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Overview



The OXYMAT 64 gas analyzer is used for the trace measurement of oxygen.

Benefits

- High linearity
- Compact design
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and service information (option)

Application

Production of technical gases

- Measurements in N_2 and CO_2

Welding

- Measurements in protective gases during welding of highly alloyed steels, titanium, etc.

Systems for air separation

- Measurements in N_2 and in inert gases (e.g. Ne, Ar)

  Measurements in CO_2

Food production

- Measurement in CO_2 (e.g. breweries)

Electronics industry

- Low-pressure version with pump

Flow soldering systems

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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)
- Connections for sample gas
  - Input: Clamping ring connection for a pipe diameter of 6 mm or ¼"
  - Output: Pipe connection with diameter 6 mm or ¼"
- High-pressure and low-pressure versions
- Catalytically active and inactive cell

Display and operator panel

- Large LCD field for simultaneous display of
  - Measured value
  - Status bar
  - Measuring ranges
- Contrast of the LCD display adjustable via the menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Five-digit measured value display (decimal point counts as one digit)
- Menu-driven operation for parameterization, configuration, 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
- Switchover from ppm/vpm measuring range to % measuring range

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)
- Expandable with 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 the service and maintenance tool

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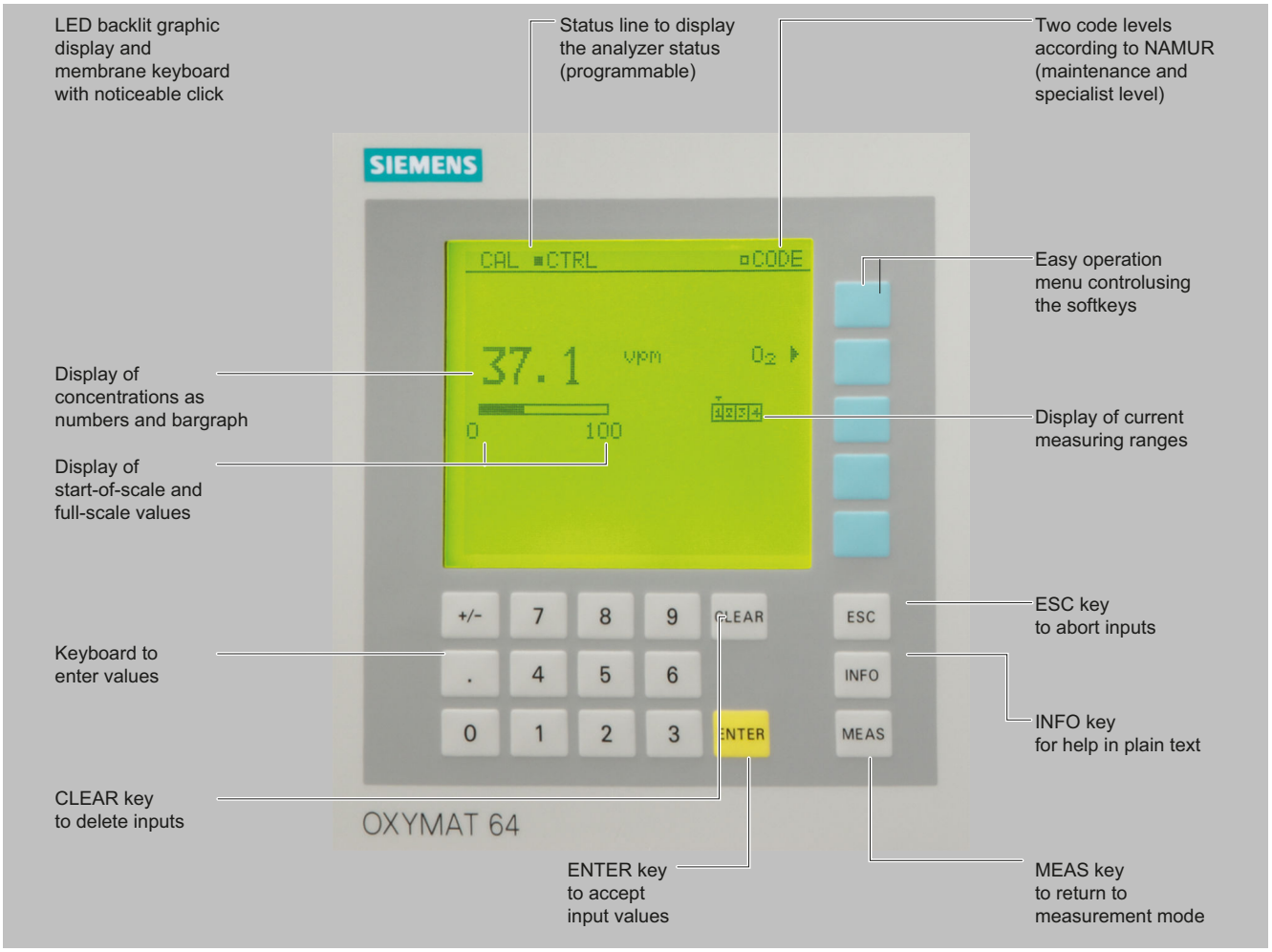
Design (continued)



OXYMAT 64, membrane keyboard and graphic display

Designs – Parts wetted by sample gas, standard

Gas path		19" rack unit
Sample gas path	Bushing Pipe inlet O_2 sensor Bypass line Connection pieces	Stainless steel, mat. no. 1.4571 Stainless steel ZrO_2 ceramic FPM (Viton) PTFE (Teflon)
Pressure sensor	Enclosure Diaphragm Sensor adapter Bypass restrictor	Polycarbonate SiO_4 Aluminum Stainless steel, mat. no. 1.4571
Flow indicator	Measuring tube Variable area Suspension boundary Angle units	Duran glass Duran glass, black PTFE (Teflon) FKM (Viton)
Pressure switch	Enclosure Diaphragm	Polycarbonate NBR

