

## Overview



The OXYMAT 61 gas analyzers use a measuring principle based on the paramagnetic alternating pressure method and are used to measure oxygen in gases.

## Benefits

- Integrated pump for reference gas (option, e.g. ambient air)
- High linearity
- Compact design
- Physically suppressed zero possible

## Application

- Environmental protection
- Boiler control in combustion plants
- Quality monitoring (e.g. in ultra-pure gases)
- Process exhaust monitoring
- Process optimization

### *Further applications*

- Chemical plants
- Gas manufacturers
- Research and development

# Extractive continuous process gas analysis

## Series 6

### OXYMAT 61

#### Design

- 19" rack unit with 4 U for installation
  - In hinged frame
  - In cabinets with or without telescopic rails
- Front plate can be swung down for servicing purposes (laptop connection)
- Gas connections for sample gas inlet and outlet; pipe diameter 6 mm or ¼"
- Gas and electrical connections at the rear of the device

#### *Display and operator panel*

- Large LCD field for simultaneous display of
  - Measured value
  - Status bar
  - Measuring ranges
- Contrast of LCD panel adjustable using menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Menu-driven operation for parameterization, test functions, adjustment
- User help in plain text
- Graphic display of concentration trend; programmable time intervals
- Bilingual operating software German/English, English/Spanish, French/English, Spanish/English, Italian/English

#### *Inputs and outputs*

- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Six digital inputs freely configurable (e.g. for measuring range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (failure, maintenance demanded, maintenance switch, limit alarm, external solenoid valves)
- Two analog inputs configurable (e.g. correction of cross-interference, external pressure sensor)
- Expansion by eight additional digital inputs and eight additional relay outputs for autocalibration with up to four calibration gases

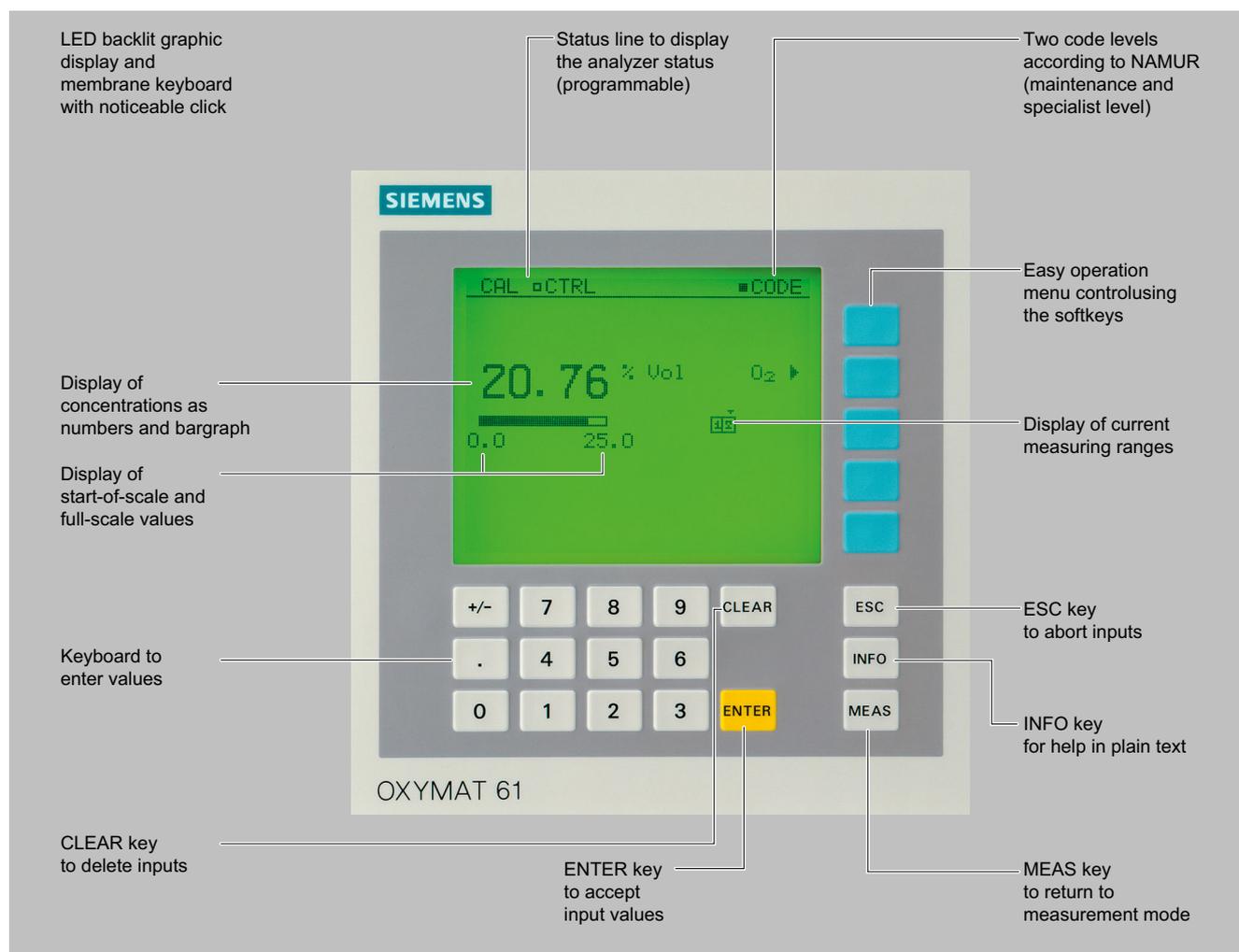
#### *Communication*

RS 485 present in basic unit (connection from the rear).

