

### Overview



Up to four gas components can be measured continuously at the same time with the ULTRAMAT 23 gas analyzer. The device can be equipped with the following sensors:

- IR detector for IR-active gases
- UV photometer for UV-active gases
- H<sub>2</sub>S sensor (electrochemical)
- O<sub>2</sub> sensor (electrochemical)
- O<sub>2</sub> sensor (paramagnetic)
- With the ULTRAMAT 23 gas analyzer for use in biogas plants, up to four gas components can be measured continuously: two infrared-sensitive gases (CO<sub>2</sub> and CH<sub>4</sub>), plus O<sub>2</sub> and H<sub>2</sub>S with electrochemical measuring cells.
- Up to four gas components can be measured continuously using the ULTRAMAT 23 gas analyzer with paramagnetic oxygen cell: three infrared-sensitive gases, plus O<sub>2</sub> ("dumbbell" measuring cell).
- With the ULTRAMAT 23 gas analyzer with UV photometer, one infrared-sensitive gas, UV-active gases (SO<sub>2</sub>, NO<sub>2</sub>) as well as O<sub>2</sub> can be measured with an electrochemical sensor.

### Benefits

- AUTOCAL with ambient air (depending on on the measured component)
  - Highly cost-effective as calibration gases are not required
- High selectivity thanks to multi-layer detectors, e.g. low cross-sensitivity to water vapor
- Analyzer cells can be cleaned on site as required
  - Cost savings due to reuse after contamination
- Menu-assisted operation in plain text
  - No manual required for operation, high level of operator safety
- Service information and logbook
  - Preventive maintenance; help for service and maintenance personnel; cost savings
- Coded input levels protect against unauthorized access
  - Increased safety
- Open interface architecture (RS 485, RS 232, PROFIBUS, SIPROM GA)
  - Simplified process integration; remote operation and control

### Special benefits when used in biogas plants

- Continuous measurement of all four key components, including H<sub>2</sub>S
- Long service life of the H<sub>2</sub>S sensor even at increased concentrations; no diluting or backflushing necessary
- Introduction and measurement of flammable gases as occurring in biogas plants (e.g. 70% CH<sub>4</sub>), is permissible (TÜV certification)

# Extractive continuous process gas analysis

## ULTRAMAT 23

### General information

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#### Application

##### Areas of application

- Optimization of small firing systems
- Monitoring of exhaust gas concentration from firing systems with all types of fuel (oil, gas and coal) as well as operational measurements with thermal incineration plants
- Room air monitoring
- Monitoring of air in fruit stores, greenhouses, fermenting cellars and warehouses
- Monitoring of process control functions
- Atmosphere monitoring during heat treatment of steel
- For use in non-potentially-explosive atmospheres

##### Application areas in biogas plants

- Monitoring of fermenters for generating biogas (input and pure sides)
- Monitoring of gas-driven motors (power generation)
- Monitoring of feeding of biogas into the commercial gas network

##### Application area of paramagnetic oxygen sensor

- Flue gas analysis
- Inerting plants
- Room air monitoring
- Medical engineering

##### Further applications

- Environmental protection
- Chemical plants
- Cement industry

##### Special versions

##### Separate gas paths

The ULTRAMAT 23 with 2 IR components without pump is also available with two separate gas paths. This allows the measurement of two measuring points as used e.g. for the NO<sub>x</sub> measurement before and after the NO<sub>x</sub> converter.

The ULTRAMAT 23 gas analyzer can be used in emission measuring systems and for process and safety monitoring.

##### Versions conforming to EN 14181 and EN 15267

According to EN 14181, which is standardized in the EU and required in many European countries, a QAL 1 qualification test, i.e. certification of the complete measuring system including gas paths and conditioning, is required for continuous emission monitoring systems (CEMS). In accordance with EN 15267, this must be performed by an independent accredited authority. In Germany, for example, the test is performed by the German Technical Inspectorate (TÜV) and the test report is submitted to the Federal/State Workgroup for Emission Control (Bund/Länder-Arbeitsgemeinschaft für Immissionsschutz - LAI) for examination/approval. Notification is also issued by the German Federal Environment Agency (Umweltbundesamt - UBA) in the Federal Gazette as well as by the German Technical Inspectorate (TÜV) <http://www.qal1.en>.

