Overview

The entire SIPROCESS GA700 device is configured in a modular fashion and consists of a basic unit and at least one – maximum two – modules. It can optionally be fitted with up to two interface modules.

Benefits

The basic unit provides:

- Transmission and evaluation of measurement results
- Display and transmission of device parameters
- Operation (parameterization, configuration)

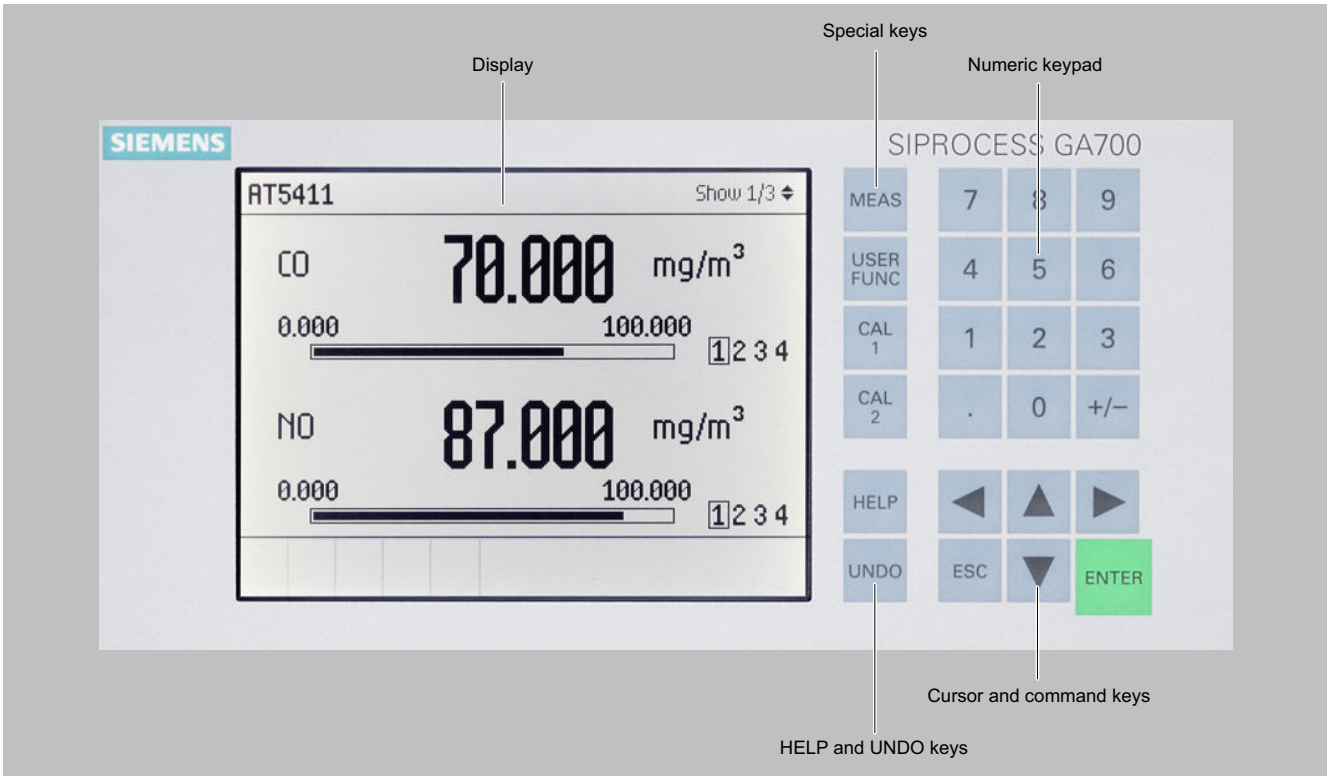
In addition to the modules, the basic unit contains the interfaces for the peripherals.

Application

Depending on the modules installed, the device is predominantly used in the following sectors:

- Chemical industry
- Petrochemicals
- Steel
- Cement
- Power generation
- Environmental protection

Design



Display and operator panel of the SIPROCESS GA700 devices

19" rack unit

- 19" rack unit with 3 height units (U) for installation
  - In hinged frame
  - In cabinets
- Gas connections directly on the analyzer module for sample gas inlet and outlet: for pipe diameter 6 mm
- Purging gas connections (optional), purging gas connection for 6 mm or 1/4" hose (optional)
- ATEX/IECEx approval for Zone 2

Wall-mounted device

- Gas connections directly on the analyzer module for sample gas inlet and outlet: Pipe union for pipe diameter 6 mm
- Purging gas connections (optional): Pipe diameter 12 mm
- ATEX/IECEx approval for Zones 1 and 2

Field device

- Field control unit: Flameproof encapsulated enclosure with mounted Ex e connection enclosure (IP55)
- Ex-d field module with installed module (IP65)
- ATEX/IECEx approval for Zone 1
- Maximum cable length of the connection cable between field module and field control unit: 7 m

Display and operator panel

- LCD panel for simultaneous display of:
  - Measured value
  - Status bar
  - Measuring ranges
- Menu-driven operation for parameterization, test functions, adjustment
- User help in plain text
- Operating software in six languages (English, German, French, Italian, Spanish, Portuguese)

Design (continued)

Inputs and outputs

- 19" rack unit and wall-mounted unit
  - 8 digital inputs, designed for 24 V, floating, freely configurable (e.g. for measuring range switchover, processing of external signals from sample preparation)
  - 8 relay outputs, with changeover contacts, freely configurable (e.g. for faults, maintenance demanded, limit alarms, external solenoid valves)
  - Ethernet connection contained in the basic unit (connection on the rear side, Ethernet RJ45, 100 Mbit)
  - Service interface (front side); Ethernet RJ45, 100 Mbit.
- Field control unit
  - 1 analog output for each component 0/4 to 20 mA
  - 5 relay outputs, with changeover contacts, freely configurable, e.g. for faults or measuring range identification
  - 5 digital inputs, designed for 24 V, floating, freely configurable, e.g. for measuring range switchover

Option modules

- 19" rack unit and wall-mounted unit
  - Option module 1.1:
    12 relay outputs and 8 digital inputs
  - Option module 2.1:
    1 analog output for each measuring component (0/4 to 20 mA or configurable according to NAMUR), plus 3 relay outputs for each module
  - Option module 2.2 I/O:
    1 analog output for each measured component (0/4 to 20 mA or configurable according to NAMUR), 4 analog inputs and 4 digital inputs
  - Option module Profibus DP:
    No additional inputs and outputs
- Field control unit
  - Option module 2.2:
    4 analog inputs 0/4 to 20 mA

Function

Essential characteristics

- Measuring range identification
- Storage of measured values possible during adjustments
- Four freely parameterizable measuring ranges, also with suppressed zero point
- Measurement range switchover possible; remote switching is also possible
- Wide range of selectable time constants (static/dynamic noise damping); i.e. the response time of the device can be matched to the respective measuring task
- Measuring point switchover for up to 12 measuring points (programmable)
- Parameterizable measuring point identification
- Automatic, parameterizable measuring range calibration
- Operation based on the NAMUR recommendation
- Three control levels with their own authorization codes for the prevention of accidental and unauthorized operator interventions
- Simple handling using a numerical membrane keyboard and operator prompting
- Customer-specific device designs such as:
  - Customer acceptance
  - TAG plates

Selection and ordering data

SIPROCESS GA700	Article No. 7MB3000-	● ● ● 0 ● - ● ● ● 0
Click on the Article No. for online configuration in the PIA Life Cycle Portal.		
Unavailable combinations are shown in PIA Life Cycle Portal as "not permitted".		
Basic unit version		
19" rack enclosure		0
Wall box (bushings, PG cable glands)		3
Wall box (bushings, PG with shielding)		4
Wall box (bushings, conduit)		5
Field control unit Ex-d (incl. 3 analog outputs and 3 digital outputs)		6
Module 1 (slot 1)		
Without		X
ULTRAMAT 7		B
OXYMAT 7		C
CALOMAT 7		F
ULTRAMAT 7 heated (65 °C)		J
OXYMAT 7 high temperature (130 °C)		K
Module 2 (slot 2)		
Without		X
ULTRAMAT 7		B
OXYMAT 7		C
CALOMAT 7		F
Option module 1		
Without		0
Option module 1.1 (12 digital outputs + 8 digital inputs)		1
Option module 2		
Without		0
Option module 2.1 (6 analog outputs + 6 additional digital outputs)		1
Option module 2.2 I/O (6 analog outputs, 4 analog inputs + 4 additional digital inputs)		2
Option module Profibus DP		3
Option module 2.2 for field control unit (4 analog inputs)		6
Preset menu language		
Language of the compact operating instructions		
• German		A
• English		B
• French		C
• Italian		D
• Spanish		E
• Portuguese		G
Ex version		
Standard, operation in non-hazardous zone		A
Standard, operation in non-hazardous zone with purging gas connection (wall unit only)		B
Version for use in hazardous zone 2 for flammable and non-flammable gases according to IECEx/ATEX II 3G Ex ec db ic nC op is IIC T4 Gc (for rack unit)		C
Version for use in hazardous zone 2 for non-flammable gases according to IECEx/ATEX II 3G Ex ec db ic nC op is IIC T4 Gc (for wall unit)		D
Version for use in hazardous zones 1 and 2 for flammable and non-flammable gases (for wall unit) according to IECEx/ATEX II 2G Ex pyb db ib op is IIC T4 Gb		E
Version for use in hazardous zones 1, 2, 22 for flammable and non-flammable gases according to IECEx/ATEX II 2G Ex pyb db ib op is IIC T4..T3 Gb; ATEX II 3G Ex ec db ic nC op is IIC T4 Gc; ATEX II 3D/2G Ex pyb,pxb db ib op is IIIC/IIC T65°C/T4..T130°C/T3 Dc/Gb; ATEX II 3D Ex tc db ib op is IIIC T65°C..T130°C Dc		G
Version for use in hazardous zones 1 and 2 for flammable and non-flammable gases ATEX II 2G Ex db eb ib IIC T4 Gb (field device only)		H
Operation in Class I DIV 2, flammable gases or non-flammable gases NI Class I DIV 2 Group ABCD Class I Zone 2 Ex ec IIC Gc		K
Operation in Class I/ II DIV 2 and Class I Zone 2 and Class III and Zone 22, non-flammable gases NI Class I DIV 2 Group ABCD DIP Class II DIV 2, Class III Group FG Class I Zone 2 Ex ec IIC Gc Zone 22 Ex tc IIIC Dc		L
Operation in Class I DIV 2 and Zone 2, for DIV 2 and Zone 2 pz (flammable and non-flammable gases) Type Z Class I DIV 2 Group ABCD DIP Class II DIV 2, Class III Group FG Class I Zone 2 Ex pz IIC Gc Zone 22 Ex py IIIC Dc		M

Selection and ordering data (continued)

Options	Order code
Add "**-Z**" to article number and then add order code	
Settings	
Tag plates (specific inscription based on customer information)	***B03***
Gönnheimer Ex p control unit (ATEX and IECEx) continuous purging	***E72***
SIMATIC PDM software with single point license	***E73***
Plug set D-sub for 19" rack enclosure	***E74***
Connecting pipe stainless steel analyzer module 1 - analyzer module 2	***E76***
Special settings	***Y12***
Versions according to CSA/ UL 61010	***B52***
Basic unit module assignment number	***D00 ... D99***