#### Options

- RS 485/RS 232 converter
- RS 485/Ethernet converter
- RS 485/USB converter
- Connection to networks via PROFIBUS DP/PA interface
- SIPROM GA software as service and maintenance tool

## Design (Continued)



OXYMAT 61, membrane keyboard and graphic display

**Designs – Parts wetted by sample gas, standard**

Gas path		19" rack unit
With hoses	Bushing	Stainless steel. Mat. no. 1.4571
	Hose	FKM (Viton)
	Sample chamber	Stainless steel. Mat. no. 1.4571
	Fittings for sample chamber	Stainless steel. Mat. no. 1.4571
	Restrictor	PTFE (Teflon)
	O-rings	FKM (Viton)
	Hose coupling	Polyamide 6

Options		
Flow indicator	Measuring tube Variable area Suspension boundary Angle units	Duran glass Duran glass, black PTFE (Teflon) FKM (Viton)

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## Design (Continued)

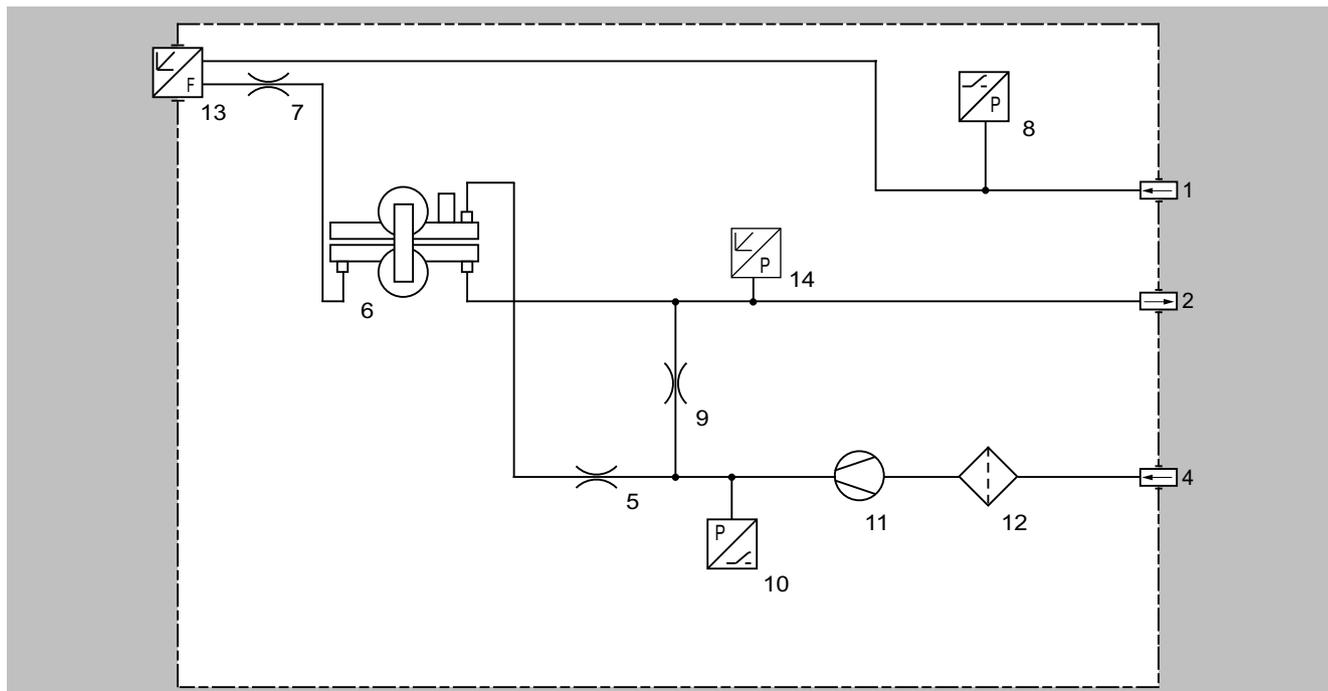
### Options

Pressure switch

Diaphragm  
Enclosure

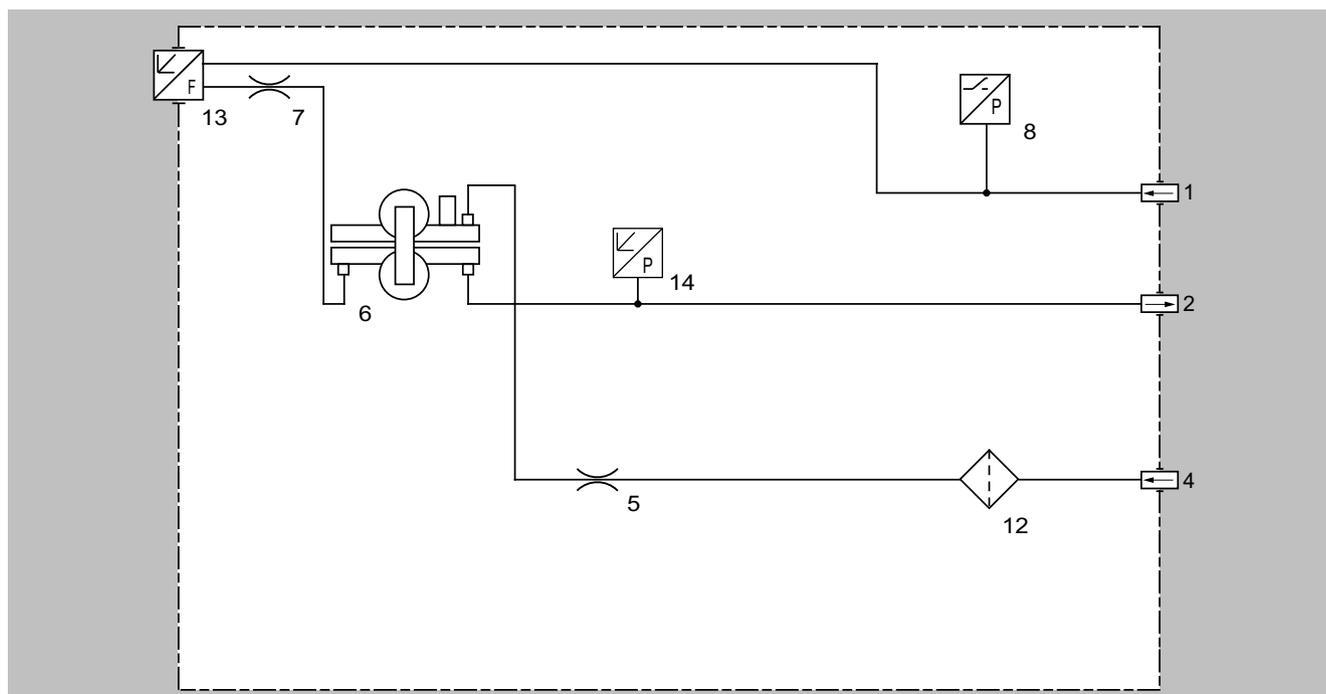
FKM (Viton)  
PA 6.3 T

### Gas path



Gas path OXYMAT 61 with integrated reference gas pump (connection for 1 100 hPa, absolute)