In Britain, the QAL 1 test reports are prepared by Sira Environmental of the Environmental Agency in accordance with the MCERTS scheme and submitted for approval and publication on the SIRA Environmental websites. The other European countries rely either on the German or English certification scheme.

For use in EN 14181 applications, the devices with the article numbers 7MB235X in the CEM CERT set (7MB1957) have undergone qualification testing according to German standards of EN 15267. These German Technical Inspectorate versions of the ULTRAMAT are suitable for measurement of CO, NO, SO<sub>2</sub> and O<sub>2</sub> according to 13th and 27th BImSchV as well as TA Luft. Smallest measuring range tested and approved by the German Technical Inspectorate:

1 and 2-component analyzer

- CO: 0 to 150 mg/m<sup>3</sup>
- NO: 0 to 150 mg/m<sup>3</sup>
- SO<sub>2</sub>: 0 to 400 mg/m<sup>3</sup>

3-component analyzer

- CO: 0 to 250 mg/m<sup>3</sup>
- NO: 0 to 250 mg/m<sup>3</sup>
- SO<sub>2</sub>: 0 to 400 mg/m<sup>3</sup>

Also tested as additional measuring ranges in accordance with EN 15267-3:

- CO: 0 to 1 250 mg/m<sup>3</sup>
- NO: 0 to 2 000 mg/m<sup>3</sup>
- SO<sub>2</sub>: 0 to 7 000 mg/m<sup>3</sup>

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

##### Version with faster response time

The connection between the two condensation traps is equipped with a stopper to lead the complete flow through the measuring cell (otherwise only 1/3 of the flow), i.e. the response time is 2/3 faster. The functions of all other components remain unchanged

##### Chopper compartment purging

Consumption 100 ml/min (upstream pressure: approx. 3 000 hPa)

### Design

- 19" rack unit with 4 HU for installation
  - In hinged frame
  - in cabinets
- Flow indicator for sample gas on front plate; option: integrated sample gas pump (standard for bench-top version)
- Gas connections for sample gas inlet and outlet as well as zero gas; pipe diameter 6 mm or ¼"
- Gas and electrical connections at the rear (portable version: sample gas inlet at front)

### Display and control panel

- Operation based on NAMUR recommendation
- Simple, fast parameterization and commissioning of analyzer
- Large, backlit LCD for measured values
- Menu-driven inputs for parameterization, test functions and calibration
- Washable membrane keyboard
- User help in plain text
- 6-language operating software

