|---|---|---|---|---|---|
| All | | | | | |
| GM32-1 | $SO_2$ | | | | |
| GM32-2 | $SO_2$ | NO | $NO_x$ | | |
| GM32-3 | $SO_2$ | NO | $NO_2$ | $NO_x$ | |
| GM32-4 | NO | $NO_x$ | | | |
| GM32-5 | $SO_2$ | NO | $NH_3$ | $NO_x$ | |
| GM32-6 | NO | $NO_2$ | $NH_3$ | $NO_x$ | |
| GM32-7 | NO | $NO_2$ | $NO_x$ | | |
| GM32-8 | NO | $NO_2$ | $NO_x$ | | |
| GM32-9 | $SO_2$ | NO | $NO_2$ | $NH_3$ | $NO_x$ |
| TRS[1] | $H_2S$ | | | | |
| | TRS | | | | |
| | $H_2S$ | $SO_2$ | NO | | |
| | TRS | $SO_2$ | NO | | |
| | $H_2S$ | $SO_2$ | NO | $NH_3$ | |
| | TRS | $SO_2$ | NO | $NH_3$ | |
| | TRS | $H_2S$ | MMK, DMDS, DMS, $SO_2$, NO, $NH_3$ | | |

1 Measured value assignment depending on configuration

### Control values on SCU – Monitor values (MO)

| Index | Control value |
|---|---|
| MO01..MO16 | Monitor value 1 = zero from MV01<br>Monitor value 2 = range from MV01<br>Monitor value 3 = zero from MV02<br>Monitor value 4 = range from MV02<br>....<br>Monitor value 27 = zero from MV14<br>Monitor value 28 = range from MV14 |

### Help values from SCU to GM32 - Help value (HV)

| Index | Reference value |
|---|---|
| HV01 | Temperature [K] |
| HV02 | Pressure [hPa] |

### GM32 operating mode – State (S)

| Index | Operating mode |
|---|---|
| S01 | Initialization |
| S02 | Measuring |
| S03 | Maintenance |
| S04 | RCycle |
| S05 | CCycle |
| S06 | ZeroAdjust |
| S07 | Alignment |
| S08 | Boxmeasuring |
| S09 | Restart |

### GM32 status (F, M, U, C, E)

| Index | Diagnostic message |
|---|---|
| F01..F64 | Failure |
| M01..M32 | Maintenance |
| U01..U08 | Uncertain |
| C01..C08 | Check |
| E01..E16 | Extended |

### Status of measured values (MV)

| Index[1] | Diagnostic message |
|---|---|
| MVxxF01..F64 | Failure |
| MVxxM01..M08 | Maintenance |
| MVxxU01..U16 | Uncertain |
| MVxxC01..C08 | Check |
| MVxxE01..E32 | Extended |

[1] xx = 1..16

GM32

# 4 Operation (Specialist Menus)

SOPAS ET
Menus

## 4.1 SOPAS ET (description)

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

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

SOPAS is based on the following techniques:

- Device communication via Ethernet (TCP/IP).
- Common engineering tool for various product lines.
- Universal device description file as data source for all relevant device data and parameters required for communication and display.
- Interfaces for direct communication with analyzers or SCU.

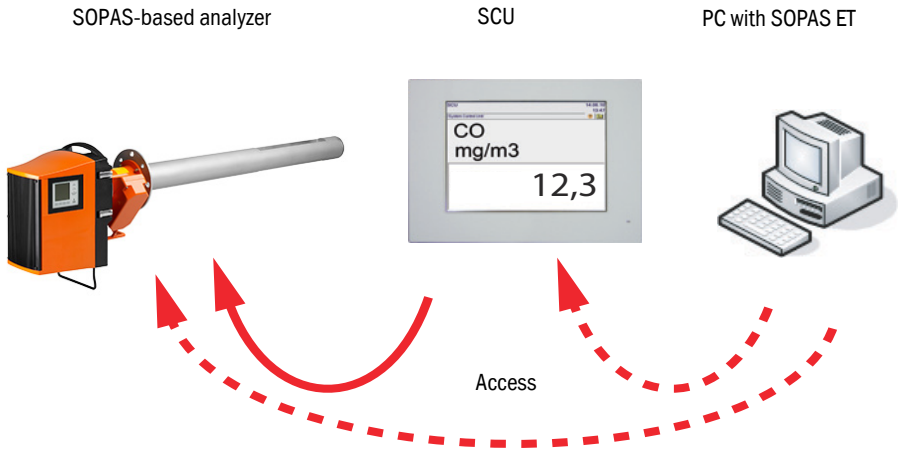
**Methods for accessing SOPAS-based analyzers**

- Via the SCU operating unit (→ p. 23, §3.2).
- Via a PC with the program (Engineering Tool) SOPAS ET

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

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

Fig. 9 SOPAS system concept



## 4.2 Menu tree (in SOPAS ET)

| GM32 | Reference | Level[1] |
|---|---|---|
| Measured values | → p. 33, § 4.2.2 | A |
| Bargraph measured values | → p. 33, § 4.2.2.1 | A |
| Parameters | → p. 34, § 4.2.3 | A |
| Device parameters | → p. 34, § 4.2.3.1 | A |
| Spectrometer | → p. 35, § 4.2.3.2 | S |
| Spectral analysis | ---[2] | S |
| Coefficients | → p. 35, § 4.2.3.3 | A |
| Coefficients boxmeasuring | → p. 36, § 4.2.3.4 | S |
| Check cycle | ---[2] | S |
| Adjustment sensor | → p. 36, § 4.2.3.5 | S |
| Mirror tracking | ---[2] | S |
| Data storage | ---[2] | S |
| Logbook configuration | → p. 37, § 4.2.3.6 | S |
| Analog output | → p. 38, § 4.2.3.7 | A |
| Analog input | → p. 38, § 4.2.3.8 | A |
| Digital input | → p. 39, § 4.2.3.9 | A |
| Digital output | → p. 39, § 4.2.3.10 | A |
| Hardware Map | → p. 41, § 4.2.3.11 | S |
| Options | ---[2] | S |
| Adjustment | → p. 42, § 4.2.4 | A |
| Alignment | → p. 42, § 4.2.4.1 | A |
| Zero adjust | → p. 43, § 4.2.4.2 | S |
| Boxmeasuring | → p. 44, § 4.2.4.3 | A |
| Diagnosis | → p. 45, § 4.2.5 | A |
| Device information | → p. 45, § 4.2.5.1 | A |
| Software versions | ---[2] | S |
| Logbook | → p. 45, § 4.2.5.2 | A |
| Check cycle | → p. 47, § 4.2.5.3 | A |
| Check values Service | ---[2] | S |
| Sensor values | → p. 47, § 4.2.5.4 | A |

[1] A = user level “Authorized user”.
S = user level “Service”.

[2] Not described in this Manual. Please contact SICK Customer Service.

| | | | |
|---|---|---|---|
| — ---- Maintenance | → p. 56, § 4.2.6 | A |
| ¦ ¦-- Operating mode switch | → p. 56, § 4.2.6.1 | A |
| ¦ ¦-- Lamp hour meter | → p. 56, § 4.2.6.2 | A |
| ¦ ¦-- Save EEPROM | → p. 57, § 4.2.6.3 | A |
| ¦ ¦-- Load EEPROM | → p. 57, § 4.2.6.4 | A |
| ¦ ¦-- Save software debug | ---[2] | S |
| ¦ ¦-- Reset parameter | ---[2] | S |
| ¦ '-- Service log | ---[2] | S |
| ¦ Maintenance Functions | ---[2] | S |
| — ---- Start-up Assistant | → p. 57, § 4.2.7 | S |

### 4.2.1 Changing the user level

The menu tree shown above is the structure for user level “Authorized user” and “Service”.

► Enter a password for the corresponding user level:

| User level | Password |
|---|---|
| Authorized client | HIDE[1] |
| Service | GM32SERVICE |

1 Upper case mandatory

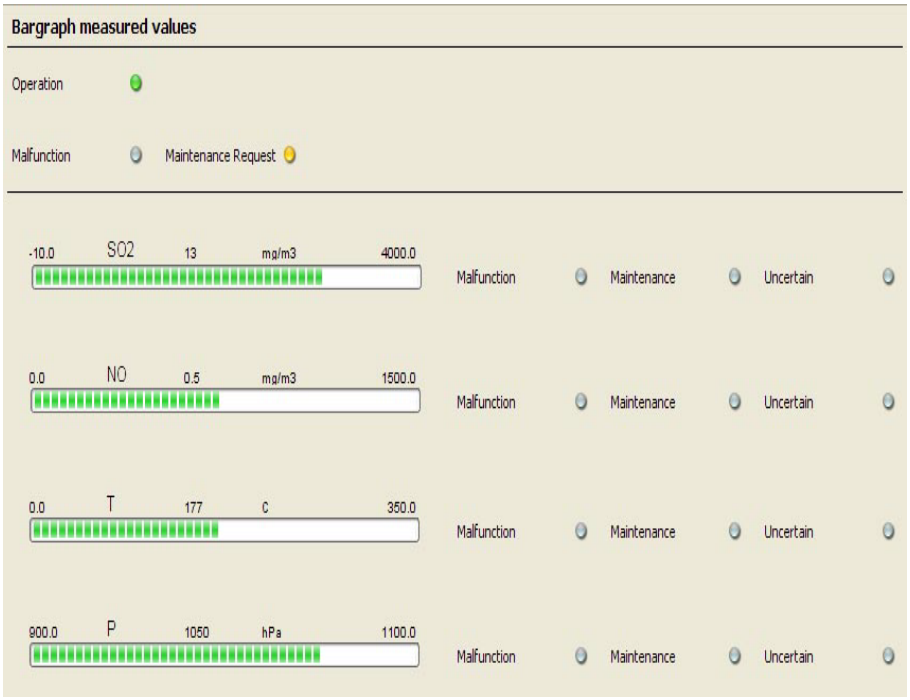
## 4.2.2 Measured values

### 4.2.2.1 Bargraph measured values

*Menu: GM32/Measured values/Bargraph measured values*

This menu shows:

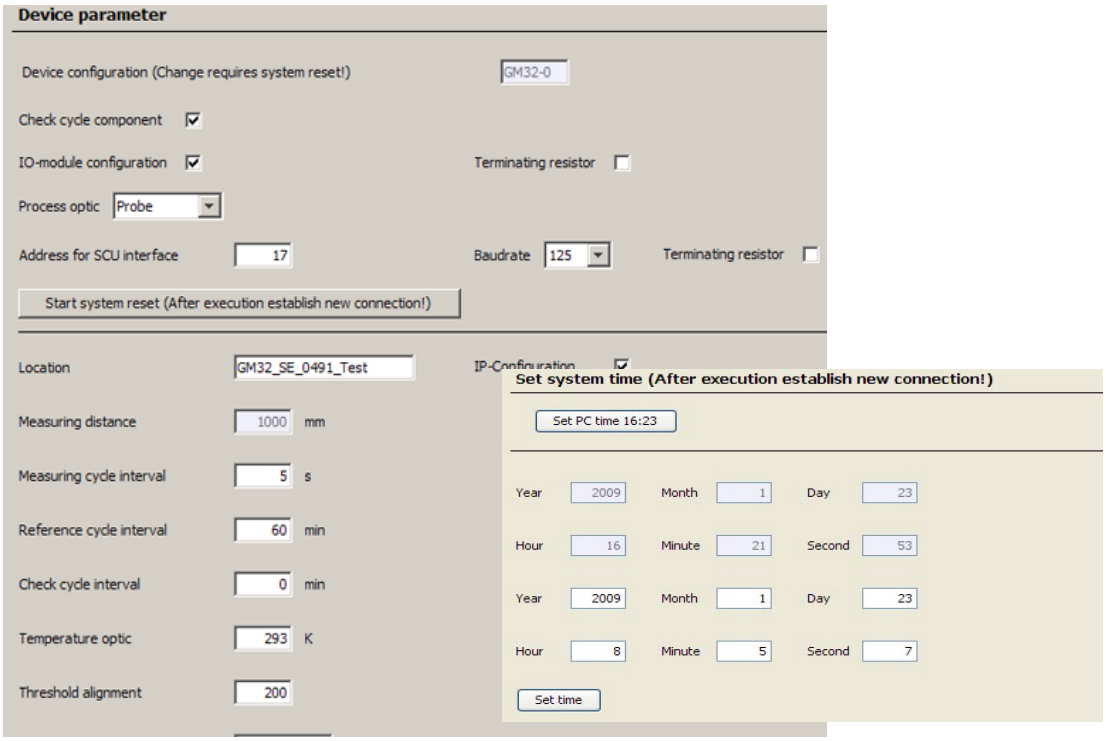
- Measured values
  The measured value display can be configured. It is defined by the assignment of analog inputs.
- Operating mode of the analyzer
- Operating mode of the components
- Current sample gas pressure
- Current sample gas temperature



## 4.2.3 Parameters

### 4.2.3.1 Device parameters

*Menu: GM32/Parameter/Device parameter*



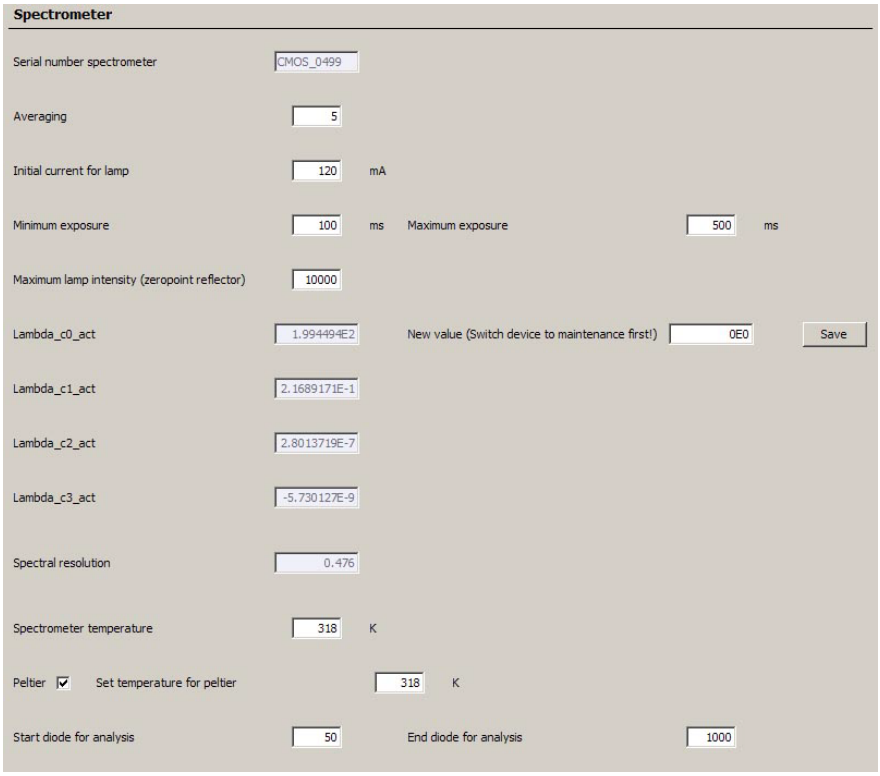

- Check cycle component: Checkmark: Check cycle component installed.
- I/O module configuration: Checkmark: I/O module installed.
- Terminating resistor (for the CAN bus to the I/O modules):
  - Checkmark set: Terminating resistor will be fitted (physically).
  - Checkmark not set: No terminating resistor fitted.
- Process optic :
  - No device: Probe installed without CAN bus
  - Probe: Probe installed with CAN bus
  - CD: Cross Duct version
- Address for SCU interface
- Baud rate
- Terminating resistor (for CAN interface to SCU):
  - Checkmark set: Terminating resistor will be fitted (physically).
  - Checkmark not set: No terminating resistor fitted.
- Location designation.
- IP-Configuration (checkmark): IP address change allowed / not allowed.
- Address for SCU interface (only when SCU used): Default: 17.
- Measuring distance: Active measuring path. The measuring path is read in from the probe via the CAN bus).
- Measuring cycle interval: Default: 5 s.
- Reference cycle interval: Interval for the reference cycle.
  Default 60 min. (change only possible for user level “*Service*”).
- Check cycle interval: Interval for the check cycle.
  0 min. means: Switched off (change only possible for user level “*Service*”).

- Temperature optic: Default 323 (change only possible for user level “*Service*”).
- Threshold alignment: No alignment below this value (editing only possible for user level “*Service*”).
- Set time: Clicking “Set time” triggers a system reset.
  Reconnect to analyzer again afterwards.

All parameters can only be set with user level “*Service*” (exception: Time).