## Design (Continued)



Gas path OXYMAT 61 with reference gas connection 3 000 to 5 000 hPa, absolute

## Legend for the gas path figures

1	Sample gas inlet	8	Pressure switch in sample gas path (option)
2	Sample gas outlet	9	Restrictor in reference gas channel (outlet)
3	Not used	10	Pressure switch for reference gas monitoring
4	Reference gas inlet	11	Pump
5	Restrictor in reference gas inlet	12	Filter
6	O <sub>2</sub> physical system	13	Flow indicator in sample gas path (option)
7	Restrictor in sample gas path	14	Pressure sensor

## Mode of operation

In contrast to almost all other gases, oxygen is paramagnetic. This property is utilized as the measuring principle by the OXYMAT 61 gas analyzers.

Oxygen molecules in an inhomogeneous magnetic field are drawn in the direction of increased field strength due to their paramagnetism. When two gases with different oxygen contents meet in a magnetic field, a pressure difference is produced between them.

In the case of OXYMAT 61, one gas (1) is a reference gas (N<sub>2</sub>, O<sub>2</sub> or air), the other is the sample gas (5). The reference gas is introduced into the sample chamber (6) through two channels (3). One of these reference gas streams meets the sample gas within the area of a magnetic field (7). Because the two channels are connected, the pressure, which is proportional to the oxygen content, causes a cross flow. This flow is converted into an electric signal by a 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 pulsating flow results in a change in the resistance of the Ni grids. This leads to an offset in the bridge which is dependent on the oxygen concentration of the sample gas.

Because the microflow sensor is located in the reference gas stream, the measurement is not influenced by the thermal conductivity, the specific heat or the internal friction of the sample gas. This also provides a high degree of corrosion resistance because the microflow sensor is not exposed to the direct influence of the sample gas.

By using a magnetic field with alternating strength (8), the effect of the background flow in the microflow sensor is not detected, and the measurement is thus independent of the sample chamber position as well as the gas analyzer's operating position.

The sample chamber is directly in the sample path and has a small volume, and the microflow sensor is a low-lag sensor. This results in a very short response time for the OXYMAT 61.

# Extractive continuous process gas analysis

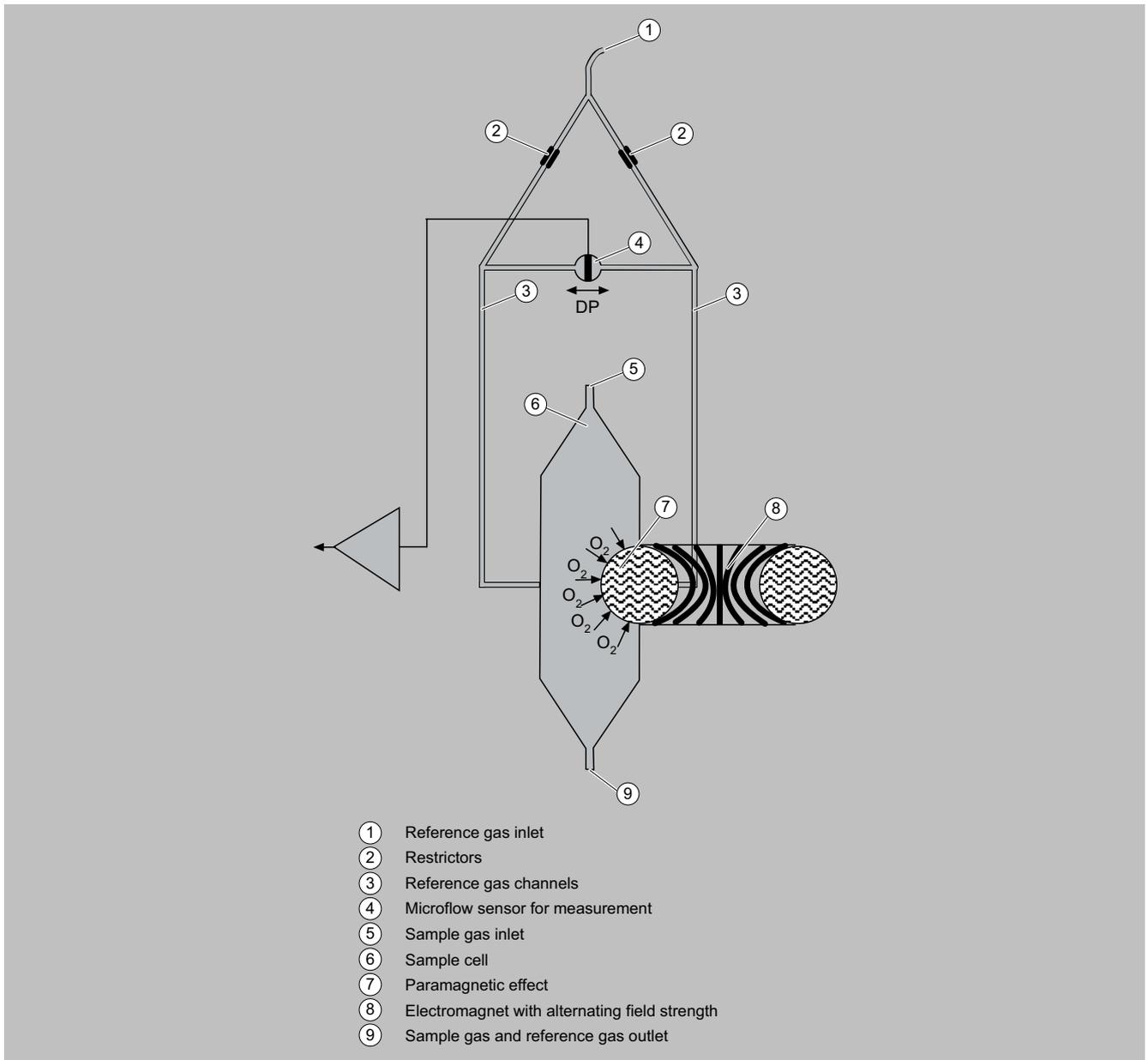
Series 6

OXYMAT 61

## Mode of operation (Continued)

### Note

The sample gases must be fed into the analyzers free of dust. Condensation in the sample chambers must be prevented. Therefore, gas modified for the measuring tasks is necessary in most application cases.



