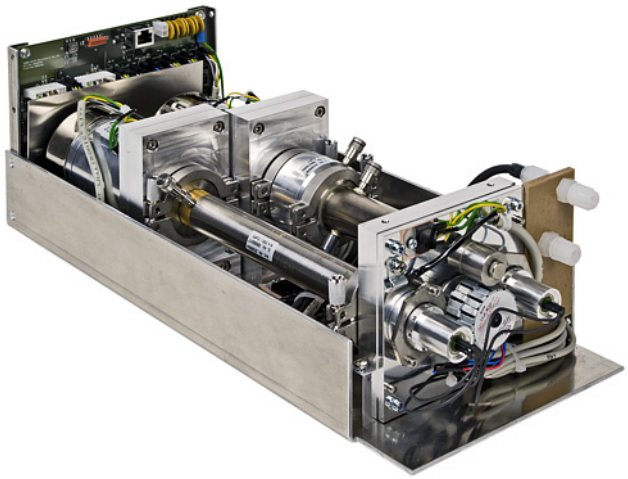
SUPPLEMENTARY OPERATING INSTRUCTIONS

Analyzer Module UNOR-MULTOR for Series GMS800

Description
Operating Functions
Technical Data



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Document Information

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Basic device: Series GMS800 gas analyzers

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Glossary

IR	Infrared (infrared light)
NDIR	Non-dispersive infrared; Designation for optical gas analysis methods in infrared spectral range
PC	Personal Computer
SOPAS	SICK Open Portal for Applications and Systems: Family of computer programs to set parameters, capture and calculate data.
SOPAS ET	SOPAS Engineering Tool: PC application program to configure modular system components.

Warning Symbols


Hazard (general)

Signal Words

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

NOTICE
Hazard which *could* result in property damage.

Information Symbols


Important technical information for this product


Nice to know


Supplementary information


Link to information at another place

UNOR-MULTOR

1 Important Information

Operating information
Application limitations
Additional documentation

1.1 Main operating information

- Electric motor operating noises are normal.

1.2 Application limitations

It is possible that another gas component contained in the sample gas can influence the analysis of the desired measuring component (cross-sensitivity).

In such a case, a constant concentration of the “interfering gas” creates a constant deviation from the true measured value every time (constant characteristic curve offset). The deviation varies accordingly when the interfering gas concentration fluctuates.

- Cross-sensitivity against a certain gas is minimized automatically when the UNOR-MULTOR also measures the concentration of this gas.
- The cross-sensitivity can be minimized through computation in the control unit when the interfering gas concentration is measured with a different Analyzer module in the GMS800.

1.3 Additional documentation/information

This document supplements the Operating Instructions for GMS800 gas analyzers. It extends the “GMS800“ Operating Instructions with technical information on the UNOR-MULTOR.

► Observe the Operating Instructions delivered with the “GMS800”.

The “GMS800” Operating Instructions also specify all further documents belonging to the individual device.

NOTICE:

► Pay primary attention to any individual information provided.

1.4 Safety information on disposal

In many applications, the “measuring chamber” of the Analyzer module is filled with a gas or gas mixture. This can also apply to the reference side of the cuvette.

► *Before the measuring chamber or cuvette is opened or severely damaged:* Check whether this component could contains dangerous gases. In case of doubt, contact the manufacturer's factory.