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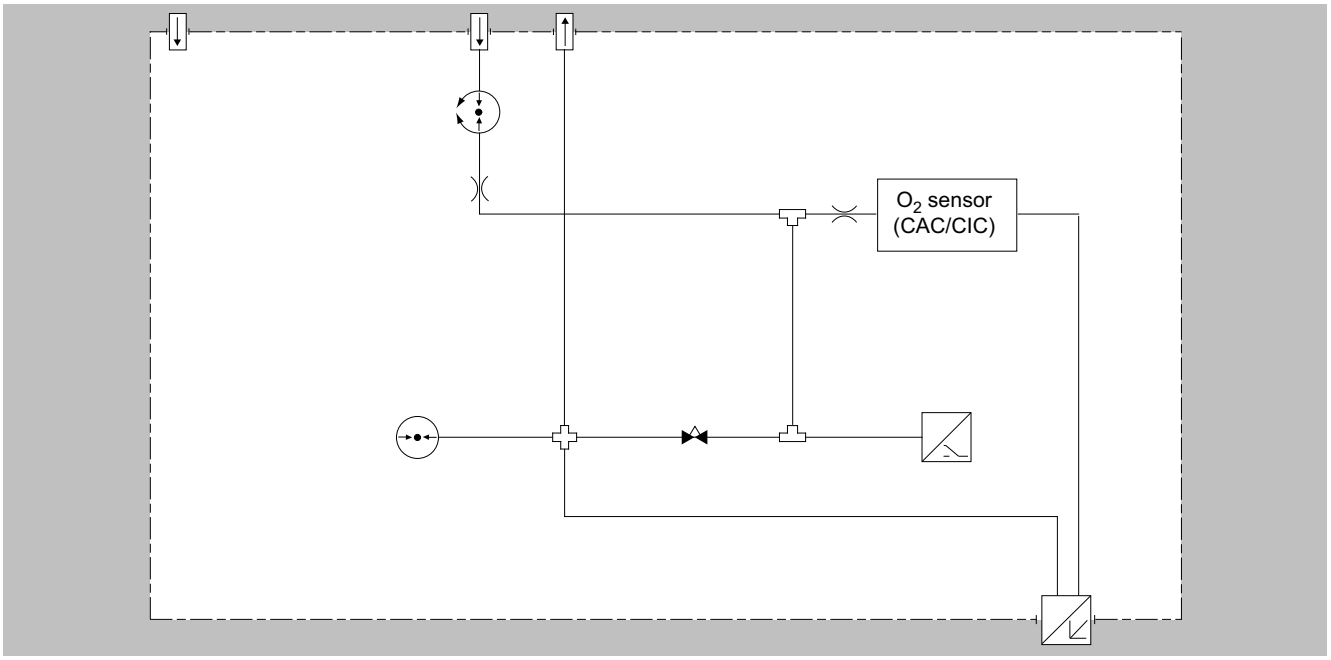
Design (continued)

Gas path (high-pressure version)



Gas path OXYMAT 64, high-pressure version

Legend for the gas path figure			
1	Sample gas inlet; inlet pressure - Without internal pressure regulator: 2 000 hPa (abs.), regulated - With internal pressure regulator: 2 000 ... 6 000 hPa (abs.)	7	Pressure switch
2	Sample gas outlet; sample gas flows off free of dynamic pressure	8	Flow measuring tube
3	Pressure regulator (order version)	9	Purging gas connection
4	O_2 sensor	10	Restrictor
5	Pressure sensor	11	Sample gas restrictor
6	Bypass restrictor		

The sample gas pressure (2 000 to 6 000 hPa) is regulated by the pressure regulator (3) at approx. 2 000 hPa or is provided by the operator with 2 000 hPa. This pressure is applied at the restrictor (10). The restrictor (10) reduces the pressure such that a sample gas flow of 15 to 30 l/h is created. This flow is subdivided via the sample gas restrictor (11) and the adjustable bypass restrictor (6) such that there is a sample gas flow of 7.5 l/h through the sensor.

If the sample gas can flow off into the atmosphere unhampered, the sample gas pressure corresponds to the atmospheric pressure. If the sample gas flows off via an exhaust gas line, it works like a flow resistance. If the resulting dynamic pressure exceeds 100 hPa (rel.), a maintenance demanded is output.

