

## Overview

The ULTRAMAT/OXYMAT 6 gas analyzer is a practical combination of the ULTRAMAT 6 and OXYMAT 6 analyzers in a single enclosure.

The ULTRAMAT 6 channel operates according to the NDIR two-beam alternating light principle and measures one or two gases highly selectively whose absorption bands lie in the infrared wavelength range from 2 to 9  $\mu\text{m}$ , such as CO, CO<sub>2</sub>, NO, SO<sub>2</sub>, NH<sub>3</sub>, H<sub>2</sub>O as well as CH<sub>4</sub> and other hydrocarbons.

The OXYMAT 6 channel is based on the paramagnetic alternating pressure method and is used to measure oxygen in gases.



ULTRAMAT/OXYMAT 6, 19" unit

## Benefits

- Corrosion-resistant materials in gas path (option)
  - Measurement possible in highly corrosive sample gases
- Cleanable sample cells
  - Cost saving in further use in case of pollution
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and servicing information (option).

### ULTRAMAT channel

- High selectivity with double-layer detector and optical coupler
  - Reliable measurements even in complex gas mixtures
- Low detection limits
  - Measurements with low concentrations.

### OXYMAT channel

- Paramagnetic alternating pressure principle
  - Small measuring ranges (0 - 0.5% or 99.5 - 100% O<sub>2</sub>)
  - Absolute linearity
- Detector element has no contact with the samples gas
  - Can be used to measure corrosive gases
  - Long lifetime
- Physically suppressed zero through suitable selection of reference gas (air or O<sub>2</sub>), e.g. 98 - 100% O<sub>2</sub> for purity monitoring/air separation.

## Application

### Applications

- Measurements for boiler control in combustion plants
- Emission measurements in incineration plants
- Measurements in the automotive industry (test benches)
- Process gas concentrations in chemical plants
- Trace measurements in pure gas processes
- Environment protection
- MAC-value monitoring at place of work
- Quality monitoring.

### Special versions

- Special applications

Besides the standard combinations special applications concerning material of the gas path, material of the sample cells (e.g. titanium, Hastelloy C22) and sample components are also available on request.

- TÜV version

TÜV-approved versions are available for measurement of CO, NO and SO<sub>2</sub> according to 13. BImSchV and TA Luft.

Smallest TÜV-approved and permitted measuring ranges:

- 1-component analyzer
  - CO: 0 to 50 mg/m<sup>3</sup>
  - NO: 0 to 100 mg/m<sup>3</sup>
  - SO<sub>2</sub>: 0 to 75 mg/m<sup>3</sup>
- 2-component analyzer (series connection)
  - CO: 0 to 75 mg/m<sup>3</sup>
  - NO: 0 to 200 mg/m<sup>3</sup>

All larger measuring ranges are also permitted.

Furthermore, the TÜV-approved versions of the ULTRAMAT/OXYMAT 6 comply with the requirements of EN 14956 and of QAL 1 according to EN 14181. Conformity of the analyzers with both standards is TÜV-certified.

Determination of the analyzer drift according to EN 14181 (QAL 3) can be carried out manually or also with a PC using the SIPROM GA maintenance and servicing software. In addition, selected manufacturers of emission evaluation computers offer the possibility for downloading the drift data via the analyzer's serial interface and to automatically record and process them in the evaluation computer.

## Design

### 19" unit

- With 4 HU for installation
  - in hinged frames
  - in cabinets, with or without slide rails
- Front panel for service can be hinged down (laptop connection)
- Internal gas paths: flexible tube made of FKM (Viton) or pipe made of titanium or stainless steel
- Gas connections for sample gas input and output: pipe diameter 6 mm or 1/4"
- Flowmeter for sample gas on the front panel (option).
- Sample cell (OXYMAT channel) – with or without flow-type compensation branch – made of stainless steel (SS, type No. 1.4571) or of tantalum for highly corrosive sample gases (e.g. HCl, Cl<sub>2</sub>, SO<sub>2</sub>, SO<sub>3</sub>, etc.)
- Monitoring (option) sample and/or reference gas (both channels).

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

## General

### Display and control panel

- Large LCD panel for simultaneous display of:
  - Measured value (digital and analog displays)
  - Status line
  - Measuring ranges
- Contrast of LCD panel adjustable using menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Menu-based operation for configuration, test functions, calibration
- User help in plain text
- Graphic display of concentration trend; programmable time intervals
- Operating software in two languages: German/English, English/Spanish, French/English, Italian/English.

### Inputs and outputs (per channel)

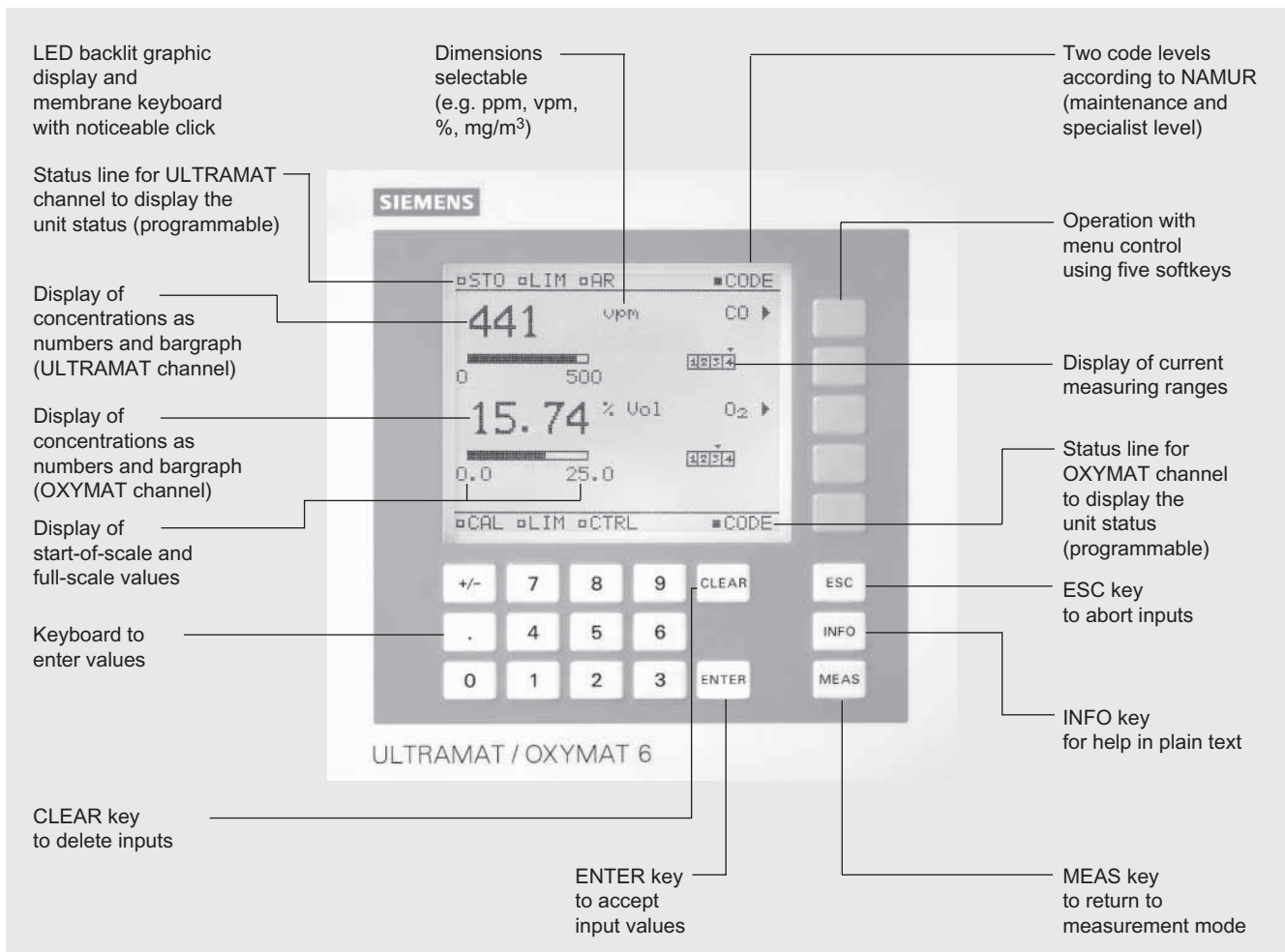
- One analog output for each measured component
- Two analog inputs programmable (e.g. correction of cross-interferences or external pressure sensor)
- Six binary inputs freely-configurable (e.g. for range switching, external signal processing from sample preparation)
- Six relay outputs freely configurable e.g. for failure, maintenance request, limit alarm, external solenoid valves
- Extension with eight additional binary inputs and eight additional relay outputs e.g. for automatic calibration with up to four calibration gases.

### Communication

RS 485 present in the basic unit (connection at the rear and for the 19" unit also behind the front plate).

### Options

- AK interface for the automotive industry with extended functions
- RS 485/RS 232 converter
- RS 485/Ethernet converter
- Linking to networks via PROFIBUS DP/PA interface
- SIPROM GA software as service and maintenance tool.