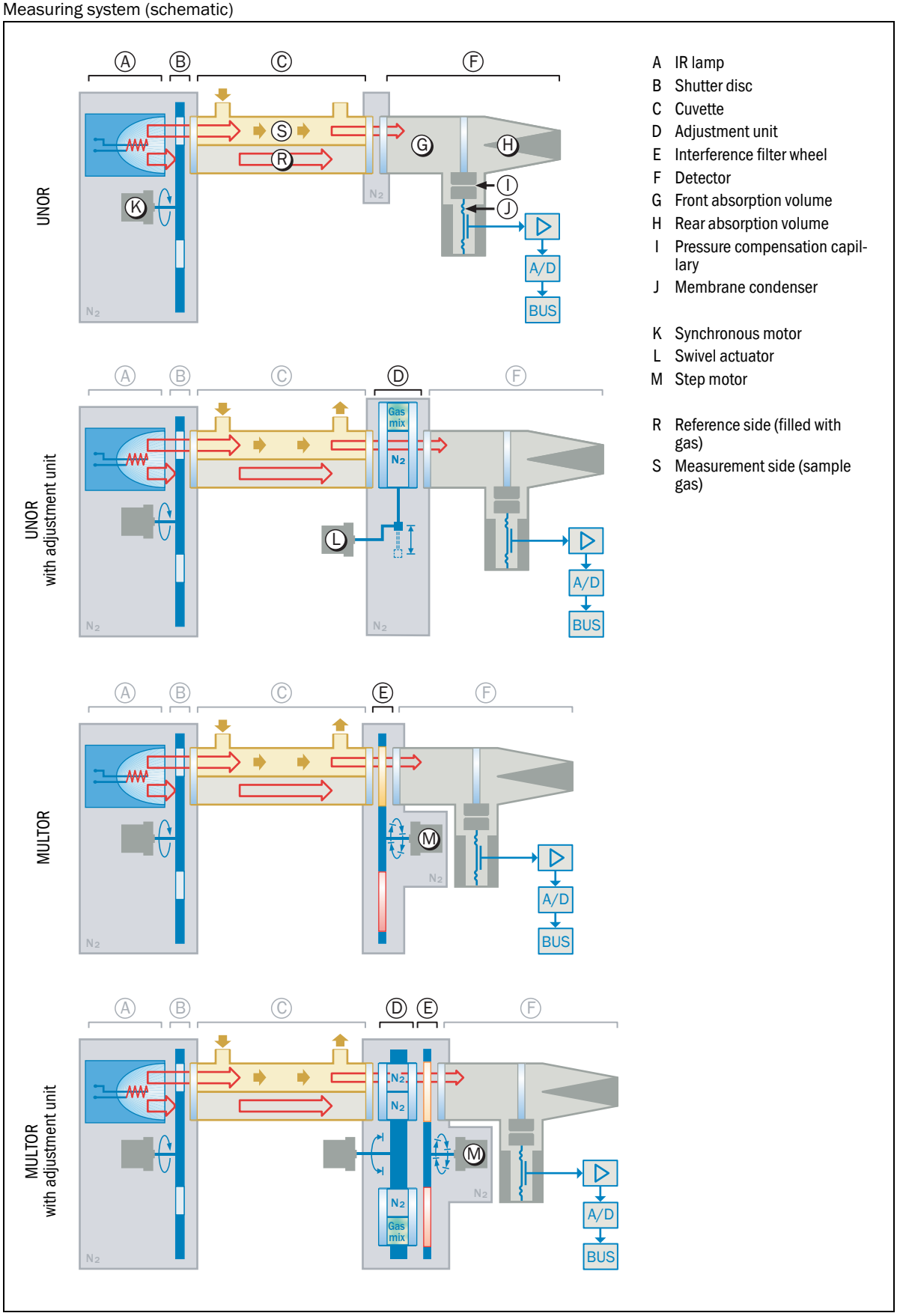
► *If the component could contain dangerous gases:* Only allow skilled persons with corresponding knowledge to dispose of such components and take appropriate protective measures at the same time (e.g. respirator mask, suctioning off, ventilation).

UNOR-MULTOR

2 Product Description

Measuring principle
Measuring ranges

Fig. 1 Measuring system (schematic)



A IR lamp
B Shutter disc
C Cuvette
D Adjustment unit
E Interference filter wheel
F Detector
G Front absorption volume
H Rear absorption volume
I Pressure compensation capillary
J Membrane condenser

K Synchronous motor
L Swivel actuator
M Step motor

R Reference side (filled with gas)
S Measurement side (sample gas)

2.1 Measuring system

Schematic representation of measuring systems → p. 8, Fig. 1

Measuring principle

The measuring principle is based on the fact that many gases have a specific absorption characteristic in the infrared light range. For this purpose, IR light is radiated through the sample gas. The concentration of a gas component in a gas mixture can be determined through suitable selection of the light wavelength and selective absorption measurement.

The NDIR dual-beam method with measurement and reference beam paths and infrared detector filled with gas is used. The optical filters for wavelength selection and the gas fillings are adapted individually to the specific sample gas properties. Sample gas flows continuously through the cuvette measurement side with its length adapted to the desired measuring range.

Sensor variants

- Sensor variant UNOR can analyze over 60 gas components with high selectivity and measuring sensitivity. Using the “flowing reference gas” option, the sensor variant UNOR is equipped so that a reference gas can flow through the cuvette reference side.
- Sensor variant MULTOR can analyze up to 3 gas components simultaneously.

When the sensor variant MULTOR is used to measure SO_2 and NO concentrations in sample gases containing water vapor, the H_2O content in the sample gas fed is also determined to optimize measuring precision. – The H_2O measured value is not a regular measuring component but an internal auxiliary variable (see also → p. 22, §5.4).