### 4.2.3.2 Spectrometer

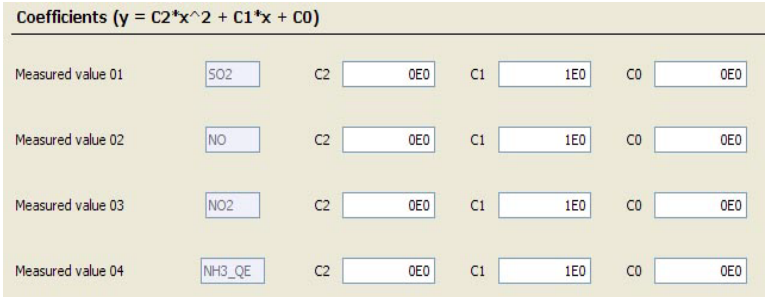
*Menu: GM32/Parameter/Spectrometer*




- Internal parameters of the spectrometer (change only possible with user level “*Service*”).

### 4.2.3.3 Coefficients

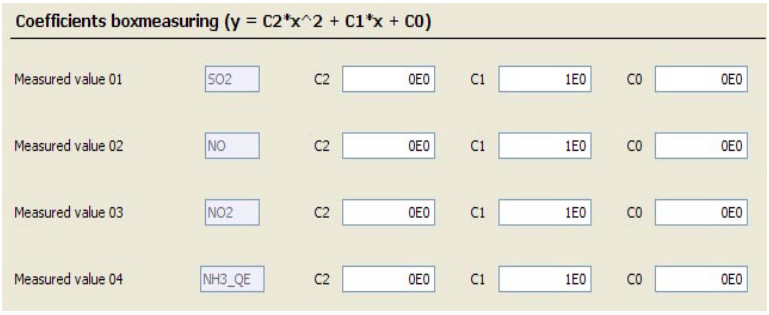
*Menu: GM32/Parameter/Coefficients*




- Polynomial to adapt measured values.

#### 4.2.3.4 Coefficients boxmeasuring

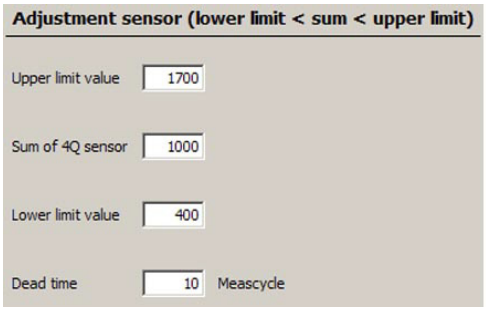
*Menu: GM32/Parameter/Coefficients boxmeasuring*




- Polynomial to adapt measured values to the filter box (change only possible with user level “*Service*”).

#### 4.2.3.5 Adjustment sensor

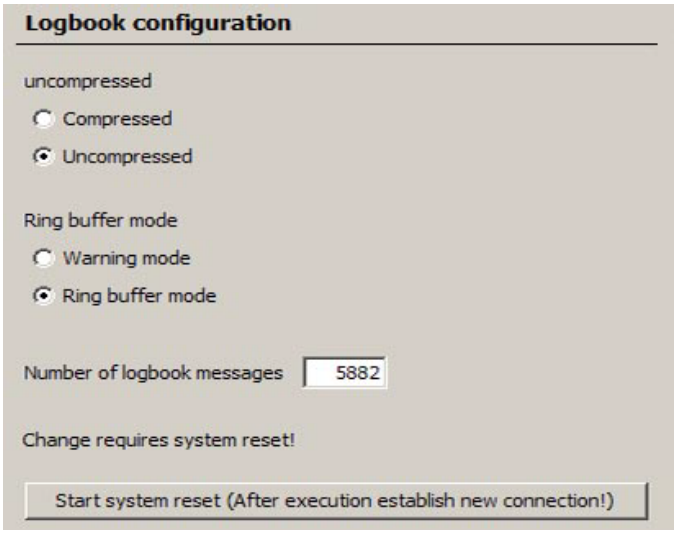
*Menu: GM32/Parameter/Adjustment sensor*




- Internal parameters of sensor alignment (change only possible with user level “*Service*”).

### 4.2.3.6 Logbook

*Menu: GM32/Parameter/Logbook configuration*




- This menu serves to set the logbook parameters (change only possible with user level "*Service*").

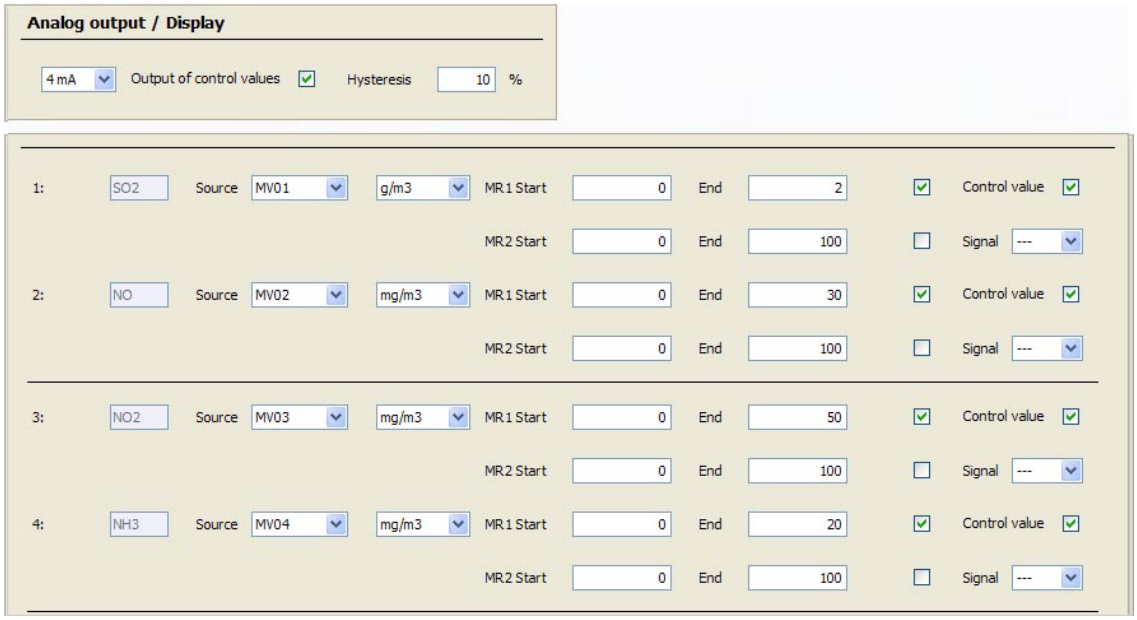
Changing the setting deletes the logbook contents.

| Input line | Remark |
|---|---|
| uncompressed<br>- Compressed<br>- Uncompressed | When an error occurs:<br>- An error counter is incremented.<br>- The error message is saved. |
| Ring buffer mode<br>- Warning mode<br>- Ring buffer mode | When the logbook buffer is full:<br>- The message "*Logbook error*" is output and no further entries are saved.<br>- The oldest entries are overwritten with the current entries.<br>*No* relevant message is displayed. |
| Number of logbook messages | Number of logbook entries |

### 4.2.3.7 Analog outputs

*Menu: GM32/Parameter/Analog output / Display*

Parameter settings for the analog outputs are also used to scale the measured value display (on the operator panel and in SOPAS ET).




- Electrical zero point “Live Zero”: 0 or 4 mA
- Output of control values after check cycle. Checkmark: Yes
  Zero and control values are output after the check cycle:
  - First of all the zero value for 90 seconds
  - Then the control value for 90 seconds.
- Hysteresis: Threshold for switching from measuring range 1 to measuring range 2, or vice-versa.
- Source: The signal source is defined during the factory calibration.
- Physical unit
- Start/End: Calibrated measuring range 1 or measuring range 2.
- Signal: Digital output on which measuring range 2 is signaled.
- Control value output can be activated or deactivated individually for each of the 16 analog outputs.
  Control value: Checkmark means: Output the control value for this channel.

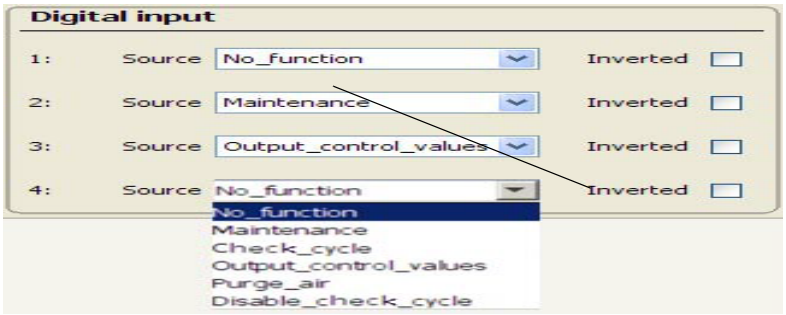
### 4.2.3.8 Analog inputs

*Menu: GM32/Parameter/Analog input*


- Signal sources for measured variables temperature T / pressure P)
- Physical unit of the measured variable
- Electrical zero point “Live Zero”: 0 or 4 mA
- Analog input range for signal source: Start / End

#### 4.2.3.9 Digital inputs

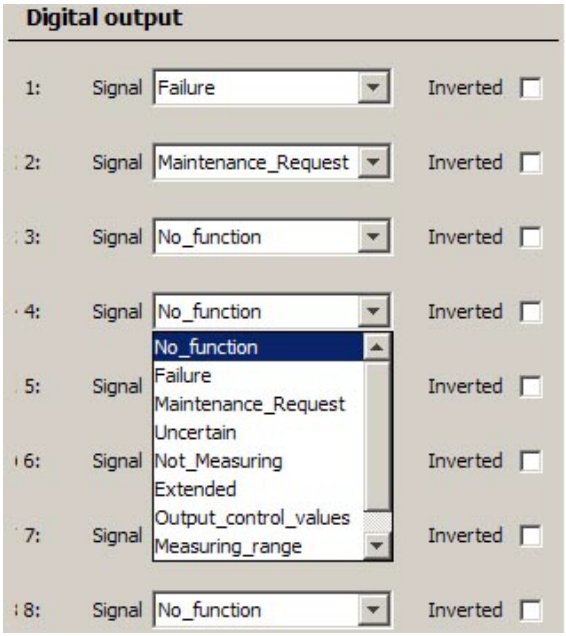
*Menu: GM32/Parameter/Digital input*




| Source | Action |
|---|---|
| Check_cycle | Triggers operating mode switch to “Check cycle” |
| Disable_check_cycle | Suppresses the check cycle |
| Maintenance | Triggers operating mode switch to “Maintenance” |
| No_function | No function assigned |
| Output_control_values | Outputs control values |
| Purge_air | Purge air monitoring |
| Inverted | Inverts the signal |

#### 4.2.3.10 Digital outputs

*Menu: GM32/Parameter/Digital output*




| Signal | Cause |
|---|---|
| Failure | A malfunction has occurred |
| Maintenance_Request | A maintenance request is available |
| Uncertain | The GM32 is in an indefinite state |
| Not_measuring | Zero adjust is running<br>Check cycle is running<br>Operating mode ”*Maintenance*”<br>Operating mode ”*Boxmeasuring*” (filter box measurement) |

| Signal | Cause |
|---|---|
| Extended | A message is available |
| Output_control_values | Outputs control values |
| Measuring_range | Outside measuring range |
| Purge air failure | Error in purge air supply |
| No_function | No function assigned |
| Inverted | Inverts the signal |

### 4.2.3.11 Hardware Map

*Menu: GM32/Parameter/Hardware Map*

This menu serves to enter the I/O modules in the sequence (left to right) in which they have been installed in the connection unit (→ connecting diagram).

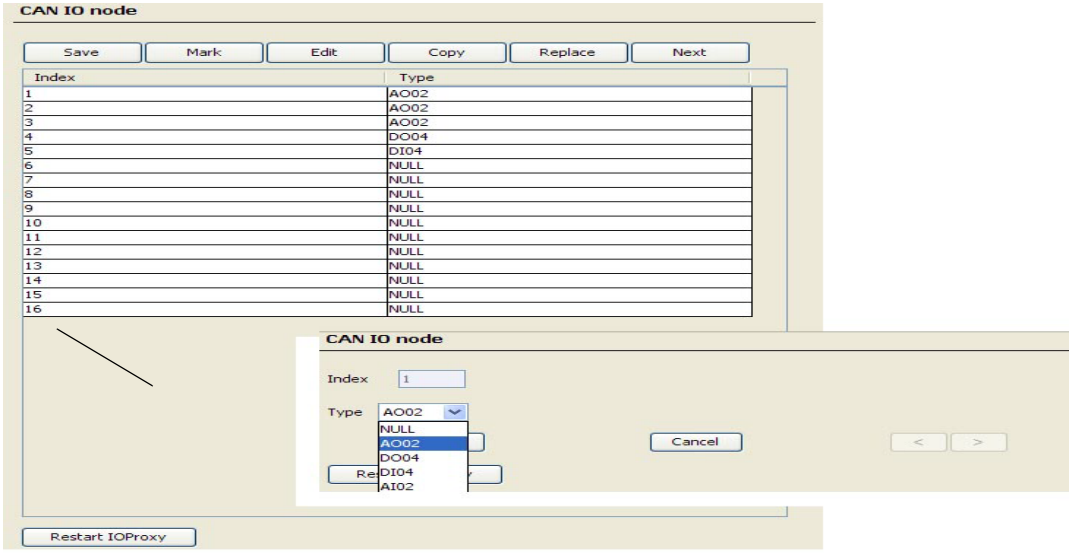



Table 2 Module Table

| Module | Description |
|---|---|
| AO02 | 2 analog outputs |
| AI02 | 2 analog inputs |
| DO04 | 4 digital outputs |
| DI04 | 4 digital inputs |

1 Enter modules.
Line 1: Module 1
Line 2: Module 2
etc.

2 Use *"Edit"* to enter installed modules in the corresponding line.
Example: The first module is an *"AO02"* module.

3 *"Save"*.

4 Store the modules with *"Restart IOProxy"*.

## 4.2.4 Adjustment

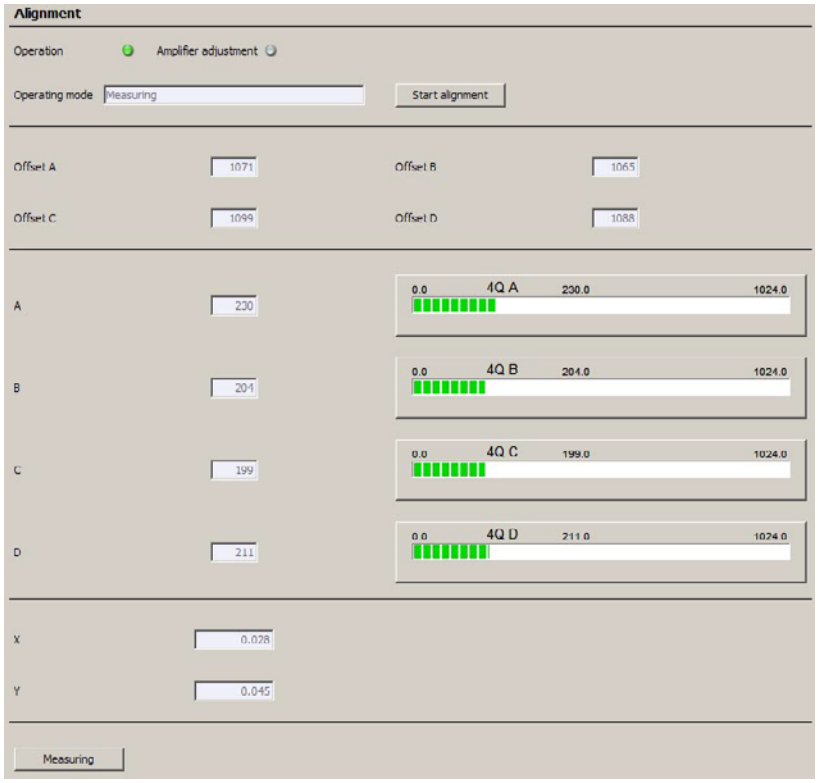
### 4.2.4.1 Alignment

*Menu: GM32/Adjustment/Alignment*

This menu serves to align the optics system.

The L adjustment of the device flange is used for optical alignment.

For further information on optical alignment → GM32 Operating Instructions

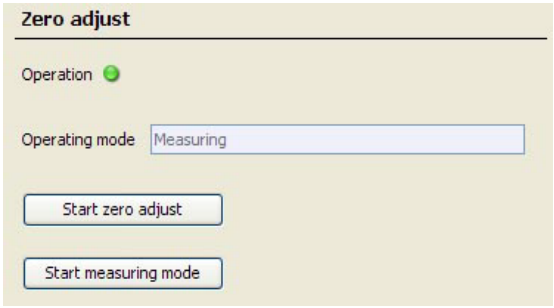



1 *"Start alignment"*
Measuring operation is suspended during alignment.
Tolerances:
X: ±0.05
Y: ±0.05

2 Click "*Measuring*" after completing alignment.

### 4.2.4.2 Zero adjust (Service level only)

*Menu: GM32/Adjustment/Zero adjust*




Zero adjust description → p. 12, §2.3

The GM32 must be at operating temperature.
► Otherwise observe the 2 hour warm-up time.