ULTRAMAT/OXYMAT 6, membrane keyboard and graphic display

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

General

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## Versions – Wetted parts, standard

Gas path ULTRAMAT channel		19" unit
With hoses	Bushing Hose Sample cell: • Body • Cell lining • Stub  • Window	SS, type No. 1.4571 FKM (e.g. Viton)  Aluminum Aluminum SS, type No. 1.4571, O-ring: FKM (e.g. Viton) or FFKM (Kalrez) CaF <sub>2</sub> , adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
With pipes	Bushing Pipe Sample cell: • Body • Cell lining • Window	Titanium Titanium, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)  Aluminum Tantalum (only for cell length 20 mm to 180 mm) CaF <sub>2</sub> , adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
With pipes	Bushing Pipe Sample cell: • Body • Cell lining • Window	SS, type No. 1.4571 SS, type No. 1.4571, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)  Aluminum Aluminum or tantalum (Ta: only for cell length 20 mm to 180 mm) CaF <sub>2</sub> , adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
Flowmeter	Metering pipe Float Float limit Elbows	Duran glass Duran glass, black PTFE (Teflon) FKM (e.g. Viton)
Pressure switch	Membrane Enclosure	FKM (e.g. Viton) PA 6.3 T

## Options

Gas path, ULTRAMAT channel		19" unit
Flowmeter	Metering pipe Float Float limit Elbows	Duran glass Duran glass PTFE (Teflon) FKM (e.g. Viton)
Pressure switch	Membrane Enclosure	FKM (e.g. Viton) PA 6.3 T

## Versions – Wetted parts, special applications (examples)

Gas path		19" unit
With pipes	Bushing Pipe Sample cell: • Body • Window	e.g. Hastelloy C22 e.g. Hastelloy C22, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)  e.g. Hastelloy C22 CaF <sub>2</sub> , without adhesive, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

## General

### Versions – Wetted parts, standard

Gas path, OXYMAT channel		19" unit
With hoses	Connection Hose Sample cell Stubs sample cell Restrictor O-rings	SS, type No. 1.4571 FKM (e.g. Viton) SS, type No. 1.4571 or Ta SS, type No. 1.4571 PTFE (e.g. Teflon) FKM (e.g. Viton)
With pipes	Connection Pipe Sample cell Restrictor O-rings	Titanium Titanium SS, type No. 1.4571 or tantalum Titanium FKM (Viton) or FFKM (e.g. Kalrez)
With pipes	Connection Pipe Sample cell Restrictor O-rings	SS, type No. 1.4571 SS, type No. 1.4571 SS, type No. 1.4571 or tantalum SS, type No. 1.4571 FKM (Viton) or FFKM (Kalrez)
With pipes	Connection Pipe Sample cell Restrictor O-rings	Hastelloy C 22 Hastelloy C 22 SS, type No. 1.4571 or tantalum Hastelloy C 22 FKM (e.g. Viton) or FFKM (e.g. Kalrez)

### Options

Gas path, OXYMAT channel		19" unit
Flowmeter	Metering pipe Float Float limit Elbows	Duran glass Duran glass PTFE (Teflon) FKM (e.g. Viton)
Pressure switch	Membrane Enclosure	FKM (e.g. Viton) PA 6.3 T

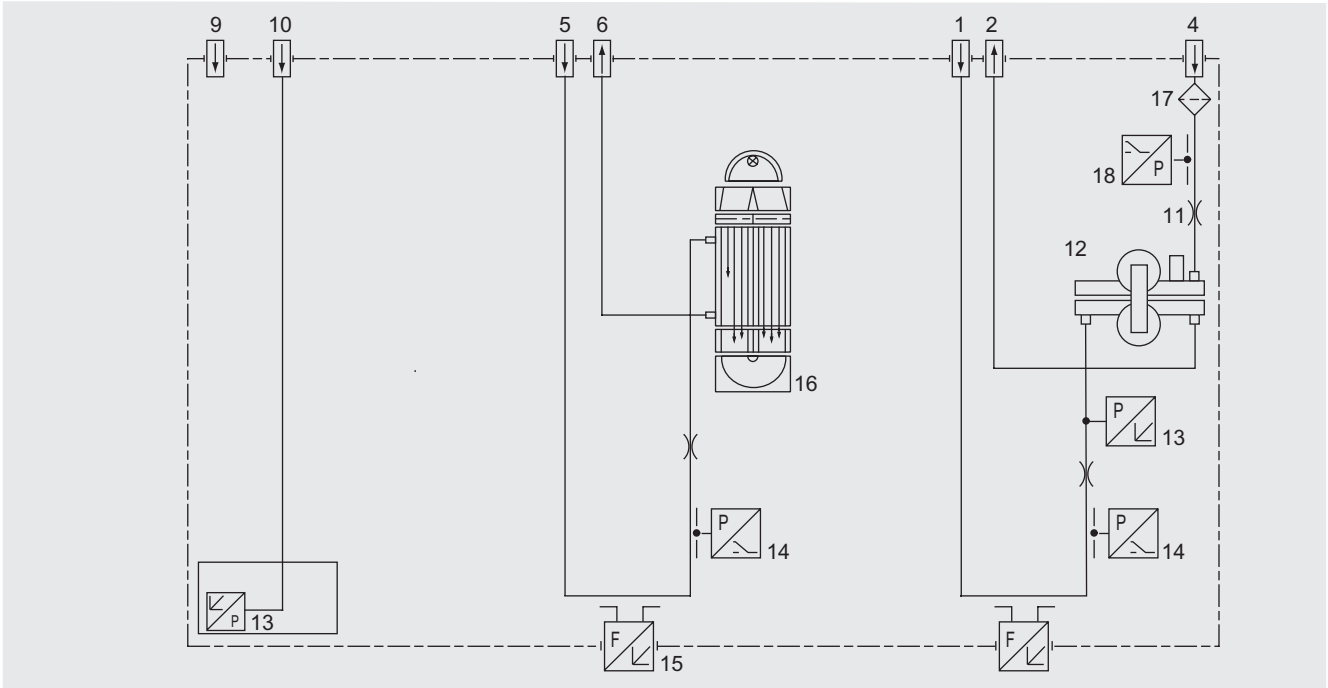
# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

General

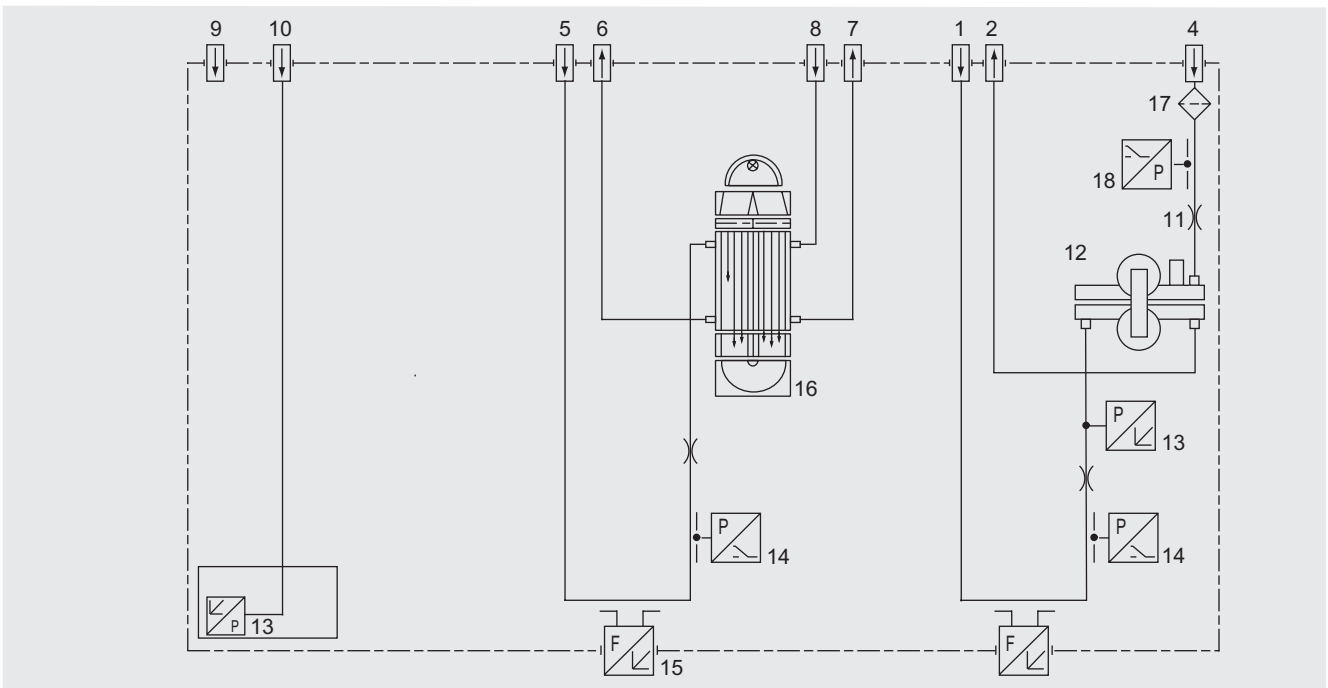
## Gas path

### Key to gas path figures

- |   |  |
|---|--|
| 1 Sample gas inlet (OXYMAT channel)               | 10 Connection pressure sensor (ULTRAMAT channel) |
| 2 Sample gas outlet (OXYMAT channel)              | 11 Restrictor (in reference gas inlet)           |
| 3 Not used  | 12 O <sub>2</sub> bench                          |
| 4 Reference gas inlet                             | 13 Pressure sensor                               |
| 5 Sample gas inlet (ULTRAMAT channel)             | 14 Pressure switch in sample gas path (option)   |
| 6 Sample gas outlet (ULTRAMAT channel)            | 15 Flowmeter in sample gas path (option)         |
| 7 Reference gas outlet (ULTRAMAT channel, option) | 16 IR bench                                      |
| 8 Reference gas inlet (ULTRAMAT channel, option)  | 17 Filter  |
| 9 Purging gas                                     | 18 Pressure switch in reference gas inlet        |



ULTRAMAT/OXYMAT 6, gas path (example) IR channel without flow-type reference compartment



ULTRAMAT/OXYMAT 6, gas path (example) IR channel with flow-type reference compartment

# Continuous Gas Analyzers, extractive

## ULTRAMAT/OXYMAT 6

### General

#### Function

##### Mode of operation, ULTRAMAT channel

The ULTRAMAT channel operates according to the infrared two-beam alternating light principle with double-layer detector and optical coupler.

The measuring principle is based on the molecule-specific absorption of bands of infrared radiation. The absorbed wavelengths are characteristic to the individual gases, but may partially overlap. This results in cross-sensitivities which are reduced to a minimum in the ULTRAMAT 6 gas analyzers by the following measures:

- Gas-filled filter cell (beam divider)
- Double-layer detector with optical coupler
- Optical filters if necessary.