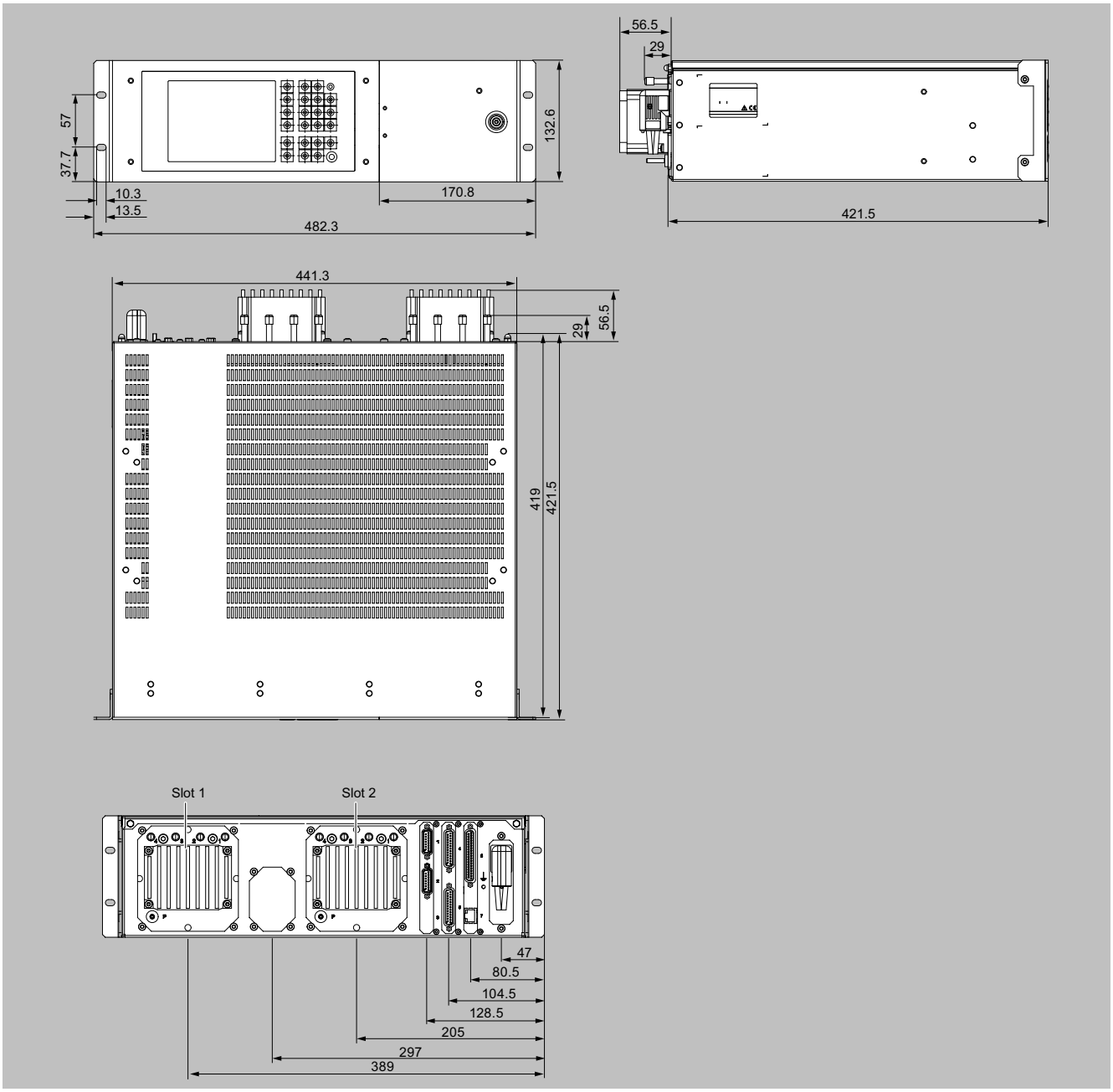
Technical specifications

	19" rack unit enclosure	Wall box	Field control unit
General information			
Operating position	Horizontal	Vertical	Horizontal
Design, enclosure			
Weight without module	8.6 kg	23 kg	27 kg
Degree of protection	IP20 according to EN 60529	IP65 according to EN 60529	IP55 according to EN 60529
Electrical characteristics			
Auxiliary power	100 ... 240 V AC (nominal range of use 85 ... 264 V), 50 ... 60 Hz (nominal range of use 47 ... 63 Hz)	100 ... 240 V AC (nominal range of use 85 ... 264 V), 50 ... 60 Hz (nominal range of use 47 ... 63 Hz)	100 ... 240 V AC (nominal range of use 85 ... 264 V), 50 ... 60 Hz (nominal range of use 47 ... 63 Hz)
Power consumption	Max. 280 VA	Max. 280 VA	Max. 280 VA
EMC interference immunity (electromagnetic compatibility)	In accordance with the standard requirements of NAMUR NE21 (05/2006) and EN 61326-1	In accordance with the standard requirements of NAMUR NE21 (05/2006) and EN 61326-1	In accordance with the standard requirements of NAMUR NE21 (05/2006) and EN 61326-1
Electrical safety	In accordance with EN 61010-1, overvoltage category II	In accordance with EN 61010-1, overvoltage category II	In accordance with EN 61010-1, overvoltage category II
Gas inlet conditions, purging gas pressure			
Continuous (recommended)	-	30 hPa above atmospheric pressure	-
Continuous (maximum)	-	< 100 hPa above atmospheric pressure	-
Transient (maximum)	-	165 hPa above atmospheric pressure	-
Electrical inputs and outputs			
Analog outputs	-	-	1 for each component 0/4 ... 20 mA, floating; load ≤ 100 Ω, R_L ≤ 750 Ω
Relay outputs	8, with changeover contacts, can be freely configured, e.g. for measuring range identification; max. load rating: 24 V AC/DC/1.7 A (total load for all 8 relay outputs in continuous operation max. 160 W), floating, non-sparking	8, with changeover contacts, can be freely configured, e.g. for measuring range identification; max. load rating: 24 V AC/DC/1.7 A (total load for all 8 relay outputs in continuous operation max. 160 W), floating, non-sparking	5, with changeover contacts, can be freely configured, e.g. for measuring range identification; load rating: 24 V AC/DC/1.7 A, floating, non-sparking
Digital inputs	8, designed for 24 V, floating, freely configurable, e.g. for measuring range switchover	8, designed for 24 V, floating, freely configurable, e.g. for measuring range switchover	5, designed for 24 V, floating, can be freely configured, e.g. for measuring range switchover
Ethernet interface Ethernet RJ45, 100 Mbit	Rear	Underside	Underside
Service port Ethernet RJ45, 100 Mbit	Front (behind door)	Inside on the processing unit	Inside on the processing unit
Interface module 1.1	12 relay outputs, with changeover contacts, load rating: 24 V AC/DC/1.7 A (total load for all 12 relay outputs in continuous operation max. 244 W), floating, non-sparking 8 digital inputs, designed for 24 V, floating, freely configurable	12 relay outputs, with changeover contacts, load rating: 24 V AC/DC/1.7 A (total load for all 12 relay outputs in continuous operation max. 244 W), floating, non-sparking 8 digital inputs, designed for 24 V, floating, freely configurable	-

Technical specifications (continued)

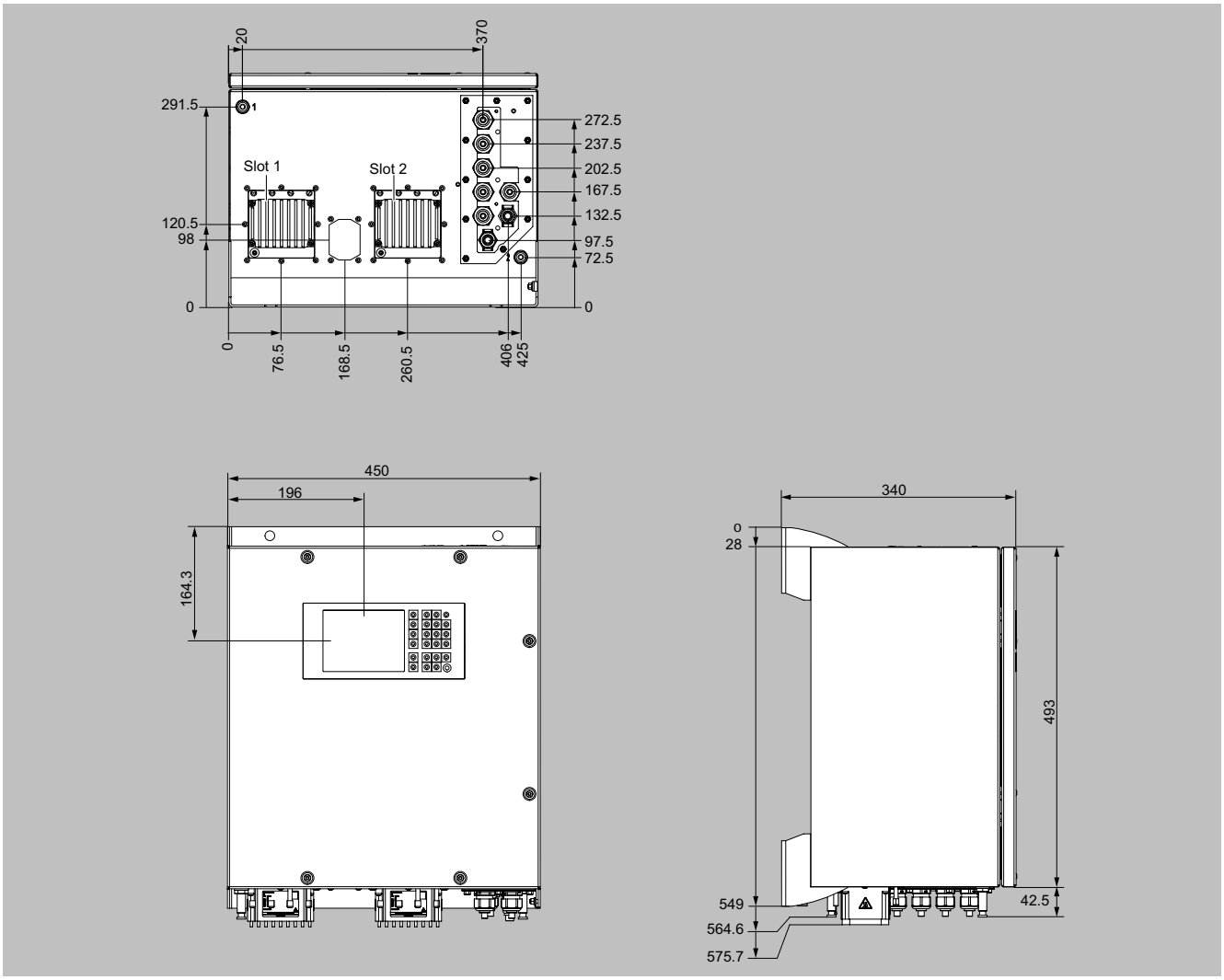
	19" rack unit enclosure	Wall box	Field control unit
Interface module 2.1	1 analog output for each component 0/4 ... 20 mA, floating; load 100 Ω ≤ R_L ≤ 750 Ω; 3 relay outputs per module, load rating: 24 V AC/DC/1.7 A (total load for all 6 relay outputs in continuous operation max. 122 W), floating, non-sparking	1 analog output for each component 0/4 ... 20 mA, floating; load 100 Ω ≤ R_L ≤ 750 Ω; 3 relay outputs per module, load rating: 24 V AC/DC/1.7 A (total load for all 6 relay outputs in continuous operation max. 122 W), floating, non-sparking	-
Interface module 2.2	1 analog output for each component 0/4 ... 20 mA, floating; load 100 Ω ≤ R_L ≤ 750 Ω; 4 analog inputs 0/4 ... 20 mA, non-isolated, internal resistance ≤ 100 Ω 4 digital inputs, designed for 24 V, floating	1 analog output for each component 0/4 ... 20 mA, floating; load 100 Ω ≤ R_L ≤ 750 Ω; 4 analog inputs 0/4 ... 20 mA, non-isolated, internal resistance ≤ 100 Ω 4 digital inputs, designed for 24 V, floating	4 analog inputs 0/4 ... 20 mA, non-isolated, internal resistance ≤ 100 W
Climatic conditions			
Permissible operating altitude	3 000 m above sea level	3 000 m above sea level	2 000 m above sea level
Permissible ambient temperature (with one module; application-dependent with two modules)	Depends on application, See technical specifications of the modules Ventilation slots must not be covered (recommended minimum clearance upward from the next device when installing 2 modules and at maximum ambient temperature: min. 1 U)	Depends on application, See technical specifications of the modules	-30 ... + 70 °C during storage and transportation 5 ... 55 °C for regular operation with OXYMAT 7 5 ... 60 °C for operation with OXYMAT 7 and with limited measuring accuracy
Permissible humidity	< 90% RH (RH: relative humidity), during storage, transportation and operation (must not fall below dew point)	< 90% RH (RH: relative humidity), during storage, transportation and operation (must not fall below dew point)	< 90% RH (RH: relative humidity), during storage, transportation and operation (must not fall below dew point)

Dimensional drawings



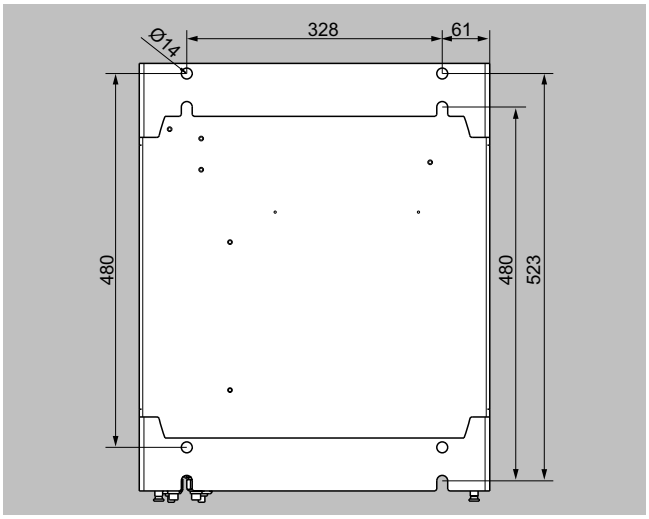
SIPROCESS GA700, rack unit, dimensions in mm

Dimensional drawings (continued)

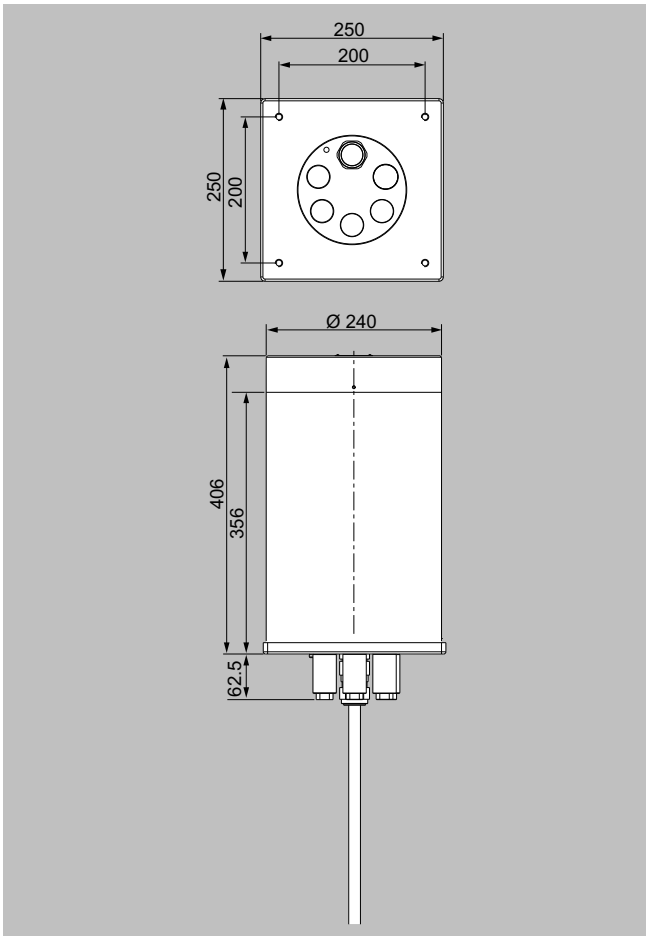


SIPROCESS GA700, wall enclosure, dimensions in mm

Dimensional drawings (continued)