OXYMAT 61, mode of operation

## Function

### Main features

- Four measuring ranges which can be freely configured, even with suppressed zero point; all measuring ranges are linear
- Electrically isolated measured value output 0/2/4 through to 20 mA (including inverted)
- Choice of automatic or manual measuring range switchover; remote switching is also possible
- Storage of measured values possible during calibration
- Wide range of selectable time constants (static/dynamic noise damping); i.e. the response time of the device can be adapted to the respective measuring task
- Easy handling thanks to menu-driven operation
- Low long-term drift
- Two control levels with separate authorization codes for the prevention of accidental and unauthorized operator interventions
- Automatic measuring range calibration parameterizable
- Operation based on NAMUR recommendation
- Monitoring of sample gas (option)
- Custom-made device designs, such as:
  - Customer acceptance
  - TAG plates
  - Drift recording
- Simple handling using a numerical membrane keyboard and operator prompting
- Short response time
- Reference gas supply either externally (N<sub>2</sub>, O<sub>2</sub> or air, approx. 3 000 hPa) or via built-in reference gas pump (ambient air, approx. 1 100 hPa abs.)
- Monitoring of reference gas with reference gas connection; only for version with built-in reference gas pump
- Different smallest measuring spans, depending on version 2.0% or 5.0% O<sub>2</sub>
- Internal pressure sensor for correction of fluctuations in the sample gas pressure

### Reference gases for OXYMAT 61

Measuring range	Recommended reference gas	Reference gas connection pressure	Comments
0 to ... vol.% O <sub>2</sub>	N <sub>2</sub>	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.
... to 100 vol.% O <sub>2</sub>	O <sub>2</sub>	2 000 ... 4 000 hPa above sample gas pressure (max. 5 000 hPa absolute)	
Approx. 21 vol.% O <sub>2</sub>	Air	Atm. air pressure with internal reference gas pump	

<sup>1)</sup> Suppressed zero point with measuring range end value 100 vol.% O<sub>2</sub>.

<sup>2)</sup> Suppressed zero point with 21 vol.% O<sub>2</sub> within the measuring span.

### Correction of zero-point error/cross-sensitivities

Accompanying gas (concentration 100 vol.%)	Zero point deviation in vol.% O <sub>2</sub> absolute
<b>Organic gases</b>	
Ethane C <sub>2</sub> H <sub>6</sub>	-0.49
Ethene (ethylene) C <sub>2</sub> H <sub>4</sub>	-0.22
Ethine (acetylene) C <sub>2</sub> H <sub>2</sub>	-0.29
1,2-butadiene C <sub>4</sub> H <sub>6</sub>	-0.65
1,3-butadiene C <sub>4</sub> H <sub>6</sub>	-0.49
N-butane C <sub>4</sub> H <sub>10</sub>	-1.26
Isobutane C <sub>4</sub> H <sub>10</sub>	-1.30
1-butene C <sub>4</sub> H <sub>8</sub>	-0.96
Isobutene C <sub>4</sub> H <sub>8</sub>	-1.06
Dichlorodifluoromethane (R12) CCl <sub>2</sub> F <sub>2</sub>	-1.32
Acetic acid CH <sub>3</sub> COOH	-0.64
N-heptane C <sub>7</sub> H <sub>16</sub>	-2.40
N-hexane C <sub>6</sub> H <sub>14</sub>	-2.02

# Extractive continuous process gas analysis

## Series 6

### OXYMAT 61

#### Function (Continued)

Accompanying gas (concentration 100 vol.%)	Zero point deviation in vol.% O <sub>2</sub> absolute
Cyclo-hexane C <sub>6</sub> H <sub>12</sub>	-1.84
Methane CH <sub>4</sub>	-0.18
Methanol CH <sub>3</sub> OH	-0.31
N-octane C <sub>8</sub> H <sub>18</sub>	-2.78
N-pentane C <sub>5</sub> H <sub>12</sub>	-1.68
Isopentane C <sub>5</sub> H <sub>12</sub>	-1.49
Propane C <sub>3</sub> H <sub>8</sub>	-0.87
Propylene C <sub>3</sub> H <sub>6</sub>	-0.64
Trichlorofluoromethane (R11) CCl <sub>3</sub> F	-1.63
Vinyl chloride C <sub>2</sub> H <sub>3</sub> Cl	-0.77
Vinyl fluoride C <sub>2</sub> H <sub>3</sub> F	-0.55
1,1 vinylidene chloride C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	-1.22
<b>Inert gases</b>	
Helium He	+0.33
Neon Ne	+0.17
Argon Ar	-0.25
Krypton Kr	-0.55
Xenon Xe	-1.05
<b>Inorganic gases</b>	
Ammonia NH <sub>3</sub>	-0.20
Hydrogen bromide HBr	-0.76
Chlorine Cl <sub>2</sub>	-0.94
Hydrogen chloride HCl	-0.35
Dinitrogen monoxide N <sub>2</sub> O	-0.23
Hydrogen fluoride HF	+0.10
Hydrogen iodide HI	-1.19
Carbon dioxide CO <sub>2</sub>	-0.30
Carbon monoxide CO	+0.07
Nitrogen oxide NO	+42.94
Nitrogen N <sub>2</sub>	0.00
Nitrogen dioxide NO <sub>2</sub>	+20.00
Sulfur dioxide SO <sub>2</sub>	-0.20
Sulfur hexafluoride SF <sub>6</sub>	-1.05
Hydrogen sulfide H <sub>2</sub> S	-0.44
Water H <sub>2</sub> O	-0.03
Hydrogen H <sub>2</sub>	+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 Table 1 must be multiplied by an adjustment factor (k):

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

All diamagnetic gases have a negative zero point deviation.