The figure shows the measuring principle. An IR source (1) which is heated to approx. 700 °C and which can be shifted to balance the system is divided by the beam divider (3) into two equal beams (sample and reference beams). The beam divider also acts as a filter cell.

The reference beam passes through a reference cell (8) filled with N<sub>2</sub> (a non-infrared-active gas) and reaches the right-hand side of the detector (11) practically unattenuated. The sample beam passes through the sample cell (7) through which the sample gas flows and reaches the left-hand side of the detector (10) attenuated to a lesser or greater extent depending on the concentration of the sample gas. The detector is filled with a defined concentration of the gas component to be measured.

The detector is designed as a double-layer detector. The center of the absorption band is preferentially absorbed in the upper detector layer, the edges of the band are absorbed to approximately the same extent in the upper and lower layers. The upper and lower detector layers are connected together via the microflow sensor (12). This coupling means that the spectral sensitivity has a very narrow band.

The optical coupler (13) lengthens the lower receiver cell layer optically. The infrared absorption in the second detector layer is varied by changing the slider position (14). It is thus possible to individually minimize the influence of interfering components.

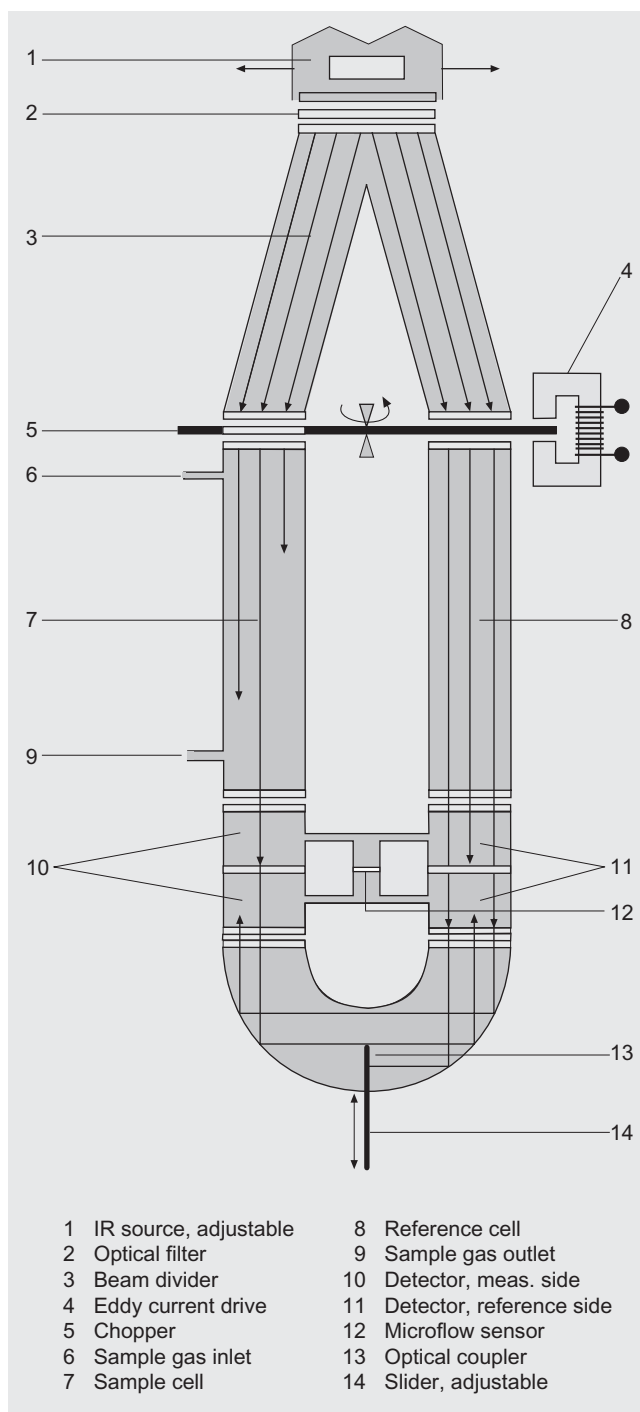
A chopper (5) rotates between the beam divider and the sample cell and interrupts the two beams alternately and periodically. If absorption takes place in the sample cell, a pulsating flow is generated between the two detector levels which is converted by the microflow sensor (12) into an electric signal.

The microflow sensor consists of two nickel grids heated to approx. 120 °C which, together with two further resistors, form a Wheatstone bridge. The pulsating flow together with the very close arrangement of the Ni grids leads to a change in resistance. This leads to an offset in the bridge which is dependent on the concentration of the sample gas.

#### Note

The sample gases have to enter the analyzer dustfree. Avoid condensate in the sample cells. Therefore an appropriate gas preparation is required for most applications.

The ambient air of the analyzer should be, in a large extent, free of high concentration of the component to be measured.



ULTRAMAT 6, mode of operation

## Mode of operation, OXYMAT channel

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

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 concentrations meet in a magnetic field, a pressure difference is produced between them.

One gas (1) is a reference gas ( $N_2$ ,  $O_2$  or air), the other is the sample gas (5). The reference gas is introduced into the sample cell (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 concentration, causes a cross flow. This flow is converted into an electric signal by a microflow sensor (4).

The microflow sensor consists of two nickel grids heated to approx. 120 °C which form a Wheatstone bridge together with two supplementary resistors. The pulsating flow results in a change in the resistance of the Ni grids. This results in a bridge offset which depends on the oxygen concentration in 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 flow 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 instrument orientation.

The sample cell is directly in the sample path and has a small volume. The microflow sensor thus responds quickly, resulting in a very short response time for the OXYMAT 6.

Vibrations frequently occur at the place of installation and may falsify the measured signal (noise). A further microflow sensor (10) through which no gas passes acts as a vibration sensor. Its signal is applied to the measured signal as compensation.

If the density of the sample gas deviates by more than 50% from that of the reference gas, the compensation microflow sensor (10) is flushed with reference gas just like the measuring sensor (4).

### Note

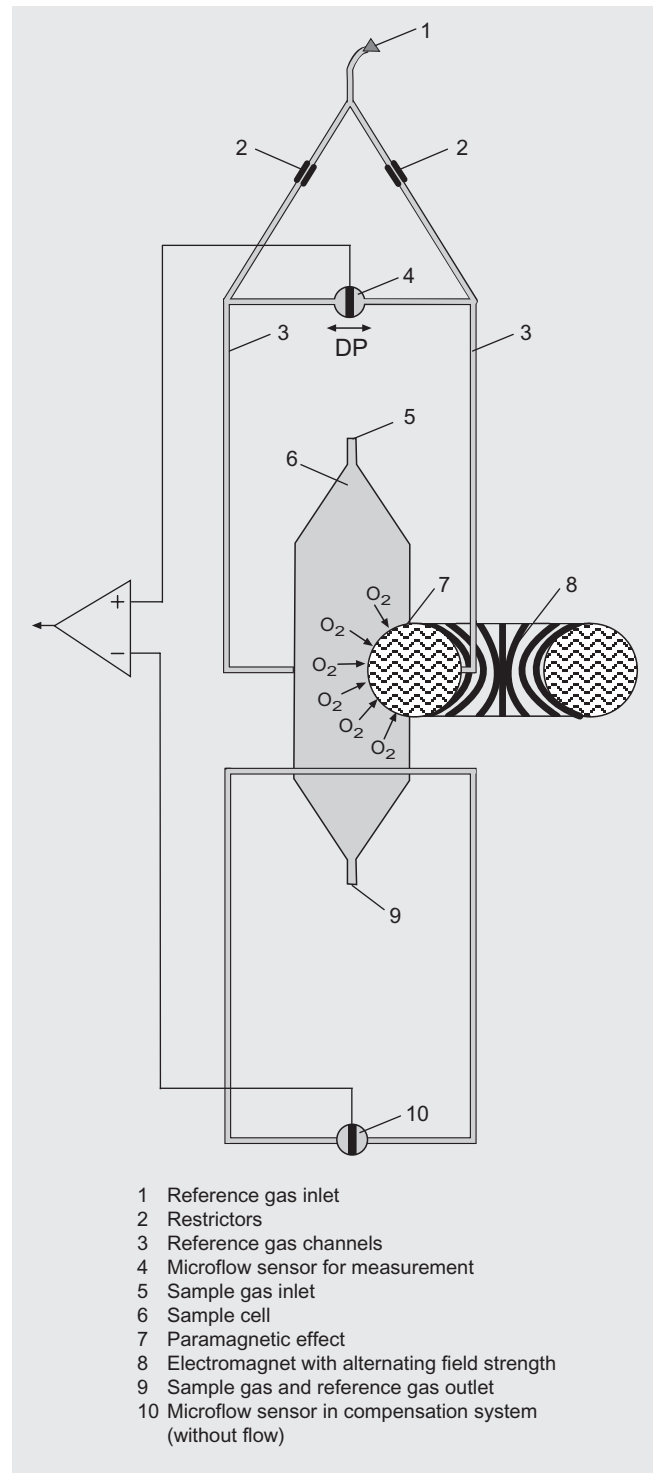
The sample gases have to enter the analyzer dust-free. Avoid condensate in the sample cells. Therefore an appropriate gas preparation is required for most applications.

The ambient air of the analyzer should be, in a large extent, free of high concentration of the component to be measured.

Flow-type reference compartments with reduced flow must not be operated with flammable or toxic gases.

ULTRAMAT channels only:

- Channels with electronically suppressed zero only differ from the standard version in the measuring range parameterizing.
- Physically suppressed zeros are carried out as special application.