Zero adjust is relative to the composition of the gas currently in the measuring path.
● Inert gas must be in the active measuring path

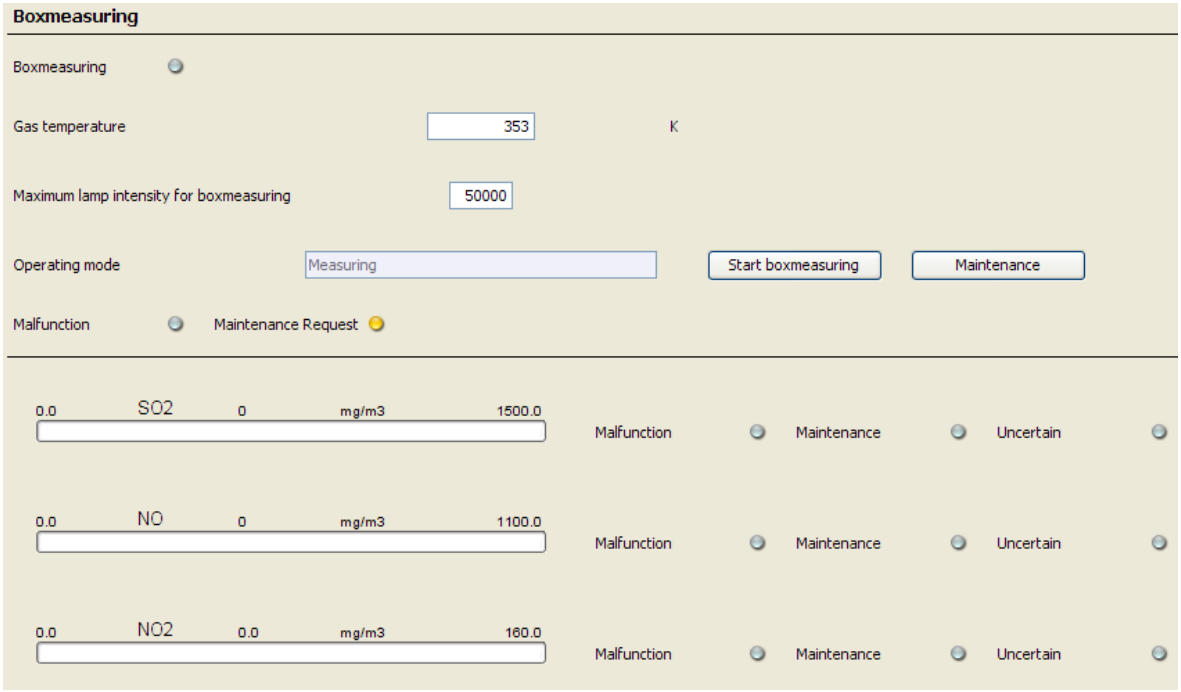
Zero adjust takes about 5 minutes.

The GM32 switches to operating mode “*Maintenance*”.

“*Start measuring mode*” automatically starts a reference cycle.
The GM32 then switches to operating mode “*Measuring*”.

### 4.2.4.3 Boxmeasuring (Service level only)

*Menu: GM32/Adjustment/Boxmeasuring*

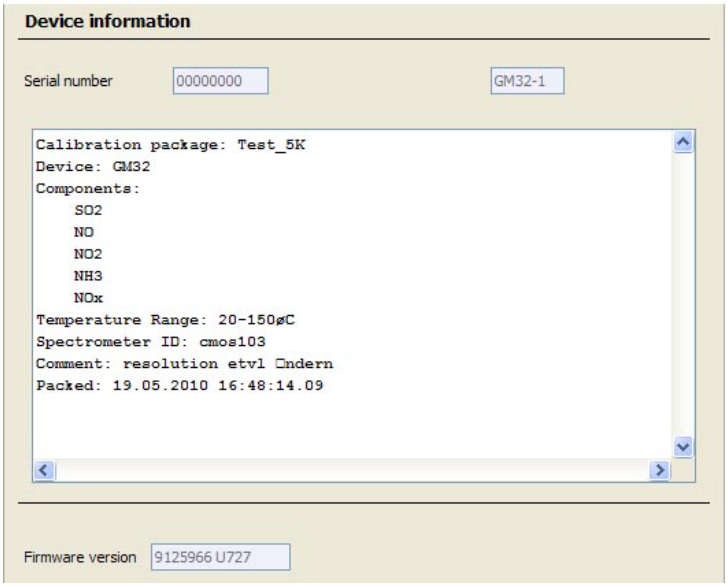



Boxmeasuring description → p. 68, § 5.2

## 4.2.5 Diagnosis

### 4.2.5.1 Device information

*Menu: GM32/Diagnosis/Device information*

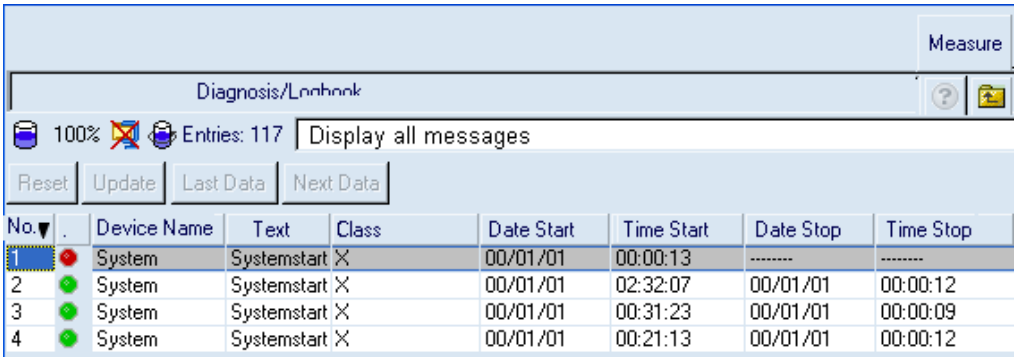



### 4.2.5.2 Logbook

*Menu: GM32/Diagnosis/Logbook*

Max. number of entries: 6000.

(Representation: Uncompressed data storage)




| Designation | Remark |
|---|---|
|  | Fill level of logbook in %.<br>When the characters are *red*: The logbook is full.<br>Warning mode: Further entries are not accepted.<br>Ring buffer mode: Oldest entries are overwritten. |
|  | Data storage:<br>Symbol *not crossed out*: Compressed.<br>Symbol *crossed out*: Uncompressed.<br><br>Significance and default: → p. 37, §4.2.3.6 |
|  | Ring buffer mode<br><br>Warning mode<br><br>Significance and default: → p. 37, §4.2.3.6 |
| Entries | Number of entries of selected filter. |

| Designation | Remark |
|---|---|
| Filter for messages | Only the filtered messages are shown.<br>- Show active failures<br>- Show all failures<br>- Show active maintenance request<br>- Show all maintenance requests<br>- Show active uncertain<br>- Show all uncertain<br>- Show active extended messages<br>- Show all extended messages<br>- Show active messages<br>- Show all messages<br>Classification → Further on in this Table. |
| Reset | Clear all entries. |
| Export<br>(Only in SOPAS ET) | All entries selected via the filter (→ Further back in this Table) are saved on the PC as .log file.<br>Format: CSV (comma-separated list). Can be read in EXCEL, for example. |
| Update | Update display of logbook entries. |
| Last Data | Scroll back. |
| Next Data | Scroll forward. |
| ▲▼ | Sort in ascending/descending order.<br>To switch sorting on or change sequence: Click column header. |
|  | Current number of message.<br>*Red* LED: Message still pending.<br>*Green* LED: Message no longer pending. |
| Device Name | Activating element: System, measured value identifier (sample gas component), subassembly, Evaluation module |
| Entries[1] | Number of times errors have occurred.<br>Significance and default value: (→ p. 37, § 4.2.3.6) |
| Text | Logbook message. |
| Class | F = Failure<br>M = Maintenance request<br>C = Check<br>U = Uncertain<br>X = Extended message / extended |
| Date Start | Format: yy-mm-dd<br>For "*Uncompressed*": Occurrence of message.<br>For "*Compressed*": Last occurrence of message. |
| Time Start | Format: hh:mm:ss<br>For "*Uncompressed*": Occurrence of message.<br>For "*Compressed*": Last occurrence of message. |
| Date Stop | Format: yy-mm-dd<br>For "*Uncompressed*": Clearing of message.<br>For "*Compressed*": Last clearing of message. |
| Time Stop | Format: hh:mm:ss<br>For "*Uncompressed*": Clearing of message.<br>For "*Compressed*": Last clearing of message. |

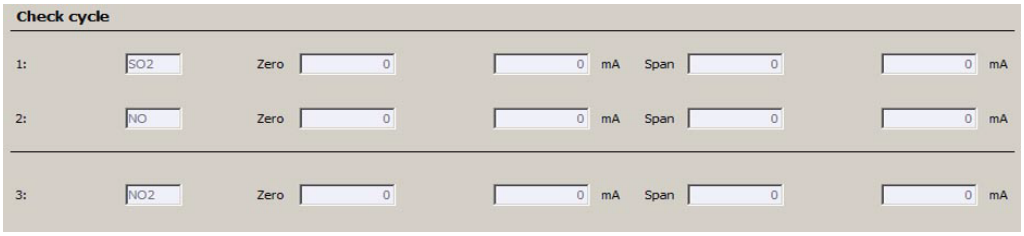
[1] Only for compressed data storage

### 4.2.5.3 Check cycle

*Menu: GM32/Diagnosis/Check cycle*

The check cycle values are the values measured during the last check cycle. "*Zero*" means no check cycle has been performed yet.

The check values are set to "*Zero*" during a restart.



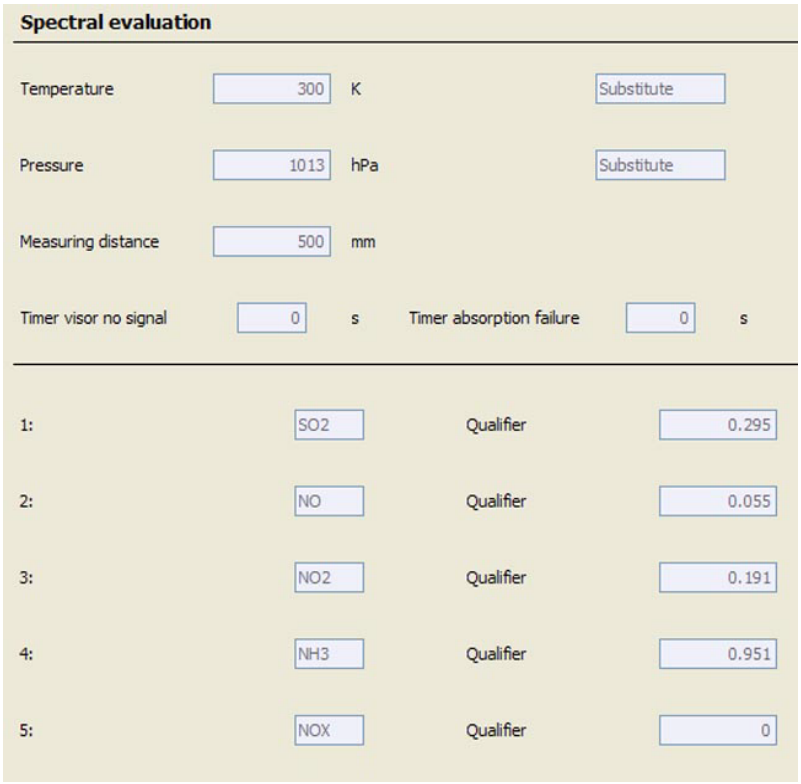

- Zero: Zero point as physical and current value
- Span: Control point as physical and current value relative to the upper measuring range value

### 4.2.5.4 Sensor values

*Menu: GM32/Diagnosis/Sensor values*

#### Spectral analysis

*Menu: GM32/Diagnosis/Sensor values/Spectral evaluation*

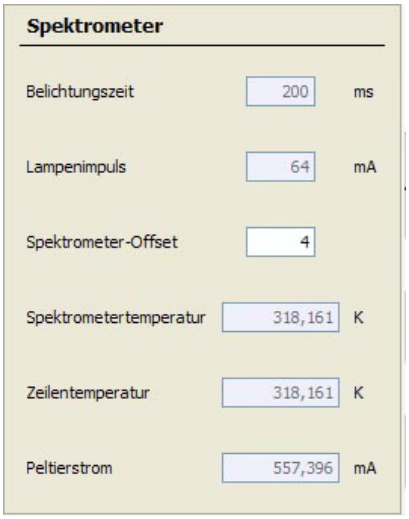



- Sources and values for spectral evaluation

### Spectrometer

*Menu: GM32/Diagnosis/Sensor values/Spectrometer*

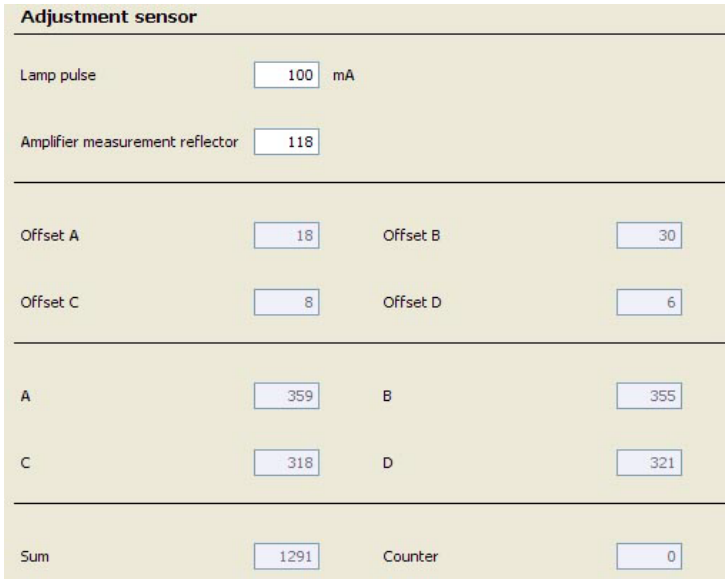
Spectrometer values from last reference cycle.




### Adjustment sensor

*Menu: GM32/Diagnosis/Sensor values/Adjustment sensor*

Limit values for lamp pulse and amplification settings are entered in the *Parameter/Adjustment sensor* menu (→ p. 36, § 4.2.3.5).

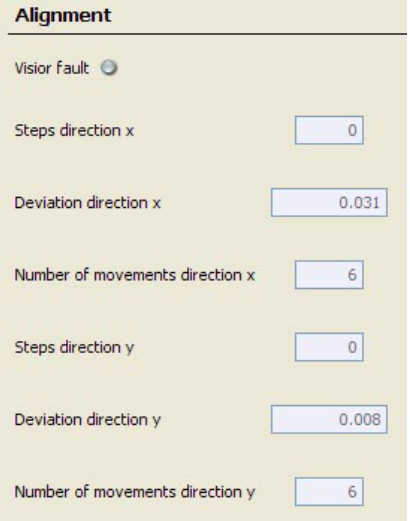



- Lamp pulse: Lamp pulse current during the 4 quadrant measurement. Changes depending on the total from the 4 quadrants.
  Criterion: Amplifier measurement reflector at 255.
- Amplifier measurement reflector: Amplification of the 4 quadrant measurement. Changes depending on the total of the 4 quadrants (max. 255).
- Offset: Offsets are determined during the check cycle or after amplifier switching.
- A .. D, Sum: Current signals.
- Counter: Delay time before correction made.

### Mirror tracking

*Menu: GM32/Diagnosis/Sensor values/Alignment*

Current values from alignment.

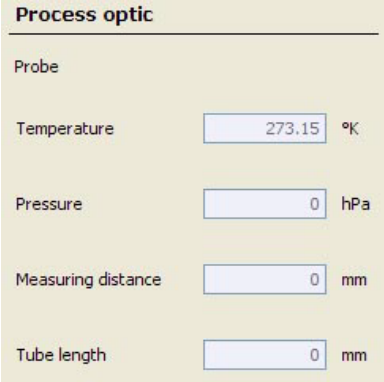



A device restart sets the number of movements to zero.

