OXYMAT 64

General information

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*

Design

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescope rails
- Front plate for service purposes can be pivoted down (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 control panel

- Large LCD field for simultaneous display of
  - Measured value
  - Status bar
  - Measurement ranges
- Contrast of the LCD field 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
- Operator support in plain text
- Graphical display of the concentration progression; time intervals parameterizable
- Bilingual operating software German/English, English/Spanish, French/English, Spanish/English, Italian/English
- Switchover from ppm measuring range to % measuring range

Input and outputs

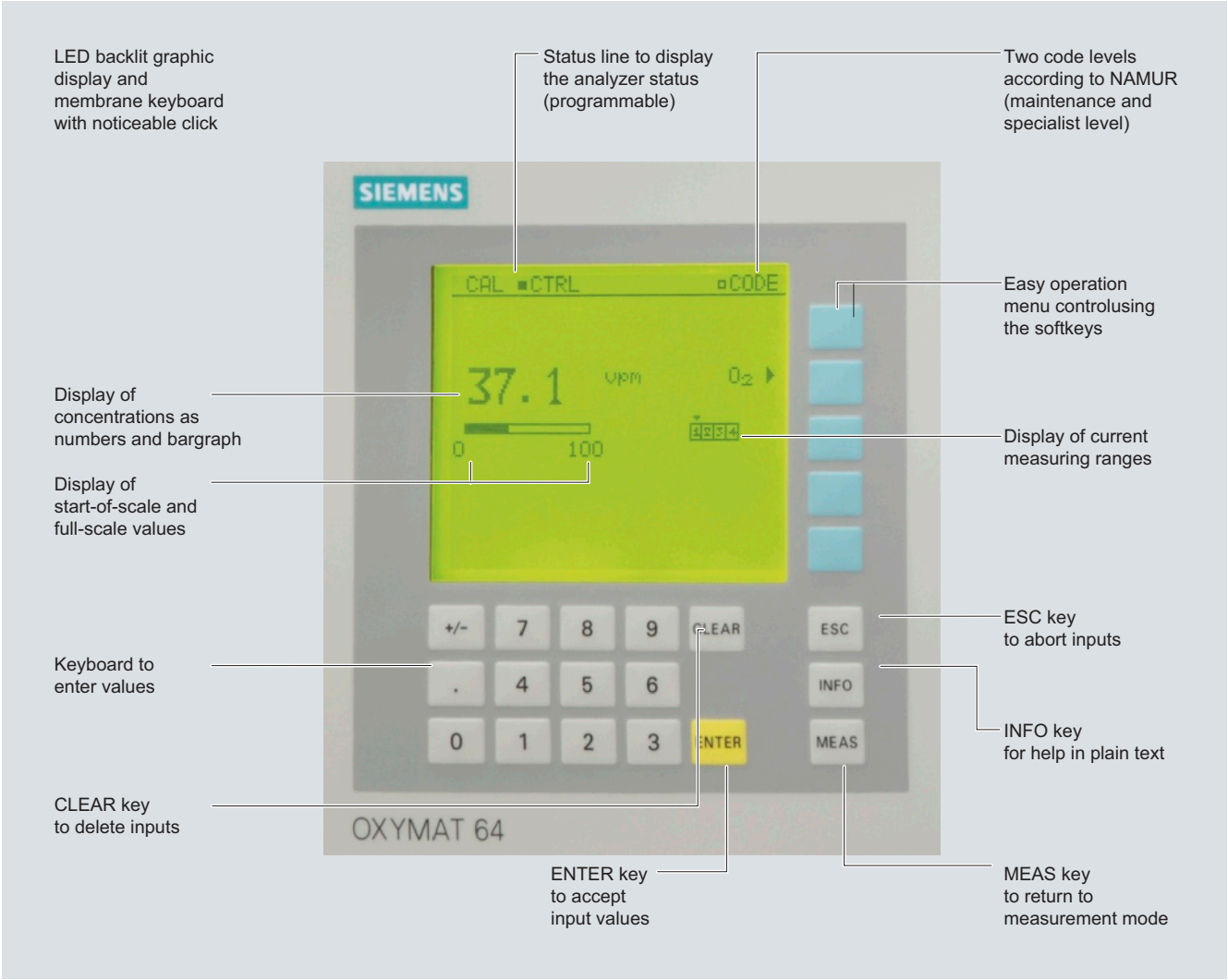
- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (failure, maintenance request, maintenance switch, threshold alarm, external solenoid valves)
- Two analog inputs configurable (e.g. correction of cross-interference, external pressure sensor)
- Extension with eight additional binary inputs and eight additional relay outputs, e.g. 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