- 1 Reference gas inlet
- 2 Restrictors
- 3 Reference gas channels
- 4 Microflow sensor for measurement
- 5 Sample gas inlet
- 6 Sample cell
- 7 Paramagnetic effect
- 8 Electromagnet with alternating field strength
- 9 Sample gas and reference gas outlet
- 10 Microflow sensor in compensation system (without flow)

OXYMAT 6, mode of operation

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

## General

### Essential characteristics

- Four freely-parameterizable measuring ranges per component
- Measuring ranges with elevated physical zero possible
- Measuring range identification
- Electrically isolated signal output selectable as 0/2/4 to 20 mA per component
- Autoranging or manual range switching possible; remote switching is also possible
- Storage of measured values possible during adjustments
- Time constants selectable within wide limits (static/dynamic noise suppression); i.e. the response time of the analyzer can be matched to the respective application
- Short response time
- Low long-term drift
- Measuring-point selection for up to 6 measuring points (programmable)
- Measuring point identification
- Monitoring of sample gas flow (option)
- Two-stage access code with authorization code to prevent unintentional and unauthorized inputs
- Automatic range calibration can be parameterized
- Simple handling using menu-based operation with numerical membrane keyboard
- Operation based on NAMUR Recommendation
- Customer-specific analyzer options such as e.g.:
  - Customer acceptance
  - Tag labels
  - Drift recording.

### ULTRAMAT channel

- Differential measuring ranges with flow-type reference cell
- Internal pressure sensor for correction of variations in atmospheric pressure in the range 600 to 1200 hPa absolute
- External pressure sensor - only with piping gas path - can be connected for correction of variations in the process gas pressure in the range 600 to 1500 hPa absolute (option)
- Sample cells for use in presence of highly corrosive sample gases (e.g. tantalum layer or Hastelloy C22).

### OXYMAT channel

- Monitoring of sample gas and/or reference gas (option)
- Different smallest spans (0.5%, 2.0% or 5.0% O<sub>2</sub>)
- Analyzer section with flow-type compensation circuit (option): a flow is passed through the compensation branch to reduce the vibration dependency in the case of highly different densities of the sample and reference gases
- Internal pressure sensor for correction of pressure variations in sample gas (range 500 to 2000 hPa absolute)
- External pressure sensor can be connected for correction of variations in sample gas pressure up to 3000 hPa absolute (option), only with piping as the gas path
- Monitoring of reference gas with reference gas connection 3000 to 4000 hPa (option)
- Sample cell for use in presence of highly corrosive sample gases.



## Reference gases

Measuring range	Recommended reference gas	Reference gas connection pressure	Remarks
0 to . . . % v/v O <sub>2</sub>	N <sub>2</sub>	2000 to 4000 hPa above sample gas pressure (max. 5000 hPa absolute)	The reference gas flow is set automatically to 5 to 10 ml/min (up to 20 ml/min when also flowing through compensation branch)
. . . to 100% v/v O <sub>2</sub> (suppressed zero with full-scale value 100% v/v O <sub>2</sub> )	O <sub>2</sub>		
Around 21% v/v O <sub>2</sub> (suppressed zero with 21% v/v O <sub>2</sub> within the span)	Air	100 hPa with respect to sample gas pressure which may vary by max. 50 hPa around the atmospheric pressure	

Table 1 Reference gases for OXYMAT 6 channel

## Correction of zero error / Cross interferences (OXYMAT channel)

Residual gas (concentration 100% v/v)	Zero deviation in % v/v O <sub>2</sub> absolute	Residual gas (concentration 100% v/v)	Zero deviation in % v/v O <sub>2</sub> absolute
<b>Organic gases</b>		<b>Inert gases</b>	
Acetic acid CH <sub>3</sub> COOH	-0.64	Argon Ar	-0.25
Acetylene C <sub>2</sub> H <sub>2</sub>	-0.29	Helium He	+0.33
1,2 butadiene C <sub>4</sub> H <sub>6</sub>	-0.65	Krypton Kr	-0.55
1,3 butadiene C <sub>4</sub> H <sub>6</sub>	-0.49	Neon Ne	+0.17
iso-butane C <sub>4</sub> H <sub>10</sub>	-1.30	Xenon Xe	-1.05
n-butane C <sub>4</sub> H <sub>10</sub>	-1.26		
1-butene C <sub>4</sub> H <sub>6</sub>	-0.96	<b>Anorganic gases</b>	
iso-butene C <sub>4</sub> H <sub>8</sub>	-1.06	Ammonia NH <sub>3</sub>	-0.20
Cyclo-hexane C <sub>6</sub> H <sub>12</sub>	-1.84	Carbon dioxide CO <sub>2</sub>	-0.30
Dichlorodifluoromethane (R12) CCl <sub>2</sub> F <sub>2</sub>	-1.32	Carbon monoxide CO	+0.07
Ethane C <sub>2</sub> H <sub>6</sub>	-0.49	Chlorine Cl <sub>2</sub>	-0.94
Ethylene C <sub>2</sub> H <sub>4</sub>	-0.22	Dinitrogen monoxide N <sub>2</sub> O	-0.23
n-heptane C <sub>7</sub> H <sub>16</sub>	-2.4	Hydrogen H <sub>2</sub>	+0.26
n-hexane C <sub>6</sub> H <sub>14</sub>	-2.02	Hydrogen bromide HBr	-0.76
Methane CH <sub>4</sub>	-0.18	Hydrogen chloride HCl	-0.35
Methanol CH <sub>3</sub> OH	-0.31	Hydrogen fluoride HF	-0.10
n-octane C <sub>8</sub> H <sub>18</sub>	-2.78	Hydrogen iodide HI	-1.19
n-pentane C <sub>5</sub> H <sub>12</sub>	-1.68	Hydrogen sulphide H <sub>2</sub> S	-0.44
iso-pentane C <sub>5</sub> H <sub>12</sub>	-1.49	Oxygen O <sub>2</sub>	+100
Propane C <sub>3</sub> H <sub>8</sub>	-0.87	Nitrogen N <sub>2</sub>	0.00
Propylene C <sub>3</sub> H <sub>6</sub>	-0.64	Nitrogen dioxide NO <sub>2</sub>	+20.00
Trichlorofluoromethane (R11) CCl <sub>3</sub> F	-1.63	Nitrogen oxide NO	+42.94
Vinyl chloride C <sub>2</sub> H <sub>3</sub> Cl	-0.77	Sulphur dioxide SO <sub>2</sub>	-0.20
Vinyl fluoride C <sub>2</sub> H <sub>3</sub> F	-0.55	Sulphur hexafluoride SF <sub>6</sub>	-1.05
1,1 vinylidene chloride C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	-1.22	Water H <sub>2</sub> O	-0.03

Table 2 Zero error due to diamagnetism or paramagnetism of residual gases with nitrogen as the reference gas at 60 °C and 1000 hPa absolute (according to IEC 1207/3)

### Conversion to other temperatures:

The zero errors mentioned in Table 2 must be multiplied with a correction 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 error).

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

## 19" unit

### Technical specifications

#### General

Position of use	Front panel vertical
Conformity	CE identification EN 50081-1 and EN 50082-2

#### Design, enclosure

Weight	Approx. 21 kg
Degree of protection	IP20 according to EN 60529

#### Electrical characteristics

EMC interference immunity (ElectroMagnetic Compatibility)	According to standard requirements of NAMUR NE21 (08/98)
Electrical safety	According to EN 61010-1, overvoltage category III
Power supply	100 ... 120 V AC (rated range 90 V ... 132 V), 48 ... 63 Hz or 200 ... 240 V AC (rated range 180 V ... 264 V), 48 ... 63 Hz
Power consumption	approx. 70 VA
Fuse links	120 ... 120 V: F1/F2 = T 1.6 A; 200 ... 240 V: F1/F2 = T 1 A

#### Electrical inputs and outputs (per channel)

Analog output	0/2/4 ... 20 mA, floating, max. load 750 $\Omega$
Relay outputs	6, with changeover contacts, freely selectable, e.g. for range identification; loading capacity: 24 V AC/DC/1 A, floating, non sparking
Analog inputs	2, designed 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, floating, freely selectable, e.g. for range switching
Serial interface	RS 485
Options	Autocal function with 8 additional binary inputs and 8 relay outputs; also with PROFIBUS PA and PROFIBUS DP

#### Ambient conditions

Perm. ambient temperature	-30 ... +70 °C during storage and transport, +5 ... +45 °C during operation
Permissible humidity	< 90% relative humidity, during storage and transport (dew point must not be fallen below)

#### Technical specifications, ULTRAMAT channel

Measuring ranges	4, switchable internally and externally; autoranging is also possible
Smallest possible measuring range	Depending on application, e.g.: CO: 0 ... 10 vpm CO <sub>2</sub> : 0 ... 5 vpm
Largest possible measuring range	Depending on application
Measuring ranges with suppressed zero	Any zero point is possible between 0 and 100%; smallest possible span 20%
Characteristic	Linearized

#### Gas inlet conditions

Permissible sample gas pressure	
• Without pressure switch	600 ... 1500 hPa (absolute)
• With pressure switch	600 ... 1300 hPa (absolute)
Sample gas flow	18 ... 90 l/h (0.3 ... 1.5 l/min)
Sample gas temperature	0 ... 50 °C
Sample gas humidity	< 90 % relative humidity or depending on application, without condensation

#### Time response

Warm-up period	With amb. temperature < 30 min (maximum accuracy achieved after 2 hours)
Response time (T <sub>90</sub> time)	Dependent on length of analyzer cell, sample gas line and parameterizable damping
Damping (electric time constant)	0 to 100 s, programmable
Dead time (purging time of gas path in analyzer at 1 l/min)	Approx. 0.5 to 5 s, depending on version
Time for internal signal processing	< 1 s

#### Pressure correction range

Pressure sensor	
• internal	600 ... 1200 hPa absolute
• external	600 ... 1500 hPa absolute

#### Measuring response (referred to 1000 hPa absolute sample gas pressure, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation	$\pm 0,1\% \dots \pm 1\%$ of smallest possible measuring range specified on rating plate depending on the unit electronic time constant (corresponds to $\pm 0.33\%$ with $2\sigma$ )
Zero drift	< 1% of measuring range/week
Measured-value drift	< 1% of measuring range/week
Repeatability	$\leq 1\%$ of respective meas. range
Minimum detection limit	1% of smallest measuring range
Linearity error	< 0.5% of full-scale value

