SUPPLEMENTARY OPERATING INSTRUCTIONS

Analyzer Module OXOR-P for Series GMS800

Description
Operating Functions
Technical Data

SICK
Sensor Intelligence.

Document Information

Described Product
Product name: Analyzer Module OXOR-P
Basic device: Series GMS800 gas analyzers

Document ID
Title: Supplementary Operating Instructions OXOR-P
Part No.: 8013033
Version: 2.0
Release: 2012-12

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Glossary

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.
Susceptibility	Magnetic susceptibility is the parameter for the magnetizability of a substance in a magnetic field.
PVDF	Polyvinylidene fluoride

Warning Symbols


Hazard (general)

Warning Levels/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

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1 Important Information

Application limitations
Additional documentation

1.1 Application limitations

Suitability

► Do not use the standard version to measure corrosive sample gases or those containing solvents (alternative versions → p. 8, § 2.3).

Measuring precision

Measurement errors can occur when the sample gas contains gas components that have a considerable magnetic susceptibility.

- Explanation → p. 8, § 2.2
- Quantitative specifications → p. 22, § 5.6

Cross-sensitivity against a particular gas component is minimized automatically when the GMS800 also measures the concentration of this gas component.

1.2 Additional documentation/information

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

► 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.

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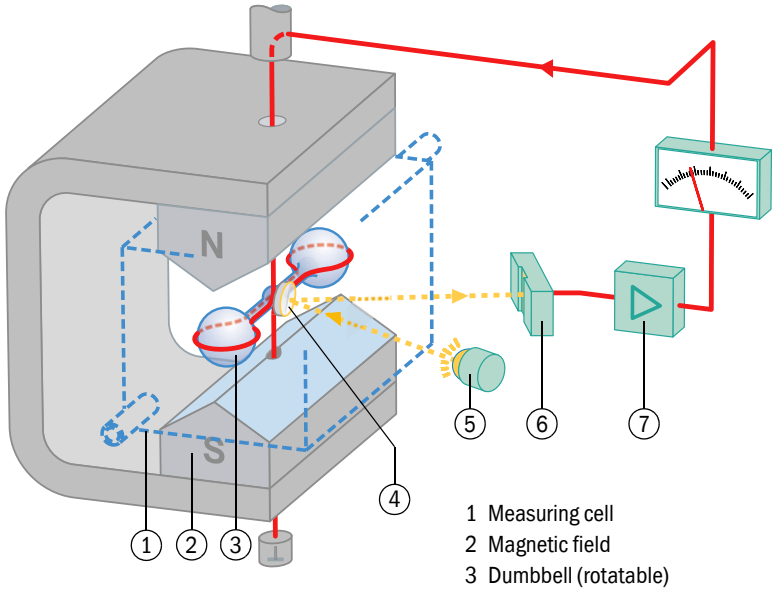
2 Product Description

Measuring principle
Measuring ranges
Product variants

2.1 Measuring principle

Fig. 1 OXOR-P measuring cell (schematic)



1 Measuring cell
2 Magnetic field
3 Dumbbell (rotatable)
4 Mirror
5 Light source
6 Detector
7 Compensation amplifier

The measuring cell of the OXOR-P module has a magnetic field in which a diamagnetic dumbbell is suspended. An opto-electronic compensation device ensures the dumbbell is continuously kept in the home position.

Sample gas flows through the measuring cell. When the sample gas contains O_2, the paramagnetic property of the O_2 changes the magnetic field. The change required for opto-electronic compensation is the measuring effect evaluated by the software.

2.2 Selectivity

The selectivity of the OXOR-P module is based on the extraordinary large magnetic susceptibility of oxygen. In comparison, the magnetic properties of other gases are so low that these need not be considered in the normal case. However, measurement errors can occur when the sample gas contains gas components that have a considerable magnetic susceptibility. There are several methods available for compensation (→ p. 18, § 4.4).

2.3 Product variants

Standard version:	Measuring cell made of standard materials (→ p. 21, § 5.4) – not resistant against corrosive substances or those containing solvents
Option:	Corrosion resistant measuring cell
Option:	Measuring cell resistant against gases containing solvents

► See the delivery documents for the product variant delivered.