### Process optic

*Menu: GM32/Diagnosis/Sensor values/Process optic*

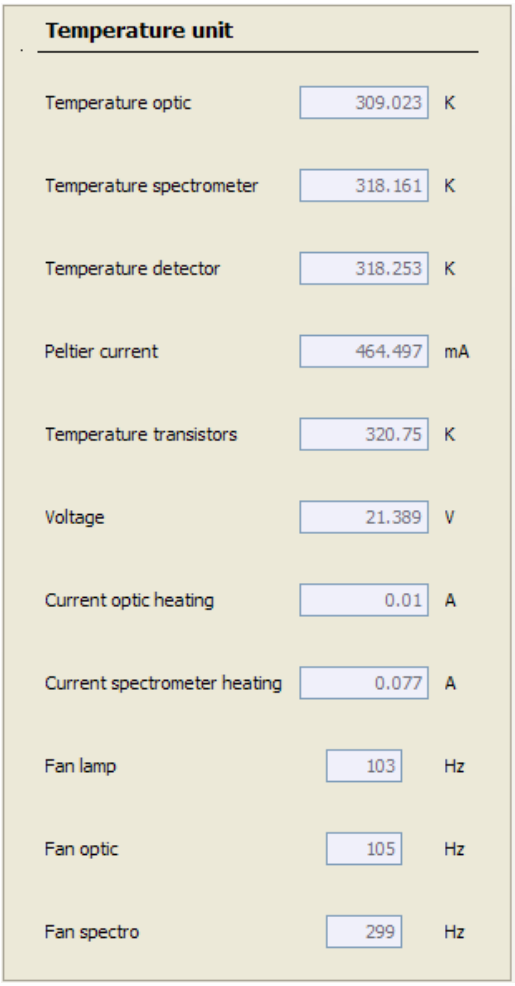
Current analyzer values



### 4.2.5.5 Temperature unit

*Menu: GM32/Diagnosis/Sensor values/Temperature unit*

Current analyzer values



4.2.5.6 **Spectra**

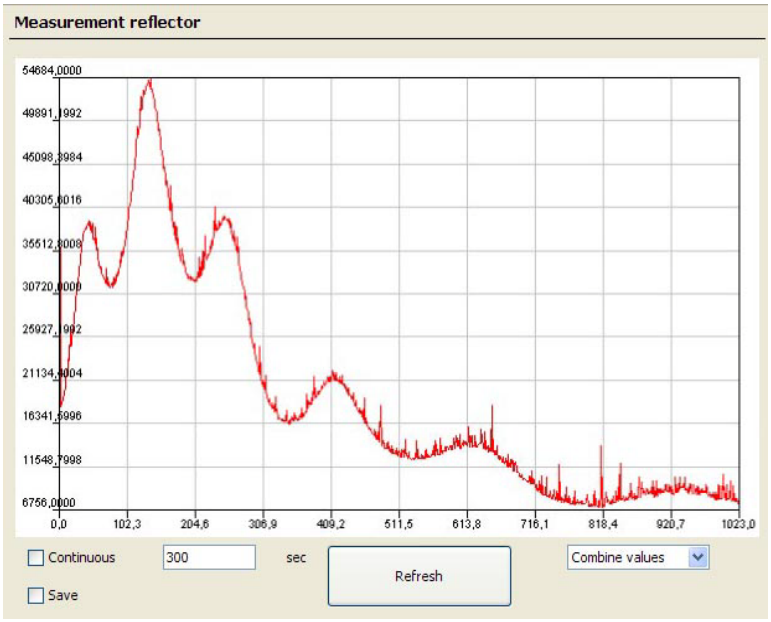
Significance of individual spectra fields:

| Field | Significance |
|---|---|
| Continuous | The displayed spectrum is continuously refreshed. |
| Time | Time interval of continuous display. |
| Record | Activates data recording<br>→ Enter name and location of file for data recording<br>→ Save |
| Refresh | Refresh spectrum. |
| Combine values<br>Show individual measured points | Combine measured value points (line display)<br>Show individual measured value points. |

Click two points in the spectrum to zoom sections of the spectrum.

**Measurement reflector**

*Menu: GM32/Diagnosis/Sensor values/Spectra/Measurement reflector*

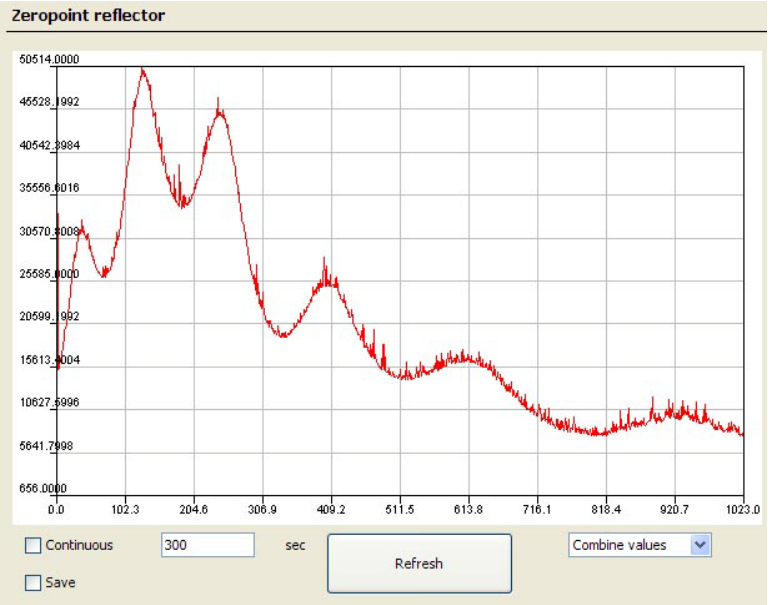



- Measurement reflector raw signal
- Maximum measurement reflector signal on the zero path: 45000 .. 50000 digits. Change with user level *Service* in menu *Parameter* → *Spectrometer* → *Maximum lamp intensity*.

### Zero point reflector

*Menu: GM32/Diagnosis/Sensor values/Spectra/Zeropoint reflector*

Raw signal measured on the zero point reflector. The nominal value corresponds to the maximum lamp intensity (→ p. 35, § 4.2.3.2).

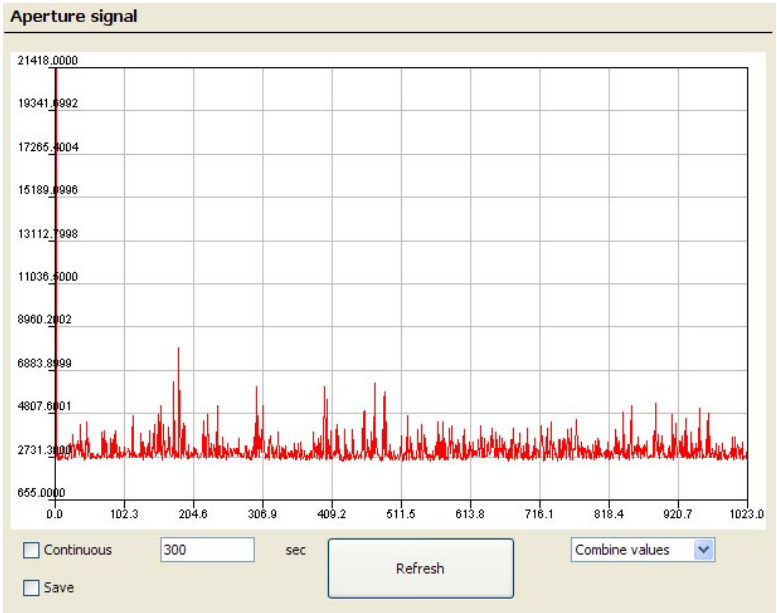



- Zero point reflector signal
- Change with user level *Service* in menu *Parameter → Spectrometer → Maximum lamp intensity*.

### Aperture signal (dark signal)

*Menu: GM32/Diagnosis/Sensor values/Spectra/Aperture signal*

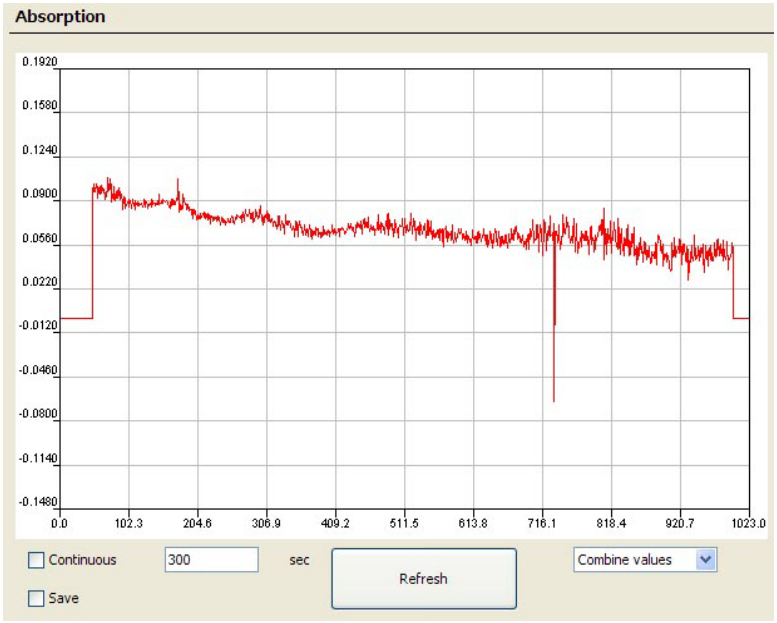
Measurement on blanking diaphragm. Only updated during the check cycle.



### Absorption

*Menu: GM32/Diagnosis/Sensor values/Spectra/Absorption*

Current absorption spectrum. A message is output when the warning or error threshold is exceeded (→ p. 35, § 4.2.3.3). Areas at start and end are masked out (→ p. 35, § 4.2.3.2).



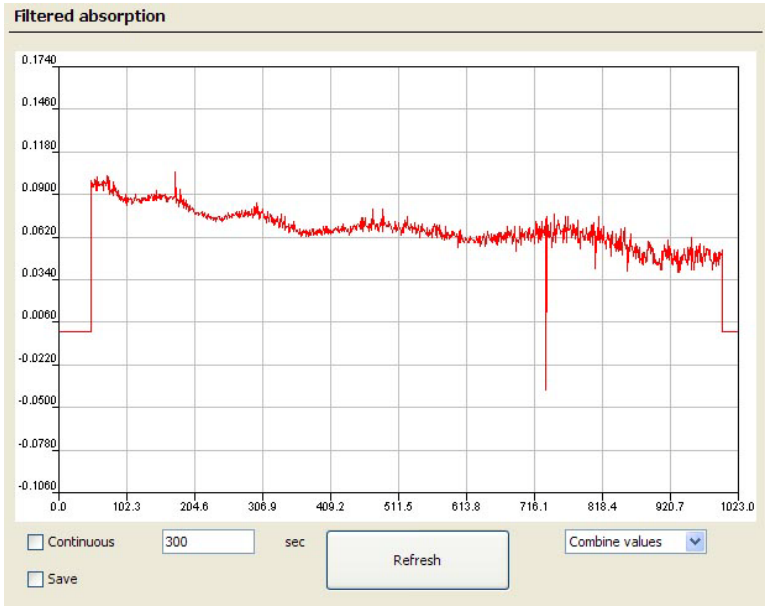

### Filtered absorption

*Menu: GM32/Diagnosis/Sensor values/Spectra/Filtered absorption*

Averaged absorption spectrum.

Preselected filter, e.g. IRR filter (infinite impulse response filter).

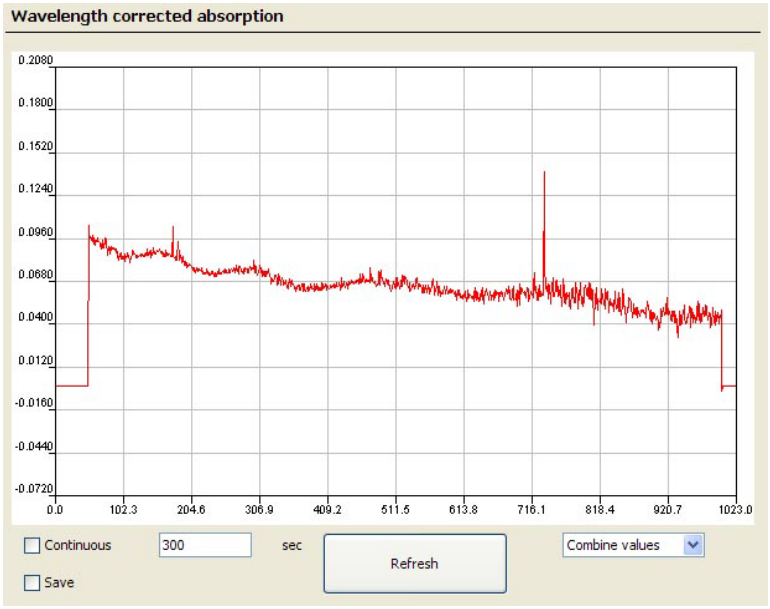
Menu */Parameter/Spectral alignment* serves to select the filter (only possible for user level "*Service*").



### Wavelength corrected absorption

*Menu: GM32/Diagnosis/Sensor values/Spectra/Wavelength corrected absorption*

Output of wavelength corrected absorption

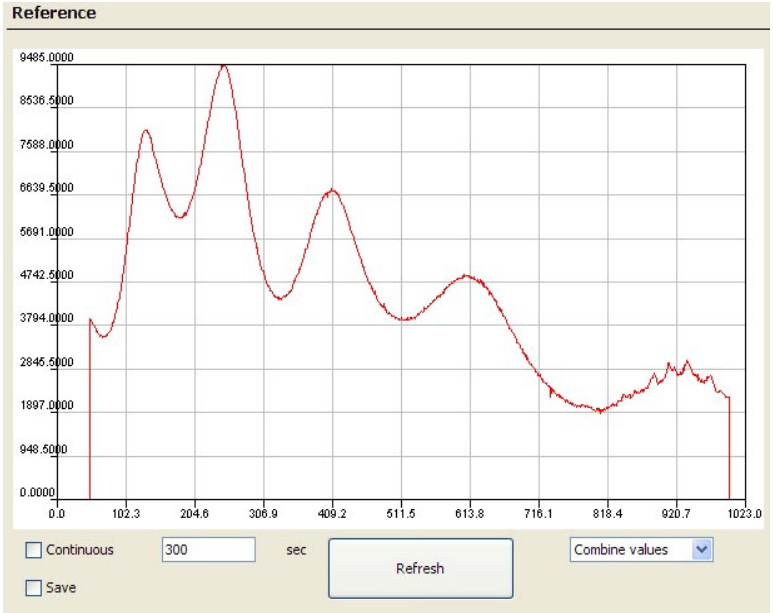



### Reference spectrum

*Menu: GM32/Diagnosis/Sensor values/Spectra/Reference*

This spectrum serves to calculate the absorption and shows the calculated spectrum on the measurement reflector on the smoke-free zero path.

Reference spectrum = (zero point reflector signal - aperture signal (dark signal)) * scaling constant.

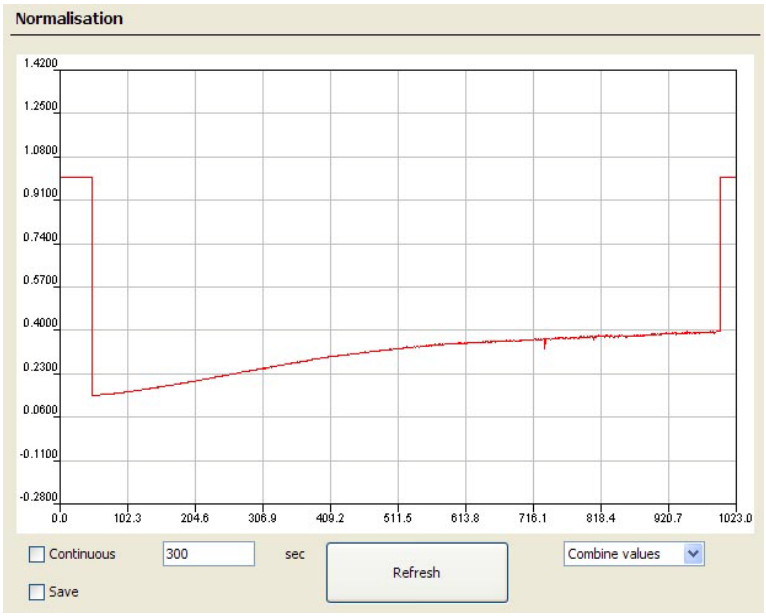


### Normalisation

*Menu: GM32/Diagnosis/Sensor values/Spectra/Normalisation*

Graphic representation of normalisation (constants for zero adjust).