#### Influencing variables (referred to 1000 hPa absolute sample gas pressure, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Ambient temperature	< 1% of measuring range/10 K (for a constant temperature of the reception cell)
Sample gas pressure	With pressure compensation: < 0.15% of span/1% change in atmospheric pressure; without pressure compensation: < 1.5% of span/1% change in atmospheric pressure
Sample gas flow	Negligible
Power supply	< 0.1% of output signal span with rated voltage $\pm 10\%$
Ambient conditions	Application-dependent influencing of measurement if ambient air contains measured component or cross-sensitive gases

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

2

## Technical specifications, OXYMAT channel

Measuring ranges	4, switchable internally and externally; autoranging is also possible
Smallest possible measuring span (referred to 1000 hPa absolute sample gas pressure, 0.5 l/min sample gas flow and 25 °C ambient temperature)	0.5% v/v, 2% v/v or 5% v/v O <sub>2</sub>
Largest possible measuring span	100 % v/v O <sub>2</sub>
Measuring ranges with suppressed zero	Any zero point is possible between 0 and 100% v/v as long as a suitable reference gas is used

## Gas inlet conditions

Permissible sample gas pressure	
• for analyzers with pipes	500 ... 3000 hPa absolute
• for analyzers with hoses	
- without pressure switch	500 ... 1500 hPa absolute
- with pressure switch	500 ... 1300 hPa absolute
Sample gas flow	18 ... 60 l/h (0.3 ... 1 l/min)
Sample gas temperature	0 ... 50 °C
Sample gas humidity	< 90% relative humidity

## Time response

Warm-up period	With ambient temperature < 30 min (maximum accuracy achieved after 2 hours)
Reading delay time	min. 1.5 ... 3.5 s, depending on version
Damping (electric time constant)	0 to 100 s, programmable
Dead time (purging time of gas path in analyzer at 1 l/min)	Approx. 0.5 ... 2.5 s depending on version
Time for internal signal processing	< 1 s

## Pressure correction range

Pressure sensor	
• internal	500 ... 2000 hPa absolute
• external	500 ... 3000 hPa absolute

**Measuring response** (referred to 1000 hPa absolute sample gas pressure, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation	< 0.75% of smallest possible measuring range specified on rating plate with an electronic time constant of 1 s (corresponds to $\pm 0.25\%$ with $2\sigma$ )
Zero drift	< 0.5%/month of smallest possible meas. span specified on rating plate
Measured-value drift	< 0.5%/month of respective measuring span
Repeatability	< 1%/month of respective measuring span
Minimum detection limit	1% of smallest measuring range
Linearity error	< 1%/month of respective measuring span

**Influencing variables** (referred to 1000 hPa absolute sample gas pressure, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Ambient temperature	< 0.5%/10 K referred to the smallest possible measuring span according to rating plate with span 0.5%: 1%/10 K
Sample gas pressure (with air (100 hPa) as reference gas, a correction of the atmospheric pressure fluctuations is only possible when the sample gas is vented to ambient air)	Without pressure compensation: < 2% of measuring span/1% change in pressure; with pressure compensation: < 0.2% of measuring span/1% change in pressure
Residual gases	Deviation in zero point corresponding to paramagnetic or diamagnetic deviation of residual gas
Sample gas flow	< 1% of smallest possible measuring span according to rating plate with a change in flow of 0.1 l/min within the permissible flow range
Power supply	< 0.1% of output signal span with rated voltage $\pm 10\%$

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

## Selection and Ordering Data

### ULTRAMAT/OXYMAT 6 gas analyzer

19" unit for installation in cabinets  
combined measurement of O<sub>2</sub> and IR absorbing gases

#### Gas connections for sample gas and reference gas

Piping with outer diameter 6 mm

Piping with outer diameter 1/4"

#### Smallest possible span O<sub>2</sub>

0.5% reference gas pressure 3000 hPa

0.5% reference gas pressure 100 hPa (external pump)

2% reference gas pressure 3000 hPa

2% reference gas pressure 100 hPa (external pump)

5% reference gas pressure 3000 hPa

5% reference gas pressure 100 hPa (external pump)

#### Sample cell (OXYMAT channel)

without flow-type compensation branch

- made of stainless steel, type No. 1.4571
- made of tantalum

with flow-type compensation branch

- made of stainless steel, type No. 1.4571
- made of tantalum

Internal gas paths	Sample cell <sup>1)</sup> (lining) (ULTRAMAT channel)	Reference cell (flow) (ULTRAMAT channel)
(both channels)		

Hose made of FKM (Viton)    Aluminium    Non-flow-type

Aluminum    Flow-type

Pipe made of titanium    Tantalum    Non-flow-type

Tantalum    Flow-type

Pipe made of SS (type No.1.4571)    Aluminum    Non-flow-type

Tantalum    Non-flow-type

#### With sample gas monitoring (both channels)

Hose made of FKM (Viton)    Aluminium    Non-flow-type

Aluminium    Flow-type

#### Additional electronics

Without

Autocal board

- With 8 additional binary inputs and outputs for OXYMAT channel
- With 8 additional binary inputs and outputs for ULTRAMAT channel
- With 8 additional binary inputs and outputs for ULTRAMAT channel and OXYMAT channel
- With serial interface for the automotive industry (AK)
- With 8 additional binary inputs and outputs and PROFIBUS PA interface for ULTRAMAT channel and OXYMAT channel
- With 8 additional binary inputs and outputs and PROFIBUS DP interface for ULTRAMAT channel and OXYMAT channel

Order No.

7MB2023 - - - - -

cannot be combined

0

1

A

B

C

D

E

F

A

B

C

D

0

1

4

5

6

8

2

3

0

1

2

3

5

6

7

0 → A21

1 → A20

B B → A26, Y02

D D → A26, Y02

F F → A26, Y02

↓

C

D

0 0 → A20, A21

1

4 → A20, A21, Y02

5 → Y02

6 → A20, A21

8 → A20, A21

2 2 → A20, A21

3

5 → Y02

1) Only for sample cell length 20 mm to 180 mm.



# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

## Selection and Ordering Data

### Further versions

Please add „-Z“ to Order No. and specify Order code.

	Order code	cannot be combined
Interface converter from RS 485 to RS 232	<b>A11</b>	→ <b>E20</b>
Flow-type reference compartment with reduced flow, 6 mm (ULTRAMAT channel) <sup>1)</sup>	<b>A20</b>	
Flow-type reference compartment with reduced flow, ¼" (ULTRAMAT channel) <sup>1)</sup>	<b>A21</b>	
Reference gas monitoring (pressure switch up to 3000 hPa), only for OXYMAT channel	<b>A26</b>	
<b>Connection pipes</b> (can only be combined with the according gas connection diameter and materials of the internal gas path)		
• Connection pipe made of titanium 6 mm, complete with screwed gland, for sample gas compartment	<b>A22</b>	
• Connection pipe made of titanium ¼", complete with screwed gland, for sample gas compartment	<b>A24</b>	
• Connection pipe made of SS (type No. 1.4571) 6 mm, complete with screwed gland, for sample gas compartment	<b>A27</b>	
• Connection pipe made of SS (type No. 1.4571) ¼", complete with screwed gland, for sample gas compartment	<b>A29</b>	
Slide rails (2 rails)	<b>A31</b>	
Set of Torx tools, socket spanner	<b>A32</b>	
Kalrez gaskets in sample gas path (O <sub>2</sub> compartment)	<b>B01</b>	
TAG labels (customer-defined inscriptions)	<b>B03</b>	
Kalrez gaskets in sample gas path (IR compartment)	<b>B04</b>	
CSA certificate – Class I Div 2	<b>E20</b>	
Clean for O <sub>2</sub> -Service (specially cleaned gas path (ULTRAMAT channel and OXYMAT channel)	<b>Y02</b>	→ <b>A22, A24</b>
Measuring range in plain text <sup>2)</sup> , if different from standard setting	<b>Y11</b>	
Special setting (only in conjunction with an application No., e.g. extended measuring range outside standard ranges, ULTRAMAT channel only)	<b>Y12</b>	
Extended special setting (only in conjunction with an application No., e.g. determination of cross-interferences, ULTRAMAT channel only)	<b>Y13</b>	
TÜV version according to 17. BImSch (ULTRAMAT channel only)	<b>Y17</b>	→ <b>E20</b>

### Retrofitting sets

	Order No.
RS 485/Ethernet converter	<b>C79451-A3364-D61</b>
RS 485/RS 232 converter	<b>C79451-Z1589-U1</b>
Autocal function with serial interface for the automotive industry (AK)	<b>C79451-A3480-D33</b>
Autocal function with 8 binary inputs/outputs for ULTRAMAT channel or OXYMAT channel	<b>C79451-A3480-D511</b>
Autocal function with 8 binary inputs/outputs and PROFIBUS PA for ULTRAMAT channel or OXYMAT channel	<b>A5E00057307</b>
Autocal function with 8 binary inputs/outputs und PROFIBUS DP for ULTRAMAT channel or OXYMAT channel	<b>A5E00057312</b>

1) Cannot be combined with non-flow-type reference compartment.

2) Standard setting: 

smallest possible measuring range	}	in % or ppm (vpm)
25% of largest possible range		
50% of largest possible range		
largest range		



# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

## Selection and Ordering Data

Order No.