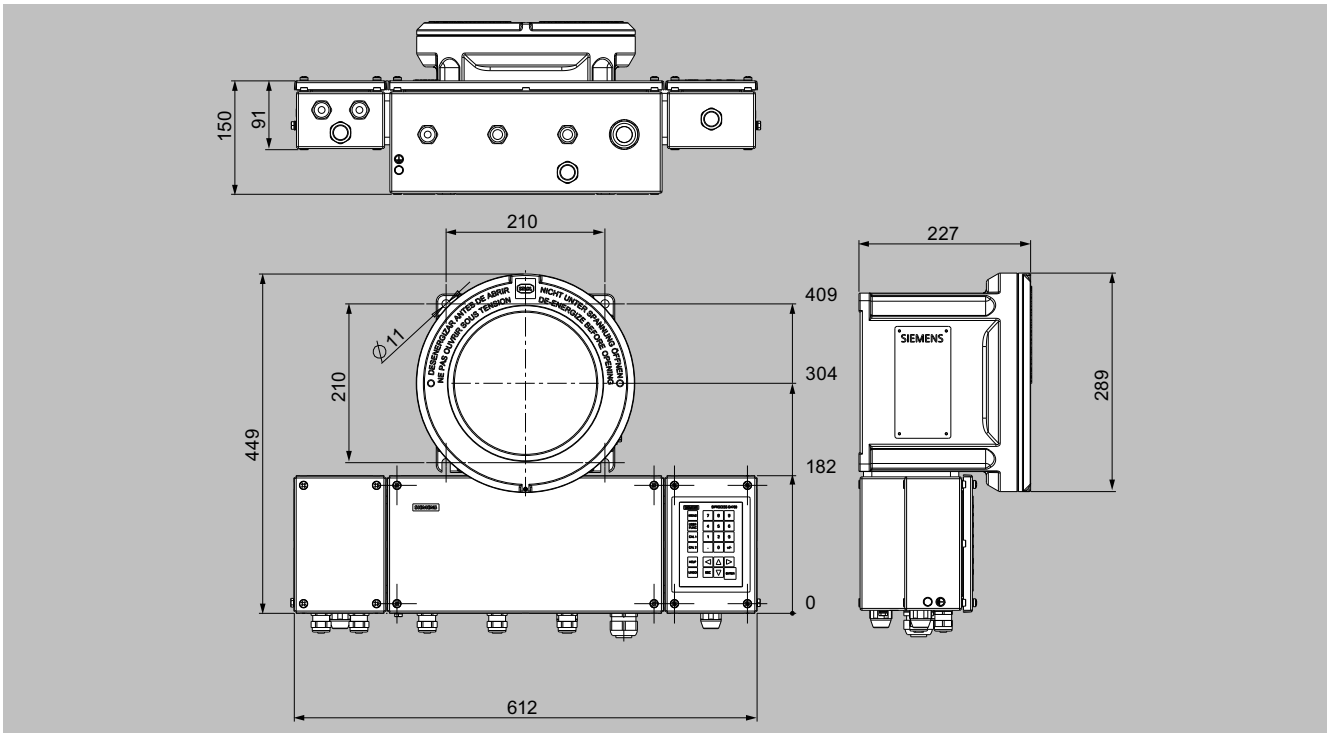


SIPROCESS GA700, wall enclosure, drilling pattern, dimensions in mm



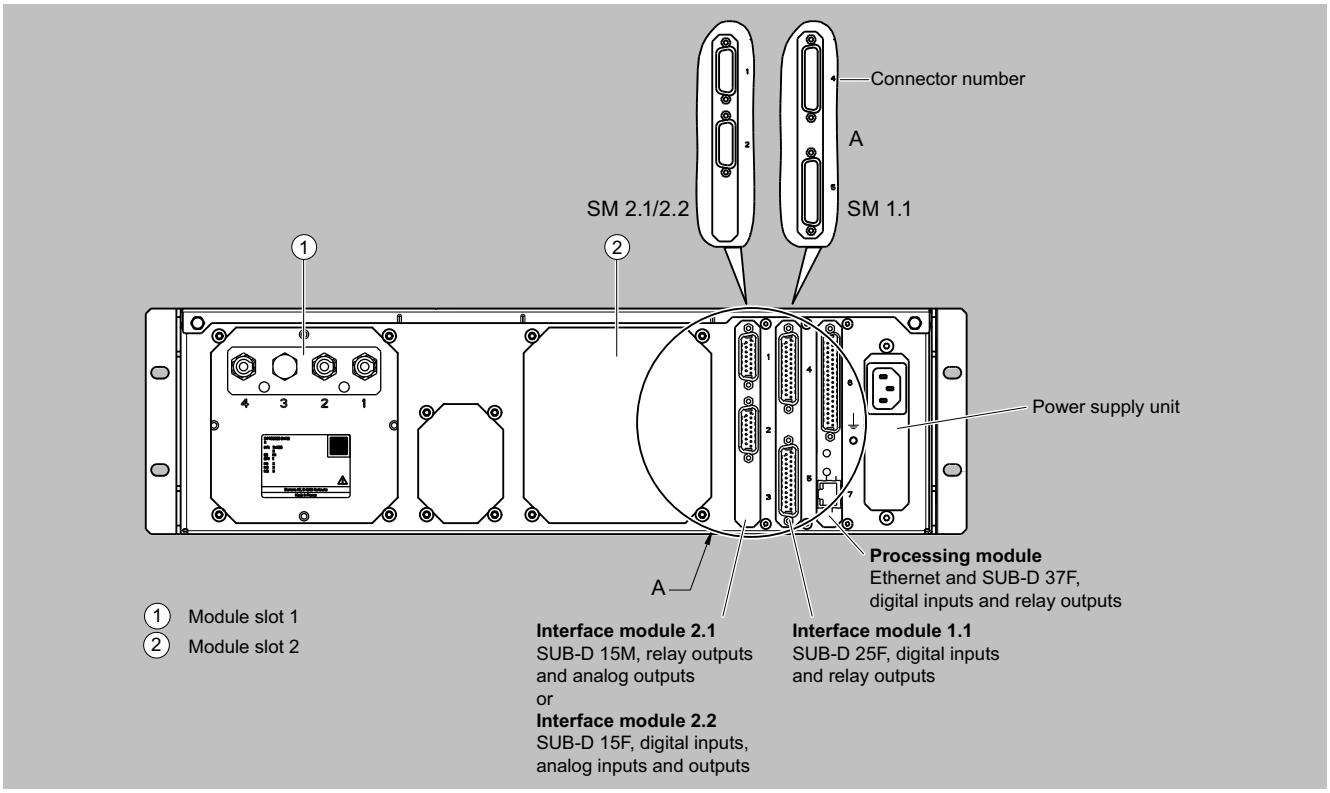
SIPROCESS GA700, field module, dimensions in mm

Dimensional drawings (continued)



SIPROCESS GA700, field control unit, dimensions in mm

Circuit diagrams



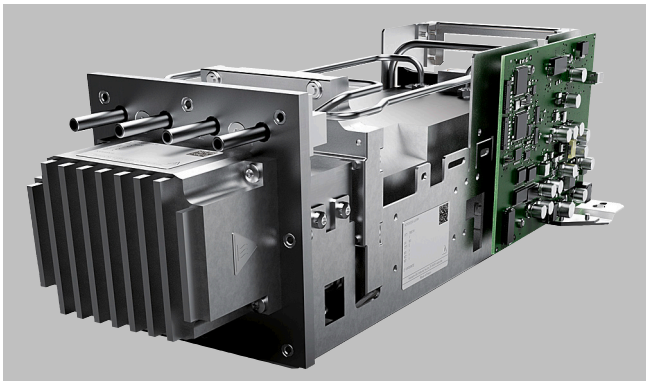
Connection of the signal cables: Expansion options for interface modules; example of rear wall of rack unit

Possible combinations

You can install a maximum of two analyzer modules in the wall-mounted and rack-mounted enclosures of the SIPROCESS GA700 series. No fixed allocation rules apply. Every module can be operated in every slot.
The following restrictions must be observed:

- Change to measuring frequency required:
  - [O7 and O7]: 8.33 Hz (O7 No. 1) - 10 Hz (O7 No. 2)
  - [O7 and U7]: 10 Hz (O7) - 12.5 Hz (U7)]
- Restricted temperature range:
  [U7 and O7] or [U7 and C7]: 5 to 45 °C
- Restricted smallest measuring range:
  [U7 and O7]
- NAMUR NE21 does not apply in combination:
  [C7 and U7] or [C7 and O7]

Overview



The ULTRAMAT 7 module functions according to the NDIR dual-beam differential mode process and measures gases whose absorption bands in the infrared wavelength range are between 2 and 9 µm, such as CO, CO_2, CH_4, SO_2 or NO. Up to two components can be measured per module.

Benefits

High selectivity due to double-layer detector
- Reliable measurements even in complex gas mixtures

Low detection limits
- Measurements with low concentrations

Analyzer cells can be cleaned as required on site
- Cost savings due to reuse after contamination

Corrosion-resistant materials in gas path (option)
- Measurement of highly corrosive sample gases possible
- Heating possible

Application

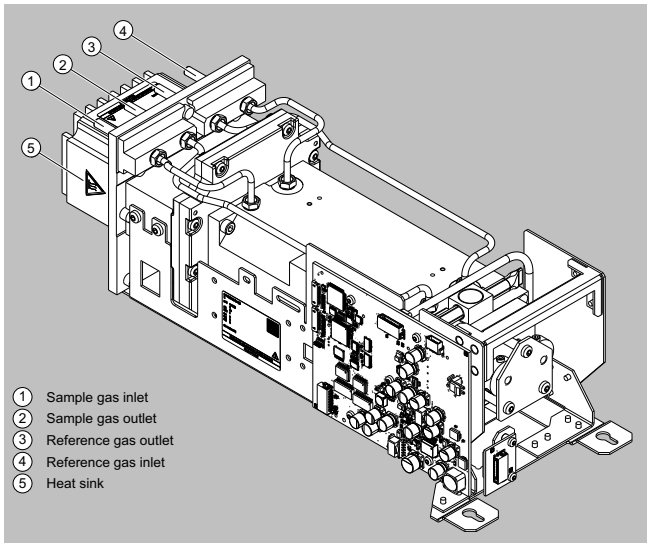
- Measurement for boiler control in combustion plants
- Process gas concentrations in chemical plants
- Trace measurements in pure gas processes
- Environmental protection
- TLV (Threshold Limit Value) monitoring at the workplace
- Quality monitoring
- introduction of flammable gases possible

Special versions

Flow-type reference cell

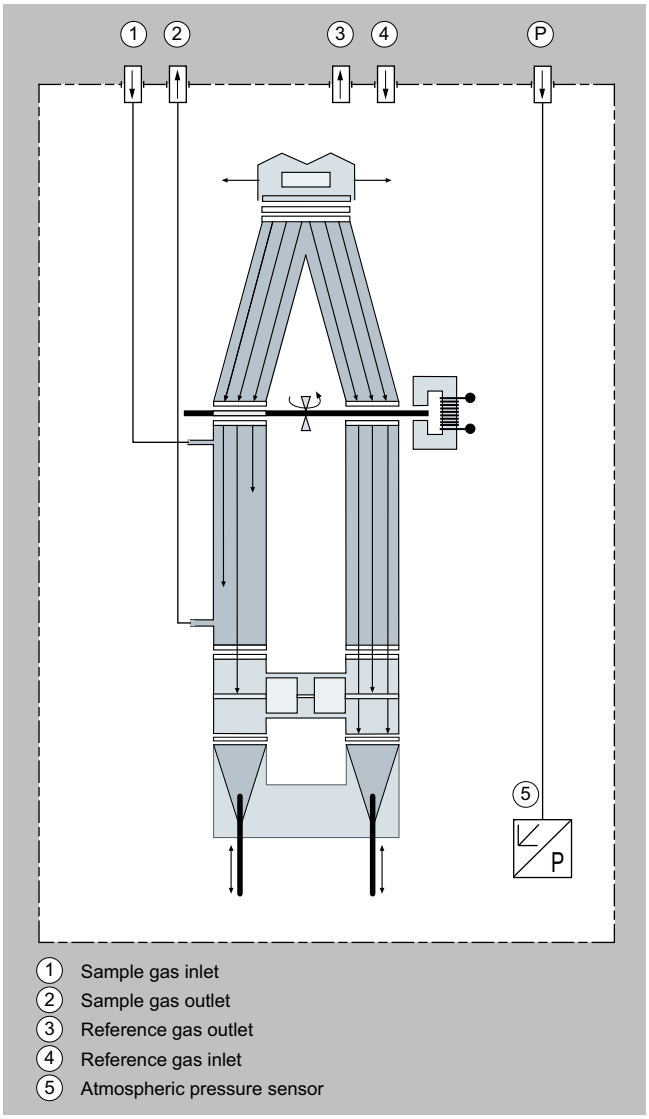
The flow through the reference cell should be adapted to the sample gas flow.

Design



ULTRAMAT 7 design

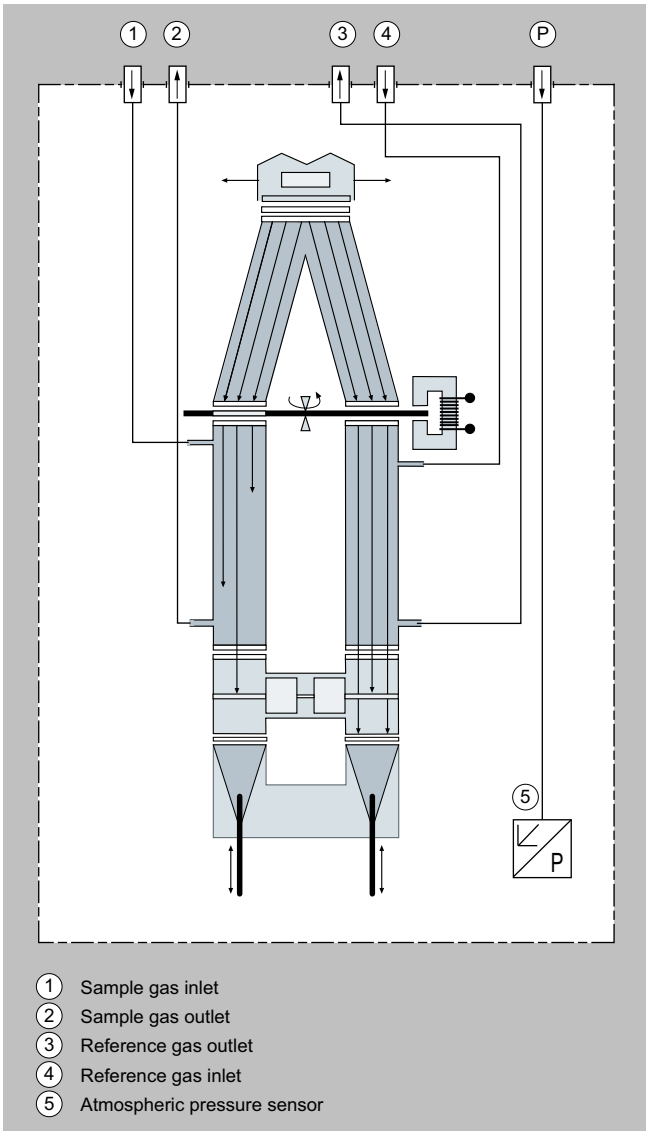
Design (continued)



1 Sample gas inlet
2 Sample gas outlet
3 Reference gas outlet
4 Reference gas inlet
5 Atmospheric pressure sensor

ULTRAMAT 7, gas path, without flow-type reference cell

Design (continued)



1 Sample gas inlet
2 Sample gas outlet
3 Reference gas outlet
4 Reference gas inlet
5 Atmospheric pressure sensor

ULTRAMAT 7, gas path, with flow-type reference cell

Mode of operation

Measuring principle

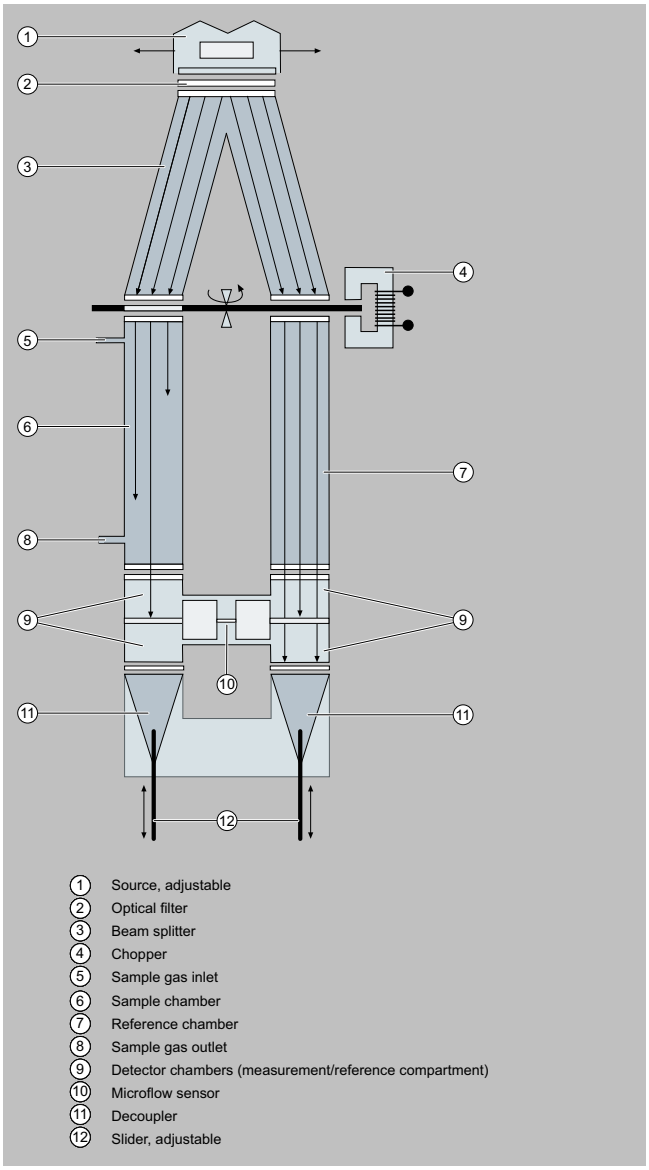
The measurements are based on the molecular-specific absorption of infrared radiation bands (absorption bands).
ULTRAMAT 7 modules use a spectral range which includes wavelengths of 2 to 9 µm. Although the absorbing wavelengths are characteristic of individual gases, they may partially overlap. This results in cross-sensitivities which are reduced to a minimum by the following measures:

- Beam splitter (gas filter)
- Double-layer detector, each gas compartment with adjustable weighting between the first and second detector layer
- Application-specific pre-installed interference filter

Principle of operation

ULTRAMAT 7 modules operate according to the infrared push-pull chopped radiation principle and are equipped with a double-layer detector.
A source with a temperature of approx. 600 °C generates infrared radiation which is emitted in the beam splitter. The beam splitter acts as a filter chamber and divides the beam equally between the sample gas and reference gas compartments.
The chopper produces a periodic modulation of the infrared radiation, and thus enables relaxation of the detector.
The reference beam passes through the reference chamber and enters the detector chamber virtually unattenuated. The detector chamber is filled with a precisely defined concentration of the gas component to be measured. The sample beam, in contrast, passes through the sample chamber filled with sample gas and enters the detector chamber attenuated to various degrees. The degree of attenuation depends on the respective sample gas concentration.
The detector is designed as a double-layer detector. The detector layer at the source end serves primarily to absorb the middle of the band. The band edges, however, are absorbed equally by both of the layers.
The detector layers at both compartments of the detector are pneumatically connected to each other via a microflow sensor. This sensor element converts the pressure difference in the detector into an electrical signal.
The weighting between the first and second detector layer is preset at the factory depending on the application. This minimizes the effect of interfering components. To ensure the long-term stability of the measured value, the ULTRAMAT 7 module supports the predictive self-diagnostics of the analyzer. This function enables you to plan maintenance measures in a timely manner.

Mode of operation (continued)



ULTRAMAT 7, principle of operation of the infrared channel

Function

Main features

- Dimension of measured value freely selectable (e.g. vpm, mg/m³)
- Four freely parameterizable measuring ranges per component
- Measuring ranges with suppressed zero point possible
- Measuring range identification
- Automatic or manual measuring range switchover selectable; remote switching is also possible
- Differential measuring ranges with flow-type reference cell
- Storage of measured values possible during calibration
- Time constants selectable within wide limits (static/dynamic noise damping); i.e. the response time of the device or component can be adapted to the respective measuring task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 4 measuring points (parameterizable)
- Measuring point identification
- Internal pressure sensor for correction of variations in atmospheric pressure in the range 700 to 1 200 hPa absolute
- Automatic measuring range calibration parameterizable
- Operation based on NAMUR recommendation
- Preventive maintenance - IR source monitoring
- Sample chamber for use in presence of highly corrosive sample gases, e.g. tantalum inlay sheet or Hastelloy C22 (special application)

Selection and ordering data

ULTRAMAT 7 module For measuring IR-absorbing gases		**Article No.** **7MB3010-**	●	●	●	●	●	-	●	A	●	●
Click on the Article No. for online configuration in the PIA Life Cycle Portal. ***Unavailable combinations are shown in PIA Life Cycle Portal as "not permitted".***												
Module version												
Standard module for 19" rack unit enclosure and wall box			0									
Heated module 65 °C for wall box			1									
Standard module for hazardous zone 19" rack unit enclosure and wall box			2									
Heated Ex module 65 °C for wall box			3									
Measured components[1]	**Possible with measuring range identification**											
CO	B[2], C ... P			A								
CO (selective)	C, D ... P			B								
CO_2	A[2], B ... P			C								
CH_4	D, E ... P			D								
C_2H_4	F, G ... P			E								
SO_2	D, E ... P			F								
NO	E, F ... J			G								
N_2O	D, E ... P			H								
NH_3 (dry)	E, F ... P			J								
CO, NO	E, F, H, R, S			Q								
CO_2, CO	E, F, H, J, L, M, P			R								
Smallest measuring range	**Largest measuring range**											
0 ... 5 vpm	0 ... 100 vpm				A							
0 ... 10 vpm	0 ... 200 vpm				B							
0 ... 20 vpm	0 ... 400 vpm				C							
0 ... 50 vpm	0 ... 1 000 vpm				D							
0 ... 100 vpm	0 ... 1 000 vpm				E							
0 ... 300 vpm	0 ... 3 000 vpm				F							
0 ... 500 vpm	0 ... 5 000 vpm				G							
0 ... 1 000 vpm	0 ... 10 000 vpm				H							
0 ... 3 000 vpm	0 ... 30 000 vpm				J							

Selection and ordering data (continued)

ULTRAMAT 7 module For measuring IR-absorbing gases		Article No. 7MB3010-	●	●	●	●	●	-	●	A	●	●
0 ... 5 000 vpm	0 ... 50 000 vpm				K							
0 ... 1%	0 ... 10%				L							
0 ... 3%	0 ... 30%				M							
0 ... 5%	0 ... 50%				N							
0 ... 10%	0 ... 100%				P							
0 ... 30%	0 ... 300%				Q							
0 ... 100 vpm (CO), 0 ... 300 vpm (NO)	0 ... 1 000 vpm CO, NO				R							
0 ... 300 vpm (CO), 0 ... 500 vpm (NO)	0 ... 3 000 vpm CO, NO				S							
Material: Gas paths, sample chambers												
Gas path	Sample chamber											
• Pipe made of stainless steel	• With aluminum lining					1						
• Pipe made of stainless steel	• With tantalum lining[3)]					2						
• Pipe made of Hastelloy	• With tantalum lining[3)]					3						
Reference gas chamber												
Non-flow-type							0					
Flow-type							1					
Pressure compensation												
Atmospheric pressure compensation									0			
Module version												
For 19" rack enclosure											A	
For wall box											B	
Version												
Standard												0

[1)] C_2H_2, C_2H_6, C_3H_6, C_3H_8, C_4H_6, C_4H_{10}, C_6H_{14}, H_2O and additional measured components possible as 7MB3017.. special application.
[2)] Not possible in combination with an OXYMAT 7 module.
[3)] Only for chamber length 20 ... 180 mm.

Options	Order code
Add "-**Z**" to article number and then add order code	
Settings	
Kalrez (6375) gaskets in sample gas path	***B04***
Clean for O2 service (specially cleaned gas path)	***B06***
Measuring range indication in plain text, if different from default setting	***Y11***
Special setting (only together with an application no., e.g. extended measuring range)	***Y12***
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	***Y13***
Marine certificate	***Y14***
Pharmacopoeia	***Y18***
Basic unit module assignment number	***D00 ... D99***

Note

See order example under "More information".

Technical specifications

The technical specifications are based on the definitions of EN 61207-1.
Unless specified otherwise, the data listed below relates to the following measurement conditions:

Measuring conditions	
Ambient temperature	25 °C
Atmospheric pressure	Atmospheric (approx. 1 000 hPa)
Sample gas flow	0.6 l/min (or Nl/min)
Sample gas humidity	Dew point < -40 °C
Site of installation	Vibration- and impact-free

ULTRAMAT 7 module	
General information	
Weight	Max. 5.2 kg (standard version)
Measuring ranges	
Number of measuring ranges	Max. 4; parameters can be assigned freely
Parameters can be assigned in the measuring ranges	
• Smallest possible measuring span	CO: 0 ... 10 vpm CO_2: 0 ... 5 vpm CH_4: 0 ... 50 vpm C_2H_4: 0 ... 300 vpm SO_2: 0 ... 50 vpm NO: 0 ... 100 vpm N_2O: 0 ... 50 vpm NH_3: 0 ... 100 vpm CO/NO: 0 ... 100 vpm CO_2/CO: 0 ... 100 vpm
• Largest possible measuring span	CO: 0 ... 100% CO_2: 0 ... 100% CH_4: 0 ... 100% C_2H_4: 0 ... 100% SO_2: 0 ... 100% NO: 0 ... 30 000 vpm N_2O: 0 ... 100% NH_3: 0 ... 100% CO/NO: 0 ... 10 000 vpm CO_2/CO: 0 ... 100%
Gas inlet conditions	
Sample gas pressure	
• Standard pressure (atmospheric pressure compensation)	500 to 1 500 hPa (absolute)
Pressure drop between sample gas inlet and sample gas outlet	< 10 hPa at 1.5 l/min
Sample gas flow	18 ... 90 l/h (0.3 ... 1.5 l/min)
Sample gas temperature	0 ... 50 °C
Sample gas humidity (rel. humidity)	< 90% (condensation inside the gas path is to be avoided)
Time response	
Warm-up period at room temperature	< 2 h
Response characteristics	
• Dead time (T_{10})	Application-specific (max. 3.6 s)
• Signal rise time (T_r) or fall time (T_f) with application-specific electronic damping of 10 s	Application specific < 14 s
• Time for device-internal signal processing T_v	Approx. 1 s
• Delayed display T_{90}	$T_{90} < T_{10} + T_{r/f} + T_v$ applies
Measuring response	
Output signal fluctuation	≤ ± 1% of smallest measuring range acc. to nameplate
Zero point drift	< ± 1%/week of smallest measuring range acc. to nameplate
Measured-value drift	≤ 1% of the current measuring range per week
Repeatability	≤ ± 1% of the current measuring range end value
Linearity error	< ± 0.5% of the current measuring range end value

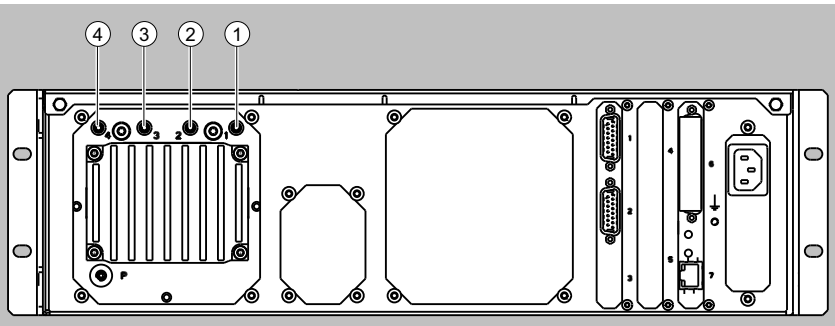
Technical specifications (continued)

ULTRAMAT 7 module	
Influencing quantities	
Ambient temperature	
• Zero point	< 1% of smallest measuring range / 2K
• Measured value	≤ 1% of the current measuring range/10 K (at constant receiver cell temperature)
Sample gas pressure	
• Without pressure compensation	≤ 1.5% of the current measuring range/1% pressure variation
• With pressure compensation switched on	≤ 0.15% of the current measuring range/1% pressure variation
Sample gas flow	≤ 1% of the current measuring range end value/0.1 l/min change in flow
Supply voltage	≤ 0.1% of the current measuring range (within the nominal range of use)
Electrical outputs	
Analog and digital interfaces	See basic unit
Climatic conditions	
Storage and transport	-30 ... 70 °C
Permissible ambient temperature (during operation in basic unit)[1]	5 ... 45 °C
Relative humidity (RH) during storage, transport or operation	< 90% (condensation on the installed components is to be avoided)
Gas connections	
Connecting sockets	Pipe connection with 6 mm outer diameter
Materials of wetted parts	
Bushing	Stainless steel mat. no. 1.4571, Hastelloy C22
Pipe	Stainless steel mat. no. 1.4571, Hastelloy C22, O-ring: FKM (e.g. Viton) or FFKM (Kalrez 6375)
Sample chamber	
• Body	Aluminum
• Inner coating	Aluminum, tantalum
• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez 6375)

[1] Applies also in combination with OXYMAT 7 or CALOMAT 7 modules

Circuit diagrams

Gas connections

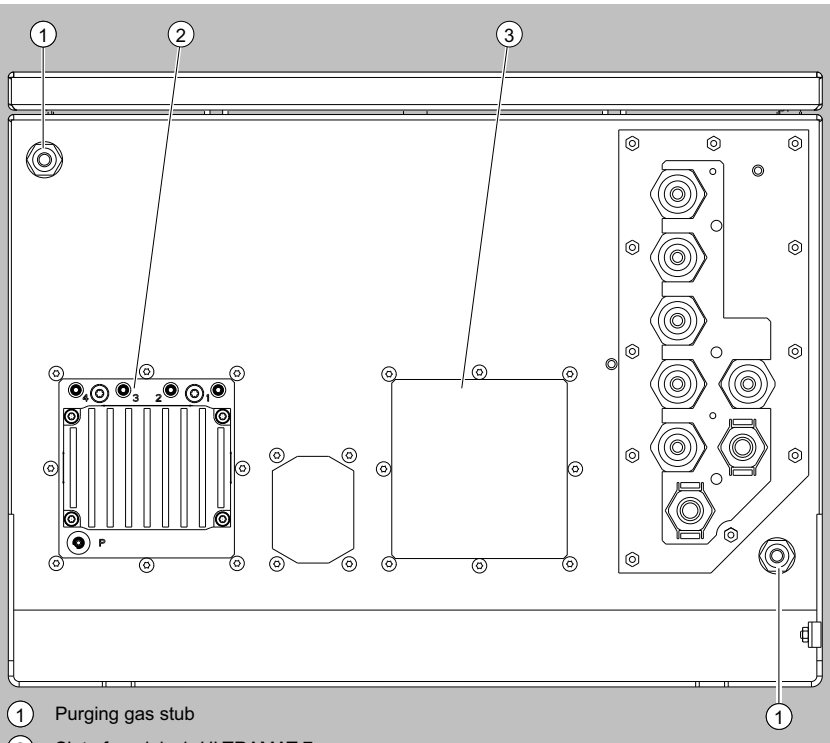


1. Sample gas inlet
2. Sample gas outlet
3. Reference gas outlet
4. Reference gas inlet

P Atmospheric pressure sensor

The sample gas connections and the reference gas connections are made of stainless steel, mat. no. 1.4404. The gas connections are designed as connection fittings with a pipe diameter of 6 mm.