### Inputs/outputs

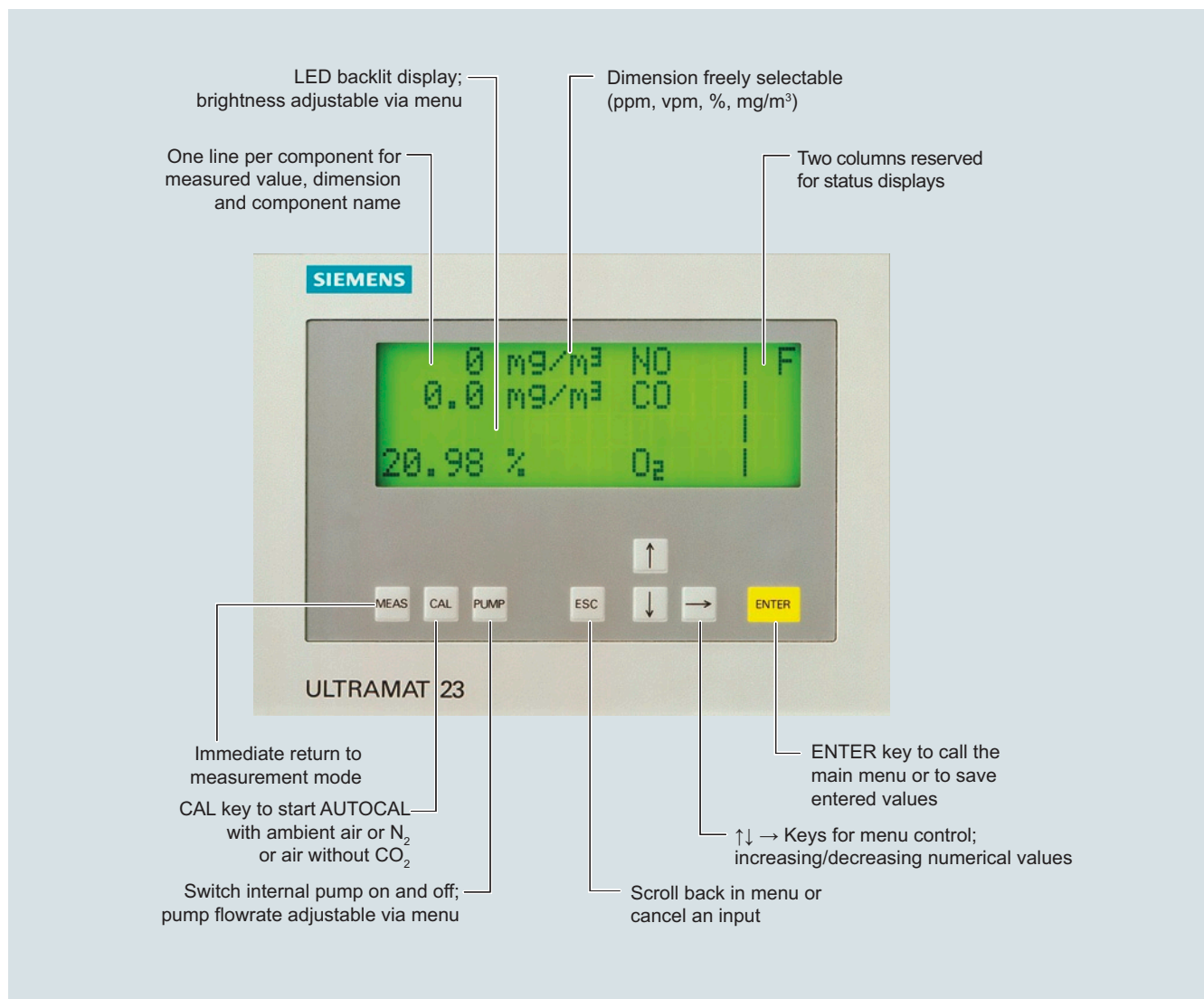
- Three digital inputs for sample gas pump On/Off, triggering of AUTOCAL and synchronization of several devices
- Eight relay outputs can be freely configured for fault, maintenance request, maintenance switch, limits, measuring range identification and external solenoid valves
- Eight additional digital inputs and relay outputs as an option
- Galvanically isolated analog outputs

### 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
- Incorporation in networks via PROFIBUS DP/PA interface
- SIPROM GA software as service and maintenance tool



ULTRAMAT 23, membrane keyboard and graphic display

**Extractive continuous process gas analysis****ULTRAMAT 23****General information****Designs – parts wetted by sample gas**