OXYMAT 64, membrane keyboard and graphic display

Designs – Parts touched by sample gas, standard

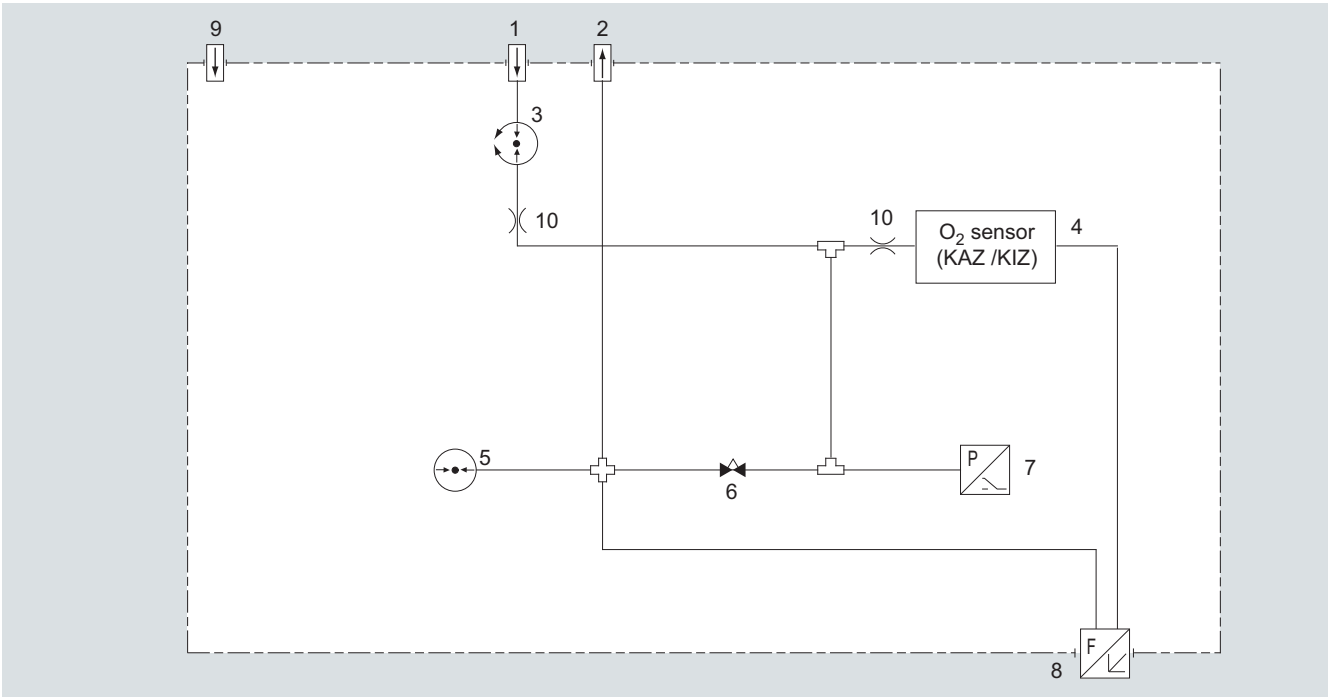
Gas path		19" rack unit
Sample gas path	Bushing	Stainless steel, mat. no. 1.4571
	Pipe inlet	Stainless steel
	O_2 sensor	ZrO_2 ceramic
	Bypass line	FPM (Viton)
	Connection pieces	PTFE (Teflon)
Pressure sensor	Enclosure	Polycarbonate
	Diaphragm	SiO_4
	Sensor adapter	Aluminum
	Bypass restrictor	Stainless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

General information

Gas path (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.)	5	Pressure sensor
		6	Bypass restrictor
		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