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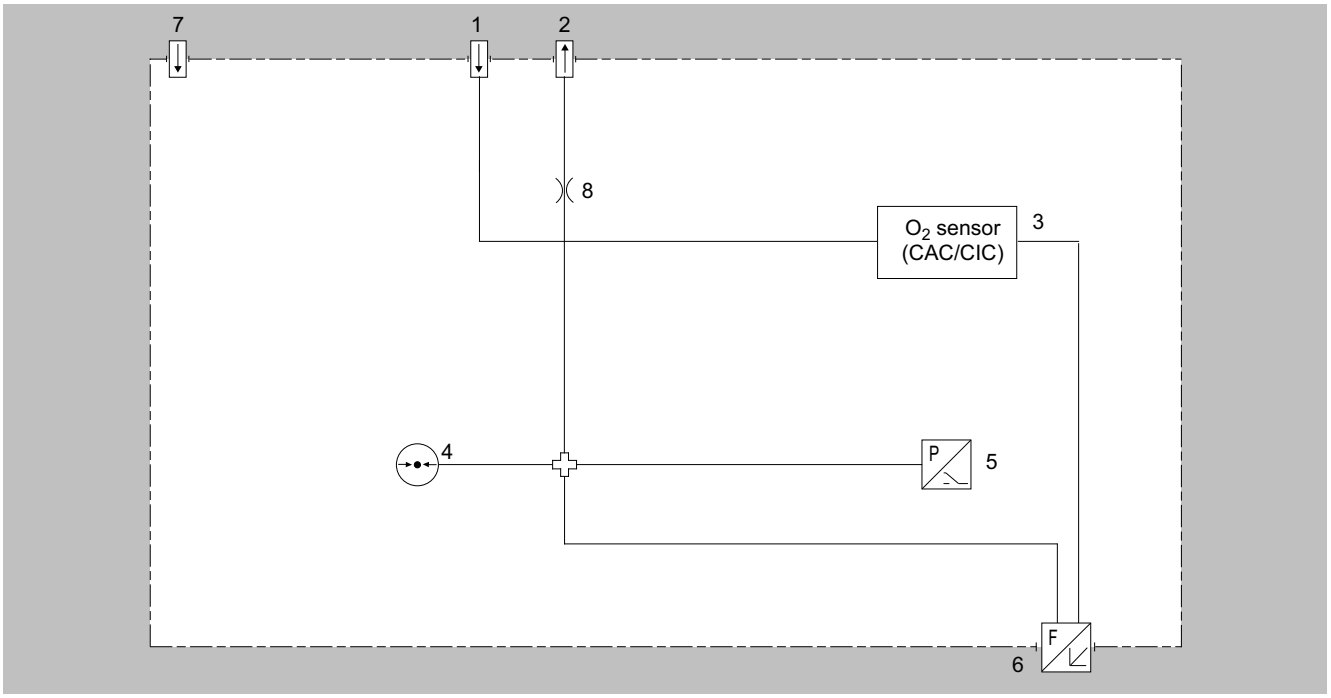
Design (continued)

Gas path (low pressure)



Gas path OXYMAT 64, low-pressure version

Legend for the gas path figure			
1	Sample gas inlet; flow 125 ml/min (7.5 l/h)	5	Pressure switch
2	Sample gas outlet; sample gas flows off free of dynamic pressure	6	Flow measuring tube
3	O_2 sensor	7	Purging gas connection
4	Pressure sensor	8	Restrictor

With the low-pressure version, the sample gas flow must be set externally to 125 ml/min. With a built-in pressure switch, the sample gas pressure is approx. 30 hPa above the current atmospheric pressure since the sample gas flows off via a restrictor. If the resulting dynamic pressure exceeds 100 hPa (rel.), a maintenance demanded is output. In order to reduce the 90% time, we recommend installation of a bypass upstream of the gas inlet which then provides a faster exchange of gas. This is particularly important with long sample gas lines between the gas sampling point and the analyzer. Please make absolutely sure that the flow in the OXYMAT 64 does not exceed 125 ml/min.

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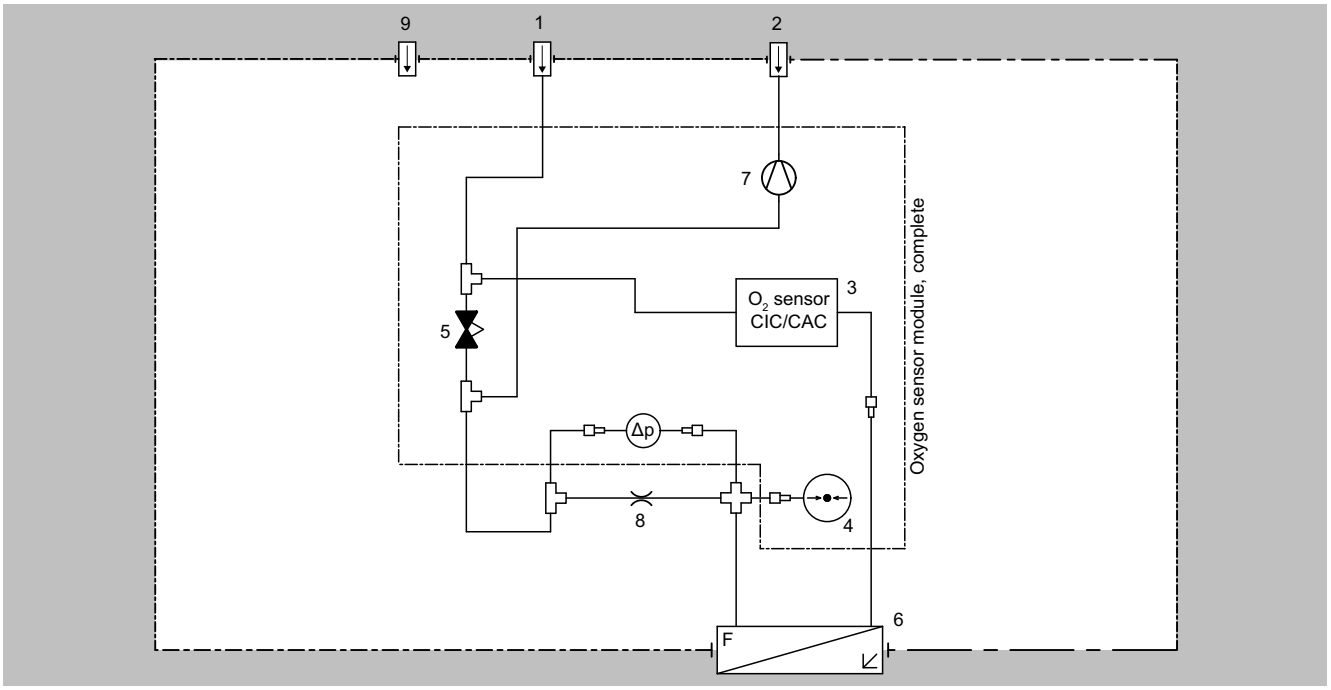
Design (continued)

Gas path (low pressure with integrated sample gas pump)



Low-pressure version with integrated sample gas pump

Legend for the gas path figure			
1	Sample gas inlet	6	Flow measuring tube
2	Sample gas outlet; sample gas flows off free of dynamic pressure	7	Sample gas pump
3	O_2 sensor	8	Restrictor
4	Pressure sensor	9	Purging gas connection
5	Needle valve		

The device version "OXYMAT 64 low-pressure with pump" is equipped with a sample gas pump which automatically provides a constant sample gas flow of 125 ml/min through the sensor. By means of an internal bypass, the total flow of sample gas through the analyzer is increased to approx. 0.4 l/min. This measure significantly improves the analyzer's response time.