Possible sensor combinations in the Analyzer module UNOR-MULTOR

- 1 UNOR sensor
- 1 MULTOR sensor
- 2 UNOR sensors
- 1 UNOR sensor + 1 MULTOR sensor

The properties of the desired measuring components and the desired physical measuring range each demand an individual metrological concept for the Analyzer module.

Adjustment unit

Both sensor variants can be fitted with an adjustment unit (→ p. 10, §2.2.1).

2.2 Options

2.2.1 Adjustment unit (option)

The adjustment unit simplifies and accelerates routine adjustments.

Zero gas flows through the Analyzer module during an adjustment procedure with an adjustment unit. The first step is a zero point adjustment. An optical filter is swiveled automatically into the beam path of the sample cuvette for the subsequent reference point adjustment – and thus simulates the presence of a span gas in the sample cuvette. The nominal values of this simulation are determined at the manufacturer's factory.

This means only a zero gas is required for an adjustment procedure with adjustment unit; a span gas for reference point adjustment is not necessary. The procedure can be started manually or can run automatically (requires automated zero gas feed).

The adjustment unit should be checked and readjusted in larger intervals during operation (recommendation: Every 6 months). For this purpose, the Analyzer module must be adjusted with real test gases beforehand.

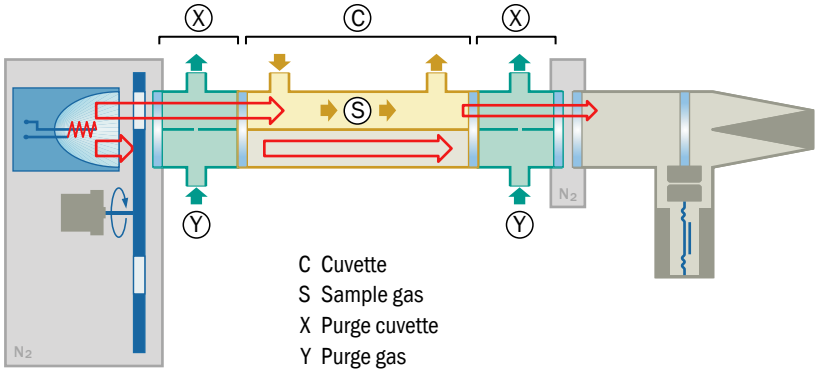
2.2.2 Purge cuvettes

The versions with purge cuvettes are intended for applications with dangerous sample gases where it must be ensured the sample gas does not flow into the gas analyzer when a window of the cuvette becomes leaky.

With purge cuvettes, each side of the cuvette is flanked by a purge cuvette through which purge gas flows continuously (→ Fig. 2). When a cuvette window is leaky, the emerging sample gas flows into the purge cuvette and from there out of the gas analyzer with the purge gas.

The GMS800 therefore requires continous purge gas for versions with purge cuvettes (→ p. 12, §3.2).

Fig. 2 Measuring system with purge cuvettes (schematic)



UNOR-MULTOR

3 Installation Information

Sample gas feed
Purge gas feed for purge cuvettes

3.1 Sample gas feed

► Observe the information on sample gas feed in the “Series GMS800” Operating Instructions.

3.2 Purge gas feed for purge cuvettes

Only valid for versions with purge cuvettes (option → p. 10, § 2.2.2)

In versions with purge cuvettes, the GMS800 enclosure has additional “purge gas inlet” und “purge gas outlet” gas connections.

Gas connections type and version → Supplementary Operating Instructions for Enclosure

1 Install an external continuous purge gas supply for GMS800.

Suitable purge gas: Chemically neutral gas (inert gas) or gas mixture suitable for diluting and transporting the measured gas without danger.

2 Feed the purge gas through the “purge gas inlet“ gas connection on the enclosure.

Allowable pressure and volume flow: → p. 25, § 6.3.2

3 Install a gas line on the “purge gas outlet” through which the purge gas and emerged sample gas are reliably discharged.

► Lead the gas line to a safe position where emerged sample gas cannot create any danger.

► *Recommendation:* Attach appropriate warning signs to the gas line or gas outlet informing about the hazardousness of the sample gas.