## Selection and ordering data

	Article No.
<b>OXYMAT 61 gas analyzer</b> 19" rack unit for installation in cabinets	7MB2001- ● ● A 0 0 - ● ● ● ●
Click on the Article No. for online configuration in the PIA Life Cycle Portal.	
<b>Unavailable combinations are shown in PIA Life Cycle Portal as "not permitted".</b>	
<b>Gas connections for sample gas and reference gas</b>	
Pipe with 6 mm outer diameter	0
Pipe with 1/4" outer diameter	1
<b>Smallest possible measuring span O<sub>2</sub></b>	
2% reference gas pressure 3 000 hPa	C
2% reference gas supply with internal pump	D
5% reference gas pressure 3 000 hPa	E
5% reference gas supply with internal pump	F
<b>Auxiliary power</b>	
100 V ... 120 V AC, 48 ... 63 Hz	0
200 V ... 240 V AC, 48 ... 63 Hz	1
<b>Sample gas monitoring</b>	
Without	A
With (including flow indicator and pressure switch)	D
<b>Add-on electronics</b>	
Without	A
AUTOCAL function with 8 additional digital inputs and outputs	B
AUTOCAL function with serial interface for the automotive industry (AK)	D
AUTOCAL function 8 additional digital inputs/outputs and PROFIBUS PA interface	E
AUTOCAL function with 8 additional digital inputs/outputs and PROFIBUS DP interface	F
<b>Language of the operating software</b>	
German	0
English	1
French	2
Spanish	3
Italian	4

Options	Order code
Add "-Z" to article number and then add order code.	
<b>Settings</b>	
Telescopic rails (2 units)	A31
Set of Torx screwdrivers, ball Allen screwdrivers	A32
Tag plates (specific inscription based on customer information)	B03
Damping element for sample gas	<b>B04 (cannot be combined with Y02)</b>
SIL Declaration of Conformity (SIL 2) Functional Safety according to IEC 61508 and IEC 61511	C20
Clean for O <sub>2</sub> service (specially cleaned gas path)	Y02
Measuring range indication in plain text, if different from default setting <sup>1)</sup>	Y11

Accessories	Article No.
RS 485/Ethernet converter	A5E00852383
RS 485/RS 232 converter	C79451-Z1589-U1
RS 485/USB converter	A5E00852382
AUTOCAL function with 8 digital inputs/outputs each	C79451-A3480-D511
AUTOCAL function with 8 digital inputs/outputs each and PROFIBUS PA	A5E00057307

# Extractive continuous process gas analysis

## Series 6

### OXYMAT 61 / 19" rack unit

#### Selection and ordering data (Continued)

Accessories	Article No.
AUTOCAL function with 8 digital inputs/outputs each and PROFIBUS DP	A5E00057312
Set of Torx screwdrivers	A5E34821625

<sup>1)</sup> Standard setting: Measuring range 1: 0 to smallest measuring span, measuring range 2: 0 to 10%, measuring range 3: 0 to 25%, measuring range 4: 0 to 100%.