Gas path OXYMAT 64, high-pressure version

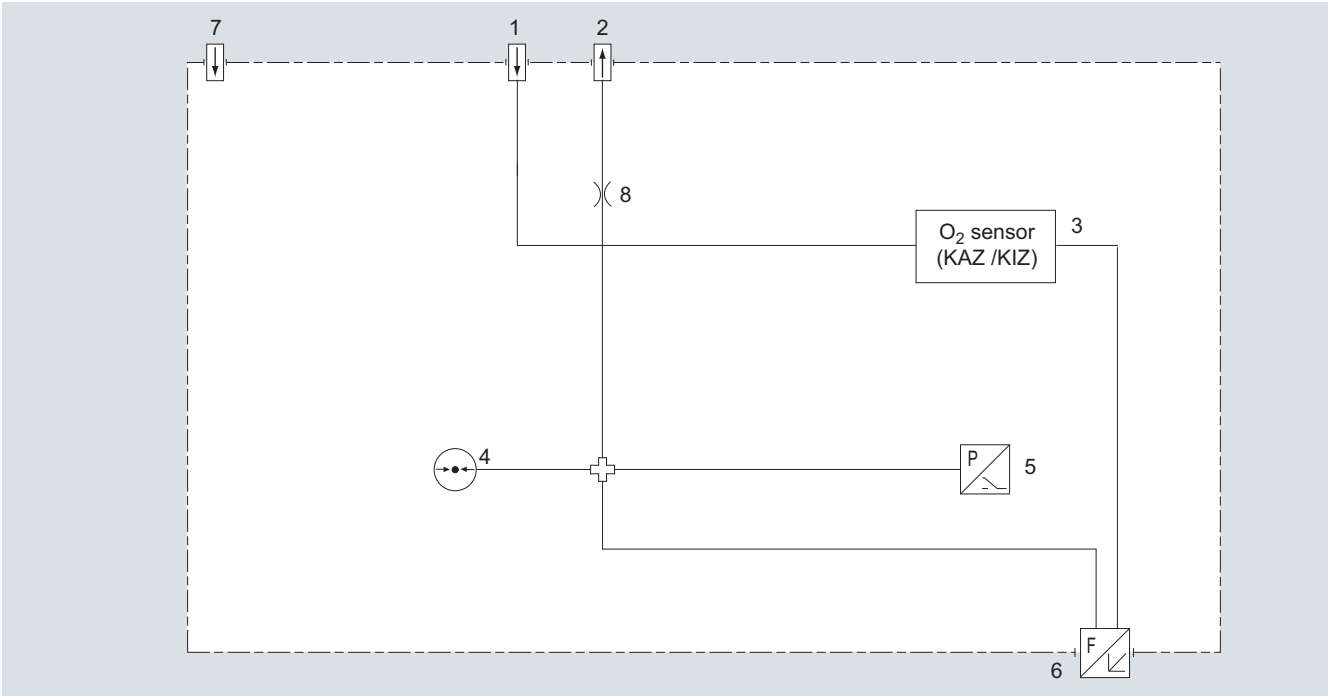
The sample gas pressure (2 000 to 6 000 hPa) is regulated by the pressure regulator (3) at approx. 2 000 hPa or is provided by the operator with 2 000 hPa. This pressure is applied at the restrictor (10). The restrictor (10) reduces the pressure such that a sample gas flow of 15 to 30 l/h is created. 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 request is output.

Gas path (low pressure)

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



Gas path OXYMAT 64, low-pressure version

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 request 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.

General information

Function

The measuring cell consists of a cylindrical (pipe-shaped) ZrO_2 membrane. The sample gas (low O_2 content) flows at a constant rate through the inside of the membrane, 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 membrane 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 membrane, which, according to equation (1), results in an electrical potential difference between the platinum electrodes.

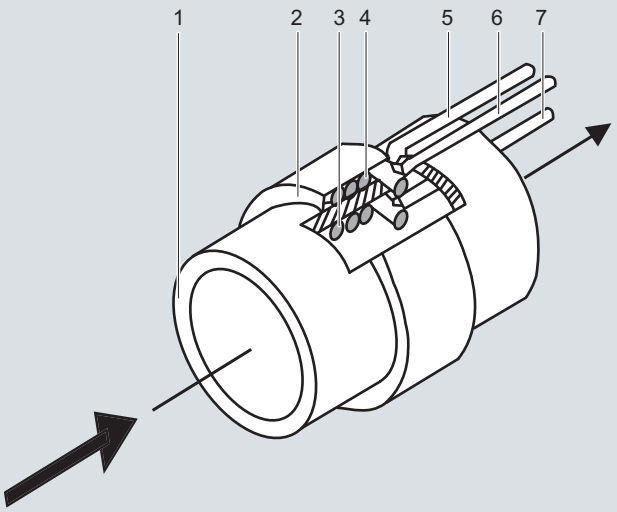
Defects in the crystal lattice, caused by contamination of the ZrO_2 material with Y_2O_3 and/or CaO (introduced originally to prevent cracks forming in ceramic material) make it easier for O_2 ions to diffuse in the ZrO_2 grid.