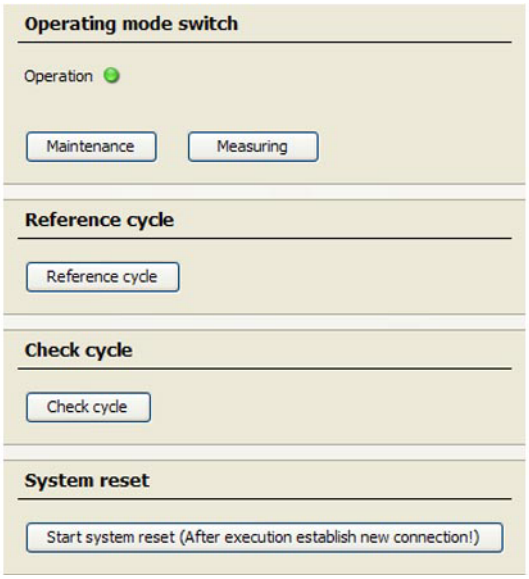
Normalisation must be between 0.8 and 5.



## 4.2.6 Maintenance

### 4.2.6.1 Operating mode switch

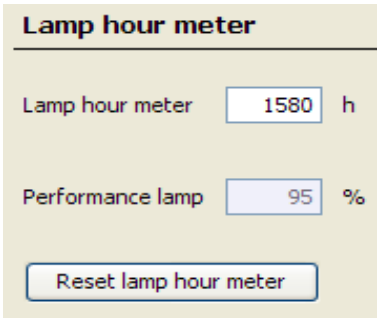
*Menu: GM32/Maintenance/Operating mode switch*




| Field | Significance |
|---|---|
| Operating mode | Displays the current operating mode. |
| Maintenance | Switches to operating mode “*Maintenance*”. |
| Measuring | Switches to operating mode “*Measuring*” |
| Reference cycle | Starts a reference cycle |
| Check cycle | Starts a check cycle |
| System reset | Resets the system.<br>Then reconnect SOPAS ET and GM32 again (→ p. 30, § 4.1). |

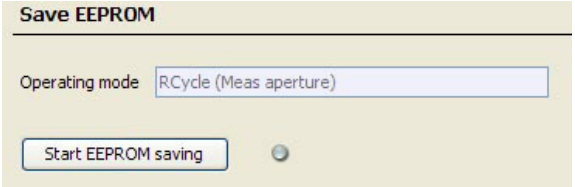
### 4.2.6.2 Lamp hour meter

*Menu: GM32/Maintenance/Lamp hour meter*



#### 4.2.6.3 Save EEPROM

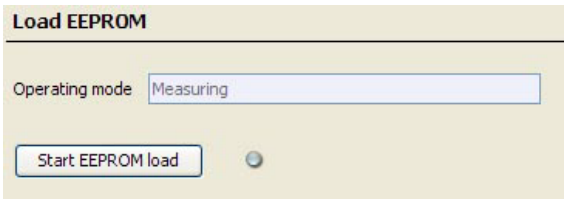
*Menu: GM32/Maintenance/Save EEPROM*




| Field | Significance |
|---|---|
| Start EEPROM saving | EEPROM contents (and therefore the parameters and adjust data) are stored on the Flashcard<br>*Attention*: Existing data are overwritten. |
| LED | Goes on when the storage process finishes. |

#### 4.2.6.4 Load EEPROM

*Menu: GM32/Maintenance/Load EEPROM*




| Field | Significance |
|---|---|
| Start EEPROM load | Loads EEPROM contents from the Flashcard.<br>This loads the parameters and adjust data. |
| LED | Goes on when the load process finishes. |

### 4.2.7 Start-up Assistant

*Menu: GM32/Start-Up Assistant*

The Start-up Assistant guides you through commissioning step by step.

*Criterion*: SOPAS ET as from Version 2.32

## 4.3 Program/data structure (“Firmware”, “Device description file”)

To load data to the GM32 analyzer:
► The GM32 analyzer can be accessed using the SCU (i.e. connect the laptop to the SCU and not to the electronic unit).

Login to SOPAS ET as “Service”.
To receive the password: Please contact SICK Customer Service.

### 4.3.1 Sequence of settings and file transfers

| Action | Imperative | Reference |
|---|---|---|
| Set the IP address of the SCU or analyzer. | - When the PCB console has been renewed.<br>- Direct access to SCU/GM32 analyzer.<br>- Login to a different network. | → p. 59, § 4.3.2 |
| Load firmware (.smf) | Install or update firmware on the GM32 analyzer / SCU.<br>This step also loads the device description file (.sdd). | → p. 60, § 4.3.3 |
| For SCU only:<br>Load device description file (.smu) | Load the SCU-specific device description file (representation adapted to the SCU display) to the SCU operator panel. | Can be loaded via SOPAS ET. |
| Load parameters (.sdv) | Load the parameters (device data) (stored on a data medium) in the GM32 analyzer/SCU. | → p. 63, § 4.3.5.3 |

### 4.3.2 Setting the GM32 analyzer/SCU IP address

► Whenever possible, do not connect your own laptop to the customer network.
It is better to use a customer's laptop (with SOPAS ET).

If you have to change the GM32 analyzer/SCU IP address temporarily:
► Note the existing settings.
► Reset the old address again after completing the work.

**Procedure**

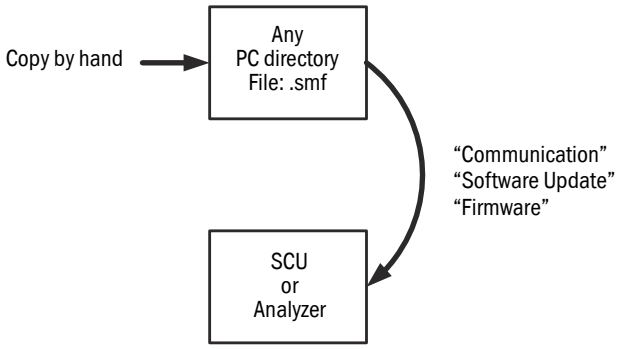
1 Start SOPAS ET.
2 Network scan assistant.
3 "*Network Configuration*".
4 "*Auto IP configuration*" ("Enable AutoIP" must be clicked).
5 "*Search*".
6 Click the desired device.
If the desired device is not found
   a) Ping the IP address under DOS:
   If no reply is received: Device switched on? Baud rate? Cable crossed (for direct connection)?
   b) Network scan assistant: Alternately, set *Custom Port 15780* and try again.
7 "*Edit*" → set the desired IP address.
(*Note*: SCU and PC must be in the same network segment)

If you have installed a new PCB console:

8 After a new "*Network scan*", the "*Basic Sensor*" reports under the set IP address.
9 Drag the "*Basic Sensor*" into the "Project tree": This loads the "*Basic Sensor*" device description.
10 Load firmware (→ p. 60, § 4.3.3).

### 4.3.3 Updating the firmware (GM32 analyzer/SCU)

Fig. 10 Loading the firmware




Existing parameters (device data) are lost when the firmware is loaded.
► First save the existing parameters (→ p. 63, § 4.3.5.2) and then load the firmware (→ p. 63, § 4.3.5.3).
Parameters that no longer match are displayed.

| Auxiliary means required |
| --- |
| Firmware installation package with .smf file (there are two .smf files for GM32 analyzers) |

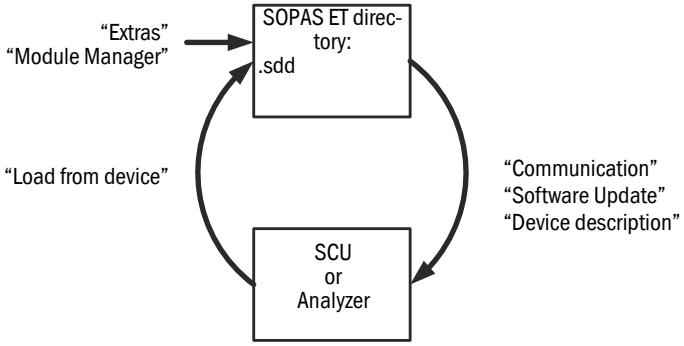
- Firmware files have the suffix .smf

**Procedure**

1 Connect the PC to the Ethernet interface of the GM32 or SCU.
2 Call SOPAS ET.
3 "*Network scan*".
4 Drag the desired device (for an empty PCB console: "*Basic Sensor*") into the "*Project tree*".
5 "*Communication*"
6 "*Software Update*"
7 "*Firmware*"
8 Follow the instructions (load .smf file)
The device description file (.sdd) is loaded automatically at the same time.
– A second device description file (.smu) must be loaded for the SCU (→ p. 61, § 4.3.4).
9 "Auto detect"
10 In the project tree:
a) "*Maintenance*"
b) "*Hardware Reset*"

### 4.3.4 Loading the device description file (“Make available to SOPAS ET”)

Fig. 11 Loading the device description file




- The device description files
  - Are located in the SOPAS ET directory (PC dependent).
  - Have the suffixes:
    - GM32 analyzer and SCU: .sdd
    - SCU: .sdd
- The device description file belongs *uniquely* to the firmware version.
- The device description file .sdd is loaded automatically when the firmware version is loaded (→ p. 60, § 4.3.3).

**Procedure**

When the device description files are *not yet* on the GM32 analyzer or SCU:

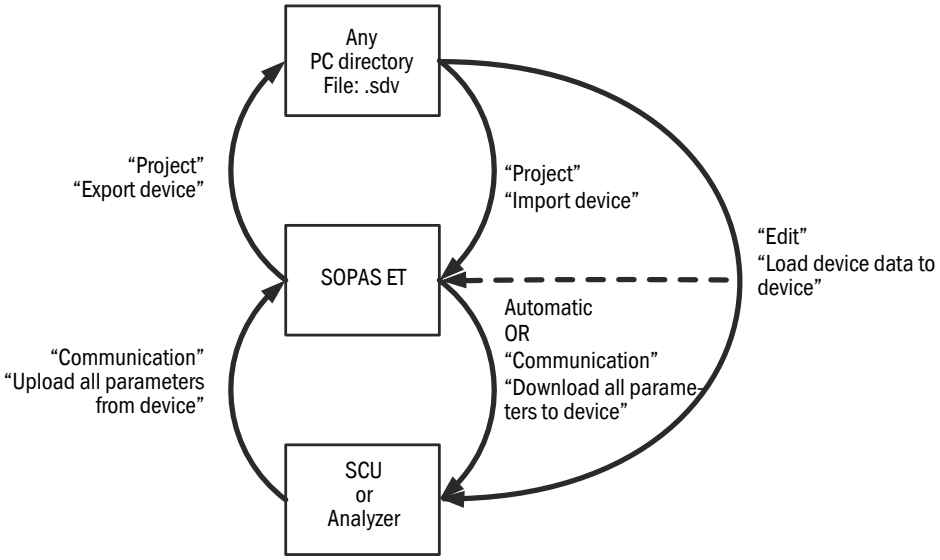
1 Provide the .sdd in any directory.
2 Call SOPAS ET.
3 “*Extras*”
4 “*Module Manager*”
5 “*Install new or update existing module*”
6 Follow the instructions.

When the device description files are *already* available on the GM32 analyzer or SCU and SOPAS ET is to be made available again:

1 Call SOPAS ET.
2 “*Network scan*”.
3 In the network scan assistant, devices with invalid or missing device description files are marked: “*Load from device*”.
4 Drag the desired device into the “*Project tree*”.
This copies the device description file for the selected device into the SOPAS ET directory.

## 4.3.5 Saving and loading parameters (device data)

Fig. 12 Loading parameters




### 4.3.5.1 Loading parameters changed in SOPAS ET to the GM32 analyzer/SCU

1 Call SOPAS ET.

2 Click device (in project tree) with the right mouse button.

3 "*Device characteristics*".

a) "*Immediate download*" : Parameters are loaded continuously to the device.

OR

b) "*Download on request*": Load parameters to the device:

1 "*Communication*"

2 "*Switch offline*"

3 "*Download all parameters to device*"

4 "*Switch online*"

#### 4.3.5.2 Saving parameters (GM32 analyzer/SCU) to an external data medium

> You can only reset the GM32 to the last usable state after data losses when you have previously saved the data on an external data medium (e.g. a PC).

- Parameter files have the suffix .sdv

1 Connect the PC to the Ethernet interface.
2 Call SOPAS ET.
3 "*Network scan*".
4 Drag the desired device into the "Project tree".
5 Click the desired device (highlighted blue).

> For a complete backup, save both the GM32 analyzer *and* SCU parameters.

6 "*Project*"
7 "*Export device*"
8 Follow further instructions.
Recommended file name (e.g. for the SCU): yyyy-mm-dd_scu_customername(.sdv)

> Leave one copy of the data with the customer device.
> (e,g, on a CD-ROM or on the customer's PC).

#### 4.3.5.3 Loading parameters from an external data medium to the GM32 analyzer/SCU

- Parameter files have the suffix .sdv

1 Connect the PC to the Ethernet interface.
2 Call SOPAS ET.
3 "*Edit*"
4 "*Load device data in device*"
5 Follow further instructions.

### 4.3.6 Loading data files from the device

The data files contain the results of the check cycles.

1 Call SOPAS ET.
*2 "Communication"*
*3 "File Upload"*

GM32

# 5 Maintenance

Maintenance plan
Maintenance work
Preventative maintenance
Recommended spare parts

## 5.1 Zero adjust (zero point check)

### Special tools and auxiliary means

| Auxiliary means required | Part No. | Required for |
|---|---|---|
| SOPAS ET | | Parameter setting |
| Ethernet cable (crossover) | 6026084 | Parameter setting |
| Mains cable (10m) [1] | 2017519 | Voltage supply (SR-unit / GPP probe) - Optional when the zero path cannot be reached with the standard cable. |
| 19 mm jaw wrench | | |

[1] Fit suitable power plug onsite.

Zero adjust is relative to the composition of the gas currently in the measuring path.

- Inert gas must be in the active measuring path
- Starting zero adjust on the operator panel is protected with a password. Password: *1234*

Performing zero adjust is noted in the device Logbook.

The ''Not_*measuring*'' signal is active during zero adjust.

### 5.1.1 Procedure

Assembly and optical adjustment → GM32 Operating Instructions

The GM32 must be at operating temperature.

► Otherwise observe the 2 hour warm-up time.

1 Switch the GM32 to operating mode “Maintenance”.
→ SOPAS ET menu *Maintenance* → *Operating mode switch* (→ p. 56, §4.2.6.1)

2 Dismount the GM32 from the measuring point.

**WARNING: Hazard resulting from gases in the gas duct**

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

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

3 Put the GM32 in a safe place and put it into operation with the probe fitted. The probe must only be in inert gas (e.g. ambient air).

If the standard cables are too short:

- Acquire additional mains cables.
- Dismount the power supply unit (→ p. 79, §5.4).

4 Clean the window.

5 Login as *Service* in SOPAS ET (→ p. 30, §).

6 Menu *Adjustment* → *Alignment.*

7 Click “*Start alignment*” to move the mirror tracking to the reference position.

8 Use the adjusting screws to align the SR-unit
(X and Y values between -0.05 ... +0.05).

9 Click "*Measuring*" to terminate the alignment function and to switch the analyzer to measuring operation.

10 Call up menu *Diagnosis* → *Sensor values* → *Spectra* → *Measurement reflector* (→ p. 51) to display the raw values from the measurement reflector in digits as graph.
The maximum must be between 45000 and 50000 digits.

11 Increase or reduce the light intensity for larger deviations. To do this, experiment by adjusting the nominal value for the "Maximum lamp intensity" of the zero point reflector in menu *Parameter* → *Spectrometer* (→ p. 35, § 4.2.3.2).

12 In menu *Maintenance* → *Operating mode switch* (→ p. 56, § 4.2.6.1), start a *Reference cycle* and wait until the analyzer switches back to measuring operation.

13 Control the raw values in menu *Diagnosis* → *Sensor values* → *Spectra* → *Measurement reflector* (→ p. 51) often.
The maximum value must be between 45000 and 50000 digits.
Adapt the maximum lamp intensity further as described in → 11 when the deviation is larger or smaller.
When the value on the measurement reflector reaches a value between 45000 and 50000 digits, the GM32 can be compared against zero in the SOPAS ET menu *Adjustment* → *Zero adjust* (→ p. 43, § 4.2.4.2).

14 Use menu *Diagnosis* → *Sensor values* → *Spectra* → *Absorption* (→ p. 53) to check the smoke-free spectrum. An approximately straight line at "0" should result.

15 Use menu *Measured value* → *Bargraph measured value* (→ p. 33, § 4.2.2.1) to check the current measured values.
The measured values should be close to the zero point and may not deviate from the upper measuring range value by more than 2%.