### ULTRAMAT/OXYMAT 6 gas analyzer

19" unit for installation in cabinets  
combined measurement of O<sub>2</sub> and IR absorbing gases

#### Power supply

100 ... 120 V AC, 48 ... 63 Hz

200 ... 240 V AC, 48 ... 63 Hz

ULTRAMAT channel	Measured component	Smallest measuring range	Largest measuring range
CO/NO	CO	0 ... 100 vpm	0 ... 1000 vpm
	NO	0 ... 300 vpm	0 ... 1000 vpm
CO/NO	CO	0 ... 300 vpm	0 ... 3000 vpm
	NO	0 ... 500 vpm	0 ... 3000 vpm
CO/NO	CO	0 ... 1000 vpm	0 ... 10000 vpm
	NO	0 ... 1000 vpm	0 ... 10000 vpm
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 100 vpm	0 ... 1000 vpm
	CO	0 ... 100 vpm	0 ... 1000 vpm
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 300 vpm	0 ... 3000 vpm
	NO	0 ... 300 vpm	0 ... 3000 vpm
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 1000 vpm	0 ... 10000 vpm
	CO	0 ... 1000 vpm	0 ... 10000 vpm
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 3000 vpm	0 ... 30000 vpm
	NO	0 ... 3000 vpm	0 ... 30000 vpm
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 1%	0 ... 10%
	CO	0 ... 1%	0 ... 10%
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 3%	0 ... 30%
	NO	0 ... 3%	0 ... 30%
CO <sub>2</sub> /CO	CO <sub>2</sub>	0 ... 10%	0 ... 100%
	CO	0 ... 10%	0 ... 100%
CO <sub>2</sub> /CH <sub>4</sub>	CO <sub>2</sub>	0 ... 10%	0 ... 100%
	CH <sub>4</sub>	0 ... 10%	0 ... 100%
CO <sub>2</sub> /NO	CO <sub>2</sub>	0 ... 100 vpm	0 ... 1000 vpm
	NO	0 ... 300 vpm	0 ... 1000 vpm
CO <sub>2</sub> /NO	CO <sub>2</sub>	0 ... 300 vpm	0 ... 3000 vpm
	NO	0 ... 500 vpm	0 ... 3000 vpm

#### Operating software and documentation

German

English

French

Spanish

Italian

7MB2024 -

0

1

AH

AJ

AC

BA

BB

BC

BD

BE

BF

BG

CG

DH

DJ

0

1

2

3

4

2



## Selection and Ordering Data

Further versions	Order code	cannot be combined
Please add „-Z“ to Order No. and specify Order code.		
Interface converter from RS 485 to RS 232	<b>A11</b>	→ <b>E20</b>
Flow-type reference compartment with reduced flow, 6 mm (ULTRAMAT channel) <sup>1)</sup>	<b>A20</b>	
Flow-type reference compartment with reduced flow, ¼" (ULTRAMAT channel) <sup>1)</sup>	<b>A21</b>	
Reference gas monitoring (pressure switch up to 3000 hPa), only for OXYMAT channel	<b>A26</b>	
<b>Connection pipes</b> (can only be combined with the according gas connection diameter and materials of the internal gas path)		
• Connection pipe made of titanium 6 mm, complete with screwed gland, for sample gas compartment	<b>A22</b>	
• Connection pipe made of titanium ¼", complete with screwed gland, for sample gas compartment	<b>A24</b>	
• Connection pipe made of SS (type No. 1.4571) 6 mm, complete with screwed gland, for sample gas compartment	<b>A27</b>	
• Connection pipe made of SS (type No. 1.4571) ¼", complete with screwed gland, for sample gas compartment	<b>A29</b>	
Slide rails (2 rails)	<b>A31</b>	
Set of Torx tools, socket spanner	<b>A32</b>	
Kalrez gaskets in sample gas path (O <sub>2</sub> compartment)	<b>B01</b>	
TAG labels (customer-defined inscriptions)	<b>B03</b>	
Kalrez gaskets in sample gas path (IR compartment)	<b>B04</b>	
CSA certificate – Class I Div 2	<b>E20</b>	
Clean for O <sub>2</sub> -Service (specially cleaned gas path (ULTRAMAT channel and OXYMAT channel)	<b>Y02</b>	→ <b>A22, A24</b>
Measuring range in plain text <sup>2)</sup> , if different from standard setting	<b>Y11</b>	
Special setting (only in conjunction with an application No., e.g. extended measuring range outside standard ranges, ULTRAMAT channel only)	<b>Y12</b>	
Extended special setting (only in conjunction with an application No., e.g. determination of cross-interferences, ULTRAMAT channel only)	<b>Y13</b>	
TÜV version according to 17. BImSch (ULTRAMAT channel only)	<b>Y17</b>	→ <b>E20</b>

Retrofitting sets	Order No.
RS 485/Ethernet converter	<b>C79451-A3364-D61</b>
RS 485/RS 232 converter	<b>C79451-Z1589-U1</b>
Autocal function with serial interface for the automotive industry (AK)	<b>C79451-A3480-D33</b>
Autocal function with 8 binary inputs/outputs for ULTRAMAT channel or OXYMAT channel	<b>C79451-A3480-D511</b>
Autocal function with 8 binary inputs/outputs and PROFIBUS PA for ULTRAMAT channel or OXYMAT channel	<b>A5E00057307</b>
Autocal function with 8 binary inputs/outputs und PROFIBUS DP for ULTRAMAT channel or OXYMAT channel	<b>A5E00057312</b>

- 1) Cannot be combined with non-flow-type reference side.
- 2) Standard setting: 

smallest possible measuring range	}	in % or ppm (vpm)
25% of largest possible range		
50% of largest possible range		
largest range		

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

## TÜV, single component (IR channel)

Component	CO (TÜV)		SO <sub>2</sub> (TÜV)		NO (TÜV)	
	Measuring range identification	Smallest measuring range from 0 to ...	Largest measuring range from 0 to ...	Smallest measuring range from 0 to ...	Largest measuring range from 0 to ...	Largest measuring range from 0 to ...
C			75 mg/m <sup>3</sup>	1500 mg/m <sup>3</sup>		
D	50 mg/m <sup>3</sup>	1000 mg/m <sup>3</sup>	300 mg/m <sup>3</sup>	3000 mg/m <sup>3</sup>		
E			500 mg/m <sup>3</sup>	5000 mg/m <sup>3</sup>	100 mg/m <sup>3</sup>	2000 mg/m <sup>3</sup>
F	300 mg/m <sup>3</sup>	3000 mg/m <sup>3</sup>	1000 mg/m <sup>3</sup>	10000 mg/m <sup>3</sup>	300 mg/m <sup>3</sup>	3000 mg/m <sup>3</sup>
G	500 mg/m <sup>3</sup>	5000 mg/m <sup>3</sup>			500 mg/m <sup>3</sup>	5000 mg/m <sup>3</sup>
H	1000 mg/m <sup>3</sup>	10000 mg/m <sup>3</sup>	3000 mg/m <sup>3</sup>	30000 mg/m <sup>3</sup>	1000 mg/m <sup>3</sup>	10000 mg/m <sup>3</sup>
K	3000 mg/m <sup>3</sup>	30000 mg/m <sup>3</sup>	10 g/m <sup>3</sup>	100 g/m <sup>3</sup>	3000 mg/m <sup>3</sup>	30000 mg/m <sup>3</sup>
P	10 g/m <sup>3</sup>	100 g/m <sup>3</sup>	30 g/m <sup>3</sup>	300 g/m <sup>3</sup>	10 g/m <sup>3</sup>	100 g/m <sup>3</sup>
R	30 g/m <sup>3</sup>	300 g/m <sup>3</sup>	100 g/m <sup>3</sup>	1000 g/m <sup>3</sup>	30 g/m <sup>3</sup>	300 g/m <sup>3</sup>
V	100 g/m <sup>3</sup>	1160 g/m <sup>3</sup>	300 g/m <sup>3</sup>	2630 g/m <sup>3</sup>	100 g/m <sup>3</sup>	1250 g/m <sup>3</sup>

### Example for ordering

ULTRAMAT/OXYMAT 6, TÜV  
IR channel  
Component CO  
Measuring range 0 ... 50/1000 mg/m<sup>3</sup>  
with hoses, non-flow-type reference compartment  
without automatic calibration (Autocal)  
230 V AC; English  
**7MB2023-0EA00-1XD1-Z +Y17**

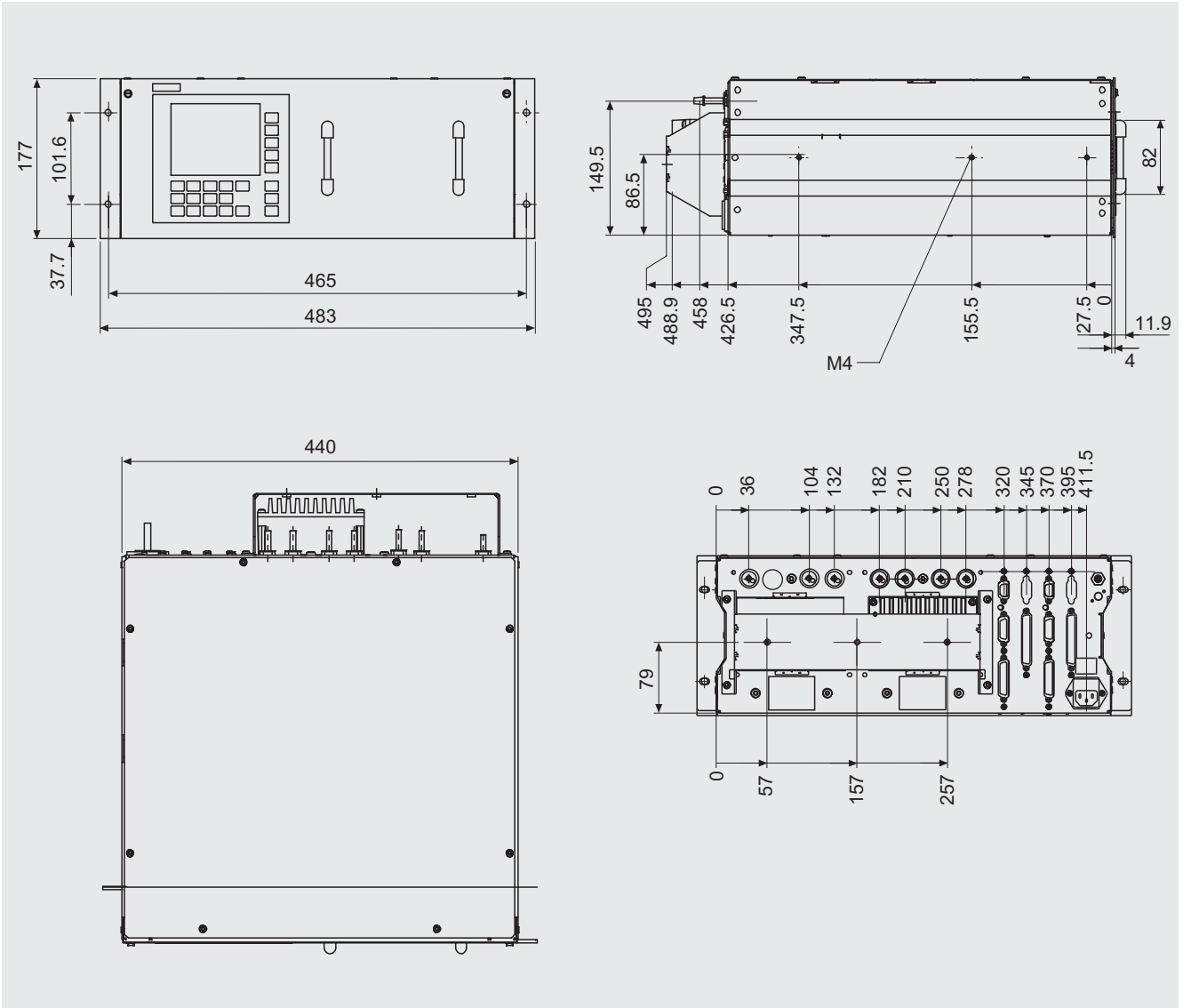
## TÜV, 2 components in series (IR channel)