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3 Functions in SOPAS ET

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

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

3.1 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
OXOR		○	○	
Measuring value display		○	○	
Measuring component 1	Component	○	○	→ p. 12 [1]
	Measured value	○	○	→ p. 12 [2]
	Unit	○	○	→ p. 12 [3]
Measuring component 2 [1]		○	○	
Measuring component 3 [1]		○	○	
Measuring component 4 [1]		○	○	
Diagnosis		○	○	
Module state	Failure	○	○	
	Maintenance request	○	○	→ p. 12 [4]
	Function(s) active	○	○	
	Uncertain state	○	○	
Logbook	Pos. | Date | Source | ...	–	○	→ p. 14, § 3.3.1
Operating hours	h	–	○	→ p. 12 [5]
Measuring component 1		○	○	
Name / unit	Component	○	●	→ p. 12 [1]
	Unit	○	○	→ p. 12 [2]
State	Failure	○	○	
	Maintenance request	○	○	→ p. 12 [4]
	Function(s) active	○	○	
	Uncertain state	○	○	
Validation measurement (QAL3)	Zero point	○	○	
	Date	○	○	
Measuring component 2 [1]		○	○	
Measuring component 3 [1]		○	○	
Measuring component 4 [1]		○	○	
Parameter		○	○	
Sampling point	Description	–	●	→ p. 12 [6]
RS485 interface	Module address	–	○	→ p. 12 [7]
	Baud rate	–	●	
	Data bits	–	●	→ p. 12 [8]
	Stop bits	–	●	
	Parity	–	●	
Measuring component 1		○	○	
Physical meas. range	Component	○	●	→ p. 12 [1]
	Unit	○	○	→ p. 12 [3]
	Start value	○	○	→ p. 12 [9]
	End value	○	○	→ p. 12 [10]
	Base value	○	○	→ p. 12 [11]
	Measuring channel	○	○	→ p. 12 [12]
	Precision	○	○	→ p. 12 [13]
Damping		–	●	
Damping (el. T90%)	Time constant [s]	–	●	
Dynamic damping	Status [On/Off]	–	●	→ p. 15, § 3.3.3
	Time constant [s]	–	●	
	Threshold	–	●	
Measuring component 2 [1]		○	○	
Measuring component 3 [1]		○	○	
Measuring component 4 [1]		○	○	

Directory	Menu contents	O	A	Explanation
Adjustment		○	○	
Measuring component 1		○	○	
Drift limit value	Zero point	–	○	→ p. 16, § 3.3.4
	Reference point	–	○	
Adjustment results		○	○	
Adjustment result	Zero point	○	○	
	Reference point	○	○	
Drifts	Zero point	○	○	→ p. 12 [14]
	Reference point	○	○	
Delete results	[Delete]	–	●	→ p. 16, § 3.3.5
Measuring component 2 [1]		○	○	
Measuring component 3 [1]		○	○	
Measuring component 4 [1]		○	○	
Maintenance		–	○	
Maintenance flag	[On]/[Off]	–	●	→ p. 12 [15]
Configurations		–	○	
User settings	[Backup]	–	●	
	[Restore last user settings]	–	●	→ p. 12 [16]
	[Restore next to last user settings]	–	●	
Factory settings	[Restore]	–	●	→ p. 12 [17]
Factory settings		○	○	
Identification		○	○	
ID numbers	Serial number	○	○	
	Material number	○	○	
	Hardware version	○	○	→ p. 13 [18]
	Software version	○	○	
	Software date	○	○	
Production release	Year | Month | Date	–	○	→ p. 13 [19]

[1] If fitted.