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Mode of operation

The measuring cell consists of a cylindrical (pipe-shaped) ZrO_2 diaphragm. The sample gas (low O_2 content) flows at a constant rate through the inside of the diaphragm, which is regulated at 650 °C. The exterior of the sensor is exposed to the ambient air (approx. 21% O_2).

Both sides of the ZrO_2 diaphragm are coated with thin platinum films that act as electrodes. This forms a solid, electrochemical cell. The amount of oxygen atoms ionized depends on the oxygen concentration at the electrodes.

The differences in concentration at each side means that a differential partial pressure prevails. Since ZrO_2 conducts ions at 650 °C, ionic migration takes place in the direction of the lower partial pressure.

An oxygen gradient arises across the width of the ZrO_2 diaphragm, which, according to equation (1), results in an electrical potential difference between the platinum electrodes.

Defects in the crystal lattice, caused by contamination of the ZrO_2 material with Y_2O_3 and/or CaO (introduced originally to prevent cracks forming in ceramic material) make it easier for O_2 ions to diffuse in the ZrO_2 grid.

Catalytically active ZrO_2 sensor (CAC)

The electrode material is made of platinum (Pt). This type of sensor has a higher cross-sensitivity when flammable accompanying gas components are present.

Catalytically inactive ZrO_2 sensor (CIC)

The catalytically inactive sensor has the same general design as the CAC. The contacts and electrode surface inside the pipe are made of a specially developed material which largely prevents catalytic oxidation except of H_2, CO and CH_4.

Measuring effect

$U = U_A + RT/4F$ (In $[O_2, air]$ - In $[O_2]$ (equation 1)
U measuring effect
U_A asymmetric voltage (voltage, at $[O_2] = [O_2, air]$
T ceramic temperature
$[O_2, air]$ O_2 concentration in the air
$[O_2]$ O_2 concentration in sample gas

Note

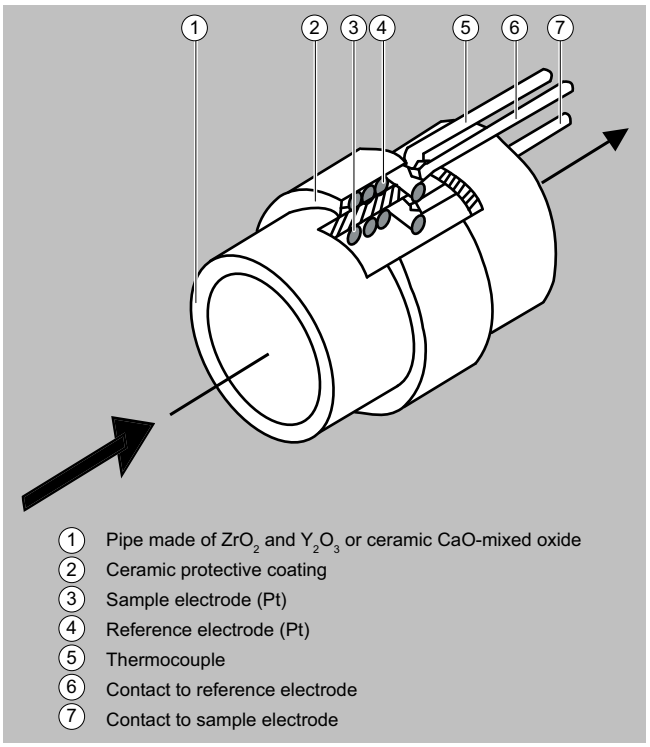
The sample gas must be fed into the analyzer free of dust. Condensation should be avoided. Therefore, gas modified for the measuring tasks is necessary in most application cases.

Calibration

Calibration of the calibration point is carried out as with the other analyzers of series 6 after a maximum of 14 days by connecting the calibration gas O_2 in residual N_2 at concentrations of approx. 60 to 90% of the master measuring range.

Contrary to the other series 6 analyzers, zero point calibration cannot be carried out using pure nitrogen, but with a "small" concentration of oxygen in nitrogen appropriate to the selected measuring range (e.g.: measuring range 0 to 10 vpm; calibration gas approx. 2 vpm O_2 in residual N_2).

Mode of operation (continued)



OXYMAT 64, principle of operation

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Function

Main features

- Four measuring ranges freely parameterizable, all measuring ranges linear
- Electrically isolated measured value output 0/2/4 through to 20 mA (including inverted) and as per NAMUR
- Automatic measuring range switchover selectable; remote switching option
- 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 (via pressure switch)
- Custom-made device designs, such as:
  - Customer acceptance
  - TAG plates
  - Drift recording
- Simple handling using a numerical membrane keyboard and operator prompting
- Smallest measuring span 0 to 10 vpm O_2
- Largest measuring span 0 to 100% (testing with ambient air)
- Internal pressure sensor for correction of the influence of sample gas pressure fluctuations

Cross-interference

Catalytically active sensor (CAC)

Very large cross-interference of all flammable accompanying gases. Thus not suitable for use with flammable accompanying gases!