UNOR-MULTOR

4 Functions in SOPAS ET

Operating functions in the PC program “SOPAS ET”
Menu tree
Explanations

- Instructions for the PC program “SOPAS ET” → User Information for the program
- Exemplary menu representations → Technical Information “Basic Control Unit (BCU)” (contains information for operating with SOPAS ET)

4.1 Menu tree in SOPAS ET

User level:	O	Operator (standard)	A	Authorized operator
Access rights:	○	Viewing	●	Setting up/starting

Directory	Menu contents	O	A	Explanation
UNOR-MULTOR		○	○	
Measured value display		○	○	
Measuring component 1	Component	○	○	→ p. 16 [1]
	Measured value	○	○	→ p. 16 [2]
	Unit	○	○	→ p. 16 [3]
Measuring component 2 [1]		○	○	
↓				
Measuring component 10 [1]		○	○	
Diagnosis		○	○	
Module state	Failure	○	○	
	Maintenance request	○	○	→ p. 16 [4]
	Function(s) active	○	○	
	Uncertain state	○	○	
Logbook	Pos. | Date | Source | ...	–	○	→ p. 18, §4.3.1
Operating hours	h	–	○	→ p. 16 [5]
Measuring component 1		○	○	
Name / unit	Component	○	●	→ p. 16 [1]
	Unit	○	○	→ p. 16 [2]
State	Failure	○	○	
	Maintenance request	○	○	→ p. 16 [4]
	Function(s) active	○	○	
	Uncertain state	○	○	
Validation measurement (QAL3)	Zero point	○	○	
	Reference point	○	○	
Measuring component 2 [1]		○	○	
↓				
Measuring component 10 [1]		○	○	
Parameter		○	○	
Sampling point	Description	–	●	→ p. 16 [6]
RS485 interface	Module address	–	○	→ p. 16 [7]
	Baud rate	–	●	
	Data bits	–	●	→ p. 16 [8]
	Stop bits	–	●	
	Parity	–	●	
Measuring component 1		○	○	
Physical meas. range	Component	○	●	→ p. 16 [1]
	Unit	○	○	→ p. 16 [3]
	Start value	○	○	→ p. 16 [9]
	End value	○	○	→ p. 16 [10]
	Base value	○	○	→ p. 16 [11]
	Measuring channel	○	○	→ p. 16 [12]
	Precision	○	○	→ p. 16 [13]
Damping		–	●	
Damping (el. T90%)	Time constant [s]	–	●	
Dynamic damping	Status [On/Off]	–	●	→ p. 19, §4.3.3
	Time constant [s]	–	●	
	Threshold	–	●	
Measuring component 2 [1]		○	○	
↓				
Measuring component 10 [1]		○	○	

Directory	Menu contents	O	A	Explanation
Adjustment		○	○	
Measuring component 1		○	○	
Drift limit value	Zero point	–	○	→ p. 20, § 4.3.4
	Reference point	–	○	
Adjustment results		○	○	
Adjustment result	Zero point	○	○	
	Reference point	○	○	
Drifts	Zero point	○	○	→ p. 16 [14]
	Reference point	○	○	
Delete results	[Delete]	–	●	→ p. 20, § 4.3.5
Measuring component 2 [1]		○	○	
↓				
Measuring component 10 [1]		○	○	
Maintenance		–	○	
Maintenance flag	[On]/[Off]	–	●	→ p. 16 [15]
Settings		–	○	
User settings	[Backup]	–	●	
	[Restore last user settings]	–	●	→ p. 16 [16]
	[Restore next to last user settings]	–	●	
Factory settings	[Restore]	–	●	→ p. 16 [17]
Factory settings		○	○	
Identification		○	○	
ID numbers	Serial number	○	○	
	Material number	○	○	
	Hardware version	○	○	→ p. 17 [18]
	Software version	○	○	
	Software date	○	○	
Production release	Year | Month | Date	–	○	→ p. 17 [19]

[1] If fitted.

4.2 Explanation of the menus in SOPAS ET

[No.] refer to menu structure (→ p. 14, § 4.1)