Wall-mounted device



1. Purging gas stub
2. Slot of module 1: ULTRAMAT 7
3. Slot of module 2

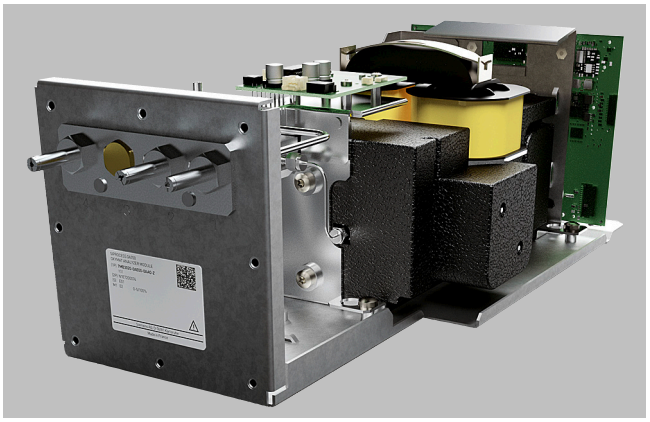
Wall-mounted device, bottom

More information

Ordering example

ULTRAMAT 7 module installed in rack-mounted enclosure
7MB3000-0BX00-1AA0-Z+D03
7MB3010-0AB10-0AA0-Z+D03
ULTRAMAT 7 module and rack-mounted enclosure supplied unassembled
7MB3000-0BX00-1AA0
7MB3010-0AB10-0AA0

Overview



The function of the OXYMAT 7 module is based on the paramagnetic alternating pressure method and is used to measure oxygen in gases.

Benefits

Paramagnetic alternating pressure principle
- Small measuring ranges (0 to 0.5% or 99.5 to 100% O_2)
- Absolute linearity

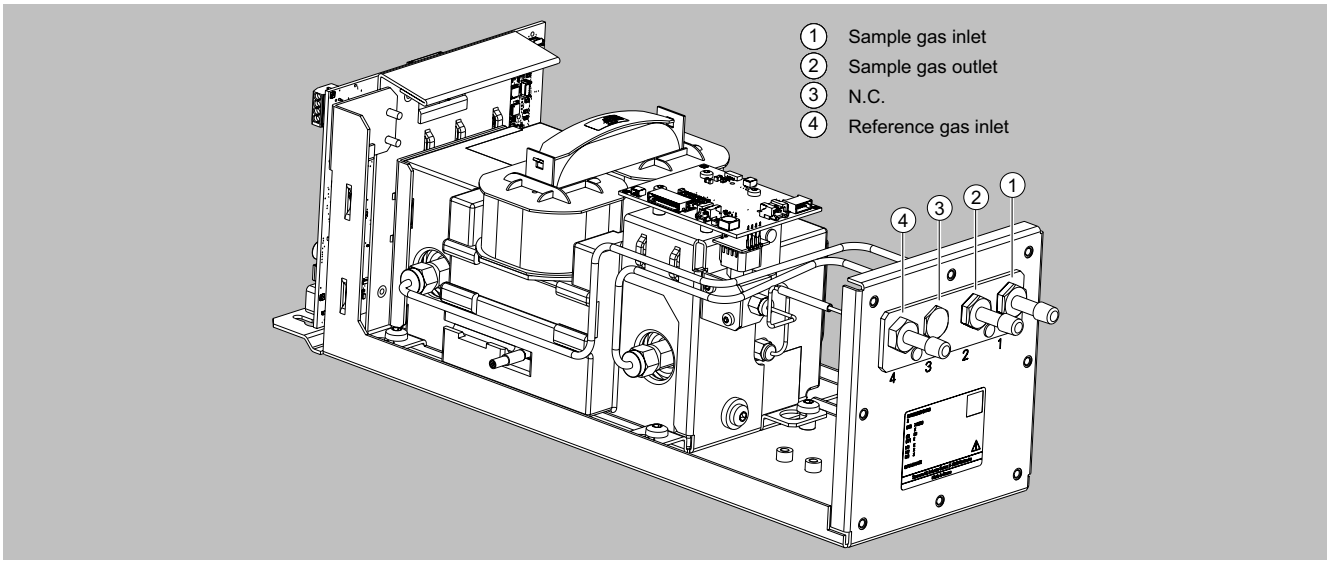
Detector element has no contact with the sample gas
- Applicable in the absence of corrosive sample gases
- Long service life
- High-heated variant

Physically suppressed zero point possible, e.g. in the measuring range 98% or 99.5% to 100% O_2
Ex (p) for Zones 1 and 2 according to ATEX-/IECEx approval, introduction of flammable gases possible

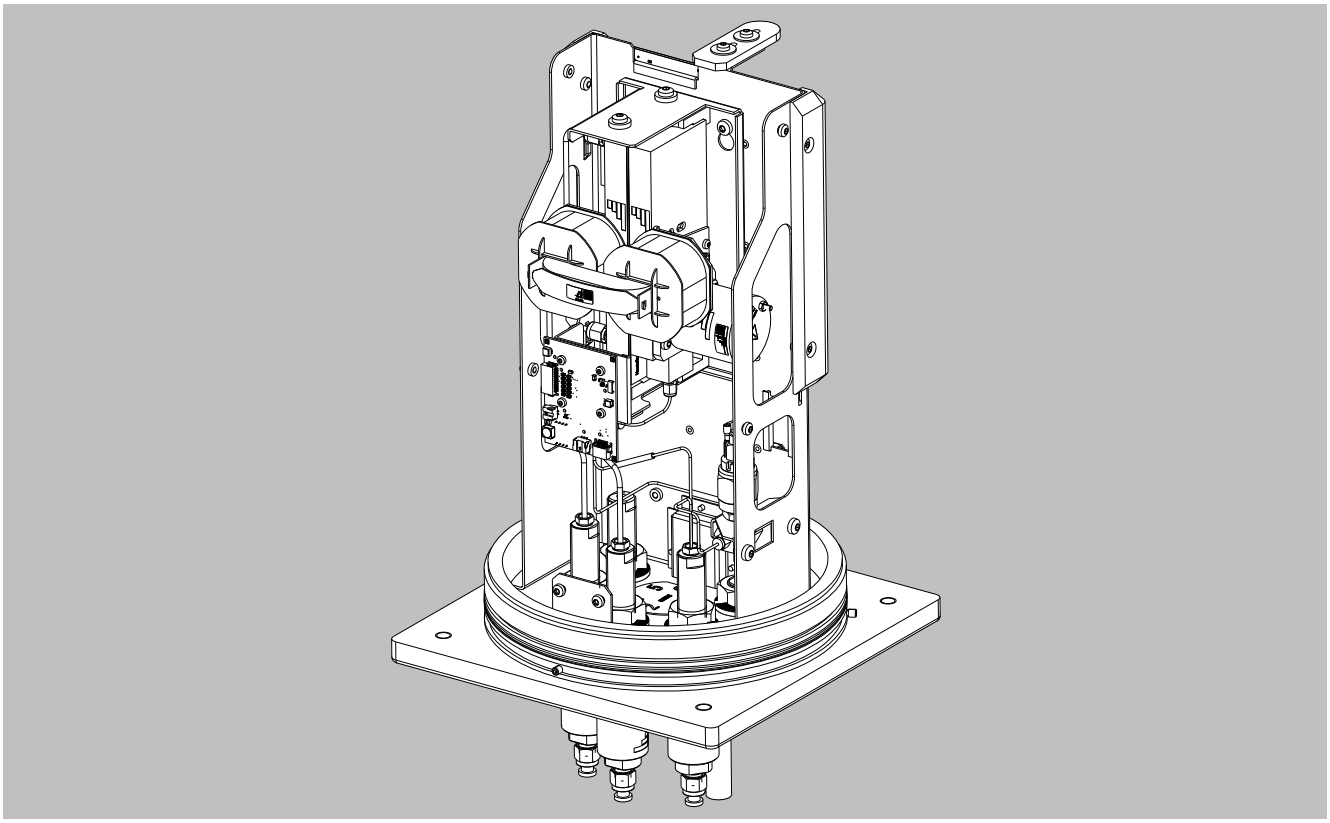
Application

- For boiler control in combustion plants
- In chemical plants
- For ultra-pure gas quality monitoring
- In environmental protection
- For quality control
- Purity control/air separator
- Versions for analyzing flammable and non-flammable gases or vapors for use in hazardous areas

Design



Design of high-pressure version, standard module, sample gas path with pipes

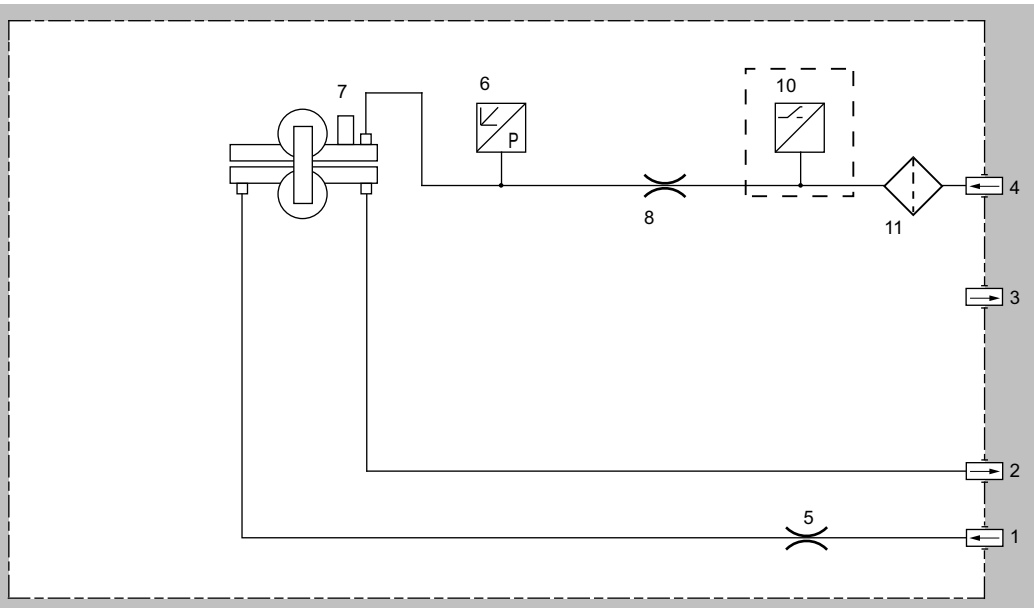


Design of high-pressure version, field module, sample gas path with pipes

Design (continued)

Gas path

High-pressure version with optional pressure switch for monitoring reference gas pressure



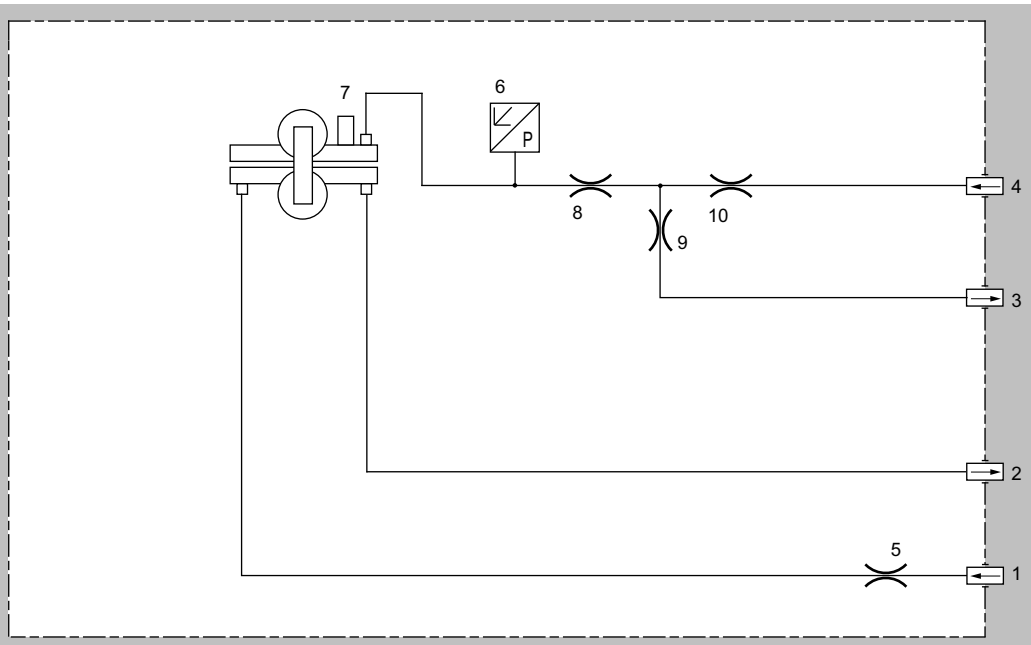
1 Sample gas inlet
2 Sample gas outlet
3 N. C.
4 Reference gas inlet
5 Sample gas restrictor
6 Pressure sensor p for sample gas pressure
7 Analyzer unit
8 Reference gas restrictor
10 Pressure switch for reference gas monitoring (optional)
11 Reference gas fine filter

Gas path plan, high-pressure version with optional pressure switch for monitoring reference gas pressure

High-pressure version with optional pressure switch for monitoring reference gas pressure	
Reference gas pressure	2 000 ... 4 000 hPa above sample gas pressure, but max. 5 000 hPa
Sample gas pressure	
• With hoses	500 ... 1 500 hPa (abs.)
• With pipes	500 ... 2 500 hPa (abs.) with internal pressure sensor 500 ... 3 000 hPa (abs.) with external pressure sensor
Sample gas path	With hoses or with pipes

Design (continued)

Low-pressure version with external reference gas pump



1. Sample gas inlet
2. Sample gas outlet
3. Bypass outlet
4. Reference gas inlet, external pump, delivery pressure approx. 100 hPa
5. Sample gas restrictor
6. Pressure sensor p for sample gas pressure
7. Analysis part
8. Reference gas restrictor
9. Bypass restrictor
10. Damping restrictor

Gas path plan, low-pressure with external reference gas pump, with hoses

Low-pressure version with external reference gas pump	
Reference gas pressure	100 hPa above the sample gas pressure (low-pressure version) for the connection of an external pump
Sample gas pressure	Atmospheric pressure ± 50 hPa
Sample gas path	With hoses
Reference gas path	With hoses