3.2 Explanation of the menus in SOPAS ET

[No.] refer to menu structure (→ p. 10, §3.1)

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 Analyzer module
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 basis value of measuring range
12	Measuring channel	Internal measuring channel for the 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] = Status “Maintenance” is activated (here as signal for active maintenance work)
16	User settings	● Backup = Save a copy of the actual module settings. ● Restore = Overwrite the actual module settings with a saved copy. [1]
17	Factory settings	Overwrite the actual module settings with the original settings from the factory.[1] ► *Recommendation:* Save the current 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

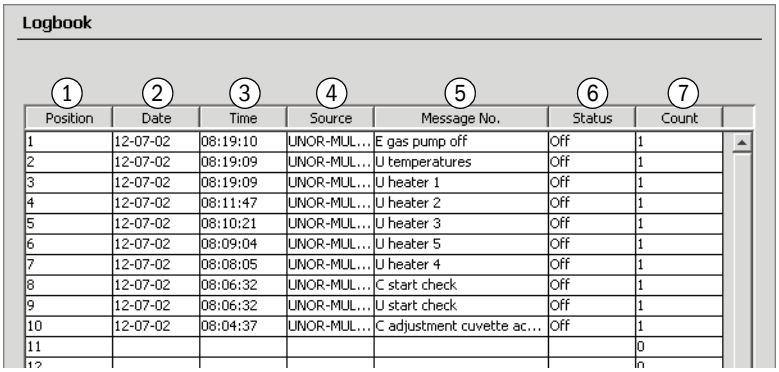
[1] A warm start is then done automatically.

3.3 Explanation of functions

3.3.1 Logbook in SOPAS ET

The Logbook Table shows the last 20 internal messages.

Fig. 2 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	Current message status
7	Total count of activations

3.3.2 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.

3.3.3 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.

3.3.4 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.

3.3.5 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.

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4 Adjustment Information

Parameter setting
Control
Adjustment interval
Zero gas
Cross-sensitivity compensation

4.1 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

4.2 Adjustment interval

- ► Adjust the OXOR-P in regular intervals. *Recommendation:* Weekly.
- ► General information concerning purpose, prerequisites and frequency of adjustments → “Series GMS800” Operating Instructions

4.3 Zero gas for the OXOR-P

The zero gas to be measured by the OXOR-P may also contain the measuring components – up to a concentration corresponding to 80% of the physical measurement span. The set-point values for zero and span gas must be at least 10% different (relative to the physical measurement span).

In applications where large cross-sensitivities occur, the zero gas or a gas mixture representing the average sample gas composition can be used as »interfering gas«. This means the cross-sensitivities can be considered physically during adjustments (→ § 4.4).

Basic information on the test gases → Operating Instructions “Series GMS800”

4.4 Cross-sensitivity compensation

Physical interfering effect

Measurement errors can occur when the zero point of the OXOR-P module is adjusted using nitrogen but the sample gas mainly comprises other gases having significant paramagnetic or diamagnetic susceptibility. In this case, the GMS800 could possibly display a certain O_2 value even when the sample gas contains no oxygen at all.

Compensation methods

a) *Adapted zero gas:* Use the corresponding »interfering gas« or an O_2-free gas mixture representing the average sample gas composition as zero gas.
   ››› The zero point is adjusted more or less under measuring conditions – this »adjusts« the cross-sensitivity effect.

b) *Manual compensation:* Use normal zero gas to adjust the zero point and do not set the setpoint value for zero gas to »0« but to a value that exactly counters the cross-sensitivity effect.
   ››› This shifts the zero point so that the cross-sensitivity effect is compensated.

c) *Automatic compensation (option):* The GMS800 measures interfering gas components simultaneously with own Analyzer modules and compensates the cross-sensitivity effects automatically using these measured values.
   ››› The cross-sensitivity effects are minimized metrologically.

OXOR-P

5 Technical Data

Ambient conditions
Sample gas specifications
Metrological specifications

5.1 Installation location requirements

Geographic height at installation location:	≤ 2500 m altitude [1]
Ambient air pressure:	700 ... 1200 hPa
Fitting position influence (tilted position influence)	< 0.05% by vol. O_2 per 1° position change

[1] Higher altitudes possible on order (option)