No.	Description	Explanation
1	Component	Name of measuring component
2	Measured value	Actual measured value of measuring component
3	Unit	Physical unit of measured value
4	Failure	LED symbol ● *Significance:* Module not ready for operation ● *Possible causes:* Malfunction, defect
	Maintenance request	LED symbol ● *Significance:* Advance warning before internal technical limits reached. ● *Possible causes:* Drift limit, operating hours, lamp intensity
	Function(s) active	LED symbol ● *Significance:* At least one internal function active that impairs or hinders normal module measuring function. ● *Possible causes:* Adjustment procedure running, validation measurement running
	Uncertain state	LED symbol ● *Significance:* Actual measured values are unreliable. ● *Possible causes:* Heating up phase, internal over/under temperature, adjustment procedure programming not plausible
5	Operating hours	Number of operating hours of the IR lamp
6	Description	Freely selectable text for module name
7	Module address	Internal CAN bus address of module (defined by hardware setting in module)
8	Baud rate	Transfer speed (standard: 9600)
	Data bits	Number of data bits (standard: 8) The GMS800 only uses the 7-bit range (ASCII code 0 ... 127) but can also communicate in 8-bit format.
	Stop bits	Number of stop bits (1 or 2; standard: 2)
	Parity	Additional identification for automatic monitoring of character transfers; [Even], [Odd], [None]. – Standard: None
9	Start value	Start value of physical measuring range
10	End value	End value of physical measuring range
11	Base value	Internal physical base value of measuring range
12	Measuring channel	Internal measuring channel for measuring component
13	Precision	[On] = higher measuring precision is available for measuring range 2 (effective in range 0 ... 20% of physical measuring range)
14	Drifts	● Last = since last adjustment ● Total = since last drift calculation initialization
15	Maintenance flag	[On] = The “Maintenance request” status of this module has been activated [1]
16	User settings	● Backup = Save a copy of the actual module settings. ● Restore = Overwrite the current module settings with a saved copy. [2]
17	Factory settings	Overwrite the actual module settings with the original settings from the factory.[2] ► *Recommendation:* Save the actual module settings first (→ “User settings”).

No.	Description	Explanation
18	Serial number	Individual module serial number
	Material number	Identification number of module version
	Hardware version	Module electronics version number
	Software version	Module software version number
	Software date	Module software revision
19	Production release	Module date of manufacture

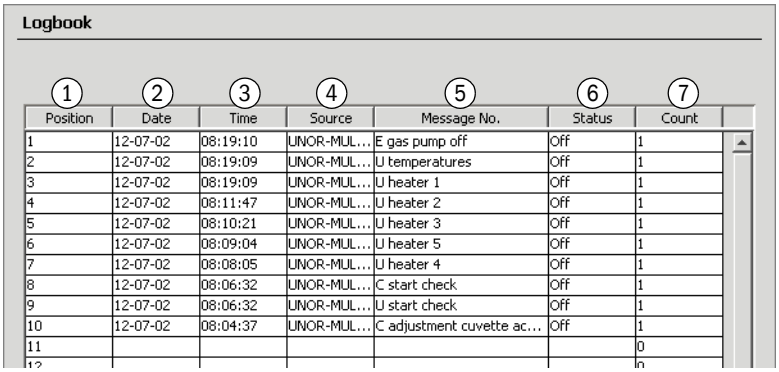
[1] This status can be manually activated at the “Service” level to signal maintenance work.
[2] A warm start is then done automatically.

4.3 Explanation of functions

4.3.1 Logbook in SOPAS ET

The Logbook Table shows the last 20 internal messages.

Fig. 3 Menu "*[Module name]*/Diagnosis/Logbook" in the PC program "SOPAS-ET" (example)



Position	Date	Time	Source	Message No.	Status	Count
1	12-07-02	08:19:10	UNOR-MUL...	E gas pump off	Off	1
2	12-07-02	08:19:09	UNOR-MUL...	U temperatures	Off	1
3	12-07-02	08:19:09	UNOR-MUL...	U heater 1	Off	1
4	12-07-02	08:11:47	UNOR-MUL...	U heater 2	Off	1
5	12-07-02	08:10:21	UNOR-MUL...	U heater 3	Off	1
6	12-07-02	08:09:04	UNOR-MUL...	U heater 5	Off	1
7	12-07-02	08:08:05	UNOR-MUL...	U heater 4	Off	1
8	12-07-02	08:06:32	UNOR-MUL...	C start check	Off	1
9	12-07-02	08:06:32	UNOR-MUL...	U start check	Off	1
10	12-07-02	08:04:37	UNOR-MUL...	C adjustment cuvette ac...	Off	1
11						0
12						0

Column	Meaning
1	Sequential number in Logbook
2	Time of last message change
3	
4	"System" = measuring system (hardware) "MV" = measuring component (measurement)
5	Short message text, e.g. "F measured value". The character prefix classifies the message: F = Failure C = Check (adjustment/validation) U = Uncertain (extra information) M = Maintenance E = Extended (status message)
6	Actual status of the message
7	Total count of activations

4.3.2 Upload (data synchronization)

Only applicable when the "SOPAS ET" PC software is used. Not applicable for systems without control unit (special versions).

The new data are not transferred automatically to "SOPAS ET" after settings for a module have been changed with the menu functions of the control unit. "SOPAS ET" continues using the previous data.