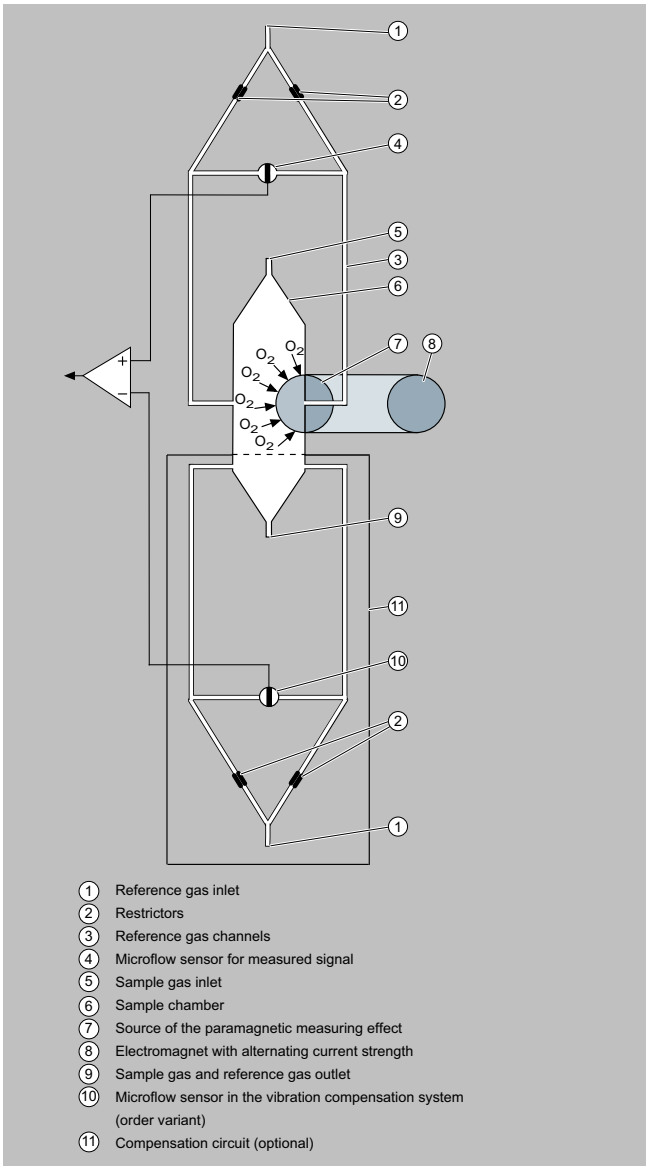
Mode of operation

Oxygen is highly paramagnetic. This outstanding property of paramagnetism is used as a physical measuring effect for oxygen analysis.
Oxygen molecules in an inhomogeneous magnetic field always move toward the higher field strength. This results in a higher oxygen concentration where the field strength is higher (higher oxygen partial pressure). If two gases with differing oxygen content are combined in a magnetic field, a (O_2 partial) pressure difference arises between them.
Since the measuring effect is always based on the difference of the oxygen content of the two gases, one refers to the sample and reference gases.
For measuring oxygen in the OXYMAT 7, the reference gas (N_2, O_2 or air) flows through two channels into the sample chamber (6). One of these partial flows enters the measuring chamber (7) in the area of the magnetic field. If the sample gas is O_2-free, the reference gas can flow out freely. If the sample gas does contain O_2, however, the oxygen molecules concentrate in the area of the magnetic field. The reference gas can then no longer flow off freely. An alternating pressure results between the two reference gas inlets. This pulsates in step with the magnetic field and depends on the oxygen concentration. This causes an alternating flow in the microflow sensor (4).
The microflow sensor consists of two nickel-plated grids heated to approximately 120°C, which, along with two supplementary resistors, form a Wheatstone bridge. The alternating flow results in a change in the resistance of the nickel-plated grids. The resulting offset in the bridge is a measure of the concentration of oxygen in the sample gas.
Because the microflow sensor is located in the reference gas flow, the measurement is not influenced by the thermal conductivity, the specific heat or the internal friction of the sample gas. Additionally, the microflow sensor is protected through this arrangement from corrosion caused by the sample gas.

Further information

The oscillating magnetic field (8) means that the basic flow at the microflow sensor is not detected. The measurement is, thus, independent of the module's operating position or the position of the sample chamber.
The sample chamber is directly in the sample path and has a small volume, and the microflow sensor is a low-lag sensor. As a result, extremely short response times are realized.
Vibrations at the installation site can interfere with the measured signal (e.g. large fluctuations in the output signal). This behavior can be compensated for by a second (optional) microflow sensor (10), which functions as a vibration sensor. Since large differences in density between the sample and reference gases further amplify the undesired influence of vibration, reference gas is channeled to both the compensation microflow sensor (10) and the sample microflow sensor (4).
The sample gases must be fed into the analyzers free of dust. Condensation in the sample chambers must be prevented. Therefore, the use of gas modified for the measuring task is necessary in most application cases.
Flowing reference gas prevents the microflow sensor from being damaged and maintains the measurement capability of the module.

Mode of operation (continued)



OXYMAT 7, principle of operation

Function

Main features

Technical features

Depending on the reference gas, the physical zero point can be set between 0% and 100% oxygen.

- Smallest measuring spans (down to 0.5% O_2) possible
- Measuring ranges with physically suppressed zero points possible (e.g. 99.5% to 100%)
- Short response time
- Low long-term drift
- Monitoring of reference gas pressure with reference gas connection 2 500 to 5 000 hPa (abs.) (option): reference gas pressure must be 2 000 ± 150 hPa higher than the sample gas pressure

Features

- Internal pressure sensor for correction of pressure variations in sample gas in the range from 500 to 2 500 hPa (absolute)
- External pressure sensor - only with piping as the gas path - can be connected for correction of variations in the sample gas pressure up to 3 000 hPa absolute (option)
- Monitoring of reference gas (option)
- Analysis part with flow-type compensation circuit as an order variant for reducing the vibration impact at the installation site
- For sample gas path with hoses: Connection cable to the pressure sensor with hoses
- Hardware adapted to application
- Customer-specific device designs, such as:
  - Clean for O_2 service (specially cleaned gas path)
  - Kalrez-6375 gaskets

Reference gases for OXYMAT 7

Measuring range	Recommended reference gas	Reference gas connection pressure	Comments
0 to ... vol.% O_2	N_2	2 000 ... 4 000 hPa above sample gas pressure (max. 5 000 hPa absolute)	The reference gas flow is set automatically to 5 ... 10 ml/min (up to 20 ml/min with flow-type compensation branch)
... to 100 vol.% O_2[1)]	O_2	2 000 ... 4 000 hPa above sample gas pressure (max. 5 000 hPa absolute)	
Approx. 21 vol.% O_2[2)]	Air	100 hPa with respect to sample gas pressure, which may vary by max. 50 hPa around the air pressure	

[1)] Suppressed zero point with measuring range end value 100 vol.% O_2.
[2)] Suppressed zero point with 21 vol.% O_2 within the measuring span.

Correction of zero-point error/cross-sensitivities

Accompanying gas (concentration 100 vol.%)	Zero point deviation in vol.% O_2 absolute
Organic gases	
Ethane C_2H_6	-0.49
Ethene (ethylene) C_2H_4	-0.22
Ethine (acetylene) C_2H_2	-0.29
1,2-butadiene C_4H_6	-0.65
1,3-butadiene C_4H_6	-0.49
N-butane C_4H_{10}	-1.26
Isobutane C_4H_{10}	-1.30
1-butene C_4H_8	-0.96
Isobutene C_4H_8	-1.06
Dichlorodifluoromethane (R12) CCl_2F_2	-1.32
Acetic acid CH_3COOH	-0.64
N-heptane C_7H_{16}	-2.40
N-hexane C_6H_{14}	-2.02
Cyclo-hexane C_6H_{12}	-1.84
Methane CH_4	-0.18
Methanol CH_3OH	-0.31
N-octane C_8H_{18}	-2.78
N-pentane C_5H_{12}	-1.68

Function (continued)

Accompanying gas (concentration 100 vol.%)	Zero point deviation in vol.% O_2 absolute
Isopentane C_5H_{12}	-1.49
Propane C_3H_8	-0.87
Propylene C_3H_6	-0.64
Trichlorofluoromethane (R11) CCl_3F	-1.63
Vinyl chloride C_2H_3Cl	-0.77
Vinyl fluoride C_2H_3F	-0.55
1,1 vinylidene chloride $C_2H_2Cl_2$	-1.22
Inert gases	
Helium He	+0.33
Neon Ne	+0.17
Argon Ar	-0.25
Krypton Kr	-0.55
Xenon Xe	-1.05
Inorganic gases	
Ammonia NH_3	-0.20
Hydrogen bromide HBr	-0.76
Chlorine Cl_2	-0.94
Hydrogen chloride HCl	-0.35
Dinitrogen monoxide N_2O	-0.23
Hydrogen fluoride HF	+0.10
Hydrogen iodide HI	-1.19
Carbon dioxide CO_2	-0.30
Carbon monoxide CO	+0.07
Nitrogen oxide NO	+42.94
Nitrogen N_2	0.00
Nitrogen dioxide NO_2	+20.00
Sulfur dioxide SO_2	-0.20
Sulfur hexafluoride SF_6	-1.05
Hydrogen sulfide H_2S	-0.44
Water H_2O	-0.03
Hydrogen H_2	+0.26

Zero point error due to diamagnetism or paramagnetism of some accompanying gases with reference to nitrogen at 60 °C und 1 000 hPa absolute (according to IEC 1207/3)

Conversion to other temperatures:

The zero point deviations listed in the table must be multiplied by an adjustment factor (k):

- with diamagnetic gases: $k = 333\ K / (\vartheta\ [°C] + 273\ K)$
- with paramagnetic gases: $k = [333\ K / (\vartheta\ [°C] + 273\ K)]^2$

All diamagnetic gases have a negative deviation from zero point.

Selection and ordering data

OXYMAT 7 module For measurement of oxygen	Article No. 7MB3020-	●	●	●	●	0	-	●	A	A	●
Click on the Article No. for online configuration in the PIA Life Cycle Portal. ***Unavailable combinations are shown in PIA Life Cycle Portal as "not permitted".***											
Module version											
Standard module (for 19" rack unit enclosure and wall box)		0									
Standard module, high temperature 130 °C (for wall box)		1									
Standard module for hazardous zone (for 19" rack unit enclosure and wall box)		2									
Standard module, high temperature for hazardous zone 130 °C (for wall box)		3									
Field module for field enclosure Ex d without purging gas connections		4									
Field module for field enclosure Ex d with purging gas connections		5									
Reference gas pressure											
Low-pressure version 100 hPa (for connecting an external pump; without pressure switch)			A								
High pressure (2 000 ... 4 000 hPa above sample gas pressure)			C								
High pressure (2 000 ... 4 000 hPa above sample gas pressure), with pressure switch			D								
Smallest possible measuring span											
0.5%				B							
1%				C							
2%				D							
5%				E							
Material: gas paths, sample chambers, gaskets											
Gas path / Sample chamber / Gasket											
• Hose made of FKM (Viton) / • Stainless steel (1.4571) / • FKM (Viton)					0						
• Pipe made of stainless steel (1.4404) / • Stainless steel (1.4571) / • FKM / Ex: Kalrez (6375)					1						
• Pipe made of Hastelloy C22 / • Hastelloy C22 / • Kalrez (6375)					2						
• High-temperature gas path, pipe made of stainless steel (1.4571) / • Stainless steel (1.4571) / • Kalrez (6375)					4						
• High-temperature gas path, pipe made of Hastelloy C22 / • Hastelloy C22 / • Kalrez (6375)					5						
Vibration compensation											
Without								0			
With								1			
Version											
Standard											0

Options	Order code
Add "-**Z**" to article number and then add order code	
Settings	
Kalrez (6375) gaskets in sample gas path	***B04***
Clean for O2 service (specially cleaned gas path)	***B06***
Emission software for Korea	***B51***
Measuring range indication in plain text, if different from default setting	***Y11***
Pharmacopoeia	***Y18***
Exclusively for measuring non-toxic sample gases (field device only)	***Y16***
Basic unit module assignment number	***D00 ... D99***

Note

See order example under "More information".

Technical specifications

The technical specifications are based on the definitions of EN 61207-1.
Unless specified otherwise, the data listed below relates to the following measurement conditions:

Measuring conditions	
Ambient temperature	25 °C
Atmospheric pressure	Atmospheric (approx. 1 000 hPa)
Sample gas flow	0.6 l/min (or Nl/min)
Reference gas	Nitrogen
Site of installation	Vibration- and impact-free

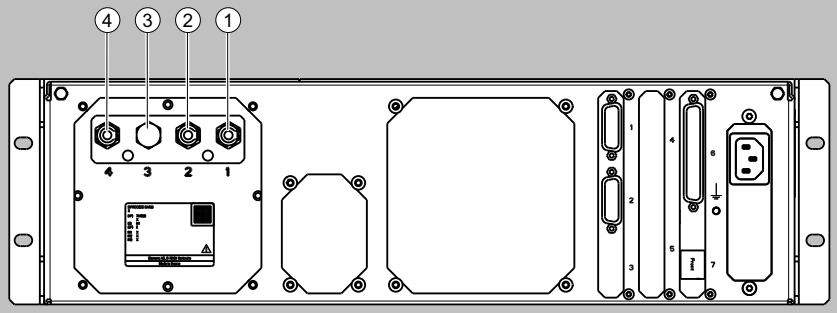
OXYMAT 7 module	
General information	
Weight	Approx. 5.5 kg (standard version)
Measuring ranges	
Number of measuring ranges	Max. 4; parameters can be assigned freely
Parameters can be assigned in the measuring ranges	
• Smallest possible measuring spans	0.5%, 1%, 2% or 5% O_2
• Largest possible measuring span	100% O_2
Gas inlet conditions	
Sample gas pressure	
• Standard devices with hoses	500 ... 1 500 hPa (abs.)
• Standard devices with hoses and ext. RG pump	Atmospheric pressure ± 50 hPa
• Standard devices with pipes	500 to 3 000 hPa (abs.); short-term max. 5 000 hPa (abs.)
• Field module	
- For non-flammable gases	500 ... 2 500 hPa (abs.)
- For flammable gases up to gas mixtures which are occasionally explosive	800 ... 1 100 hPa (abs.)
Reference gas pressure	
• High-pressure connection	2 000 hPa above sample gas pressure (within the permissible reference gas pressure range 2 500 ... 5 000 hPa, abs.)
• Low-pressure connection with external reference gas pump	100 hPa above sample gas pressure
Pressure drop between sample gas inlet and sample gas outlet	< 100 hPa at 1 l/min
Sample gas flow	18 ... 60 l/h (0.3 ... 1 l/min)
Sample gas temperature	0 ... 60 °C
Sample gas humidity (rel. humidity)	< 90% (condensation inside the gas path is to be avoided)
Sample chamber temperature	
Standard version	Approx. 72 °C
Time response	
Warm-up period at room temperature	< 2 h
Response characteristics	
• Delayed display T_{90} with an electronic damping setting of 0 s and a sample gas flow of 1 Nl/min.	≤ 1.9 s; ≤ 2.4 s (field module including flame arrestor)
• Dead time T_{10}	≤ 1.1 s; < 1.6 s (field module)
Measuring response	
Output signal fluctuation with static damping constant of 0 s and dynamic noise damping of 5% / 10 s	≤ ±0.5% of smallest measuring span (noise bandwidth corresponds to 1% = 6σ value or 0.333% = 2σ value), with vibration compensation activated: < 1.5 times the value
Detection limit	≤ 1% of smallest measuring span according to nameplate (with vibration compensation activated: < 1.5 times the value)
Measured-value drift	
• At the zero point	≤ ±0.5% of the smallest measuring span/month or ≤ ± 50 vpm O_2/month, whichever is greater

Technical specifications (continued)