Catalytically inactive sensor (CIC)

There is only a slight cross-interference in the case of accompanying gases with a concentration in the range of the O_2 concentration. H_2, CO and CH_4 still have a noticeable effect in the case of flammable accompanying gas components.

Measured component / interference gas	Interference gas offset
78 vpm O_2 /140 vpm CO	-6.1 vpm
10 vpm O_2 /10 vpm CO	-0.6 vpm
74 vpm O_2 / 25 vpm CH_4	-0.3 vpm
25 vpm O_2 / 357 vpm CH_4	-1.1 vpm
25 vpm O_2 / 70 vpm H_2	-3 vpm
5 vpm O_2 / 9.6 vpm H_2	-0.55 vpm
170 vpm O_2 / 930 vpm C_2H_4	-118 vpm

Examples of typical interference gas offsets on a catalytically inactive sensor

The listed deviations depend on the specimen and can deviate by up to ± 0.2 vpm. The actual deviation must be determined individually or the error is eliminated through a corresponding calibration measure (displacement of the interference gas offset).

Function (continued)

Important information

Zirconium dioxide oxygen sensors are subject to damage in the presence of reducing atmospheres. These are atmospheres with very little free excess oxygen and flammable components (reducing components). In such atmospheres, the oxygen is consumed by oxidation of the reducing components on the hot sensor parts. Reducing components can shorten the service life of the sensor and lead to sluggish performance of the sensor.

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Selection and ordering data

OXYMAT 64 gas analyzer 19" rack unit for installation in cabinets	Article No. 7MB2041-	●	●	●	1	●	-	●	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".											
Sensor											
ZrO_2: catalytically active cell (CAC)		0									
ZrO_2: catalytically inactive cell (CIC)		1									
ZrO_2: catalytically active cell (CAC); with differential pressure sensor		2									
ZrO_2: catalytically inactive cell (CIC); with differential pressure sensor		3									
Sample gas pressure											
High pressure, without pressure regulator; 2 000 hPa (abs.)			A								
High pressure, with pressure regulator; 2 000 ... 6 000 hPa (abs.)			B								
Low pressure, with pump, atmosphere			C								
Low pressure, without suction pump, atmosphere			D								
Gas connection											
Input: Clamping ring connection 6 mm / outlet: Fittings 6 mm				A							
Input: Clamping ring connection ¼" / outlet: Fittings ¼"				B							
Add-on electronics											
Without						0					
AUTOCAL function with 8 additional digital inputs and outputs						1					
AUTOCAL function with 8 additional digital inputs/outputs and PROFIBUS PA interface						6					
AUTOCAL function with 8 additional digital inputs/outputs and PROFIBUS DP interface						7					
Auxiliary power											
100 V ... 120 V AC, 48 ... 63 Hz								0			
200 V ... 240 V AC, 48 ... 63 Hz								1			
Explosion protection											
Without										A	
Language of the operating software											
German											0
English											1
French											2
Spanish											3
Italian											4

Options	Order code
Add "-**Z**" to article number and then add order code.	
Settings	
Telescopic rails (2 units)	**A31**
Tag plates (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
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**

Accessories	Article No.
RS 485/Ethernet converter	**A5E52327218**
RS 485/RS 232 converter	**A5E52327214**
RS 485/USB converter	**A5E52327216**
AUTOCAL function with 8 digital inputs/outputs each	**C79451-A3480-D511**
AUTOCAL function with 8 digital inputs/outputs each and PROFIBUS PA	**A5E00057307**
AUTOCAL function with 8 digital inputs/outputs each and PROFIBUS DP	**A5E00057312**
Set of Torx screwdrivers	**A5E34821625**

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Technical specifications

OXYMAT 64, 19" rack unit	
General information	
Measuring ranges	4, internally and externally switchable; automatic measurement range switchover 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)	0 ... 10 vpm O_2
Largest possible measuring span	0 ... 100%
Service position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2 and RoHS
Design, enclosure	
Degree of protection	IP20 according to EN 60529
Weight	Approx. 11 kg
Electrical characteristics	
EMC interference immunity (electromagnetic compatibility)	In accordance with standard requirements of NAMUR NE21 (08/98) and EN 61326
Electrical safety	In accordance with EN 61010-1, overvoltage category II
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. 37 VA
Fuse ratings	100 ... 120 V: 1.0T/250 200 ... 240 V: 0.63T/250
Gas inlet conditions	
Sample gas flow	
• Through the sensor	7.5 l/h
• Total consumption	15 ... 30 l/h
Permissible sample gas pressure	
• Without internal pressure regulator	2 000 hPa (abs.)
• With internal pressure regulator	2 000 ... 6 000 hPa (abs.)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Sample gas humidity	< 1% relative humidity
Time response	
Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Damping (electrical time constant)	0 ... 100 s, configurable
Dead time (high-pressure version) (purging time of the gas path in the device at 125 ml/min)	10 ... 30 s
Dead time (low-pressure version without pump)	< 5 s
Dead time (low-pressure version with pump)	< 10 s
Time for device-internal signal processing	< 1 s
Pressure correction range	
Pressure sensor internal	800 ... 1 100 hPa (abs.)
Measuring response	Based on sample gas pressure 1 013 hPa absolute, 7.5 l/min sample gas flow and 25 °C ambient temperature
Output signal fluctuation	< ± 1% of the smallest possible measuring range according to nameplate, with electronic damping constant of 1 s
Zero point drift	< ± 1% of the current measuring span/month
Measured-value drift	< ± 1% of the current measuring span/month
Repeatability	< 3% of the current measuring span
Detection limit	1% of current measuring range, < 0.1 vpm in measuring range 0 ... 10 vpm
Linearity error	< 2% of the current measuring span

Technical specifications (continued)