► *To transfer the current data of a module to "SOPAS ET":* Start the "Upload all parameters from device" function in "SOPAS ET" once.

4.3.3 Damping

Constant damping

When "damping" has been programmed, the average value from the current measured value and the previous measured values (floating averaging) are displayed instead of the current measured value.

Possible uses include:

- Damping metrological measured value fluctuations (noise)
- Smoothing fluctuating measured values when only the average value is relevant

Damping is done in the Analyzer module and therefore affects all measured value displays and outputs. It is also active during an adjustment procedure.

- Increasing damping normally increases the reaction time (90% time) of the gas analysis system accordingly.
- Reducing damping can possibly increase the measurement signal “noise” (measuring turbulence).
- Time constant = 0 s means: No damping.

CAUTION: Risk of incorrect adjustment

The “Measuring time, test gas” must be at least 150% of the set damping time constant during adjustments.

► *When damping has been reset or increased:* Check whether adjustment settings need to be adapted.

Dynamic damping

“Dynamic damping” serves to compensate measured value fluctuations without significantly increasing the reaction time. Dynamic damping is automatically deactivated when the measured value changes rapidly and strongly as against “normal” damping. This allows “smoothing” continuous minor measured value fluctuations but rapid measured value changes are still displayed without delay. Dynamic behavior is determined with the “Threshold” parameter:

- When the measured values change only slowly, dynamic damping functions as constant damping.
- When the difference of successive measured values is greater than the set limit, dynamic damping is terminated automatically and remains disabled as long as the measured values continue to change rapidly.
- Dynamic damping is active again when measured value differences are below the limit again (which means measured values changes remain slight).

Dynamic damping also affects all measured value displays and outputs.

4.3.4 Drift limit values

Purpose

Analyzer module drifts are caused, for example, by contamination, mechanical changes or aging effects. The total drift (i.e. the deviation from original state) increases gradually. It is not practical to keep compensating an ever increasing total drift through computation. Inspect and reset the Analyzer module when total drift has become very large.

Drift limit values monitor total drift automatically. These also protect against erroneous adjustments.

Functionality

After every adjustment, an Analyzer module compares the calculated total drift with the drift limit value. Drift limit value violation is reported in two stages:

- Status “M” (Maintenance request) is activated when the total drift reaches 100 ... 120% of the drift limit value.
- Status “F” (Failure) is activated when the total drift reaches more than 120% of the drift limit value.
- When an adjustment procedure shows that a calculated drift has reached more than 150% of the drift limit value, the result from this adjustment procedure is ignored and the previous adjustment remains valid.

- The drift limit values are set in the factory (standard value: 10%).
- A Service function is available to reset all drift values to “0” (Drift reset). This is useful after Analyzer module maintenance when this has established a new original state.

4.3.5 Deleting adjustment results

The “Delete results” function deletes all determined drift values of a measuring component. Drift limit values then refer to new drift values.

The data of the previous adjustment which was performed before are then no longer displayed. Test gas settings (e. g. nominal value) are not changed.

CAUTION: Risk of incorrect adjustment

If very large drift values are displayed after a manual adjustment procedure (→ Operating Instructions “Basic Control Unit (BCU)”), a test gas used probably did not match the relevant test gas setting or gas feed was interrupted – and the adjustment result was still accepted.

► Do not delete incorrect adjustment results, but repeat the adjustment carefully.

► Do not use the deletion of adjustment results to nullify large drift values caused by extensive physical changes of an Analyzer module. Instead, clean the Analyzer module or perform an adjustment.[1]

► *After an Analyzer module has been cleaned, altered or exchanged:* Delete the relevant adjustment results and perform an adjustment.

[1] By the manufacturer's Customer Service or authorized skilled persons with appropriate training.

UNOR-MULTOR

5 Adjustment Information

Parameter setting
Control
Adjustment interval
Special H_2O adjustment

5.1 Setting parameters and controlling adjustments

The control unit controls the adjustments.

- ► Individual adjustment of each shown measuring component and each measuring range.
- ► Programming of the adjustment parameters for each measuring component of the GMS800 → Technical Information “Basic Control Unit (BCU)”
- ► Manual start of an adjustment procedure → Operating Instructions of the control unit
- ► Adjustment procedure
  - For H_2O measurement (only when necessary → §5.4): See separate Service information
  - For all other measured components: → “Series GMS800” Operating Instructions

5.2 Adjustment interval

- ► General information concerning purpose, prerequisites and frequency of adjustments → Operating Instructions “Series GMS800”
- ► *Special case:* H_2O adjustment with measured components SO_2 and NO (→ §5.4)

5.3 Using the adjustment unit (option)

When the Analyzer module has an adjustment unit fitted (option), a span gas is not required for the reference point adjustment during routine adjustments. The adjustment unit can be used instead of span gas. Just a zero gas is needed here for an adjustment procedure for this Analyzer module.