Catalytically active ZrO_2 sensor (CAZ)

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 (CIZ)

The catalytically inactive sensor has the same general design as the CAZ. 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.



1 Pipe made of ZrO_2 and Y_2O_3 or ceramic CaO-mixed oxide
2 Ceramic protective coating
3 Sample electrode (Pt)
4 Reference electrode (Pt)
5 Thermoelement
6 Contact to reference electrode
7 Contact to sample electrode

OXYMAT 64, principle of operation

Measuring effect

$U = U_A + RT/4F (\ln [O_2,air] - \ln [O_2])$ (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 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 analyzers of Series 6, the 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 … 10 vpm; calibration gas approx. 2 ppm O_2 in residual N_2).

Essential characteristics

- Four measurement ranges freely parameterizable, all measurement ranges linear
- Galvanically isolated measurement value output 0/2/4 through 20 mA (also inverted) and as per NAMUR
- Autoranging selectable; possibility of remote switching
- Storage of measured values possible during adjustments
- Wide range of selectable time constants (static/dynamic noise suppression); 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 their own authorization codes for the prevention of accidental and unauthorized operator interventions
- Automatic, parameterizable measuring range calibration
- Operation based on the NAMUR recommendation
- Monitoring of the sample gas (via pressure switch)
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording
- Simple handling using a numerical membrane keyboard and operator prompting
- Smallest span 0 to 10 vpm O_2
- Largest span 0 to 100 % (testing with ambient air)
- Internal pressure sensor for correction of the influence of sample gas pressure fluctuations

Influence of interfering gas

Catalytically active sensor (CAZ)

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

Catalytically inactive sensor (CIZ)

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 / interfering gas	Diagonal 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 diagonal gas offsets on a catalytically inactive sensor

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

19" rack unit

Technical specifications

General	
Measurement ranges	4, internally and externally switchable; automatic measuring range switchover also possible
Smallest possible 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 %
Operating 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 (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98) and EN 61326
Electrical safety	In accordance with EN 61010-1, overvoltage category II
Power supply	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 values	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
• Overall 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
Dynamic 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, parameterizable
Dead time (high-pressure version) (purging time of the gas path in the unit 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 (referred to sample gas pressure 1 013 hPa absolute, sample gas flow 7.5 l/min, and ambient temperature 25 °C)	
Output signal fluctuation	< ± 1 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s
Zero point drift	< ± 1 % of the current span/month
Measured-value drift	< ± 1 % of the current 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
Influencing variables (relating to 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	• When pressure compensation has been switched off: < 1 % of current span/1 % pressure change • When pressure compensation has been switched on: < 0.2 % of current span/1 % pressure change
Residual gases, deviation from zero point	
• Catalytically active sensor (CAZ)	Only gases with non-combustible residual gas components can be introduced
• Catalytically inactive sensor (CIZ)	Residual 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 span with a change in flow of 10 ml/min
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %
Electrical inputs and outputs	
Analog output	0/2/4 ... 20 mA, 4 … 20 mA (NAMUR), isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 … 20 mA for external pressure sensor and correction of influence of residual gas (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measurement range switchover
Serial interface	RS 485
Options	AUTOCAL function each with 8 additional binary 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)

Selection and ordering data		Order No.		
OXYMAT 64 gas analyzer 19" rack unit for installation in cabinets	D)	**7MB2041-** ■■■**1**■-■**A**■■		Cannot be combined
Sensor				
ZrO_2: Catalytically active cell (CAC)		**0**		**0**
ZrO_2: Catalytically inactive cell (CIC)		**1**		**1**
ZrO_2: Catalytically active cell (CAC); with differential pressure sensor		**2**		**2**
ZrO_2: Catalytically inactive cell (CIC); with differential pressure sensor		**3**		**3**
Sample gas pressure				
High pressure, without pressure regulator	2 000 hPa (abs.)	**A**		**A**
High pressure, with pressure regulator	2 000 ... 6 000 hPa (abs.)	**B**		**B**
Low pressure, with pump	Atmosphere	**C**		**C**
Low pressure, without suction pump	Atmosphere	**D**		**D**
Gas connection				
Input	Clamping ring connection 6 mm	**A**		
Output	Fittings 6 mm			
Input	Clamping ring connection ¼"	**B**		
Output	Fitting ¼"			
Add-on electronics				
Without		**0**		
AUTOCAL function				
• With 8 additional binary inputs/outputs		**1**		
• With 8 additional binary inputs/outputs and PROFIBUS PA interface		**6**		
• With 8 additional binary inputs/outputs and PROFIBUS DP interface		**7**		
Power supply				
100 to 120 V AC, 48 to 63 Hz		**0**		
200 to 240 V AC, 48 to 63 Hz		**1**		
Explosion protection				
Without		**A**		
Language				
German		**0**		
English		**1**		
French		**2**		
Spanish		**3**		
Italian		**4**		