OXYMAT 64, 19" rack unit	
Influencing quantities	Based on sample gas pressure 1 013 hPa absolute, 7.5 l/min sample gas flow and 25 °C ambient temperature
Ambient temperature	< 2%/10 K referred to current measuring span
Sample gas pressure only possible if the sample gas can flow out into the ambient air	• With disabled pressure compensation: < 1% of current measuring span/1% pressure variation • With enabled pressure compensation: < 0.2% of current measuring span/1% pressure variation
Accompanying gases, deviation from zero point	
• Catalytically active cell (CAC)	Only gases with non-flammable accompanying gas components can be introduced
• Catalytically inactive cell (CIC)	Accompanying gas concentration of 10 vpm H_2; CO and CH_4 have a lower cross-interference; higher HCs are negligible
Sample gas flow	< 2% of the smallest possible measuring span with a change in flow of 10 ml/min
Auxiliary power	< 0.1% of the current measuring range with nominal voltage ± 10%
Electrical inputs and outputs	
Analog output	0/2/4 ... 20 mA, 4 ... 20 mA (NAMUR), floating; max. output 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 correction of influence of accompanying gas (correction of cross-interference)
Digital inputs	6, designed for 24 V, floating, freely configurable, e.g. for measurement 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
Climatic conditions	
Permissible ambient temperature	-40 ... +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)

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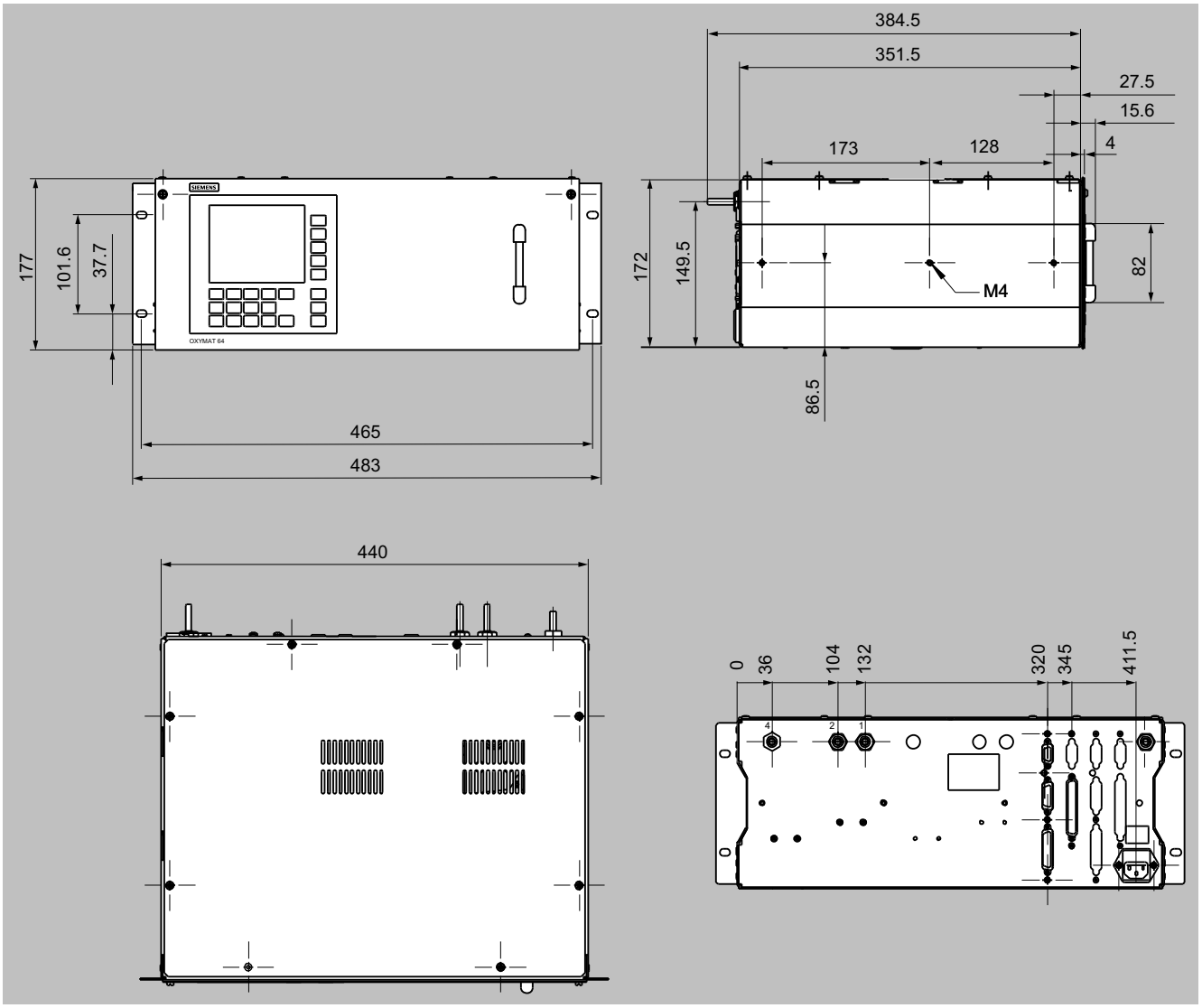
Dimensional drawings