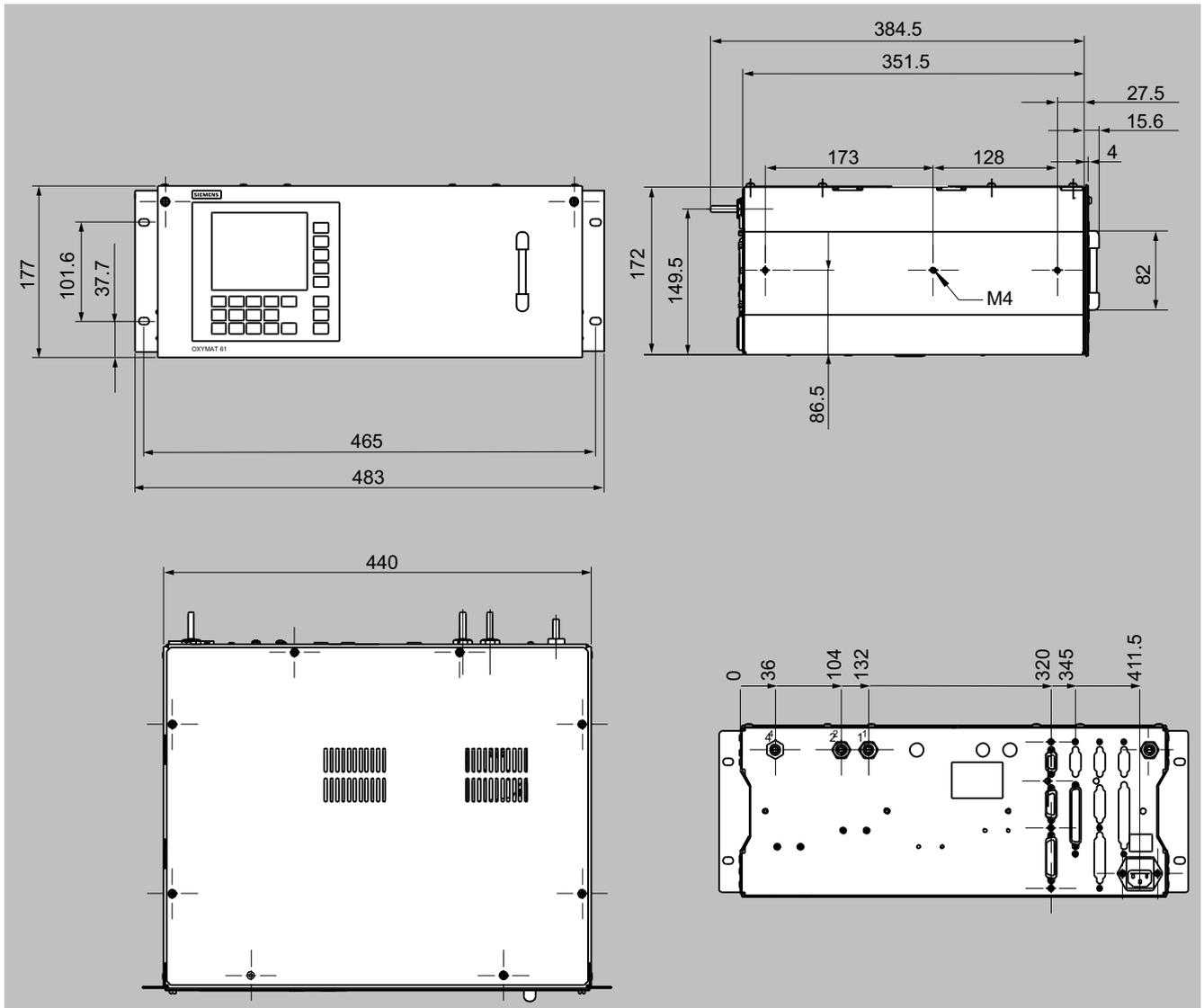
#### Technical specifications

OXYMAT 61, 19" rack unit	
<b>General information</b>	
Measuring ranges	4, internally and externally switchable; automatic measuring range switchover is also possible
Smallest possible measuring span (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	2 vol.% or 5 vol.% O <sub>2</sub>
Largest possible measuring span	100 vol.% O <sub>2</sub>
Measuring ranges with suppressed zero point	Any zero point within 0 ... 100 vol.% can be implemented, provided that a suitable reference gas is used
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1 and EN 50082-2
<b>Design, enclosure</b>	
Degree of protection	IP20 according to EN 60529
Weight	Approx. 13 kg
<b>Electrical characteristics</b>	
Auxiliary power	100 ... 120 V AC (nominal range of use 90 ... 132 V), 48 ... 63 Hz or 200 ... 240 V AC (nominal range of use 180 ... 264 V), 48 ... 63 Hz
Power consumption	Approx. 45 VA
EMC (electromagnetic compatibility)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	According to EN 61010-1, overvoltage category III
Fuse ratings	100 ... 120 V: 1.0T/250 200 ... 240 V: 0.63T/250
<b>Gas inlet conditions</b>	
Permissible sample gas pressure	
• External reference gas supply	800 ... 1 200 hPa, absolute
• With integrated pump	Atmospheric pressure ± 50 hPa
Sample gas flow	18 ... 60 l/h (0.3 ... 1 l/min)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Sample gas humidity	< 90% relative humidity
Reference gas pressure (high-pressure version)	2 000 ... 4 000 hPa above sample gas pressure, but max. 5 000 hPa, absolute (version without reference gas pump)
Reference gas pressure (low-pressure version) with external pump	Min. 100 hPa above sample gas pressure
<b>Time response</b>	
Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Delayed display (T <sub>90</sub> )	3.5 s
Damping (electrical time constant)	0 ... 100 s, configurable
Dead time (purging time of the gas path in the device at 1 l/min)	Approx. 0.5 ... 2.5 s, depending on the version
Time for device-internal signal processing	< 1 s
<b>Pressure correction range</b>	
Pressure sensor internal	500 ... 2 000 hPa, absolute (see gas inlet conditions for permissible sample gas pressure)

#### Technical specifications (Continued)

OXYMAT 61, 19" rack unit	
<b>Measuring response</b>	
Output signal fluctuation	Based on sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature < ± 0.75% of the smallest possible measuring range according to nameplate, with electronic damping constant of 1 s (corresponds to ± 0.25% at 2 σ)
Zero point drift	< ± 0.5%/month of the smallest possible measuring span according to nameplate
Measured value drift	< ± 0.5%/month of the current measuring range
Repeatability	< 1% of the current measuring range
Detection limit	1% of the current measuring range
Linearity error	< 1% of the current measuring range
<b>Influencing variables</b>	
Ambient temperature	Based on sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature < 1% of the current measuring range/ 10 K Zero offset: < 0.1 vol.% O <sub>2</sub> absolute/10 K
Sample gas pressure (with air (100 hPa) as internal reference gas supply, correction of the atmospheric pressure fluctuations is only possible if the sample gas can vent to ambient air.)	<ul style="list-style-type: none"> <li>With disabled pressure compensation: &lt; 2% of the current measuring range/1% pressure variation</li> <li>With enabled pressure compensation: &lt; 0.2% of the current measuring range/1% pressure variation</li> </ul>
Accompanying gases	Zero point deviation corresponding to paramagnetic or diamagnetic deviation of accompanying gas (see table)
Sample gas flow at zero point	< 1% of the current measuring range according to nameplate with a change in flow of 0.1 l/min within the permissible flow range
Auxiliary power	< 0.1% of the current measuring range with nominal voltage ± 10%
<b>Electrical inputs and outputs</b>	
Analog output	0/2/4 ... 20 mA, floating; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely configurable, e.g. for measuring range identification; load rating: 24 V AC/DC/1 A, floating
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and accompanying gas influence correction (correction of cross-interference)
Digital inputs	6, designed for 24 V, floating, freely configurable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function each with 8 additional digital inputs and relay outputs, also with PROFIBUS PA or PROFIBUS DP
<b>Climatic conditions</b>	
Permissible ambient temperature	-30 ... +70 °C during storage and transportation, 5 ... 45 °C during operation
Permissible humidity	< 90% relative humidity as annual average during storage and transportation (must not fall below dew point)