5.2 Metrological specifications

Measured variable:	O_2 volume concentration
Possible measuring ranges: [1]	
– Standard:	0 ... 1% by vol. O_2 to 0 ... 100% by vol. O_2
– Option:	Suppressed measuring range (up to 95 ... 100% by vol. O_2)
Smallest measuring range:	0 ... 1% by vol. O_2
Detection limit (3σ): [2]	< 0.5% of measurement span
Linearity deviation:	< 1% of measurement span
Zero point drift	≤ 1% of the lowest measured value per week [3] or
– For measuring ranges < 5% by vol.:	< 0.05% by vol. per week
Reference point drift:	≤ 1% of measured value per week
Ambient temperature influence:	
– Measurement span ≥ 5% by vol. O_2:	< 2% of measurement span per 10 K
– Measurement span < 5% by vol. O_2:	< 0.1% by vol. O_2 per 10 K
Air pressure influence [4]	
– Without pressure compensation:	< 1% of measured value per 1% pressure change
– With automatic pressure compensation: [5] [6]	< 0.1% of measured value per 1% pressure change
Sample gas volume flow influence (throughflow dependency) [7]	< 0.2% by vol. O_2
Mains voltage/mains frequency influence: [8]	< 0.5% of smallest measurement span
Setting time (t_{90}): [9]	< 4 s
Run-in time:	60 minutes typical

[1] Actual measuring range, see specification of individual device.
[2] With constant electronic damping with time constant $T_{90, el.}$ = 15 s.
[3] Option.
[4] *When the sample gas outlet 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] Volume flow change 10 ... 60 l/h.
[8] Within the specified voltage and frequency ranges.
[9] For sample gas volume flow = 60 l/h and constant electronic damping $T_{90, el.}$ = 1 s (adjustable 1 ... 600 s).

5.3 Technical gas requirements

Allowable sample gas temperature: [1]	0 ... 45 °C (32 ... 113 °F) [2]
Allowable sample gas dew point:	Below ambient temperature
Particles in the sample gas:	Free from dust and aerosols [3]
Allowable sample gas pressure [4]	
– For gas paths with hoses:	–200 ... +300 hPa (–0.2 ... +0.3 bar)
– For gas paths with pipes:	–200 ... +1000 hPa (–0.2 ... +1.0 bar)
Sample gas volume flow [1]	
– Minimum:	5 l/h (83 cm^3/min)
– Maximum:	100 l/h (1660 cm^3/min) [5]
– With built-in gas pump: [6]	30 ... 60 l/h (500 ... 1000 cm^3/min)
– Standard:	30 l/h (500 cm^3/min)

[1] Keep constant during operation.
[2] *When a sample gas cooler is used*: Always above the cooler temperature (dew point).
[3] When entering the gas analyzer.
[4] Relative to the ambient/atmospheric air pressure.
[5] Potentially explosive atmospheres: Observe approval requirements.
[6] Option in Gas module.

5.4 Materials with sample gas contact

Version	Materials[1]
Standard:	Viton B, PVDF, glass, stainless steel (1.4571), platinum, nickel
Option:	Solvent/corrosion resistant materials [2]

[1] Depending on device type
[2] Please inquire

5.5 Measuring ranges

Measuring component	Measuring range		
	Standard	Option.	Performance-tested [1]
O_2	100 % by vol.	1 % by vol.	25 % by vol.

[1] Approvals→ §5.7

5.6 Influence effects

Theoretical cross-sensitivities due to magnetic susceptibility

Gas components (100% by vol.)	Formula	Zero point shift [Percent by volume O_2]
Argon	Ar	–0.22
Acetylene	C_2H_2	–0.01
Benzole	C_6H_6	–1.24
Ethane	C_5H_6	–0.34
Ethanol	C_2H_5OH	–0.63
Ethylene	C_2H_4	0.00
Carbon dioxide	CO_2	–0.23
Carbon monoxide	CO	+0.06
Methane	CH_4	–0.01
Neon	He	+0.15
N-octane	C_8H_{18}	–2.45
Sulphur dioxide	SO_2	–0.18
Hydrogen sulfide	H_2S	–0.39
Nitrogen oxide	NO	+42.71
Hydrogen	H_2	+0.23
Water vapor	H_2O	–0.03
Xenon	Xe	–0.92

5.7 Approvals

Conformities	OXOR-P
EN 15267-3	●
EN 14181	●
2000/76/EC (17th BImSchV)	●
2001/80/EC (13th BImSchV)	●
27th BImSchV	●

5.8 Auxiliary power supply for the module

Voltage supply:	24 VDC
Power input:	≤ 30 W

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OXOR-P

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