- Explanation of the adjustment unit function → p. 10, §2.2.1
- Programming an adjustment procedure with adjustment unit → Technical Information “Basic Control Unit (BCU)”
- General information on test gases → “Series GMS800” Operating Instructions

5.4 H_2O adjustment for measured components SO_2 and NO

- ► *If the Analyzer module UNOR-MULTOR measures the concentrations of SO_2 and NO simultaneously (only with sensor variant MULTOR):* Check whether the H_2O content is also measured.
- ► *If this is the case:* Have the H_2O measurement adjusted about once a year (Service task).

The Menu tree has a corresponding measuring component (e.g. “Measuring component 4”) with component name “H2O” or similar when the H_2O content is measured to support SO_2 and NO measurement.
This is an internal auxiliary variable not normally shown in the measured value displays.

UNOR-MULTOR

6 Technical Data

Ambient conditions
Sample gas specifications
Metrological specifications

6.1 Installation location requirements

Geographic height at installation location:	≤ 2500 m altitude [1]
Ambient air pressure:	700 ... 1200 hPa
Jolts, oscillations (5 ... 59 Hz)	
– Displacement:	Max. ±0.035 mm
– Activation acceleration amplitude:	Max. 5 ms^{-2}
Fitting position influence (tilted position influence)	No influence for constant tilted position up to ±15° [2]

[1] Higher altitudes possible on order (option).
[2] Perform an adjustment after changing the fitting position.

6.2 Metrological specifications

Measured variable:	Volume concentration of a gas component
Measuring ranges:	See specification for individual device
Detection limit (3σ): [1]	
– Standard measuring ranges:	< 0.5% of measurement span
– Small measuring ranges: [2]	< 1% of measurement span
Linearity deviation:	< 1% of measurement span[3]
Zero point drift	
– Standard measuring ranges:	≤ 1% of lowest measured value per week
– Small measuring ranges: [2]	≤ 2% of lowest measured value per week
Reference point drift:	≤ 1% of measured value per week
Sample gas volume flow influence (throughflow dependency)	
– With cuvette length ≥ 1.2 mm:	< 0.1% per 10 l/h change
– With cuvette length < 1.2 mm:	< 0.5% per 10 l/h change
Ambient temperature influence:	
– Zero point, standard measuring ranges:	< 1% of smallest measurement span per 10 K change
– Reference point, standard measuring ranges:	< 1% of measured value per 10 K change
– Zero point, small measuring ranges: [2]	< 2% of smallest measurement span per 10 K change
– Reference point, small measuring ranges: [2]	< 2% of measured value per 10 K change
Air pressure influence [4]	
– Without pressure compensation:	0.5 ... 1.0% of measured value per 1% pressure change
– With automatic pressure compensation: [5] [6]	< 01% of measured value per 1% pressure change
Mains voltage and mains frequency influence: [7]	< 0.5% of smallest measurement span
Response time (t_{90}) [8]	
– UNOR:	3 s [9]
– MULTOR:	≤ 25 s
Run-in time:	Approx. 45 minutes [9]

[1] With constant electronic damping with time constant $T_{90, el.}$ = 15 s.
[2] Valid for measuring ranges < 2x smallest measuring range (→ p. 26, §6.5).
[3] MULTOR: Typical value for standard conditions.
[4] *When the sample gas is open:* Atmospheric air pressure influence.
When the sample gas outlet is fed back to the process: Process gas pressure influence.
[5] *When the sample gas outlet is open:* Option »Baro correction«.
When the sample gas outlet is fed back to the process: Option “Sample gas pressure correction”.
[6] Effective range: 700 ... 1300 hPa.
[7] Within the specified voltage and frequency ranges.
[8] With sample gas volume flow = 60 l/h, depending on cuvette length and sample gas volume flow (MULTOR: and number of measuring components). Influenced by adjustable electronic damping ($T_{90, el.}$ = 1 ... 600 s).
[9] Typical value for standard conditions.