## Dimensional drawings



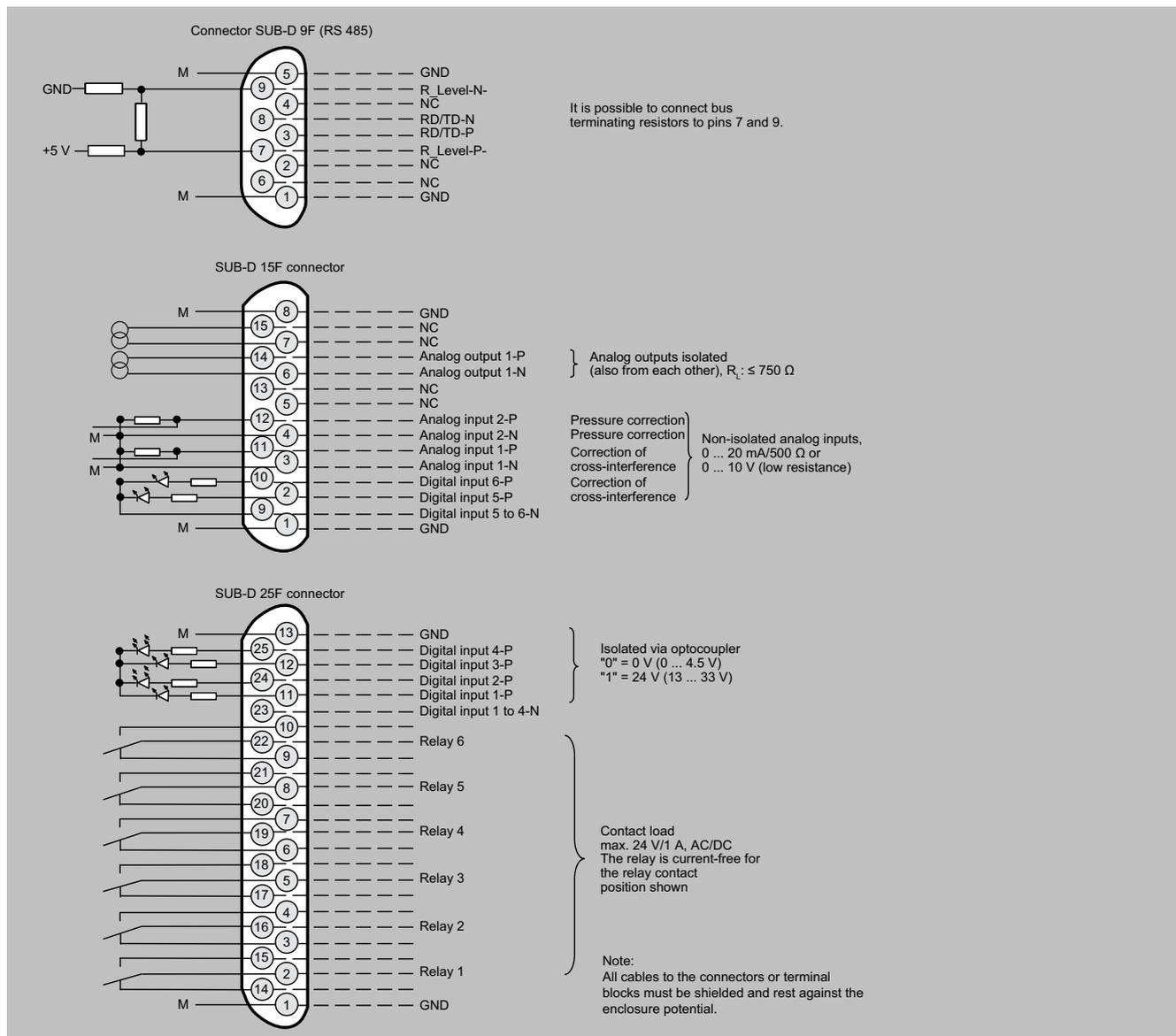
OXYMAT 61, 19" rack unit, dimensions in mm

# Extractive continuous process gas analysis

## Series 6

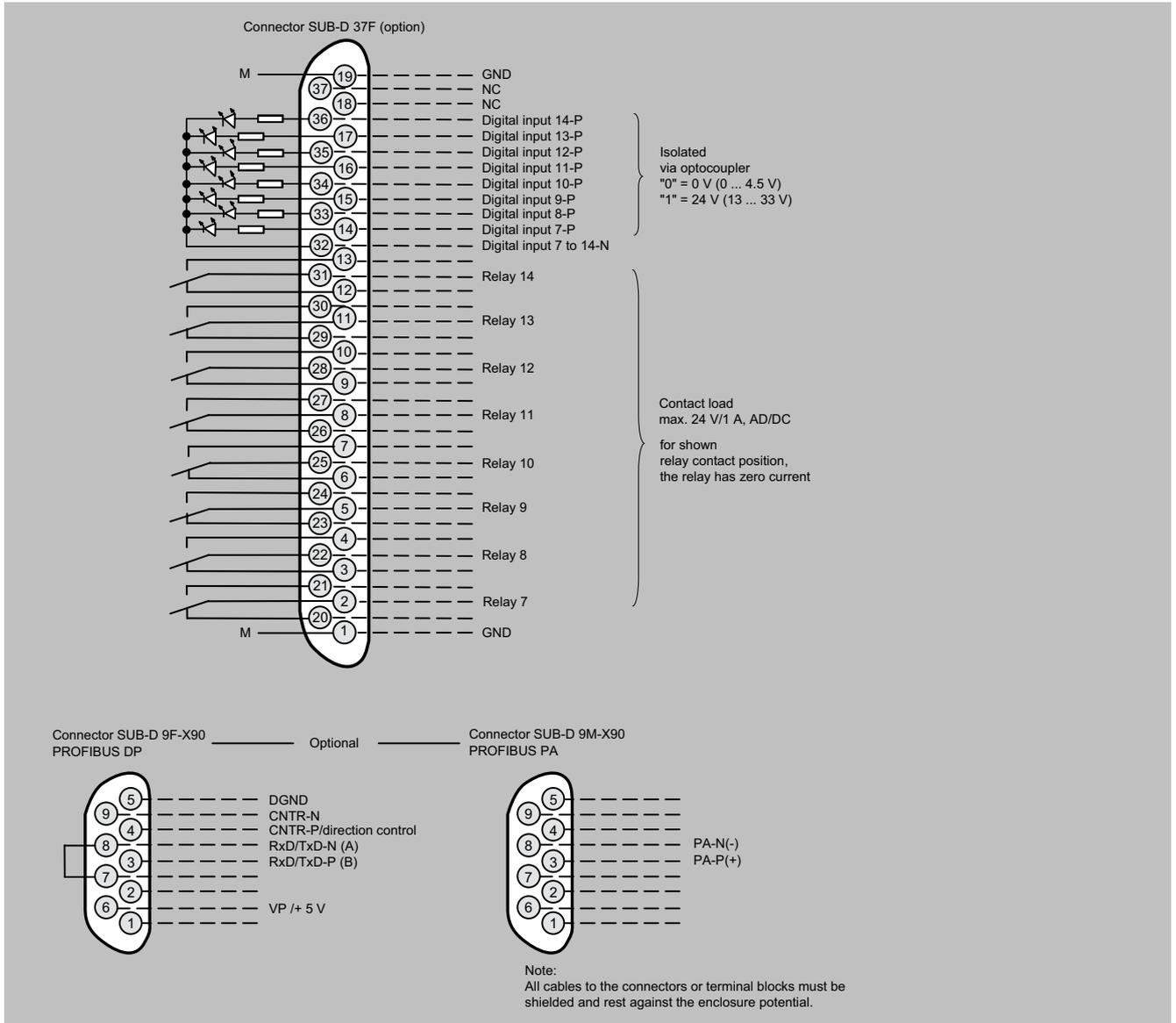
### OXYMAT 61 / 19" rack unit

#### Circuit diagrams



OXYMAT 61, 19" rack unit, pin assignment

Circuit diagrams (Continued)