16 Switch the GM32 to operating mode "*Maintenance*".
Menu *Maintenance* → *Operating mode switch* (→ p. 56, § 4.2.6.1)

17 Fit the GM32 back onto the measuring point.

## 5.2 Boxmeasuring

### Special tools and auxiliary equipment

| Auxiliary means required | Part No. | Required for |
|---|---|---|
| Filter box and accessories | | Linearity measurement |
| Test gases | | → p. 71, §5.2.2 |
| Computer with SOPAS ET | | Parameter setting |
| Ethernet cable (crossover) | 6026084 | Parameter setting |

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

**WARNING: Hazards through toxic or combustible gases.**

► The user must be familiar with the hazards through toxic and combustible gases.

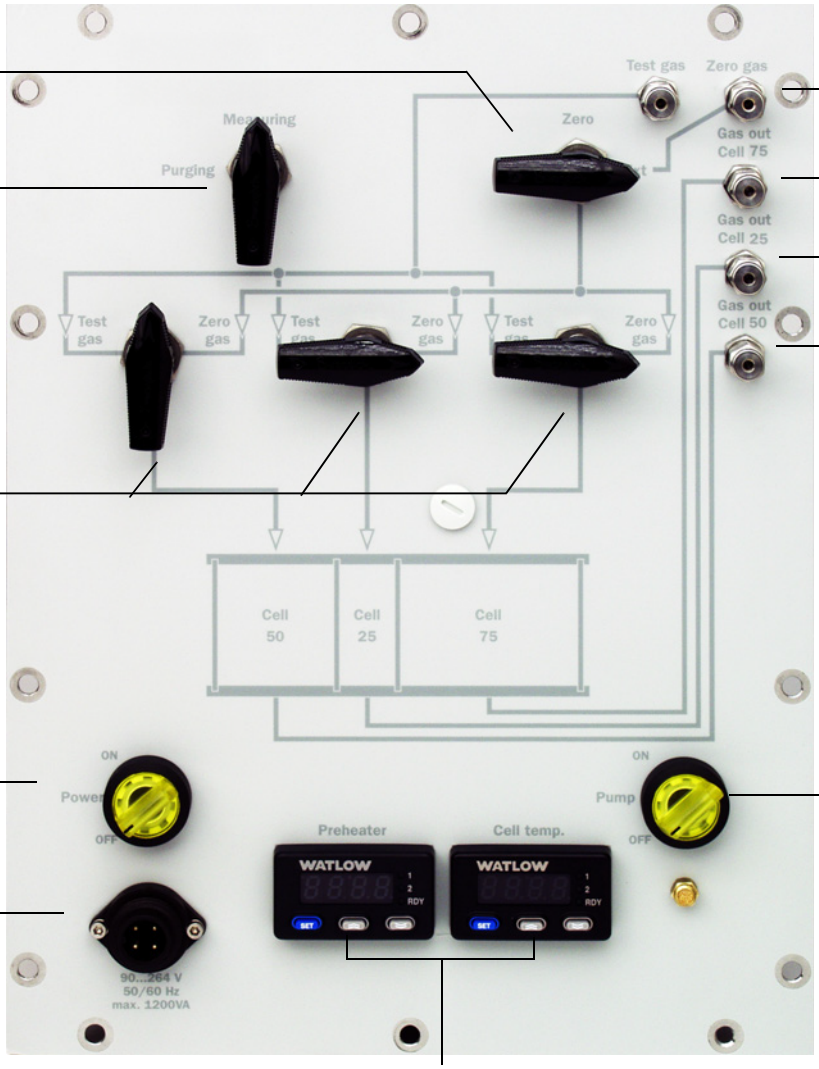
### 5.2.1 Preparing the filter box

1 Switch the filter box and pump on.

Warm-up phase for filter box to 80 °C (nominal temperature): Approx. 2 h

**WARNING: Risk of breakage for windows in the sample gas chambers**
► Operate the filter box with max. 1 bar.

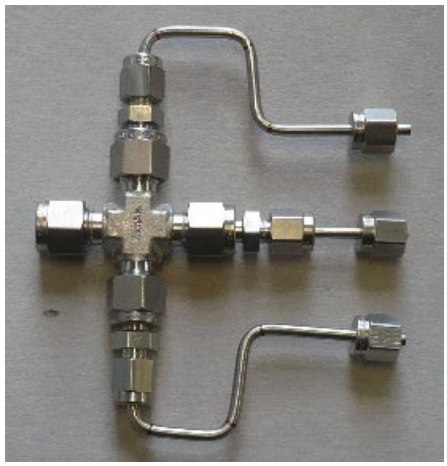
2 Set the nominal temperature to 80 °C (“*Set*” button and arrow buttons).
3 Set all valves to the “Zero gas” position.
4 Set “*Purge valve*” to *Purging*.




Recommendation: Use nitrogen ($N_2$) as zero gas.

5 Fit the drain hose screw fitting to the gas outlets

Fig. 13 Drain hose screw fitting



6 Connect the drain hose to the screw fitting

► Lay the drain hose away from the measuring location (e.g. outdoors)
⊗ Do not bend the hose

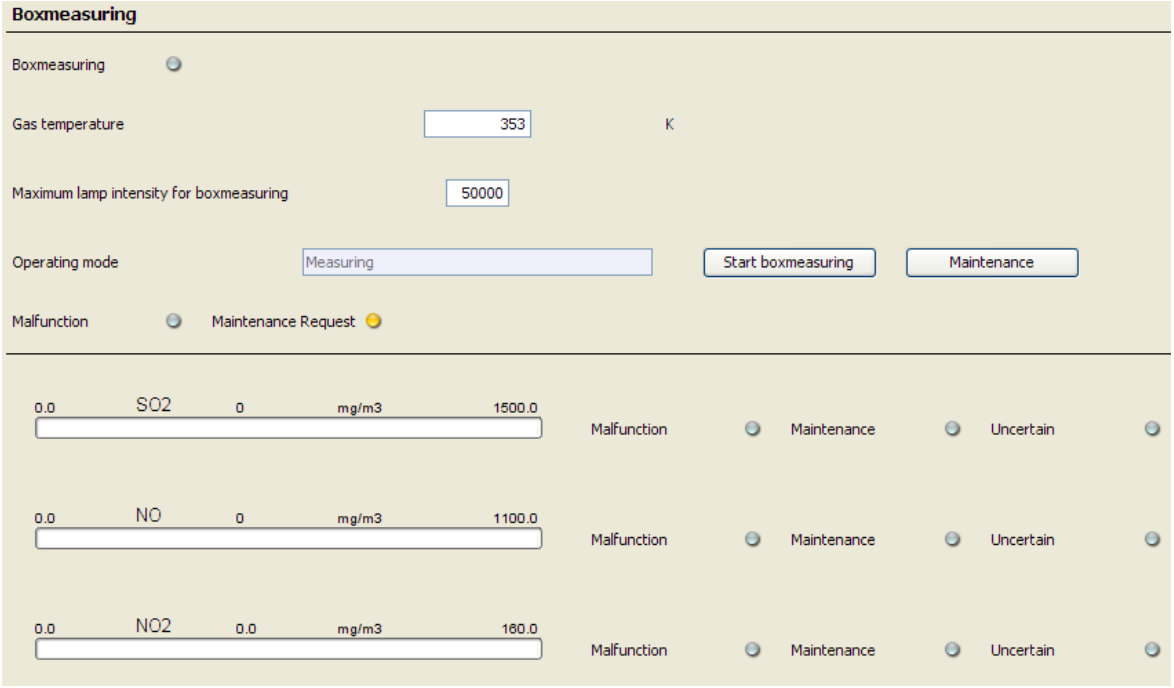
7 Select the suitable Suprasil reflector matching the measuring path (flange-flange) from the filter box accessories.
- Measuring path <5m (R=-1982)
- Measuring path >5m (R=-5000).

8 Fit the reflector on the filter box.

9 Fit the suitable GM32 adapter plate to the filter box

### 5.2.2 Determining the necessary test gas concentration

1 Calculation of the maximum nominal concentration
SOPAS ET menu *Adjustment* → *Boxmeasuring* (→ p. 44, § 4.2.4.3)




$$C_{TG} = \frac{FS}{0,15} \cdot \frac{(273 + T)}{273} \cdot \frac{1}{F}$$

$C_{TG}$ Result is in vppm to order the test gases
FS Measuring range in $mg/m^3$ (see Fig. above)
T Temperature set for the filter box in °C
F Conversion factor ppm to $mg/Nm^3$:
NO = 1.34; NO2 = 2.05; NH3 = 0.76; SO2 = 2.86

2 Calculation of nominal values for the various chamber lengths

$$C_{Nom} = C_{TG} \cdot F \cdot \frac{273}{(273 + T)} \cdot \frac{AirPressure}{1013} \cdot L \cdot 0,001$$

| | |
|---|---|
| $C_{Nom}$ | Nominal concentration in mg/m³ |
| $C_{TG}$ | Test gas concentration in ppm |
| T | Temperature set for the filter box in °C |
| F | Conversion factor ppm to mg/Nm³:<br>NO = 1.34; NO2 = 2.05; NH3 = 0.76; SO2 = 2.86 |
| L | Chamber length in mm |

Table 3 Test gas concentration, example Table

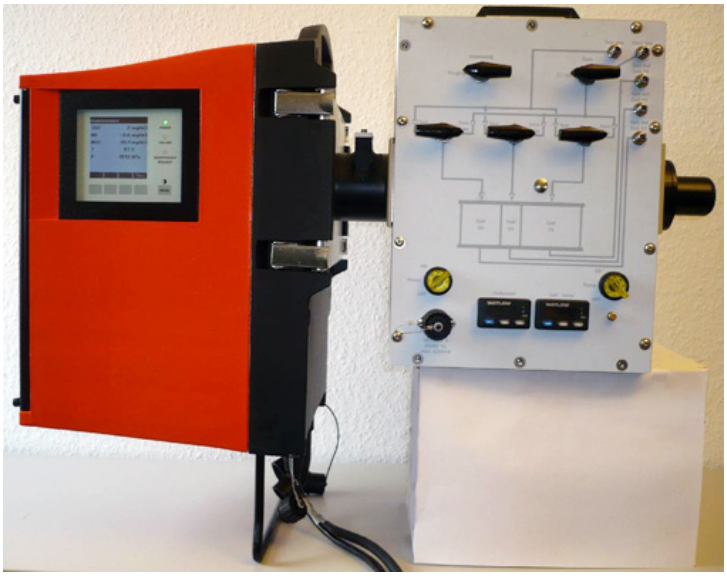
| Chamber length [mm] | Nominal [mg/m³] | Actual [mg/m³] |
|---|---|---|
| 25 | | |
| 50 | | |
| 75 | | |
| 100 | | |
| 125 | | |
| 150 | | |

5.2.3 **Procedure**

1 Login as *Service* in SOPAS ET.
2 SOPAS ET menu *Maintenance* → *Operating mode switch* (→ p. 56, § 4.2.6.1).
3 Click "*Maintenance*" to switch the GM32 to operating mode *Maintenance*.
4 Open the analyzer by loosening the tension clips, remove the hinge pin and take the analyzer off the device flange by loosening the tension clips.
5 Mount the analyzer on the filter box and fasten with the tension clips.

► Provide an approx. 20 cm high support for the filter box.

Fig. 14 GM32 with filter box



6 SOPAS ET menu *Adjustment* → *Boxmeasuring* (→ p. 44, § 4.2.4.3)

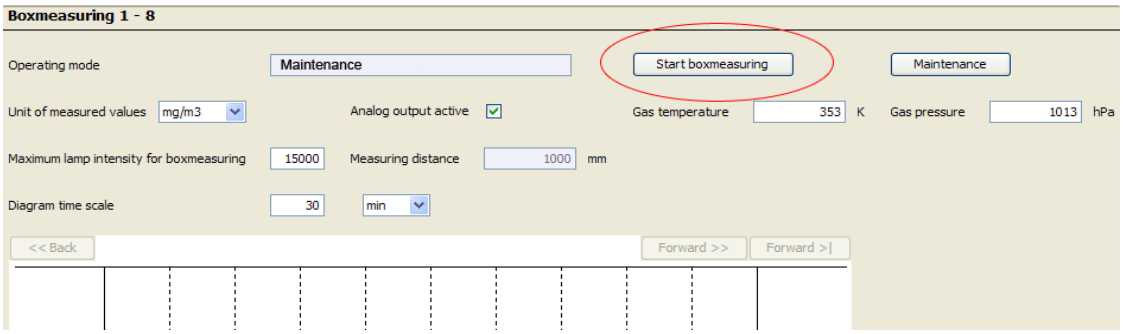
7 Enter the filter box temperature under *"Gas temperature"*

> *Note*: Check the nominal value on the filter box.
> Standard value: 80 °C (353 K).

8 Flush the filter box with zero gas (→ p. 69, § 5.2.1)

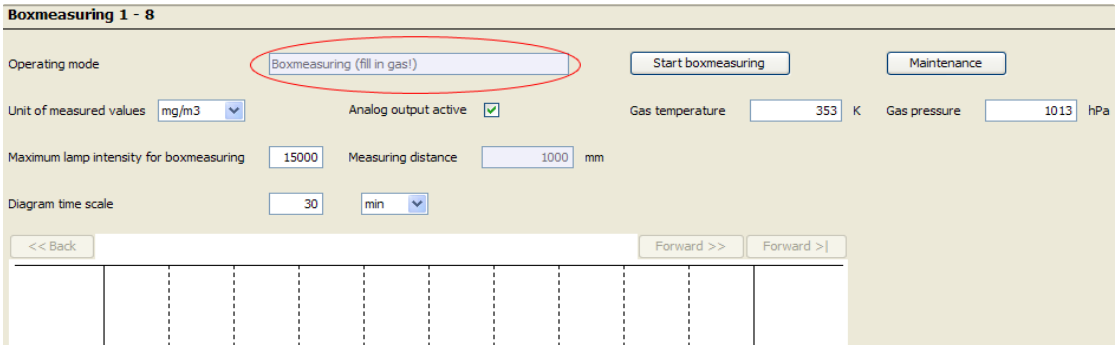
> Recommendation: Use nitrogen ($N_2$) as zero gas.

9 Click "*Start boxmeasuring*" to start filter box measurement.

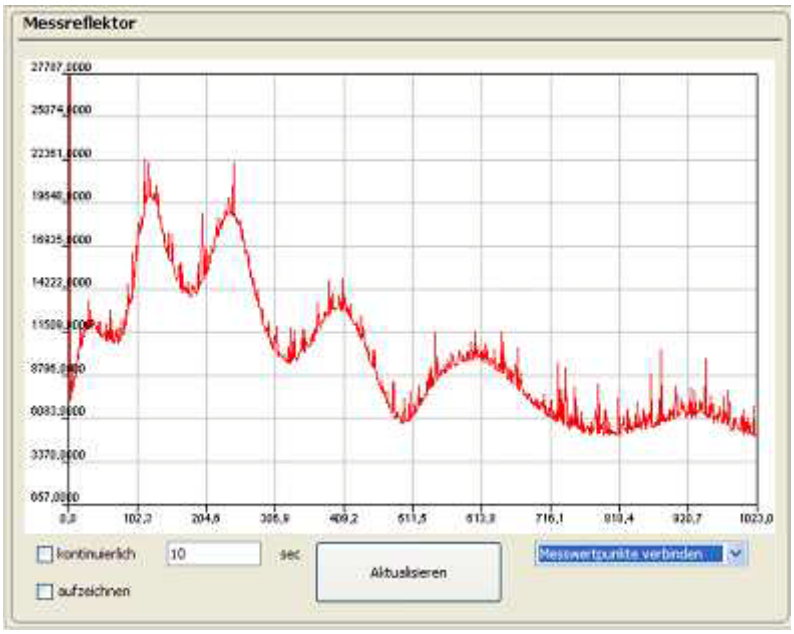



> - Status line on operator panel: "Boxmeasuring"
> - Maintenance request (yellow LED) active

10 Wait (up to approx. 20 minutes) until the message "*Boxmeasuring (fill in gas!)*" appears in "*Operating mode*".

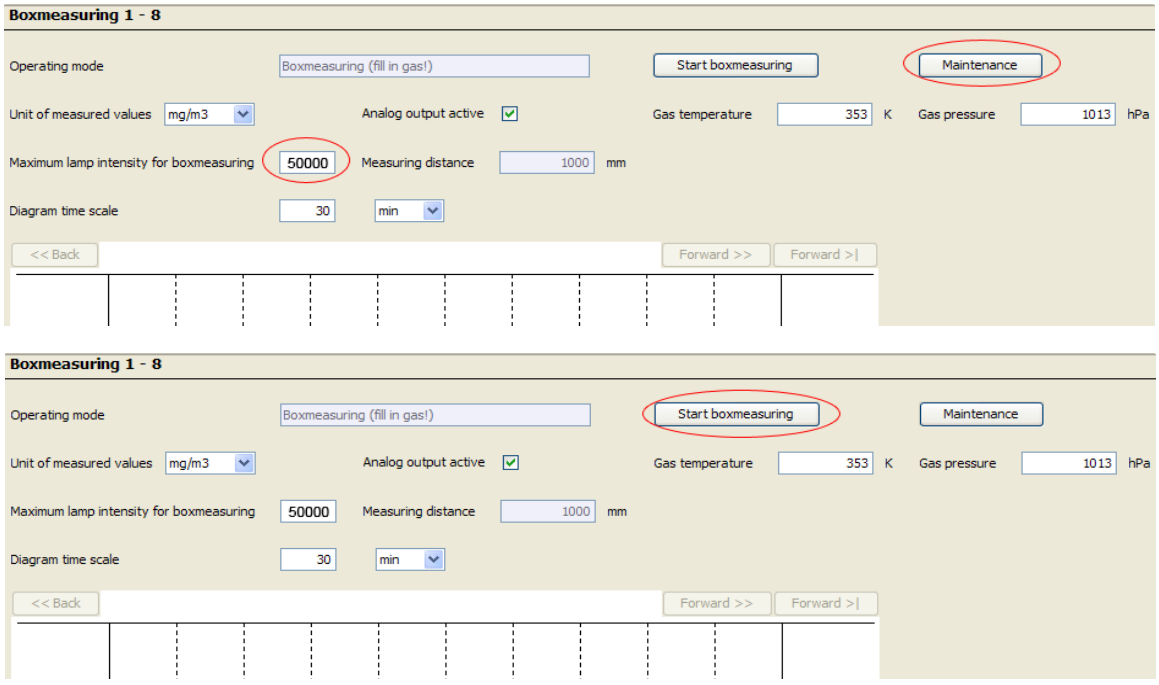


11 SOPAS ET menu *Diagnosis* → *Sensor values* → *Spectra* → *Measurement reflector* (→ p. 51)
The maximum must be between 30000 and 50000.