Component	CO (TÜV)		NO (TÜV)	
	Smallest measuring range from 0 to ...	Largest measuring range from 0 to ...	Smallest measuring range from 0 to ...	Largest measuring range from 0 to ...
AH	75 mg/m <sup>3</sup>	1000 mg/m <sup>3</sup>	200 mg/m <sup>3</sup>	2000 mg/m <sup>3</sup>
AJ	300 mg/m <sup>3</sup>	3000 mg/m <sup>3</sup>	500 mg/m <sup>3</sup>	3000 mg/m <sup>3</sup>
AC	1000 mg/m <sup>3</sup>	10000 mg/m <sup>3</sup>	1000 mg/m <sup>3</sup>	10000 mg/m <sup>3</sup>

### Example for ordering

ULTRAMAT/OXYMAT 6, TÜV  
IR channel  
Components CO/NO  
Measuring range CO: 0 ... 75/1000 mg/m<sup>3</sup>  
NO: 0 ... 200/2000 mg/m<sup>3</sup>  
with hoses, non-flow-type reference compartment  
without automatic calibration (Autocal)  
230 V AC; English  
**7MB2024-0EA00-1AH1-Z +Y17+Y18**

Dimensional drawings



ULTRAMAT/OXYMAT 6, 19" unit, dimensions in mm

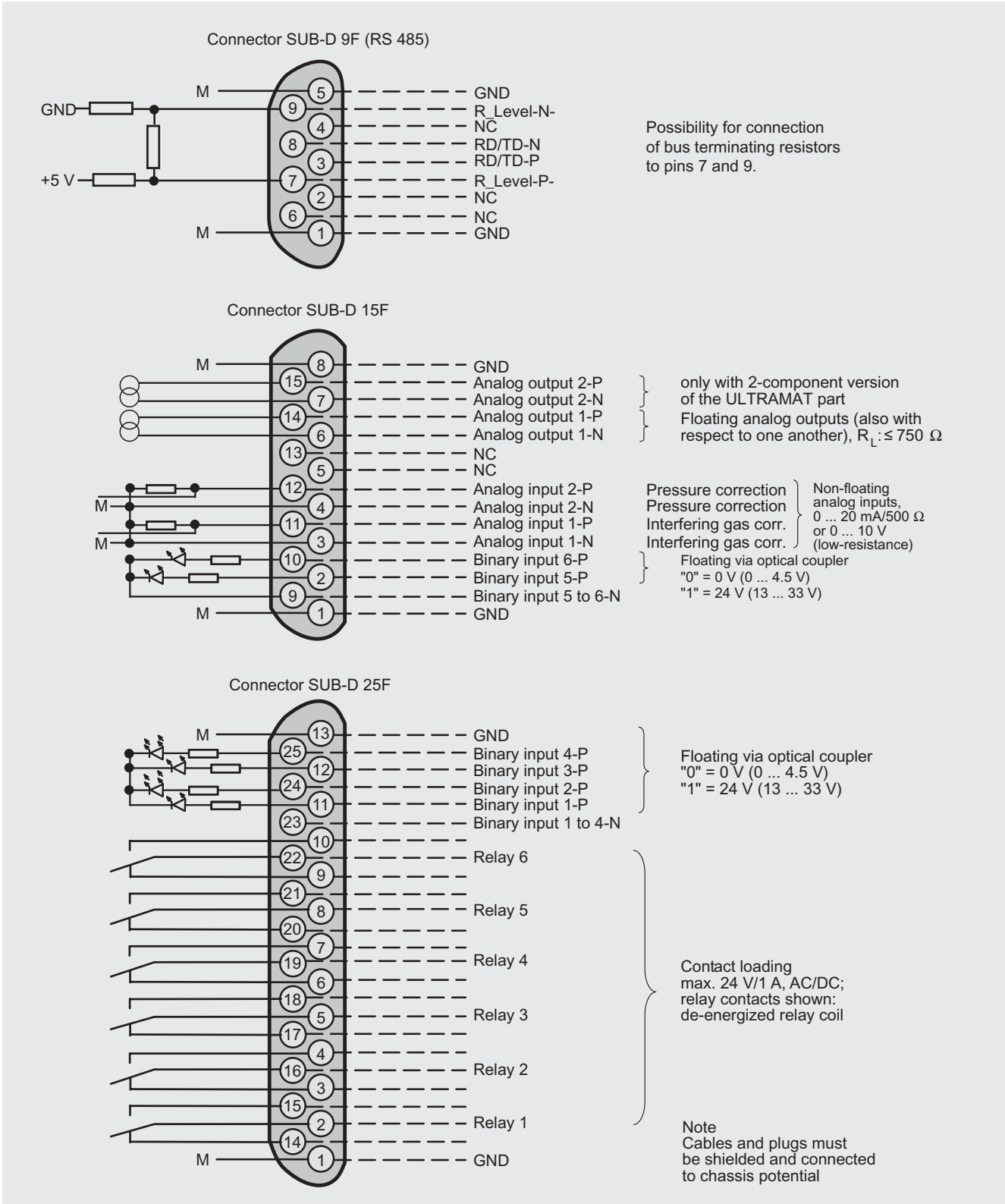
# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

## Schematics

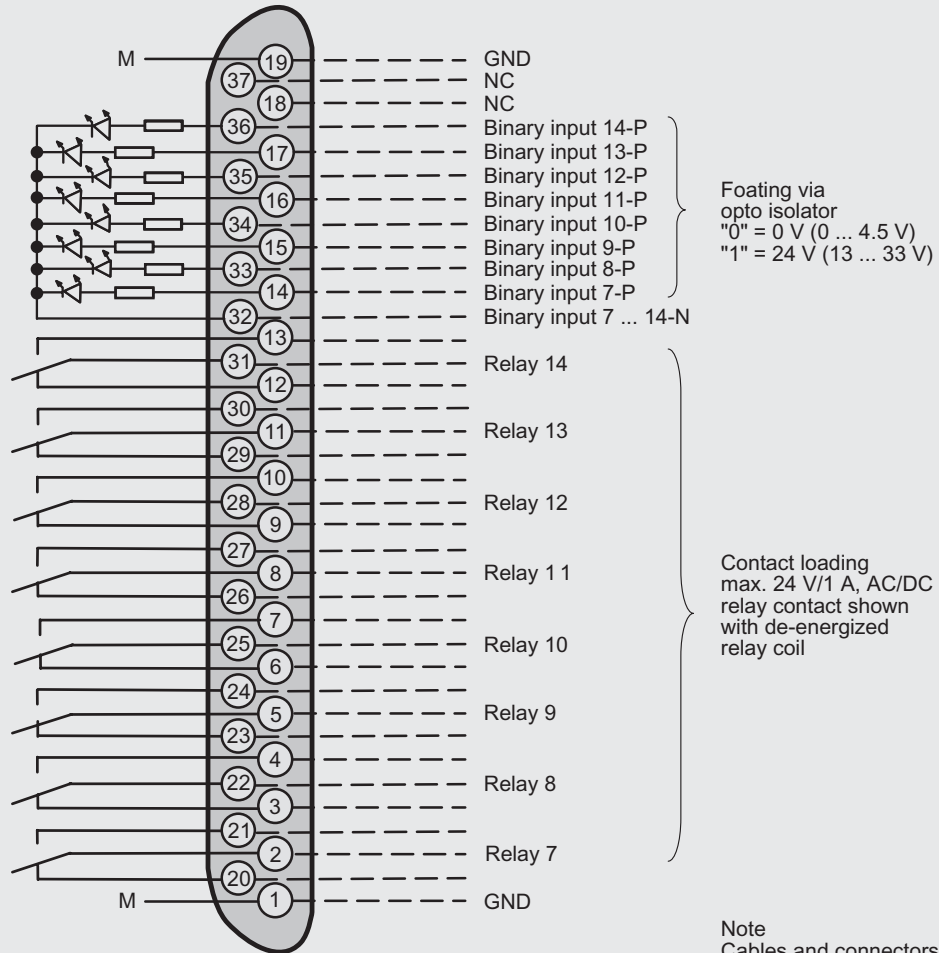
### Pin assignment (electrical and gas connections)

2



ULTRAMAT/OXYMAT 6, 19" unit, pin assignment

Connector SUB-D 37F (Option)

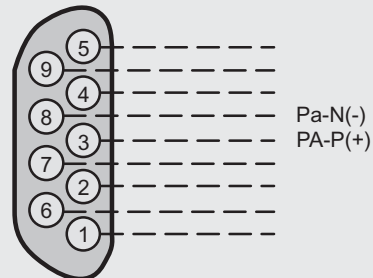
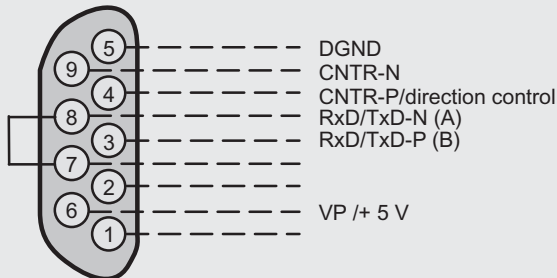


Note  
Cables and connectors must be shielded and connected to chassis potential.