OXYMAT 64, 19" rack unit, dimensions in mm

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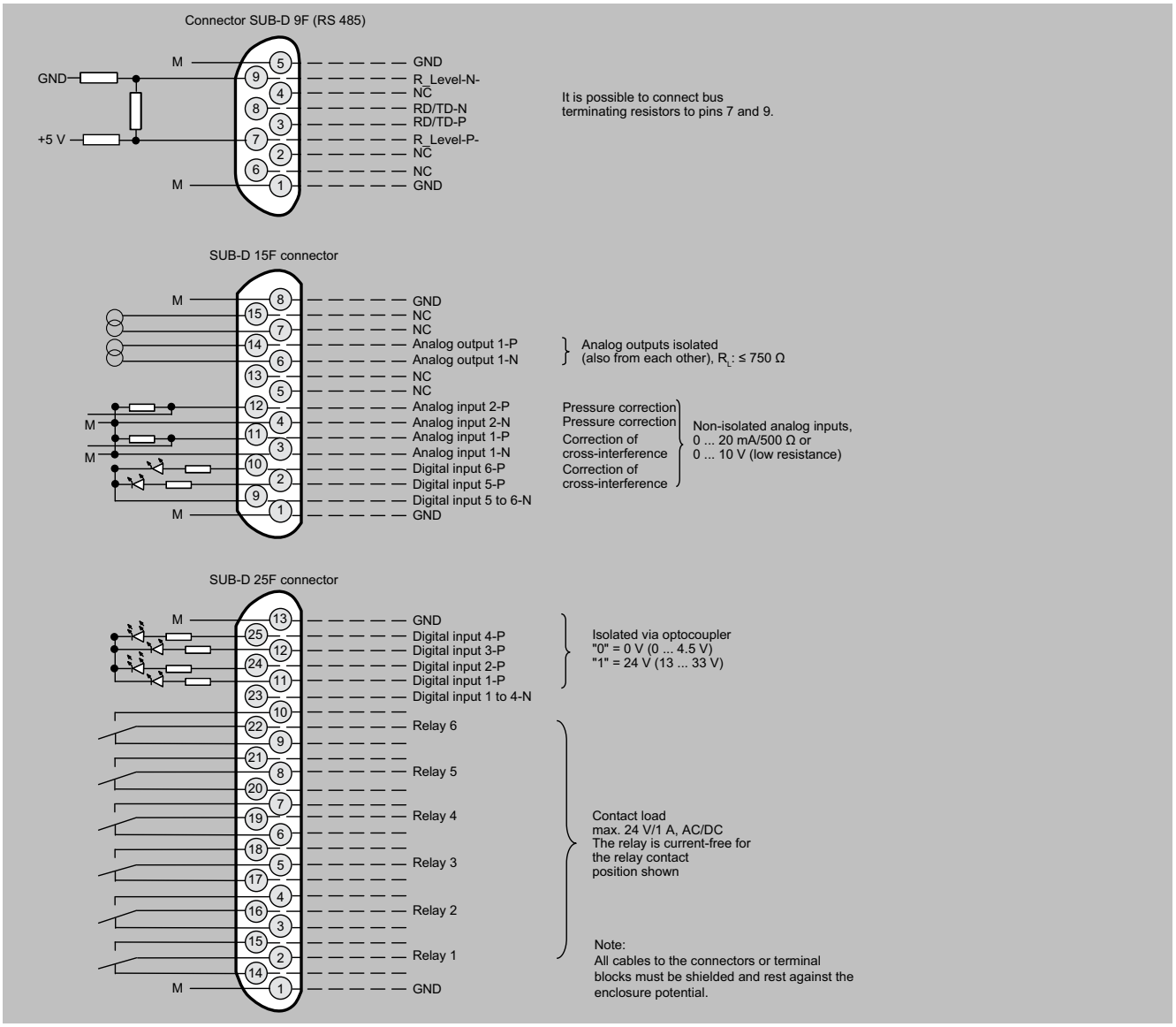
Circuit diagrams



OXYMAT 64, 19" rack unit, pin assignment

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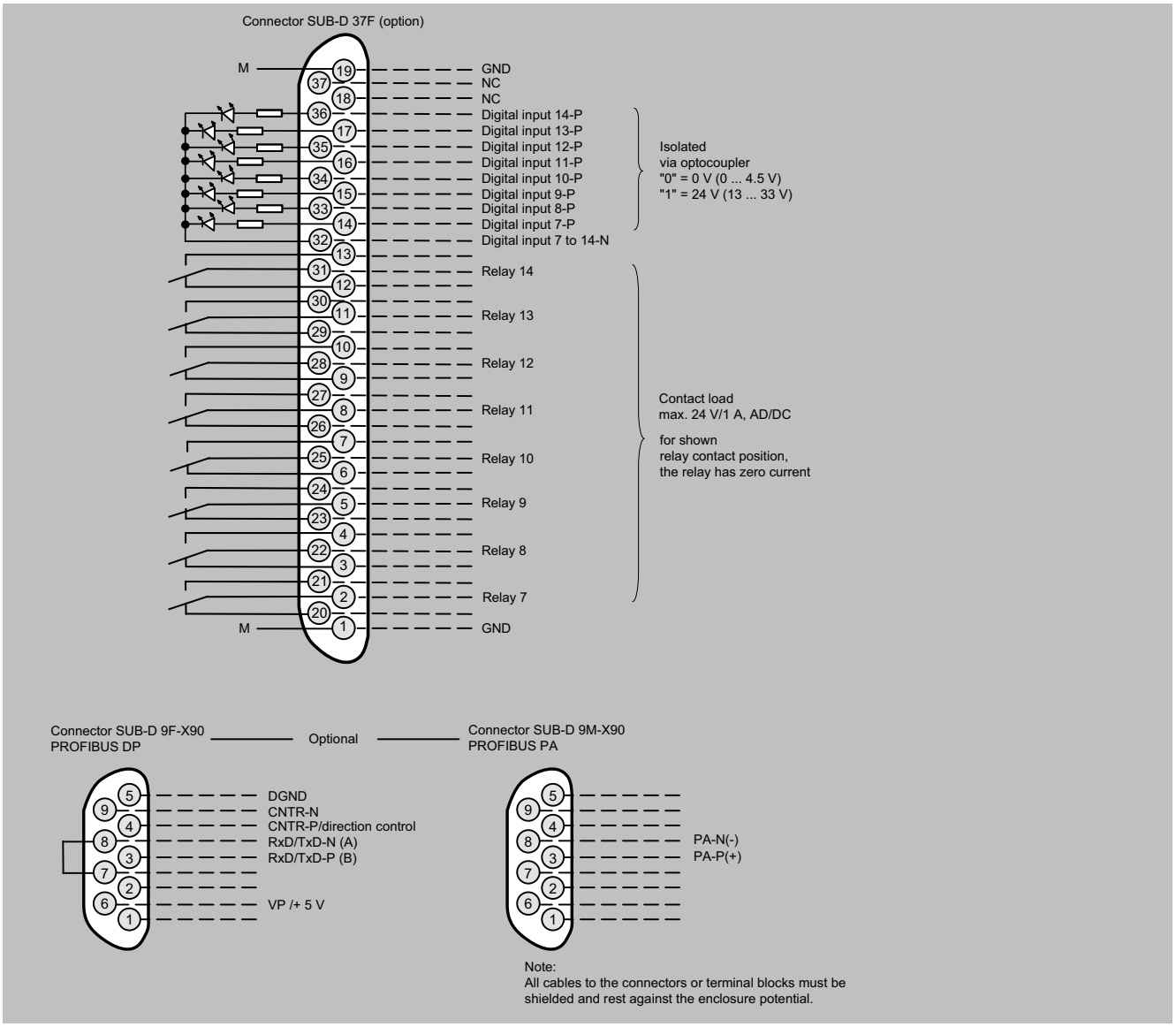
Circuit diagrams (continued)