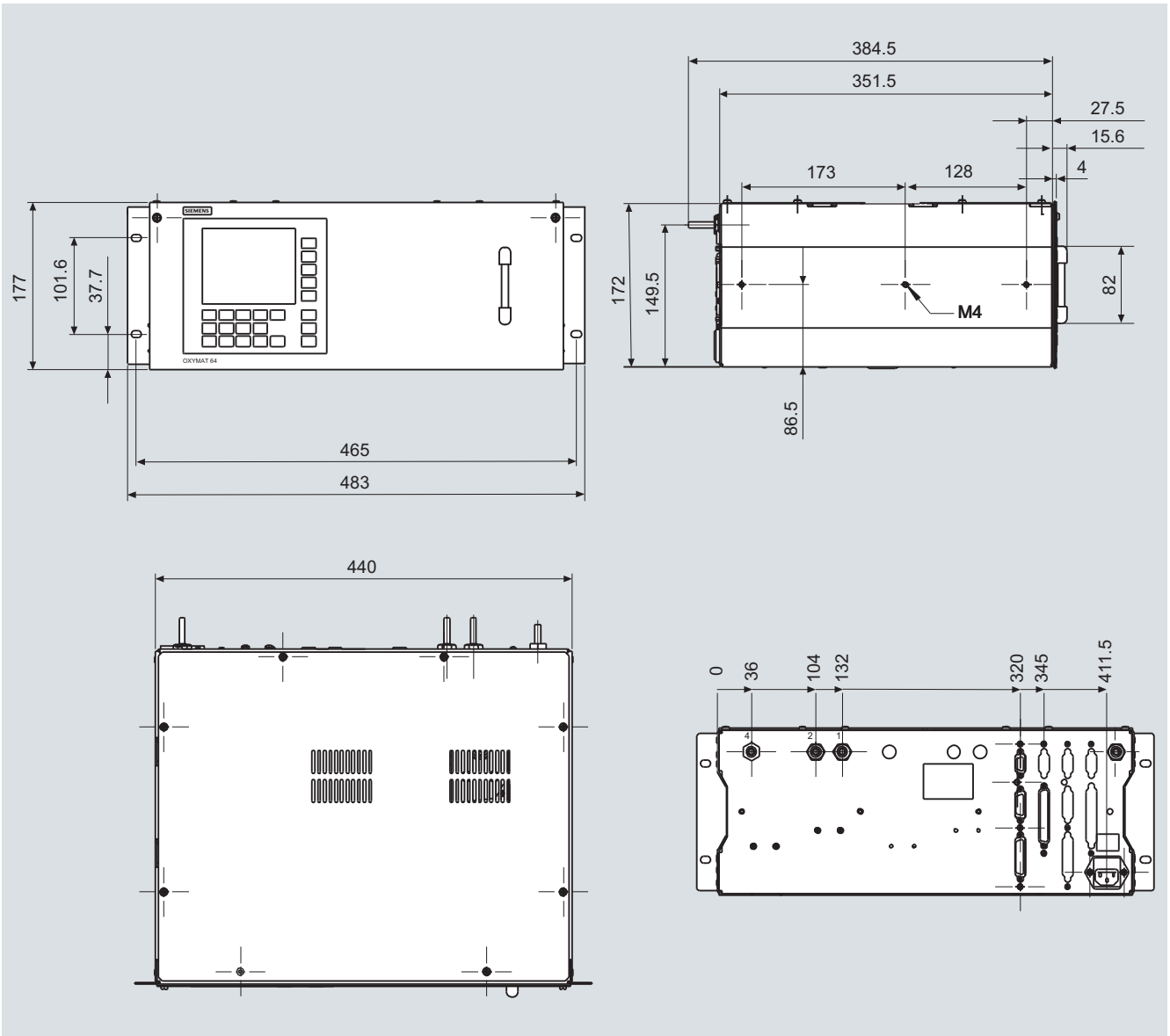
Additional versions	Order code
Add "-Z" to Order No. and specify Order code	
Telescopic rails (2 units)	**A31**
TAG labels (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction 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**