If this is not the case:

– Experiment with the value for the "*Maximum lamp intensity for boxmeasuring*". Click "*Maintenance*" after changing the value.
Change the lamp intensity (maximum 50000) for the filter box accordingly and repeat "*Start boxmeasuring*".




12 SOPAS ET menu *Diagnosis* → *Sensor values* → *Spectra* → *Absorption* (→ p. 53).
Measurement signal must be approximately at zero and be straight as average value.

13 Fit pressure reducer on the test gas cylinder.

- ► Open the gas outlet of the pressure reducer and cylinder valve for a short time to flush the gas fitting.
- ► Set the pressure reducer to a value between 0.5 and 1 bar.
- ► Close the gas outlet and make a connection to the filter box.
- ► Open the gas outlet again afterwards.

14 Make a connection between fitting and filter box (test gas).

15 Set the valve to select the appropriate chamber or combination.
Set the "*Measuring / Purging*" valve to "*Purging*" to fill the chamber quickly.

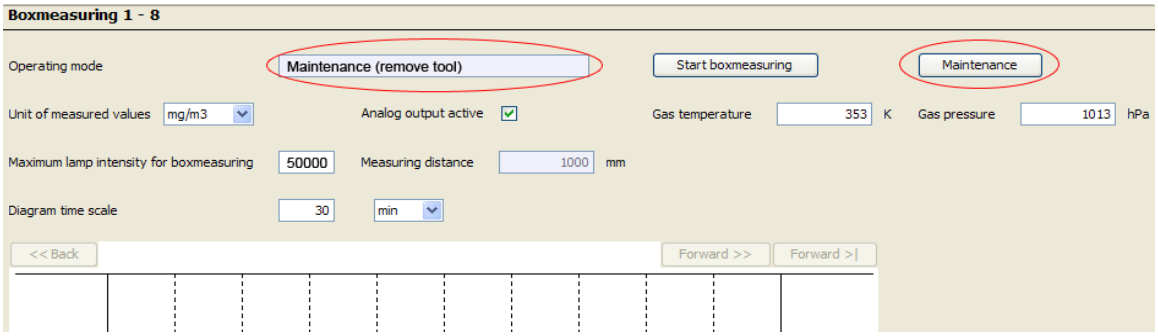
16 When the measured value shown in SOPAS ET is constant, switch the "*Measuring / Purging*" to "*Measuring*".
The overpressure is reduced.
Wait for a constant measured value and note the display.

17 Repeat test gas application with all possible chambers and combinations.

18 Close the cylinder valve. Switch valve "*Measuring / Purging*" to "*Purging*".
Set all chambers to "*Test gas*".
When the pressure in the pressure reducer has dropped to zero, switch all chamber valves to "*Zero gas*".

19 Dismount the pressure reducer from the test gas cylinder.
To carry out another measurement with a different test gas:
Start again at → 13.

20 After measurement has completed, click "*Maintenance*". The message "Maintenance (remove tool)" appears under "*Operating mode*"




21 Dismount the filter box from the GM32.

22 Fit the GM32 back onto the measuring point.

23 SOPAS ET menu *Maintenance* → *Operating mode switch.*
Click "*Measuring*" to switch the GM32 to operating mode *"Measuring"*.

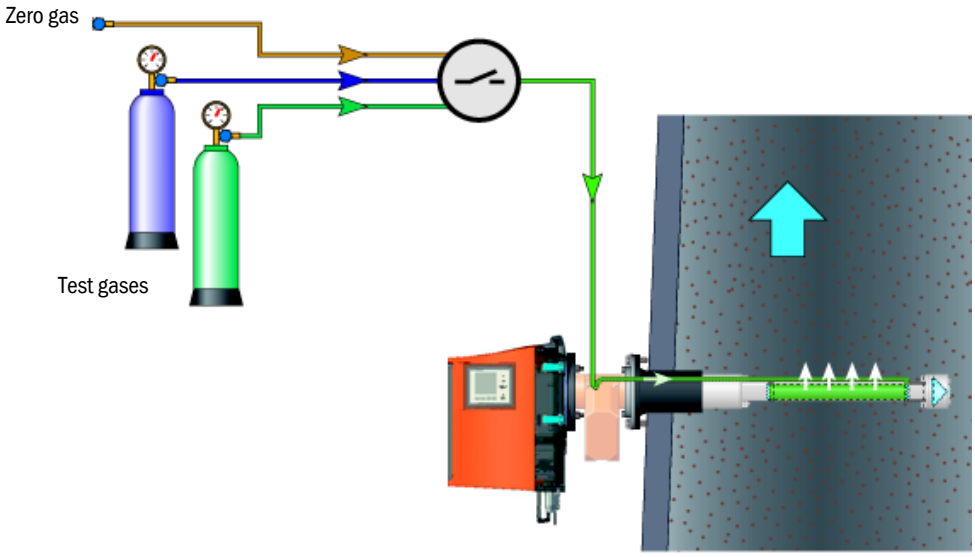
The GM32 triggers a reference cycle.

The check is completed with operating mode ''*Measuring*''.

The filter box scaling is overwritten automatically.

## 5.3 Test gas feeding (for GPP measuring probe)

Fig. 15 Test gas measurement with GPP probe

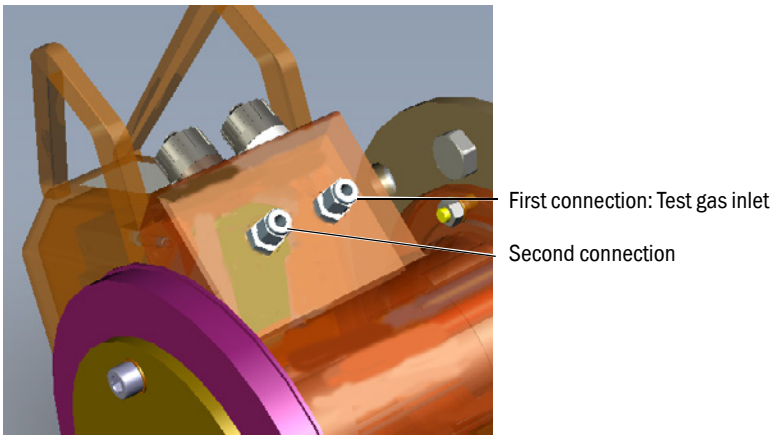



For GPP measuring probes, a gas check can be carried out with the measuring probe fitted in the gas duct.

An overpressure is created in the filter frit when gas (zero or test gas) is blown in. If this overpressure is high enough, the sample gas is forced out of the filter frit and replaced by the gas blown in.

The zero or test gas concentration in the filter frit is measured and the GM32 adjusted accordingly.

Fig. 16 Test gas connections on the GPP probe




- The GPP probe has a gas connection for test gas measurement.
- A second connection is available for, for example:
  - Pressure measurement
  - Sample extraction for comparison measurements
  - Filter backflushing
  - To increase the amount of test gas available.

### 5.3.1 One-off initial measurement - determining the test gas pressure

**WARNING: Hazard through escaping gases**
Hot and/or noxious gases can escape during work on the test gas connection, depending on the equipment conditions.
- ► Test gases may only be applied by skilled persons who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

| Material required |
|---|
| SOPAS ET |
| Instrument air or $N_2$ |
| Pressure gauge / pressure reducer |
| Supply line 1/4" with Swagelok fitting |

The GPP probe remains installed in the gas duct.

1 Switch the GM32 to *Maintenance* (on the operator panel or in SOPAS ET menu: *GM32/ Maintenance/Operating mode switch* → p. 56, § 4.2.6.1)
2 Connect $N_2$ or instrument air to the probe via a pressure reducer (→ p. 76, Fig. 16).
3 Set the pressure reducer to 0 bar, open the valve completely.
4 Set the pressure to approx. 3 bar.
5 Observe the measured values in the measured value display (operator panel or SOPAS ET).
*The measured value display must show "Zero".*
When "Zero" is *not* displayed after approx. 30 s (depending on the $T_{90}$ setting of the analyzer): Increase the pressure gradually until "*Zero*" is displayed.
6 When "*Zero*" is displayed: Reduce the pressure in small steps until the measured value display starts to rise.
Then increase the pressure by approx. 0.5 bar.
7 Note the pressure shown on the pressure gauge.
Use this value as primary pressure value in the future.

Determine the test gas pressure again when the pressure in the gas duct changes.

The difference pressure is in the range 2 mbar ... 30 mbar.

8 Close the valve on the pressure reducer.
9 If no further measurements are to be made: Set the GM32 back into measuring operation (on the operating console or in SOPAS ET menu: *GM32/Maintenance/Operating mode switch).*

### 5.3.2 Manual test gas feeding

**WARNING: Hazard through escaping gases**
Hot and/or noxious gases can escape during work on the test gas connection, depending on the equipment conditions.
► Test gases may only be applied by skilled persons who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

| Material required |
|---|
| SOPAS ET |
| Instrument air or $N_2$ |
| Pressure gauge / pressure reducer |
| Supply line 1/4" with Swagelok fitting |

1 Switch the GM32 to *Maintenance* (on the operator panel or in SOPAS ET menu: *GM32/Maintenance/Operating mode switch* → p. 56, § 4.2.6.1)
2 Connect the desired zero and/or test gas via pressure reducer to the probe (→ p. 76, Fig. 16).
3 Set the pressure gauge (→ p. 77, § 5.3.1) to the primary pressure determined.

Determine the test gas pressure again when the pressure in the gas duct changes.

4 If no further measurements are to be made: Set the GM32 back into measuring operation (on the operating console or in SOPAS ET menu: *GM32/Maintenance/Operating mode switch).*

### 5.3.3 Using mixed gases as test gases

Safe mixed conditions:

| Mixed gas | Safe mixed gas conditions |
|---|---|
| $SO_2$ + NO | > 10% NO included in $SO_2$ |
| $SO_2$ + $NO_2$ | > 10% $NO_2$ included in $SO_2$ |
| NO + $SO_2$ | > 10% $SO_2$ included in NO |
| NO + $NO_2$[1] | > 25% $NO_2$ included in NO |
| $NO_2$ + $SO_2$ | > 50% $SO_2$ included in $NO_2$ |
| $NO_2$ + NO[1] | > 10% NO included in $NO_2$ |

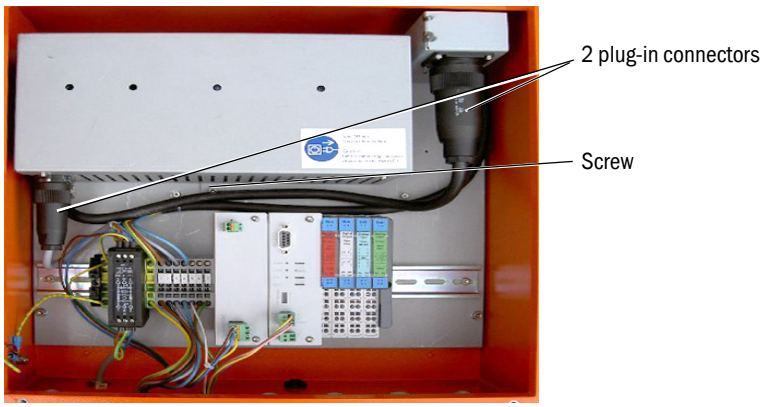
[1] As far as available

## 5.4 Fitting and removing the power supply unit of the connection unit

The removed power supply unit can be used for direct voltage supply for the SR-unit, e.g. when this must be removed from the gas duct for a zero adjust.

1 Disconnect the connection unit from the mains.
2 Open the housing cover of the connection unit (4 x 4 mm hexagon socket).

Fig. 17 Opening the connection unit




3 Loosen both plug connections of the power supply unit.
4 Unscrew the screw underneath the power supply unit (4 mm hexagon socket).
5 Push the power supply unit upwards and take out.
6 The power supply unit can be hung on the bracket of the SR-unit.

Fig. 18 Power supply unit hung on

Fit in the reverse sequence.

GM32

# 6 Shutting down/Restarting

## 6.1 Qualification requirements

The same qualifications as for maintenance are required for shutting down.

**Correct handling of system components**

During all work, ensure system components are not subjected to excessive mechanical or climatical stress:

- Always secure the SR-unit in a safe location and free from jolts.
- Protect system components against rain, dust or other unallowed ambient conditions, especially when dismounted.

## 6.2 Shutting down

Safety information for shutdown

- ► 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 under high pressure. Never open the housing, release the quick-release fasteners or remove the measuring probe without taking appropriate protective measures.
- ► If the conditions in the sample gas duct are particularly difficult and do not allow work on the open duct, even with protective equipment, the work must be carried out when the sample gas duct is inactive or has been flooded with ambient air.
- ► The purge air feed must remain in constant operation and the SR-unit may not be opened or swiveled as long as the measuring probe is in the sample gas duct. This is also applicable when the sample gas duct is out of operation because residual gases or dust can lead to contamination or corrosive deposits on the system components.
- ► As described in the following, to protect against IR radiation, first switch off the power supply to the SR-unit and disconnect the power supply plug before opening the housing or swiveling the flange fixture.

### 6.2.1 Equipment required

- Personal protective clothing and equipment (see safety information above)
- At least the following tools:
  - Complete wrench set containing, apart from others, the following wrenches:
  - 2 x 24 mm open-ended spanners or ring spanners
  - 1 x 19 mm open-ended spanner or ring spanner
  - Allen key set
  - Insulated screwdriver set
- Cleaning cloths for rough cleaning the outside of devices
- Consumables; when the measuring system is to be used again:
  - Desiccant cartridge (Part No.: 2 010 549) including the pin wrench provided to exchange the cartridges
- Suitable cover to close off the duct-side flange with tube after removing the measuring system (when necessary)
- Stored transport safety devices and, when available, the original packaging of the measuring system
- Insulation material/close box to protect cables against atmospheric conditions

### 6.2.2 Shutdown

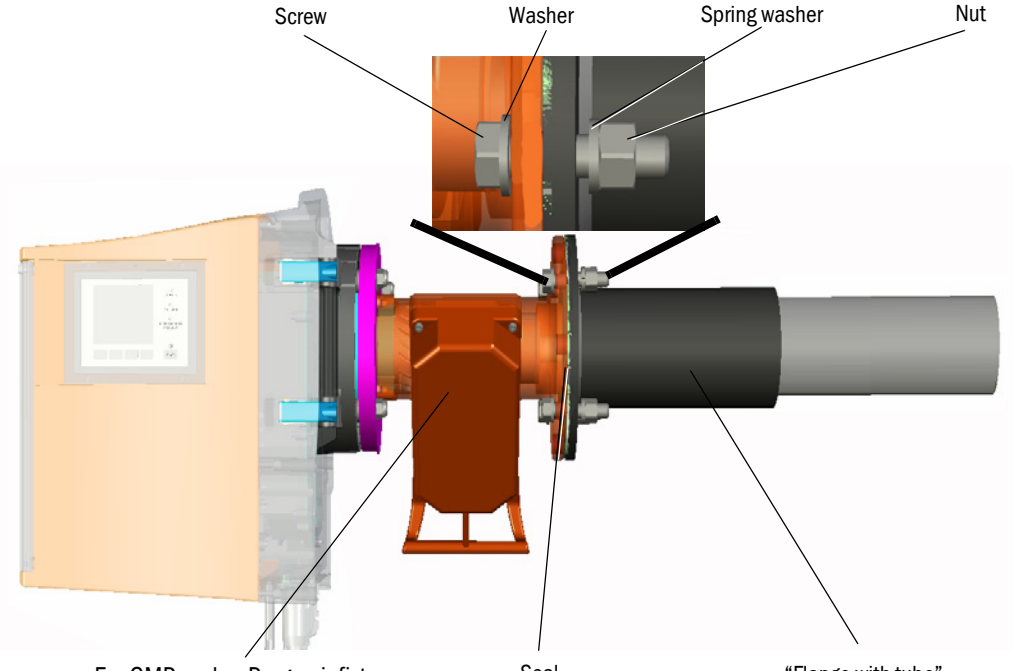
- Ensure measuring signals are no longer evaluated.