OXYMAT 7 module	
• For span gas	≤ ±0.5% of the current measuring span/month or ≤ ± 50 vpm O_2/month, whichever is greater
Repeatability	
• At the zero point	≤ ±0.5% of the smallest measuring span or ≤ ± 50 vpm O_2, whichever is greater
• For span gas	≤ ±0.5% of the current measuring span/month or ≤ ± 50 vpm O_2, whichever is greater
Linearity error with dry ambient air[1)]	< 0.1%
Influencing quantities	
Ambient temperature	
• Deviation at zero point	≤ 0.5% of the smallest measuring span/ 10 K or ≤ 50 vpm O_2/10 K, whichever is greater
• Deviation of the span gas	≤ 0.5% of the current measuring span/ 10 K or ≤ 50 vpm O_2/10 K, whichever is greater
Sample gas pressure	
• Deviation at zero point	≤ 0.2% of the smallest measuring span/1% pressure variation or ≤ 50 vpm O_2/1% pressure variation, whichever is greater
• Deviation of the span gas	≤ 0.2% of the current measuring span/1% pressure variation or ≤ 50 vpm O_2/1% pressure variation, whichever is greater
Sample gas flow	
• Deviation at zero point	≤ 1% of smallest measuring span per 0.1 l/min change in flow or ≤ 50 vpm O_2 per 0.1 l/min change in flow within the permissible flow range (0.3 to 1 l/min), whichever is greater
• Deviation of the span gas	≤ 1% of current measuring span per 0.1 l/min change in flow or ≤ 50 vpm O_2 per 0.1 l/min change in flow within the permissible flow range (0.3 to 1 l/min), whichever is greater
Accompanying gases	Zero point deviation (cross-sensitivity) in accordance with Table A.1 of EN 61207-3
Supply voltage	< 0.1% of the current measuring span (within the nominal range of use)
Electrical inputs and outputs	
Analog and digital interfaces	See basic unit
Gas connections	
Connecting sockets	Pipe connection with 6 mm outer diameter
Climatic conditions	
Storage and transport	-30 ... 70 °C
Permissible ambient temperature[2)]	0 ... 50 °C
Relative humidity (RH) during storage, transport or operation	< 90% (condensation on the installed components is to be avoided)

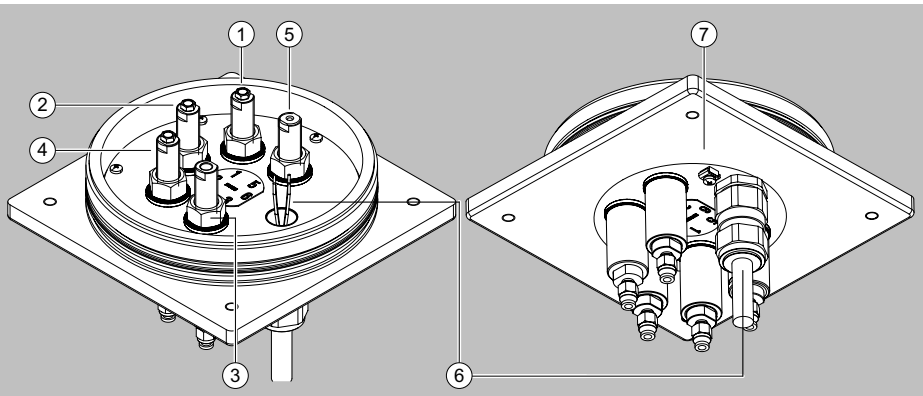
[1)] Untreated ambient air contains less than 20.95% O_2 (literature value) since existing humidity of the oxygen content is decreased relatively.
[2)] Restriction for installing together with an ULTRAMAT 7 module: 5 ... 45 °C.

Circuit diagrams



1 Sample gas inlet
2 Sample gas outlet
3 N.C., bypass outlet for version with external reference gas pump
4 Reference gas inlet

Gas connections for sample gas inlet and outlet, reference gas: Fittings, 6 mm pipe diameter

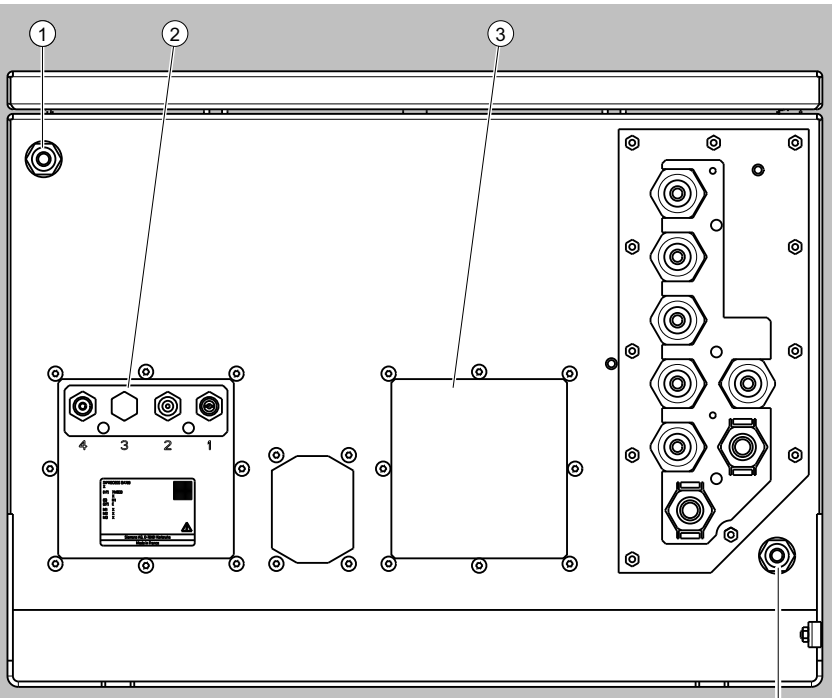


1 Sample gas inlet
2 Sample gas outlet
3 Blanking plug or purging gas connection
4 Reference gas inlet
5 Breathing apparatus (pressure compensation coupling)
6 Cable bushing
7 Ground connection

The sample gas connections are made of stainless steel Mat. No. 1.4571 or Hastelloy Mat. No. 2.4819.
The reference gas connection is made of stainless steel Mat. No. 1.4571.
Gas connections are fitted with a clamping ring screw connection for 6 mm pipes.

Gas connections of the field module

Circuit diagrams (continued)



1 Purging gas stub
2 Slot of module 1: OXYMAT 7
3 Slot of module 2

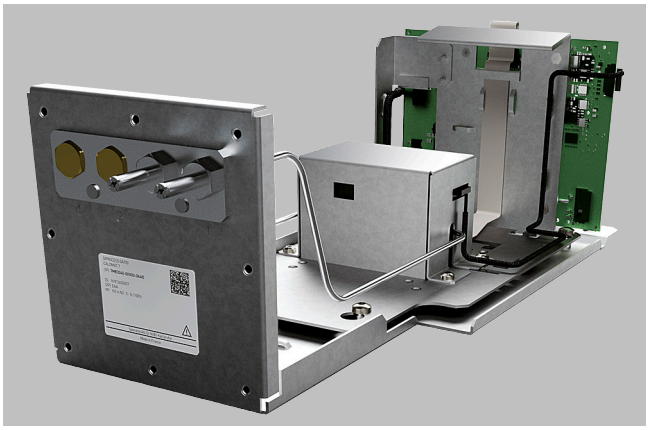
Wall-mounted device, bottom

More information

Ordering example

OXYMAT 7 module installed in wall box
7MB3000-3AX00-1AA0-Z+D02
7MB3020-0CE00-0AA0-Z+D02
OXYMAT 7 module and ULTRAMAT 7 module built into rack-mounted enclosure
7MB3000-0AA00-1AA0-Z+D05
7MB3020-0CE00-0AA0-Z+D05
7MB3010-0CA10-0AA0-Z+D05
OXYMAT 7 module and wall box supplied unassembled
7MB3000-3CX00-1AA0
7MB3020-0CE00-0AA0

Overview



The CALOMAT 7 module is primarily used for quantitative determination of H_2 or He in digital or quasi-digital non-corrosive gas mixtures.
Concentrations of other gases can also be measured if their thermal conductivity differs significantly from their accompanying gases, such as Ar, CO_2, CH_4.

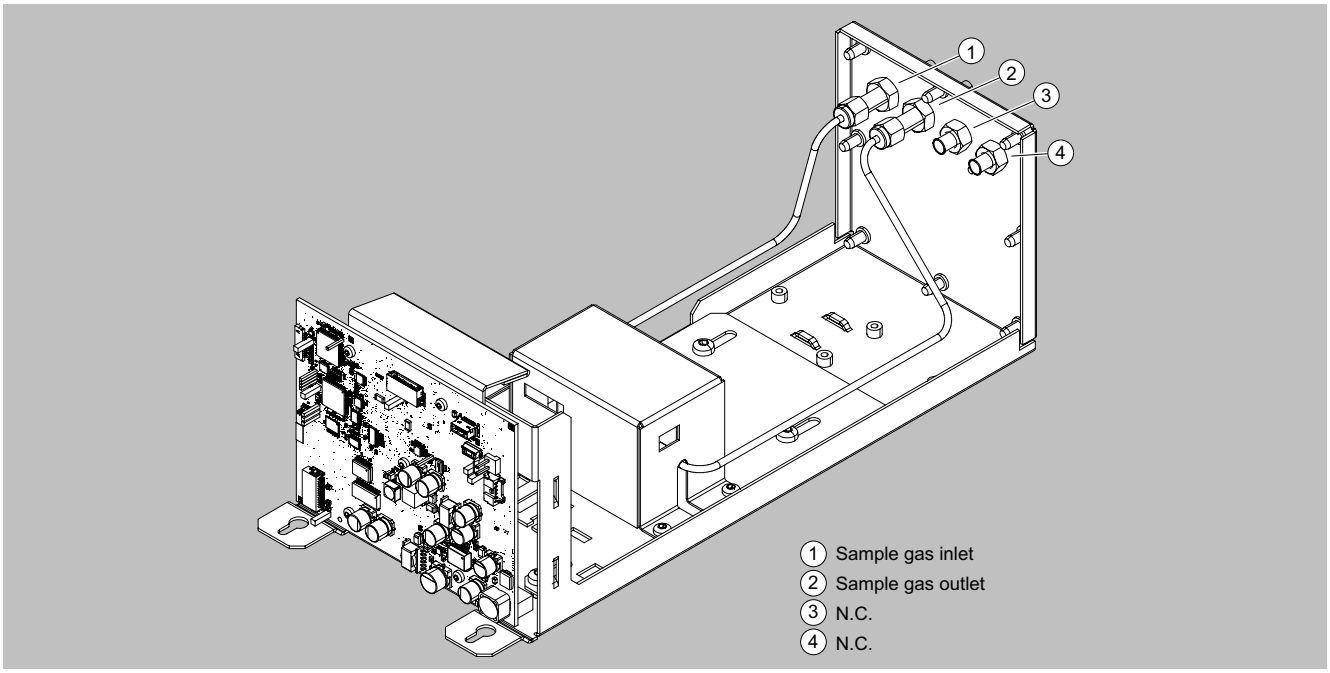
Benefits

- Small T_{90} time due to micromechanical-produced Si sensor
- Universally applicable hardware basis, high measuring range dynamics (e.g. 0 to 0.5%, 0 to 100%, 95 to 100% H_2)
- Open interface architecture (analog, digital, Ethernet)
- SIMATIC PDM network for maintenance and servicing information (optional)
- Introduction of flammable gas possible

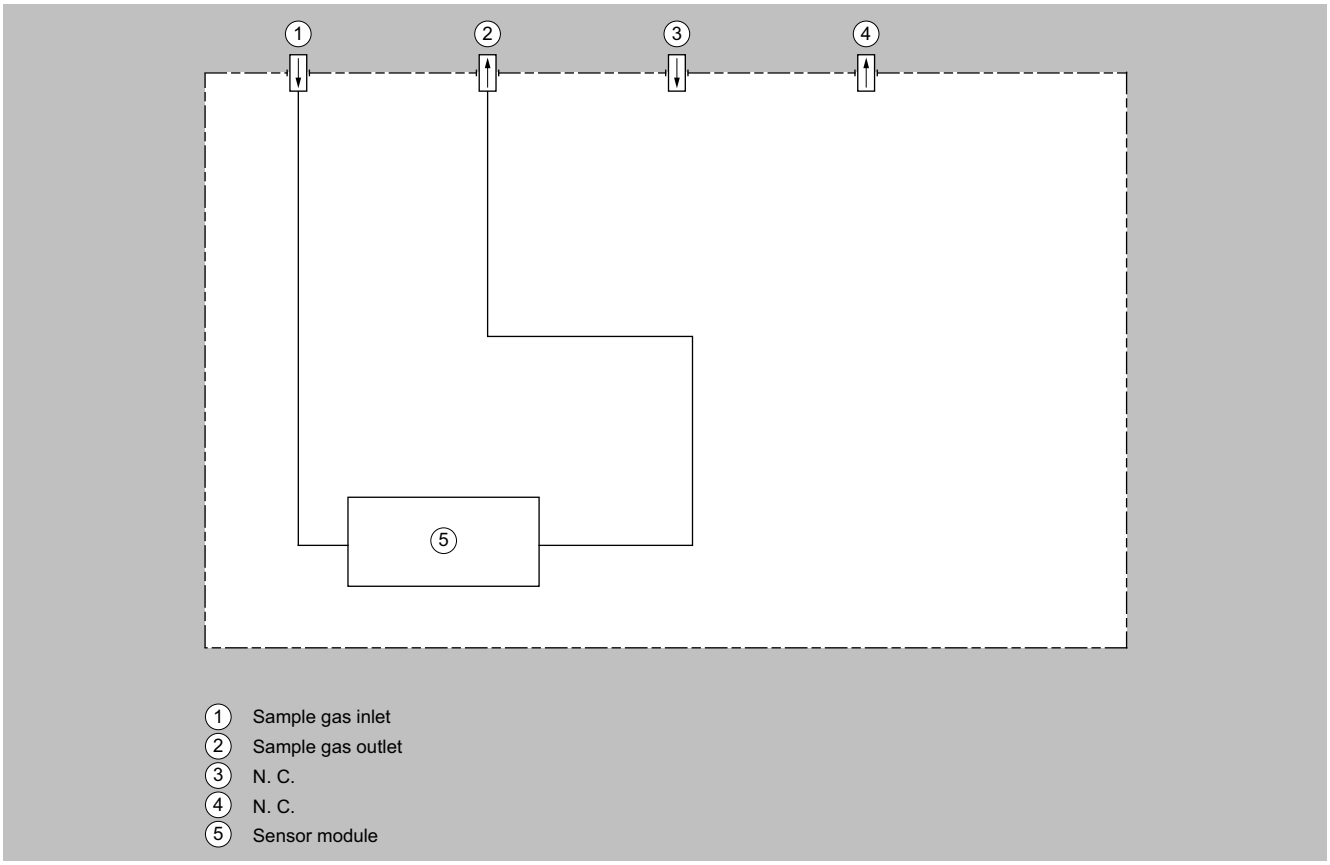
Application

- Pure gas monitoring (0 to 0.5% H_2 in Ar)
- Protective gas monitoring (0 to 2% He in N_2)
- Hydroargon gas monitoring (0 to 25% H_2 in Ar)
- Forming gas monitoring (0 to 25% H_2 in N_2)
- Gas production:
  - 0 to 2% He in N_2
  - 0 to 10% Ar in O_2
- Chemical applications:
  - 0 to 2% H_2 in NH_3
  - 50 to 70% H_2 in N_2
- Wood gasification (0 to 30% H_2 in $CO/CO_2/CH_4$)
- Blast furnace gas (0 to 5% H_2 in $CO/CO_2/CH_4/N_2$)
- Bessemer converter gas (0 to 20% H_2 in CO/CO_2)

Design



Structure of CALOMAT 7



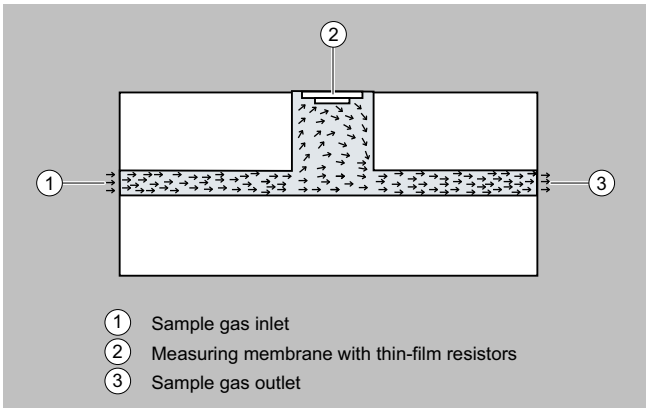
CALOMAT 7, gas path

Mode of operation

The measuring method is based on the different levels of thermal conductivity of gases. CALOMAT 7 modules work with a micromechanically produced Si chip, the measuring membrane of which is equipped with thin-film resistors.
The resistors contained in the diaphragm are regulated for constant temperature. The amperage required fluctuates in accordance with the thermal conductivity of the sample gas. This raw value determined in this way is processed further electronically to calculate the gas concentration.
The sensor is in a thermostatically controlled stainless steel enclosure in order to suppress the effect of the ambient temperature. To rule out flow influences, the sensor is mounted in a bore hole next to the flow channel.