Retrofitting sets	Order No.
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function each with 8 binary inputs/outputs	**C79451-A3480-D511**
AUTOCAL function 8 binary inputs/outputs each and PROFIBUS PA	**A5E00057307**
AUTOCAL function 8 binary inputs/outputs each and PROFIBUS DP	**A5E00057312**

D) Subject to export regulations AL: 9I999, ECCN: N

19" rack unit

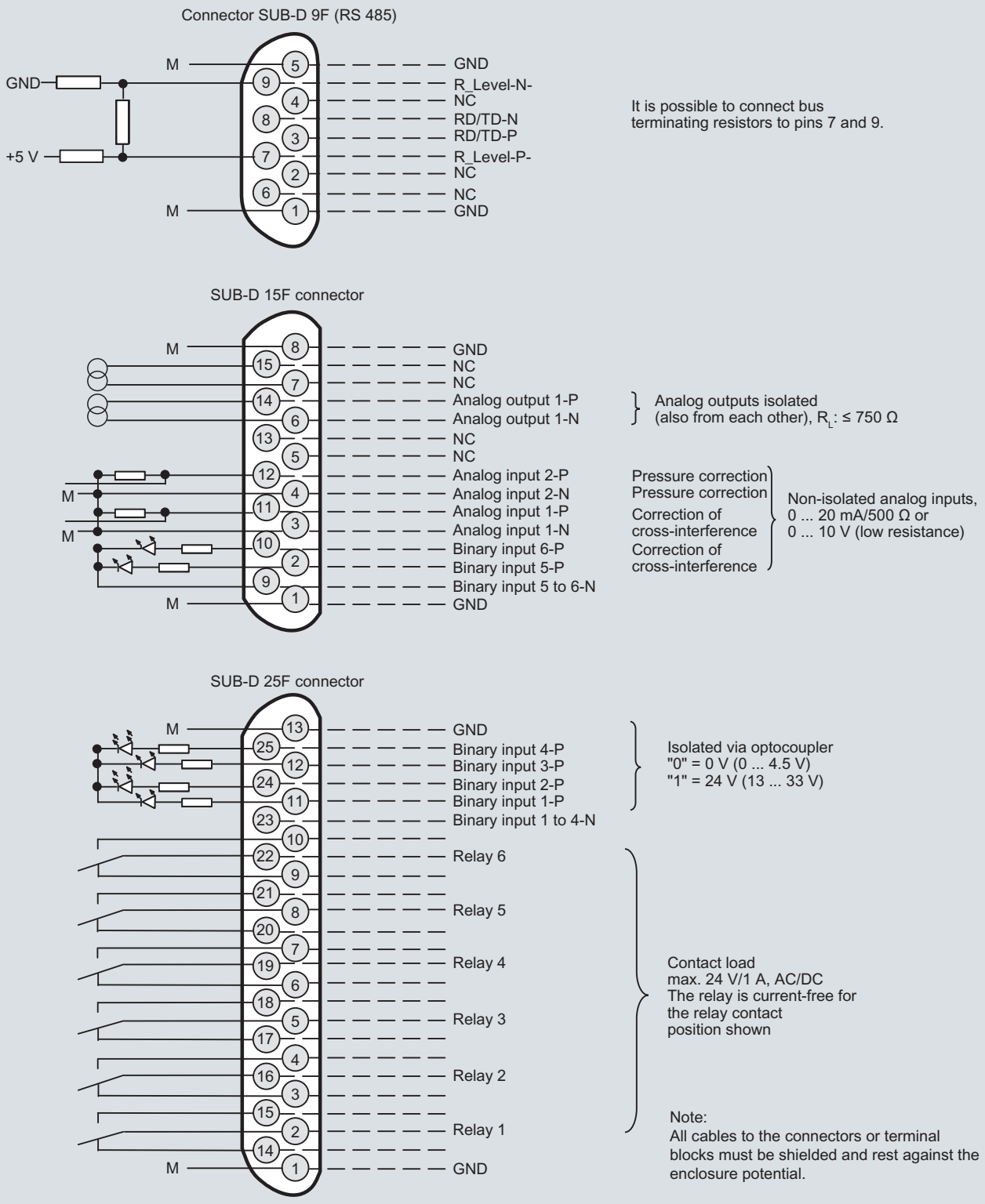
Dimensional drawings



OXYMAT 64, 19" rack unit, size in mm

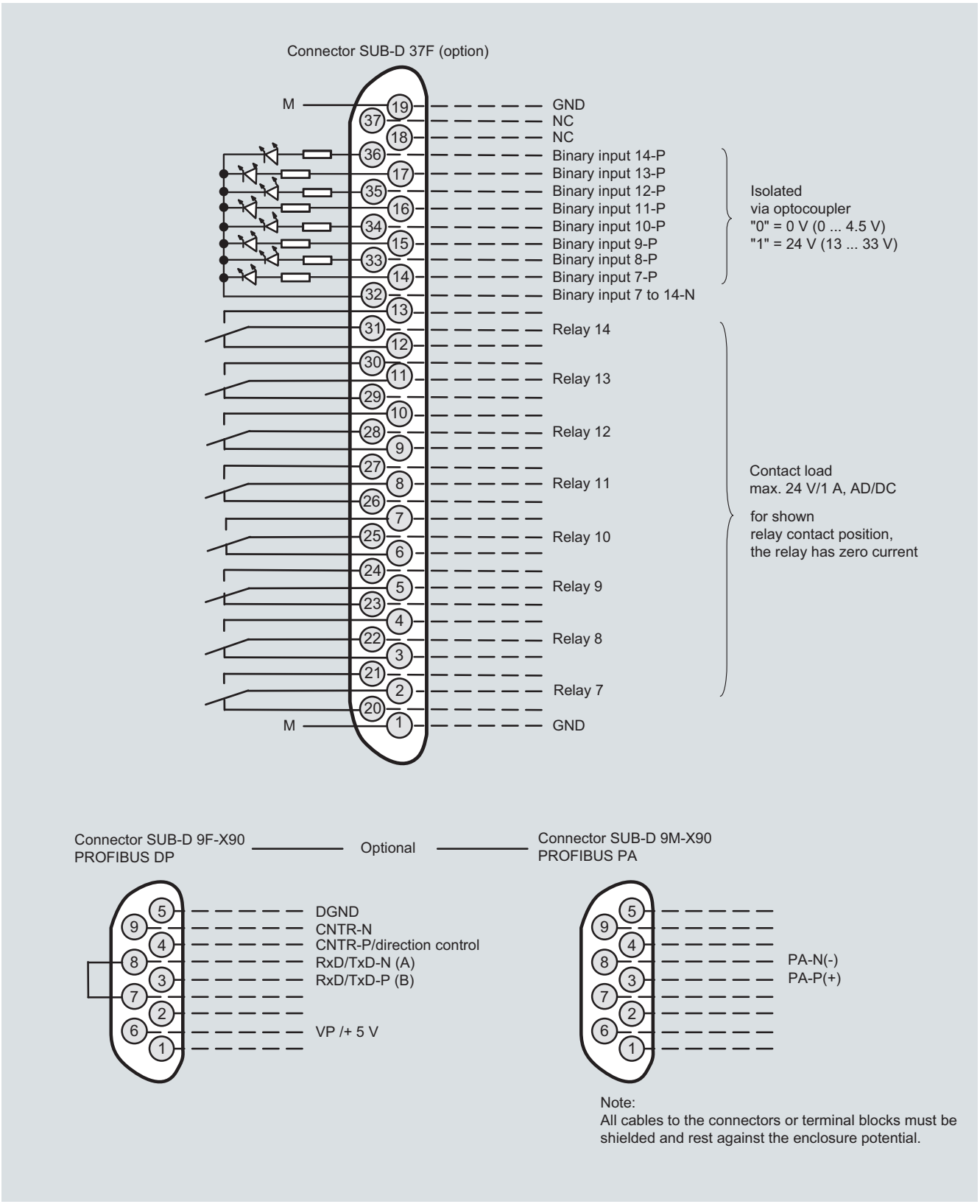
Schematics

Pin assignment (electrical connections)