#### 6.2.2.1 Removing from the sample gas duct

Connections on GM32: See GM32 Operating Instructions

- If fitted, remove the weatherproof cover from the SR-unit by unscrewing the two knurled nuts on the top and lifting the cover from the SR-unit.
- Switch the power supply to the SR-unit off. Leave the purge air supply, if present, switched on for the time being.
- Unscrew the locking bushings of the three plug-in connectors on the underside of the SR-unit and remove the plug-in connectors.
- Loosen the cable clamp for the earthing conductor and remove the cable.
- If a GPP measuring probe is used, also remove as well the plug of the power supply cable from the heating control of the measuring probe.
- Under consideration of the safety information (→ p. 82, § 6.2), remove the SR-unit together with the fitted measuring probe out of the sample gas duct.
  To do this, loosen the four screw fastenings (→ p. 83, Fig. 19) with two 24 mm wrenches and pull the measuring probe with fitted SR-unit carefully out of the sample gas duct.
  On no account open the quick-release fasteners on the side of the SR-unit housing when the measuring probe with the SR-unit is still in the sample gas duct.

Fig. 19 Disconnecting the measuring probe with fitted SR-unit from the duct-side "flange with tube"




- Lay the SR-unit with the fitted measuring probe on the floor and free from jolts.

► Close off the duct-side flange with tube as necessary with a suitable protective cover.

High temperatures

If the sample gas duct is operated at high temperatures, the measuring probe will remain hot for some time after it has been removed.

► It should be handled with care in this case. GMP measuring probes cool down faster when the purge air supply remains switched on for a few minutes.

### 6.2.3 Disconnecting the purge air connection

On systems with purge air supply:

► Switch the power supply to the purge air unit off (as necessary, after an appropriate wait time for cooling down).

► Loosen the hose clamp of the purge air hose on the measuring probe or on the optional differential pressure sensor and take the purge air hose off.

If a differential pressure sensor is fitted (see Fig. 7.10, page 80):

► Loosen the hose clamp on the purge air inlet of the measuring probe and take off the differential pressure sensor including the associated hose piece.

► Disconnect the signal cable on the differential pressure sensor by pulling off both 6.3 mm flat pin bushings in the housing.

► If the signal cable of the existing measuring point should be reused, protect the cable end with the open flat pin bushings against atmospheric conditions with insulation material or a close box.

The next tasks are to first put the purge air unit and further components - as far as applicable - out of operation.

### 6.2.4 Putting the purge air unit out of operation

On systems with purge air supply:

**WARNING: Ensure the power supply remains switched off**

► Ensure the power supply of the purge air unit is completely switched off and remains so by switching off the corresponding circuit breaker and the motor switch, and secure these against being switched on again.

If the existing measuring point is to used for the purge air unit again, e.g., for a different measuring system:

► Check the technical data or contact SICK to determine whether the purge air unit is suitable for the planned application purpose.

  ► If yes: Close off the open end of the purge air hose tight to prevent dirt or moisture entering the hose.

If no further use on the measuring point is planned:

► Remove the weatherproof cover, if fitted, from the purge air unit.

► Open the connection unit, loosen the connection cable clamps and remove the cable.

► If the connection cable is to remain at the measuring point, insulate the open cable end and protect them with a close box against atmospheric conditions.

► Loosen the fastening screws of the purge air unit and take it off from the retainers or base as completely assembled unit

► If desired, remove the purge air hose. To do this, loosen its hose clamp on the outlet connection of the purge air unit.

## 6.3 Further components on the measuring point

### 6.3.1 Connection unit and cabling

If the existing cabling at the measuring point is no longer required in its present form, remove the cabling as described in the following.

- ► Disconnect all lines provided by the customer from the terminal strip of the connection unit.
- ► Loosen the fastening of the connection unit.
- ► Remove the connection unit with all pre-assembled cables with plugs.
- ● If there are problems in removing the pre-assembled cables with plugs together with the connection unit:
  - ► Disconnect the pre-assembled cables from the terminal strip in the connection unit and remove these from the installation ducts or installation location.

If the cables provided by the customer at the measuring point can be used for other purposes:

- ► Insulate all open cable ends.
- ► Protect the cable ends against atmospheric conditions, e.g., with a close box to prevent corrosion and contamination.

## 6.4 Conservation measures, correct storage and transport

This Section describes how to prepare the GM32 for storage for later use or transport.

- ► Clean the outside of the closed SR-unit housing and all other components with damp cleaning cloths. Pay special attention to removing chemical residues or condensate deposits. A mild cleaning agent that does not leave any residues can be used here.
- ► Select a dry, frost-free room without strong temperature fluctuations for storage.

If the original packaging is available or in all cases where the SR-unit and measuring probe are to be stored or transported separately:

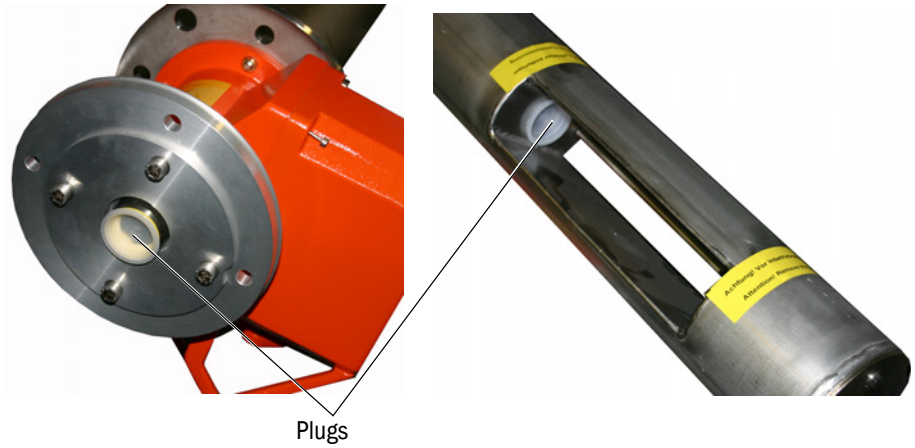
- ► Separate the measuring probe from the SR-unit (→ p. 83, Fig. 19):
  - ► Push the sealing ring to one side so that the measuring probe can be removed without hindrance after the screw fitting has been loosened.
  - ► Loosen the three nuts with a 19 mm wrench and carefully remove the measuring probe without damaging the threaded bolts on the SR-unit.
- ► Keep all the fastening parts with care.

To prevent absorbed moisture damaging the SR-unit, check and replace the desiccant cartridges when necessary:

- ► Check the desiccant cartridges. As preparation for the storage period, the cartridges should then also be exchanged when the drying granulate is only slightly discolored when compared with new cartridges.
- ► Protect the openings on the SR-unit and measuring probe against atmospheric conditions. In this case, use the transport safety devices, as far as available, used during delivery of these components. Apart from that, materials such as weatherproof adhesive tape and plastic foils are also suitable.
- ► If the measuring probe and SR-unit remain connected, the front cover of the SR-unit and the plastic protective cap on the measuring probe flange are not required. If a GPP measuring probe is used and is to remain fitted, no transport safety devices are required because GPP measuring probes do not have an open measuring gap.

Fig. 20 Transport safety devices in the SR-unit

Fig. 21 Transport safety devices on the probe (shown here on a GPP probe)




- Pack the complete measuring system for storage or transport preferably in the original packing. If this is not available, ensure the packaging used, under consideration of the weight of system components as well, provides adequate protection against impact loads as well as against atmospheric conditions.

## 6.5 Preparing for restarting

### 6.5.1 New measuring task

If the planned measuring task is different to the original task (e.g., modified sample gas composition, different measuring point):

- ► Ask SICK Service or the responsible sales partner whether a new factory calibration is required for the changed measuring task and which system components may have to be returned (usually the SR-unit).

If a factory calibration is necessary:

- ► If the measuring system has not been stored in the meantime, prepare it for transport as described in §6.4 (→ p. 87).
- ► The original packaging is best suited for shipping. The packaging must always provide sufficient protection for transport.
- ► Send the SR-unit and/or other system components as agreed to the address specified by your SICK contact person.

### 6.5.2 Previous measuring task

If a factory calibration is not necessary for the new measuring task and the measuring system is used for the new measuring task without intermediate storage:

- ► Clean the outside of the closed SR-unit housing and the connected measuring probe with damp cleaning cloths. Pay special attention to removing chemical residues or condensate deposits. A mild cleaning agent that does not leave any residues can be used here.

### 6.5.3 Purge air unit maintenance

On measuring systems with purge air unit:

- ► Perform maintenance on the purge air unit before restarting.

GM32

# 7 Annex

Commissioning checklist

## 7.1 Commissioning checklist

# Commissioning Check List GM32

**Customer data**

| | | | |
|---|---|---|---|
| Customer: | | Customer no: | |
| Country: | | City: | |
| Plant: | | Location: | |

**1 Device data**

| | | | |
|---|---|---|---|
| Device type: | | Device no: | |
| Serial no: | | | |
| Process optic: | GMP ☐ | GPP ☐ | CD ☐ |
| Serial no: | | Device no: | Type: |

**2 Plant data**

| | | | |
|---|---|---|---|
| Location: | Outside ☐ | Under cover ☐ | Inside ☐ |
| Tag number | | | |
| Orientation of the stack | Horizontal ☐ | Vertical ☐ | Angle of ____ ° |
| Orientation of the GM32 | Horizontal ☐ | Vertical ☐ | Angle of ____ ° |
| Length of probe / Flange-Flange (CD) | ____ mm | Active measurement distance / Aperture | ____ mm |
| Zero path | ____ mm | Differential pressure | ____ hpa |
| Ambient temperature | ____ °C | Gas temperature | ____ °C |
| I/O Modules on site ☐ | | I/O Modules relocated ☐ | |
| Plant operating status | | | |

**3 Prerequisite**

| | | Y | N | Remarks |
|---|---|---|---|---|
| 3.1 | Documentation + Delivery complete | ☐ | ☐ | |
| 3.2 | Platform at measurement spot has suitable dimension? | ☐ | ☐ | |
| 3.3 | If this measurement location is under legal regulation, has it been acknowledged by an official body? | ☐ | ☐ | |
| 3.4 | Customer specific data for parameterization available? | ☐ | ☐ | |
| 3.5 | Purge air unit installed and electrically connected? | ☐ | ☐ | |
| 3.6 | Connection unit installed and electrically connected? | ☐ | ☐ | |
| 3.7 | Zero point stands / tube available (only CD)? | ☐ | ☐ | |

| 4 | **Preliminary work** | Y | N | Remarks |
|---|---|---|---|---|
| 4.1 | Mounting of flanges like described in the Operating Instruction? | ☐ | ☐ | |
| 4.2 | Check for damage | ☐ | ☐ | |
| 4.3 | Check ambient conditions (ref. ch. 2) | ☐ | ☐ | |
| 4.4 | Check mounting conditions (ref. ch. 2) | ☐ | ☐ | |
| 4.5 | Check mounting | ☐ | ☐ | |
| 4.6 | Check cables / wires for correct installation | ☐ | ☐ | |
| 4.7 | Check main power supply voltage | ☐ | ☐ | |

| 5 | **Purge Air Unit (only GMP / Cross-Duct)** | Y | N | Remarks |
|---|---|---|---|---|
| 5.1 | Purge air unit type | X | X | |
| 5.2 | Check the rotation direction | ☐ | ☐ | |
| 5.3 | Check hoses for correct installation | ☐ | ☐ | |
| 5.4 | Purge air heating installed? | ☐ | ☐ | |
| 5.5 | Differential pressure monitor installed? | ☐ | ☐ | |

| 6 | **Sender / receiver unit** | Y | N | Remarks |
|---|---|---|---|---|
| 6.1 | Clean all optical surfaces | ☐ | ☐ | |
| 6.2 | Dessicant cartridges exchanged? | ☐ | ☐ | |
| 6.3 | Check output of power supply voltages | ☐ | ☐ | |
| 6.3.1 | 26V±0,3V: | ☐ | ☐ | |
| 6.3.2 | 115V±1V: | ☐ | ☐ | |
| 6.4 | Check emission free zero point | ☐ | ☐ | |
| 6.5 | Adjust purge air heating (option) | ☐ | ☐ | Value: |
| 6.6 | Check and adjust differential pressure monitor (option) | ☐ | ☐ | |
| 6.7 | Install the GM32 at the measurement spot | ☐ | ☐ | |
| 6.8 | Adjust optical alignment | ☐ | ☐ | |
| 6.9 | Check signals | ☐ | ☐ | |
| | A: | B: | | |
| | C: | D: | | |
| 6.10 | Note lamp data | ☐ | ☐ | |
| | Maximum lamp intensity: | | | Exposure: ms |
| | | | | Lamp pulse: mA |
| 6.11 | Note software revision | ☐ | ☐ | |
| | Device Process: | | | Display: |
| | Process optic: / | | | |

| | | |
|---|---|---|
| 6.12 Check stepper motor for proper function | ☐ | ☐ |
| 6.13 Check parameterization | ☐ | ☐ |
| 6.14 Parameterize the I/O Modules | ☐ | ☐ |
| 6.15 Perform loop test | ☐ | ☐ |
| 6.16 Measured values are plausible (ref. Ch. 8) | ☐ | ☐ |
| 6.17 Save device data | ☐ | ☐ |
| 6.18 Complete Commissioning Sign-Off Sheet | ☐ | ☐ |
| 6.19 Instruct the operator personnel<br>Hand over the maintenance manual and check lists<br>- Measurement reading<br>- Perform customer maintenance<br>- Read messages | ☐ | ☐ |

## 7 Input / Output / Ranges

### 7.1 Analog output / Display

| Live zero: mA | | | Output of control values: Y ☐ / N ☐ | | | | |
|---|---|---|---|---|---|---|---|
| Analog output | Comp. | Source | Unit | Range | | Control value | Remark |
| | | | | Start | Ende | | |
| 1 | | | | | | ☐ | |
| 2 | | | | | | ☐ | |
| 3 | | | | | | ☐ | |
| 4 | | | | | | ☐ | |
| 5 | | | | | | ☐ | |
| 6 | | | | | | ☐ | |
| 7 | | | | | | ☐ | |
| 8 | | | | | | ☐ | |
| 9 | | | | | | ☐ | |
| 10 | | | | | | ☐ | |
| 11 | | | | | | ☐ | |
| 12 | | | | | | ☐ | |
| 13 | | | | | | ☐ | |
| 14 | | | | | | ☐ | |
| 15 | | | | | | ☐ | |
| 16 | | | | | | ☐ | |

### 7.2 Analog input

| Analog input | Source | Unit | Live zero | Start | End |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |

7.3. Digtalausgang

| Digitalausgang | Quelle | Inv. |
|---|---|---|
| 1 | | ☐ |
| 2 | | ☐ |
| 3 | | ☐ |
| 4 | | ☐ |

7.4 Digital input

| Digital input | Source | Inv. |
|---|---|---|
| 1 | | ☐ |
| 2 | | ☐ |
| 3 | | ☐ |
| 4 | | ☐ |

**8 Measurement values after commissioning**

| | Unit | Range | Reading | Zero point | Span point |
|---|---|---|---|---|---|
| SO2 | | | | | |
| NO | | | | | |
| | | | | | |
| | | | | | |
| Temp. | | | | - X - | - X - |
| Press. | | | | - X - | - X - |

**Remarks**

| | |
|---|---|
| Date : _____ | Name<br>Plant personnel: _____<br>Engineer: _____ |

## R



## S



## T



## U



## W



## Z

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