6.3 Gas technical requirements

6.3.1 Sample gas

Allowable sample gas temperature: [1]	0 ... 45 °C (32 ... 113 °F)
Allowable sample gas dew point:	Below ambient temperature
Particles in the sample gas:	Sample gas should be free from dust and aerosols [2]
Allowable sample gas pressure [3]	
– With sample gas paths with hoses:	–200 ... +300 hPa (–0.2 ... +0.3 bar)
– With sample gas paths with pipes:	–200 ... +1000 hPa (–0.2 ... +1.0 bar)
Sample gas volume flow [1]	
– Recommended:	30 ... 60 l/h (500 ... 1000 cm^3/min)
– Standard:	30 l/h
– Without built-in sample gas pump:	5 ... 100 l/h (83 ... 1666 cm^3/min)
– With built-in sample gas pump:	30 ... 60 l/h (500 ... 1000 cm^3/min)

[1] Keep constant during operation; check and observe regulations in approvals when available.
[2] When entering the gas analyzer.
[3] Relative to ambient pressure (700 ... 1200 hPa).

6.3.2 Purge gas

Only valid for version with purge cuvettes (→ p. 10, § 2.2.2).

Suitable purge gas:	Dry inert gas (chemically neutral gas/gas mixture without condensable components)
Allowable purge gas pressure [1]	15 ... 30 hPa
Purge gas volume flow	
– Minimum:	10 l/h (167 cm^3/min)
– Maximum:	100 l/h (1666 cm^3/min)
– Recommended:	10 ... 80 l/h (167 ... 1333 cm^3/min)
– Standard:	20 l/h (333 cm^3/min)

[1] Relative to the ambient/atmospheric air pressure.

6.4 Materials with sample gas contact

Component	Material
Fittings/connections:	Stainless steel
Cuvette:[1]	Stainless steel 1.4571, aluminium, gold
Optical window:[2]	CaF_2 or BaF_2
Synthetics:[3]	Viton B, PVDF
Adhesive:	Special adhesive

[1] Depending on device version; gold inner coating on some device versions.
[2] Depending on device version.
[3] Depending on device version: Not valid for versions with gas paths with pipes.

6.5 Measuring ranges

- Conversion from ppm to mg/m³ relative to 20°C, 1013 hPa.
- All specifications valid for a mixture of the measuring components and N_2.

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Measuring component	Smallest measuring range			Largest measuring range
	Technical		Performance-tested[1]	
	ppm	mg/m³		% by vol.
C_2H_2	300	350		100
$C_2H_2F_4$	100	500		100
C_2H_4	300	500		100
C_2H_6	100	135		5
C_2H_6[2]O	300	600		5
C_2H_6[3]O	100	200		100
C_3H_6	300	560		20
C_3H_6O	500	1300		100
C_3H_8	100	200		100
C_4H_{10}	100	260		20
C_4H_6	5000	12000		50
C_5H_{12}	300	1000		10
C_6H_{14}	300	1150		4
$C_6H_{18}OSi_2$	100	725		0.1
$C_6H_4Cl_2$	300	2000		4
C_7H_{16}	300	1350		50
CCl_3F	500	3000		30
CH_2Cl_2	200	750		100
CH_4	70	50		10
CH_4O	500	700		10
CH_4O	150	200		100
$CHCl_2F$	500	2300		100
$CHClF_2$	100	400		100
CO	20	25	75 mg/m³	100
CO+CO_2	50			
CO_2	10	20	25 % by vol.	10
$COCl_2$	200	900		30
CS_2	200	680		100
N_2O	25	50	50 mg/m³	100
NH_3	300	200		100
NO	75	100	100 mg/m³	100
SF_6	50	330		100
SO_2	26	75	75 mg/m³	100

[1] Approvals→ p. 27, §6.6.
[2] With hydrocarbons (C_nH_n).
[3] Without hydrocarbons (C_nH_n).

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Measuring component	Smallest measuring range			Largest measuring range
	Technical		Performance-tested[1]	
	ppm	mg/m³		% by vol.
CH_4	280	200	286 mg/m³	100
CO	160	200	200 mg/m³	100
CO_2	100	200	25 % by vol.	100
NO	190	250	250 mg/m³	100
SO_2	85	250	250 mg/m³	100

[1] Approvals → §6.6.

6.6 Approvals

Conformities	UNOR	MULTOR
EN 15267-3	●	●
EN 14181	●	●
2000/76/EC (17th BImSchV)	●	–
2001/80/EC (13th BImSchV)	●	●
27th BImSchV	●	●
TI Air with incineration plants for CH_4	–	●

6.7 Auxiliary power supply for the module

Voltage supply:	24 VDC
Power input:	≤ 150 W

UNOR-MULTOR

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