Connector SUB-D 9F -X90  
PROFIBUS DP

optional

Connector SUB-D 9M -X90  
PROFIBUS PA

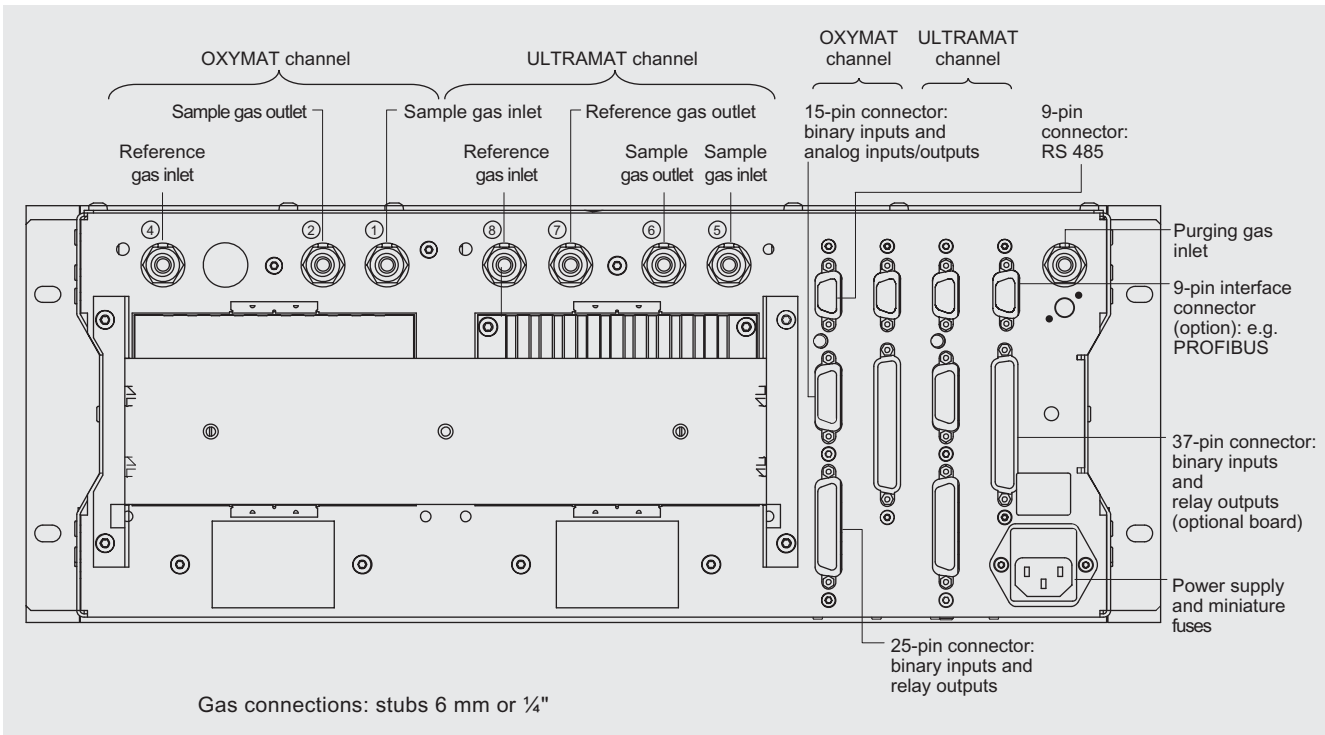


ULTRAMAT/OXYMAT 6, 19" unit, pin assignment of Autocal board and PROFIBUS connectors

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

19" unit

2



ULTRAMAT/OXYMAT 6, 19" unit, gas and electrical connections

### Selection and Ordering Data

Manual	Order No.
<b>ULTRAMAT 6 / OXYMAT 6</b> Gasanalysengerät für IR-absorbierende Gase und Sauerstoff (German)	<b>C79000-G5200-C143</b>
<b>ULTRAMAT 6 / OXYMAT 6</b> Gas Analyzers for IR-absorbing Gases and Oxygen (English)	<b>C79000-G5276-C143</b>
<b>ULTRAMAT 6 / OXYMAT 6</b> Analyseurs de gaz pour la mesure de composants infrarouges et doxygène (French)	<b>C79000-G5277-C143</b>
<b>ULTRAMAT 6 / OXYMAT 6</b> Analizadores para gases absorbentes de infrarrojo y oxígeno (Spanish)	<b>C79000-G5278-C143</b>
<b>ULTRAMAT 6 / OXYMAT 6</b> Analizzatori per i gas assorbenti raggi infrarossi ed ossigeno (Italian)	<b>C79000-G5272-C143</b>

# Continuous Gas Analyzers, extractive ULTRAMAT/OXYMAT 6

## Proposition of spare parts

### Selection and Ordering Data

Description	7MB2023	7MB2024	2 years (qty)	5 years (qty)	Order No.
<b>Analyzer section</b>					
<u>Analyzer section, ULTRAMAT channel</u>					
• O-ring for hose cell	x	x	1	2	C75121-Z101-C1
• O-ring for chopper	x	x	1	2	C75121-Z101-C2
• O-ring for reflector	x	x	1	2	C75121-Z101-C3
• O-ring for cover (window, front side)	x	x	2	2	C75121-Z101-C4
• O-ring for cooler element	x	x	1	1	C75121-Z101-C5
• O-ring for cover (window, rear side)	x	x	2	2	C79121-Z100-A24
• IR source	x	x	1	1	C79451-A3462-B12
• Cover (cell length 20 mm ... 180 mm)	x	x	2	2	C79451-A3462-B151
• Cover (cell length 0.2 mm ... 6 mm)	x	x	2	2	C79451-A3462-B152
• O-rings, set	x	x	—	1	C79451-A3462-D501
<u>Analyzer section, OXYMAT channel</u>					
• O-ring	x	x	1	2	C74121-Z100-A6
• O-ring (measuring head)	x	x	2	4	C79121-Z100-A32
• Spacer	x	x	—	1	C79451-A3277-B22
• Sample cell, SS, type No. 1.4571, non-flow-type compensation branch	x	x	—	1	C79451-A3277-B535
• Sample cell, tantalum, non-flow-type compensation branch	x	x	—	1	C79451-A3277-B536
• Sample cell, SS, type No. 1.4571, flow-type compensation branch	x	x	—	1	C79451-A3277-B537
• Sample cell, tantalum, flow-type compensation branch	x	x	—	1	C79451-A3277-B538
• Measuring head, non-flow-type compensation branch	x	x	1	1	C79451-A3460-B525
• Measuring head, flow-type compensation branch	x	x	1	1	C79451-A3460-B526
<b>Sample gas path</b>					
O-ring (stubs)	x	x	2	4	C71121-Z100-A159
Pressure switch	x	x	1	2	C79302-Z1210-A2
Flowmeter (only version with pump)	x	x	1	1	C79402-Z560-T1
<u>Sample gas path, ULTRAMAT channel</u>					
• O-ring (chopper)	x	x	1	2	C75121-Z100-C3
• Stubs	x	x	—	1	C79451-A3478-C9
<u>Sample gas path, OXYMAT channel</u>					
• Restriction, SS, type No. 1.4571, pipe gas path	x		2	2	C79451-A3480-C10
• Restriction, titanium, pipe gas path	x	x	2	2	C79451-A3480-C37
• Reference gas path, 3000 hPa	x	x	1	1	C79451-A3480-D518
• Capillary tube, 100 hPa, connection set	x	x	1	1	C79451-A3480-D519
• Restriction, SS, type No. 1.4571, pipe gas path	x	x	1	1	C79451-A3250-C5
<b>Electronics</b>					
Front panel with keyboard	x	x	1	1	C79165-A3042-B506
Adapter board, LCD/ keyboard	x	x	1	1	C79451-A3474-B605
LC display	x	x	1	1	W75025-B5001-B1
Connector filter	x	x	—	1	W75041-E5602-K2
Fuse link, T 0.63/250 V	x	x	2	3	W75054-L1010-T630
Fuse link, 1 A, 110/220 V	x	x	2	3	W75054-L1011-T100
Fuse link, 2.5 A, 250 V	x	x	2	3	W75054-L1011-T250
<u>Electronics, ULTRAMAT channel</u>					
• Motherboard, without firmware	x	x	—	1	C79451-A3474-B620
• Fuse link, 1.6 A, 250 V	x	x	2	3	W75054-L1011-T160
<u>Electronics, OXYMAT channel</u>					
• Motherboard, without firmware	x	x	—	1	C79451-A3474-B601
• Temperature fuse	x	—	—	1	W75054-T1001-A150

If the unit was delivered with specially cleaned gas path for high oxygen content (so-called "Cleaned for O<sub>2</sub> service"), please absolutely specify it for a spare part order. This is the only way to guarantee that the gas path furthermore corresponds to the special requirements for this variant.