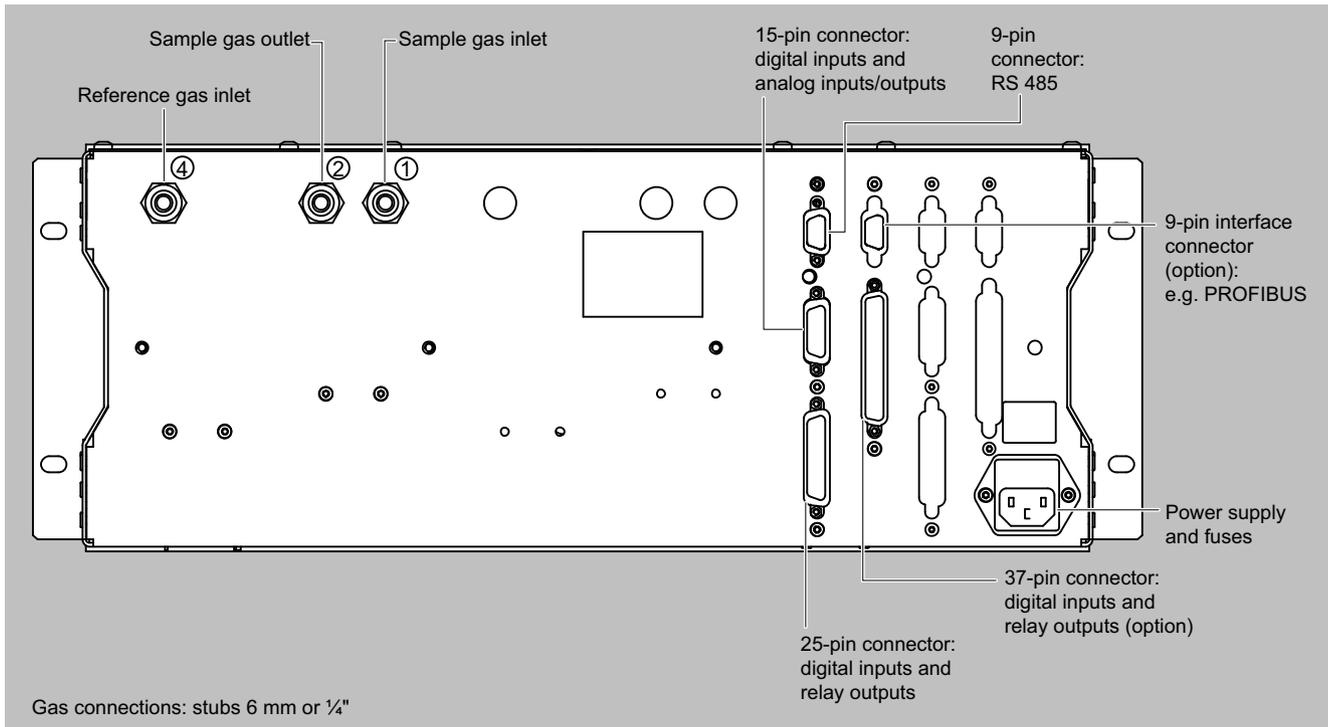
OXYMAT 61, 19" rack unit, pin assignment of the AUTOCAL board and PROFIBUS plugs

# Extractive continuous process gas analysis

## Series 6

### OXYMAT 61 / 19" rack unit

#### Circuit diagrams (Continued)



OXYMAT 61, 19" rack unit, gas and electrical connections

### Selection and ordering data

Description	2 years (unit)	5 years (unit)	Article No.
<b>Analyzer unit</b>			
Reference gas supply (pump, restrictor, pressure switch, hose)	1	1	A5E00114838
Set of gaskets for reference gas pump	2	5	A5E35875733
O-ring	1	2	C74121-Z100-A6
Pressure switch (sample gas)	1	2	C79302-Z1210-A2
Flowmeter	1	2	C79402-Z560-T1
Sample chamber			
• Stainless steel, mat. no. 1.4571; non-flow-type compensation branch	-	1	C79451-A3277-B535
• O-ring (measuring head)	2	4	C79121-Z100-A32
• O-ring (fitting)	2	4	C71121-Z100-A159
Measuring head (non-flow-type compensation branch)	1	1	C79451-A3460-B525
Restrictor for sample gas path, hose	2	2	C79451-A3480-C10
Reference gas path, 3000 hPa (set of parts)	1	1	C79451-A3480-D518
<b>Electronics</b>			
Front plate with keyboard	1	1	A5E00259978
Motherboard, with firmware: see spare parts list	-	1	
Adapter plate, LCD/keyboard	1	1	C79451-A3474-B605
Magnetic field connection plate	-	1	C79451-A3474-B606
LC display	1	1	A5E31474846
Plug-in filter	-	1	W75041-E5602-K2
Fusible element			
• 0.63 A/250 V (230 V version)	2	3	W79054-L1010-T630
• 1.0 A/250 V (110 V version)	2	3	W79054-L1011-T100

If the OXYMAT 61 was supplied with a specially cleaned gas path for high oxygen context (so-called "Clean for O<sub>2</sub> service"), please specify when ordering spare parts. This is the only way to ensure that the gas path will continue to comply with the special requirements for this version.

### More information

If the OXYMAT 61 was supplied with a specially cleaned gas path for high oxygen context ("Clean for O<sub>2</sub> service"), please ensure that you specify this when ordering spare parts. This is the only way to ensure that the gas path will continue to comply with the special requirements for this version.