OXYMAT 64, 19" rack unit, pin assignment of the AUTOCAL board and PROFIBUS plugs

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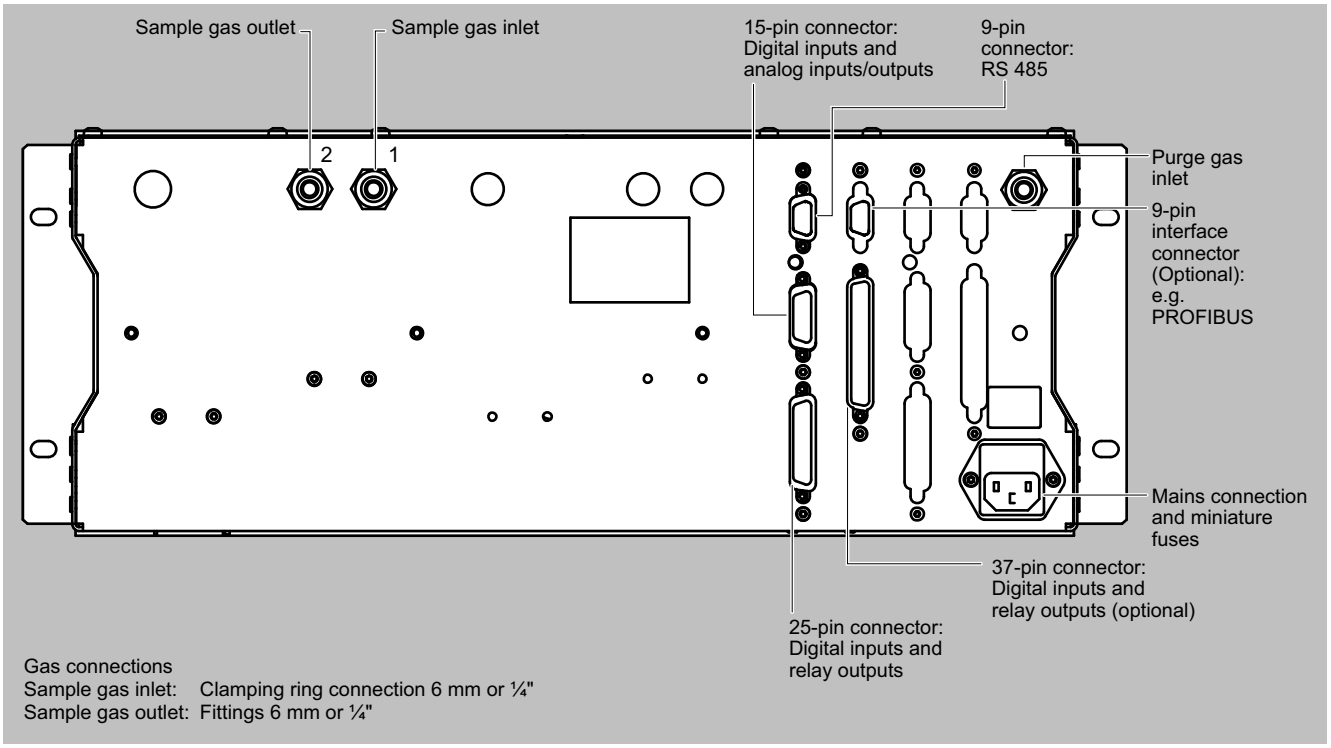
Circuit diagrams (continued)



OXYMAT 64, 19" rack unit, gas and electrical connections

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Selection and ordering data

Description	7MB2041	2 years (unit)	5 years (unit)	Article No.
Pressure regulator as spare part	x	-	1	A5E01008972
Flowmeter	x	-	1	A5E01061561
Adapter plate, LC display/keyboard	x	1	1	C79451-A3474-B605
LC display	x	-	1	A5E31474846
Plug-in filter	x	-	1	W75041-E5602-K2
Fuse, T 0.63 A, line voltage 200 ... 240 V	x	2	4	W79054-L1010-T630
Fuse, T 1 A, supply voltage 100 ... 120 V	x	2	4	W79054-L1011-T100