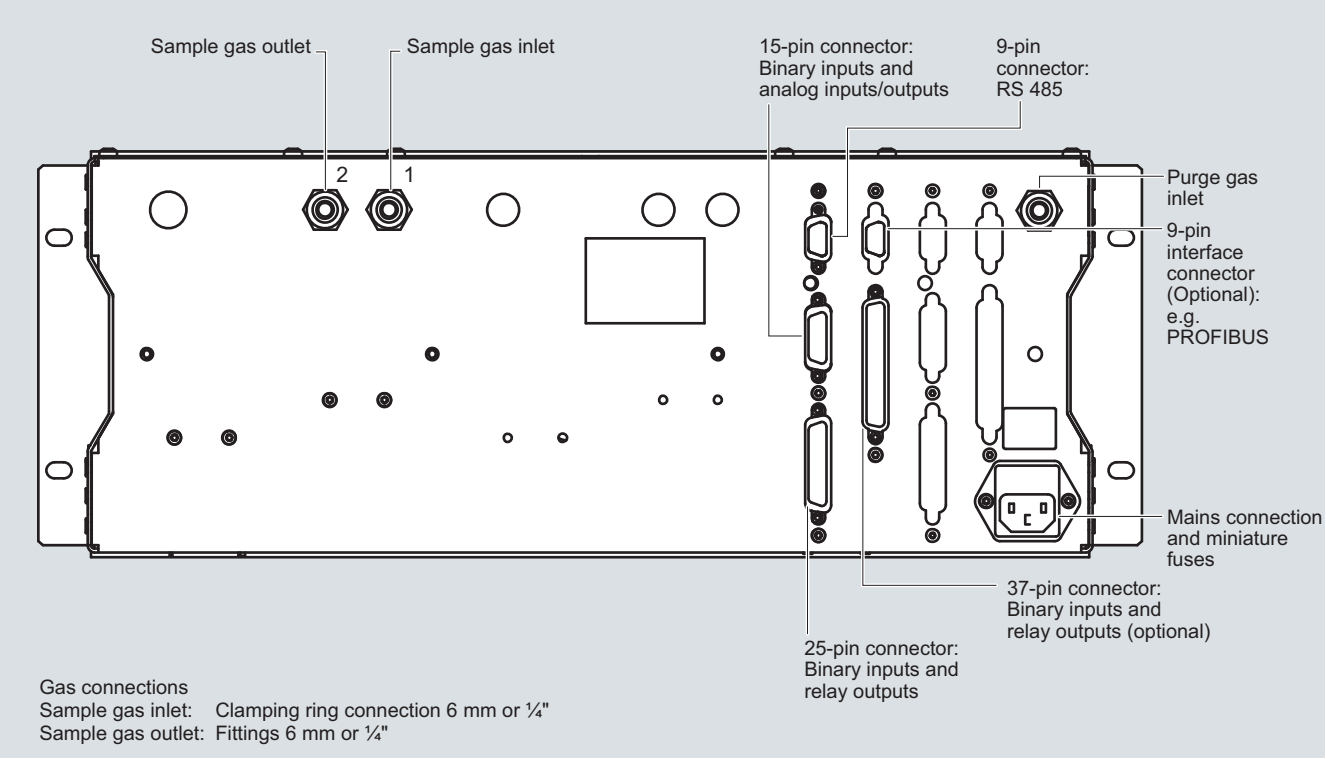
OXYMAT 64, 19" rack unit, pin assignment

19" rack unit



OXYMAT 64, 19" rack unit, pin assignment of the AUTOCAL plate and PROFIBUS plug

Gas connections and pin assignment



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

Documentation

Selection and ordering data

Operating instructions		Order No.
OXYMAT 64		
Gas analyzer for measuring trace oxygen		
• German		**A5E00880382**
• English		**A5E00880383**
• French		**A5E00880384**
• Spanish		**A5E00880385**
• Italian		**A5E00880386**
Gas analyzers of Series 6 and ULTRAMAT 23		
Schnittstelle/Interface PROFIBUS DP/PA		
• German and English	D)	**A5E00054148**

D) Subject to export regulations AL: 9I999, ECCN: N

Suggestions for spare parts

Selection and ordering data

Description	7MB2041	2 years (quantity)	5 years (quantity)		Order No.
Pressure regulator as spare part	x	–	1		**A5E01008972**
Flowmeter	x	–	1		**A5E01061561**
Adapter plate, LC display/keypad	x	1	1		**C79451-A3474-B605**
LC display	x	–	1		**W75025-B2001-B1**
Connector filter	x	–	1	F)	**W75041-E5602-K2**
Fuse, T 0.63 A, line voltage 200 … 240 V	x	2	4		**W79054-L1010-T630**
Fuse, T 1 A, line voltage 200 … 240 V	x	2	4		**W79054-L1011-T100**

F) Subject to export regulations AL: N, ECCN: EAR99H