Note

The sample gases must be fed into the analyzers free of dust. Condensation (dew point sample gas < ambient temperature) is to be avoided in the sample chambers. Therefore, the use of gas modified for the measuring tasks is necessary in most application cases.



CALOMAT 7, mode of operation

Function

Main features

- Four freely parameterizable measuring ranges, also with suppressed zero point; all measuring ranges are linear
- Smallest measuring spans down to 0.5 % H_2 (with suppressed zero point: 95 to 100 % H_2) possible
- Automatic or manual measuring range switchover selectable; remote switching is also possible
- Storage of measured values possible during calibration
- Time constants selectable within wide limits (static/dynamic noise damping); i.e. the response time of the device can be adapted to the respective measuring task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 6 measuring points (parameterizable)
- Measuring range identification
- Measuring point identification
- External pressure sensor can be connected – for correction of variations in sample gas pressure
- Automatic measuring range calibration parameterizable
- Operation based on the NAMUR recommendation

Function (continued)

Cross-interferences

To determine the cross-interferences of accompanying gases with several interfering gas components, you must know the sample gas composition. The following table contains the zero offsets for the carrier gas N_2 as H_2 equivalent values with 10 % interference gas.

Interference gas	H_2 equivalent values with 10 % interference gas
CH_4	+1.77 %
C_2H_6	+0.47 %
C_3H_8	-0.28 %
CO	-0.10 %
CO_2	-0.84 %
O_2	+0.19 %
N_2O	-0.83 %
NH_3	+1.45 %
Ar	-1.22 %
He	+6.32 %
SF_6	-2.15 %
SO_2	-1.47 %
Synth. Air	+0.40 %
H_2O (3 %)	+0.38 %

Zero offset in the system H_2 in N_2

If you are using accompanying gas concentrations ≠ 10 %, you can use the corresponding multiples of the respective table value as an approximation. This procedure applies depending on the type of gas for an accompanying gas concentration range up to approx. 25 %.
The thermal conductivity of most gas mixtures has a non-linear response. Even ambiguous results can occur in specific concentration ranges, e.g. with H_2 in He mixtures.
In addition to the zero offset, the accompanying gas can also affect the characteristic curve. For most gases, however, the effect on the characteristic curve is negligible.

Selection and ordering data

CALOMAT 7 module For the measurement of gases in binary or quasi-binary gas mixtures	Article No. 7MB3040-	●	●	●	●	●	-	0	●	●	●
Click on the Article No. for online configuration in the PIA Life Cycle Portal.											
Unavailable combinations are shown in PIA Life Cycle Portal as "not permitted".											
Module version											
Standard module for 19 inch rack unit enclosure and wall box		0									
Standard module for hazardous zone for 19 inch rack unit enclosure and wall box		2									
Measured components, corrosive gas mixtures											
Non-corrosive gas mixtures only			X								
Measuring range, corrosive mixtures											
Non-corrosive gas mixtures only				X							
Material of gas path											
Stainless steel 1.4571					0						
Reference gas chamber											
None (for non-corrosives gas mixtures)						0					
Measured components, non-corrosive mixtures											
H_2 in N_2									A		
H_2 in Ar									B		
He in N_2									C		
He in Ar									D		
He in H_2									E		
Ar in N_2									F		
Ar in O_2									G		
CH_4 in N_2									H		
CH_4 in Ar									J		
CO_2 in N_2									K		
Special version: H_2 in N_2 (for blast furnace gas, converter gas, wood gasification)									Q		
Smallest measuring range / **Largest measuring range**											
0 ... 0.5% / 0 ... 100%										A	
0 ... 1% / 0 ... 100%										B	
0 ... 2% / 0 ... 100%										C	
0 ... 5% / 0 ... 100%										D	
0 ... 10% / 0 ... 100%										E	
0 ... 10% / 0 ... 80%										F	
Version											
Standard											0

The following mixtures are available as a special application (7MB3047):	
H_2 in He	N_2 in O2
H_2 in CO_2	N_2 in H2
H_2 in synthetic air	Synthetic air in Ar
H_2 in CH_4	Synthetic air in CO_2
He in synthetic air	Synthetic air in H_2
Ar in He	Synthetic air in He
Ar in CO_2	CO_2 in Ar
Ar in synthetic air	CO_2 in synthetic air
Ar in H_2	CO_2 in H_2
N_2 in Ar	CH_4 in synthetic air
N_2 in He	CH_4 in H_2
N_2 in CH_4	O_2 in N_2

Selection and ordering data (continued)

Options	Order code
Add "-Z" to article number and then add order code	
Settings	
Clean for O2 service (specially cleaned gas path)	***B06***
Measuring range indication in plain text, if different from default setting	***Y11***
Special setting (only in conjunction with application no.)	***Y12***
Extended special setting (only in conjunction with application no.)	***Y13***
Basic unit module assignment number	***D00 ... D99***

Note

See order example under "More information".

Technical specifications

The technical specifications are based on the definitions of EN 61207-1.
Unless specified otherwise, the data listed below relates to the following measurement conditions:

Measuring conditions	
Ambient temperature	25 °C
Atmospheric pressure	Atmospheric (approx. 1 000 hPa)
Sample gas flow	0.6 l/min (or Nl/min)
Reference application	H_2 in N_2*
Site of installation	Vibration- and impact-free

* The technical specifications for time and measuring response as well as for the influencing quantities can sometimes differ significantly for other gas mixtures.

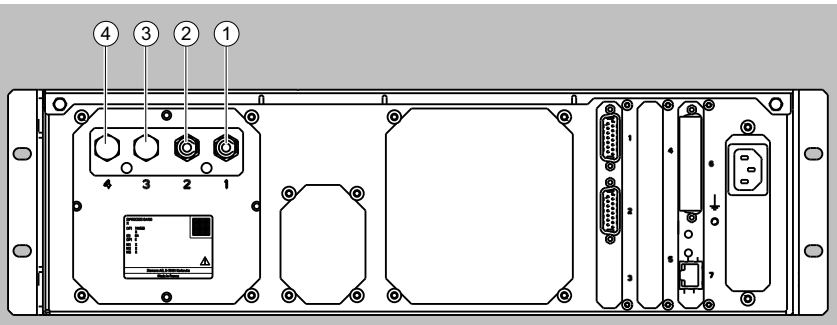
CALOMAT module	
General information	
Weight	Approx. 3 kg
Measuring ranges	
Number of measuring ranges	Max. 4; parameters can be assigned freely
Parameters can be assigned in the measuring ranges	
• Smallest possible measuring span	0.5% H_2 in N_2
• Largest possible measuring span	100% H_2 in N_2
• Smallest possible measuring span with suppressed zero point	5% (e.g. 95% ... 100%) H_2 in N_2
Gas inlet conditions	
Sample gas pressure	700 ... 1 200 hPa (abs.)
Pressure drop between sample gas inlet and sample gas outlet	< 50 hPa at 1.5 l/min
Sample gas flow	30 ... 90 l/h (0.5 ... 1.5 l/min)
Sample gas temperature	0 ... 70 °C
Sample gas humidity (rel. humidity)	< 90% (condensation inside the gas path is to be avoided)
Sample chamber temperature	
Standard version	Approx. 72 °C
Time response	
Warm-up period at room temperature	< 30 min (max. accuracy after 2 h)
Response characteristics	
• Delayed display T_{90} with device-internal signal damping (low pass filter) of 1 s	< 2.5 s
• Dead time (T_{10}) at 1 l/min	< 0.5 s
• Adjustable signal damping range	0 to 100 s

Technical specifications (continued)

CALOMAT module	
Measuring response	
Output signal fluctuation with device-internal signal damping of 1 s	≤ ± 0.5% of the smallest measuring span acc. to nameplate (σ < ± 8.33 vpm H_2)
Detection limit	≤ 1% of the smallest measuring span according to nameplate
Measured-value drift	≤ ± 1%/week of smallest measuring span according to nameplate or ≤ 50 vpm H_2/week, whichever is greater
Repeatability	≤ ± 1% of the current measuring span or 100 vpm H_2
Linearity error	≤ ± 1% of the current measuring span or 100 vpm H_2
Influencing quantities	
Ambient temperature	≤ ± 0.5%[1]/10 K of the current measuring span or ≤ ± 50 vpm H_2/10 K
Sample gas pressure	≤ ± 0.5%[1] of the current measuring span/1% pressure variation or ≤ ± 50 vpm H_2/1% pressure variation
Sample gas flow	≤ ± 0.2% of the smallest possible measuring span with a change in flow of 1 dl/min within the permissible flow range
Accompanying gases (interference gases)	The interference gas sensitivity depends on the application and must be determined in each case except for applications with blast furnace gas / converter gas / wood gasification (pre-adjusted).
Supply voltage	≤ ± 0.1% of characteristic curve end value (within the nominal range of use)
Electrical inputs and outputs	
Analog and digital interfaces	See basic unit
Climatic conditions	
Storage and transport	-30 ... 70 °C
Permissible ambient temperature (during operation in basic unit)[2]	0 ... 50 °C
Relative humidity (RH) during storage, transport or operation	< 90% (condensation on the installed components is to be avoided)
Gas connections	
Connecting sockets	Pipe connection with 6 mm outer diameter
Materials of wetted parts	
Gas connection	Stainless steel material no. 1.4571
Clamping rings and union nut (set)	Stainless steel material no. 1.4401
Sample gas pipes	Stainless steel material no. 1.4404
Sensor mounting block	Stainless steel material no. 1.4571
Sensor	Si, SiO_xN_y, Au, epoxy resin, glass
Gasket, contained in the sensor module	Perfluorelastomere FFKM

[1] Values less than the detection limit are not useful
[2] Restriction for installing an ULTRAMAT 7 module: 5 ... 45 °C.

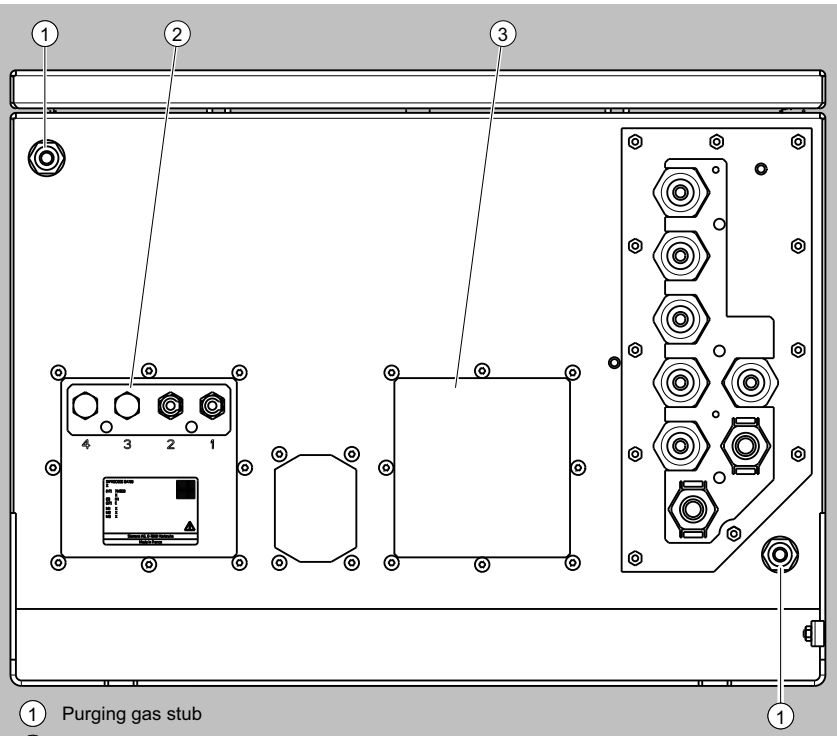
Circuit diagrams



1 Sample gas inlet
2 Sample gas outlet
3 N.C.
4 N.C.

CALOMAT 7 gas connections

The sample gas connections are made of stainless steel with material no. 1.4571 and are designed as connection fittings with a pipe diameter of 6 mm.



1 Purging gas stub
2 Slot of module 1: CALOMAT 7
3 Slot of module 2

Wall-mounted device, bottom

More information

Ordering example

CALOMAT 7 module installed in wall box
7MB3000-3FX00-1AA0-Z+D12
7MB3040-0XX00-0BB0-Z+D12

Overview

Gas path		ULTRAMAT 7	OXYMAT 7	CALOMAT 7
With hoses (Viton)	Bushing	–	PVDF	–
	Hose	–	FKM (Viton)	–
	Sample chamber	–	Stainless steel 1.4571	–
	Nozzle (sample chamber)	–	Stainless steel 1.4571	–
	Restrictor	–	PTFE (Teflon)	–
	O-ring	–	FKM (Viton)	–
With pipes (stainless steel)	Bushing	Stainless steel 1.4571	Stainless steel 1.4571	Stainless steel 1.4571
	Pipe	Stainless steel 1.4571	Stainless steel 1.4404	Stainless steel 1.4404
	Sample chamber			
	• Body	Aluminum	Stainless steel 1.4571	–
	• Lining	Aluminum or tantalum	–	–
	• Window	CaF2, adhesive: E353	–	–
	Sensor mounting block	–	–	Stainless steel 1.4571
	Sensor	–	–	Si, SiO_xN_y, AU, epoxy resin, glass
	Sample gas restrictor	–	Stainless steel 1.4571	–
	O-rings	FKM (Viton) or FFKM (Kalrez 6375)	FKM (Viton) or FFKM (Kalrez 6375)	FFKM (Kalrez 6375)
With pipes (Hastelloy)	Bushing	Hastelloy C22	Hastelloy C22	–
	Pipe	Hastelloy C22	Hastelloy C22	–
	Sample chamber			
	• Body	Aluminum	Hastelloy C22	–
	• Lining	Tantalum	–	–
	• Window	CaF2, adhesive: E353	–	–
	Sample gas restrictor	–	Hastelloy C22	–
	O-rings	FKM (Viton) or FFKM (Kalrez 6375)	FFKM (Kalrez 6375)	–