<b>Gas path</b>	<b>19" rack unit</b>	<b>Desktop unit</b>	
<b>With hoses</b>	Condensation trap/gas inlet	-	PA (polyamide)
	Condensation trap	-	PE (polyethylene)
	Gas connections 6 mm	PA (polyamide)	PA (polyamide)
	Gas connections 1/4"	Stainless steel, mat. no. 1.4571	Stainless steel, mat. no. 1.4571
	Hose	FPM (Viton)	FPM (Viton)
	Pressure switch	FPM (Viton) + PA6-3-T (Trogamide)	FPM (Viton) + PA6-3-T (Trogamide)
	Flowmeter	PDM/Duran glass/X10CrNiTi1810	PDM/Duran glass/X10CrNiTi1810
	Elbows/T-pieces	PA6	PA6
	Internal pump, option	PVDF/PTFE/EPDM/FPM/Trolene/ stainless steel, mat. no. 1.4571	PVDF/PTFE/EPDM/FPM/Trolene/ stainless steel, mat. no. 1.4571
	Solenoid valve	FPM70/Ultramide/ stainless steel, mat. no. 1.4310/1.4305	FPM70/Ultramide/ stainless steel, mat. no. 1.4310/1.4305
	Safety condensation trap	PA66/NBR/PA6	PA66/NBR/PA6
	Analyzer chamber		
	<ul style="list-style-type: none"> <li>• Body</li> <li>• Lining</li> <li>• Fitting</li> </ul>	Aluminum Aluminum Stainless steel, black anodized, mat. no. 1.4571	Aluminum Aluminum, black anodized Stainless steel, mat. no. 1.4571
	<ul style="list-style-type: none"> <li>• Window</li> <li>• Adhesive</li> <li>• O-ring</li> </ul>	CaF <sub>2</sub> , quartz E353 FPM (Viton)	CaF <sub>2</sub> E353 FPM (Viton)
<b>With pipes, only available in version "without pump"</b>	Gas connections 6 mm / 1/4"	Stainless steel, mat. no. 1.4571	
	Pipes	Stainless steel, mat. no. 1.4571	
	Analyzer chamber		
	<ul style="list-style-type: none"> <li>• Body</li> <li>• Lining</li> <li>• Fitting</li> </ul>	Aluminum Aluminum Stainless steel, mat. no. 1.4571	
	<ul style="list-style-type: none"> <li>• Window</li> <li>• Adhesive</li> <li>• O-ring</li> </ul>	CaF <sub>2</sub> E353 FPM (Viton)	

ULTRAMAT 23 also available as bench-top unit:

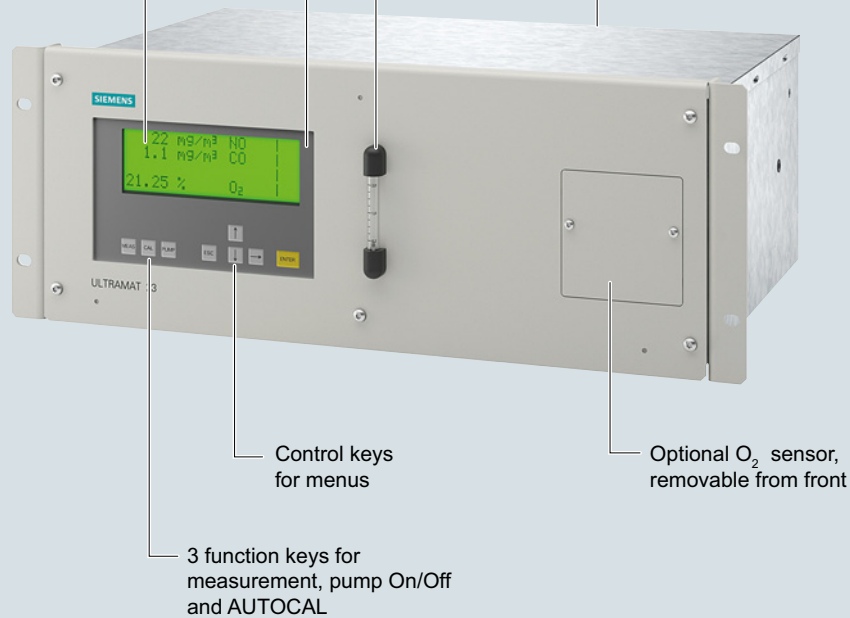
- 2 handles on top cover
- 4 rubber feet for setting up
- No mounting frame

80-digit display  
(4 lines/20 characters)

Dust-tight and washable  
membrane keypad

Flowmeter in conjunction with  
pressure switch for monitoring  
the sample gas flow

Gas and electrical  
connections on rear  
panel (portable version  
simple gas at front)



Control keys  
for menus

Optional O<sub>2</sub> sensor,  
removable from front

3 function keys for  
measurement, pump On/Off  
and AUTO CAL

ULTRAMAT 23, design

# Extractive continuous process gas analysis

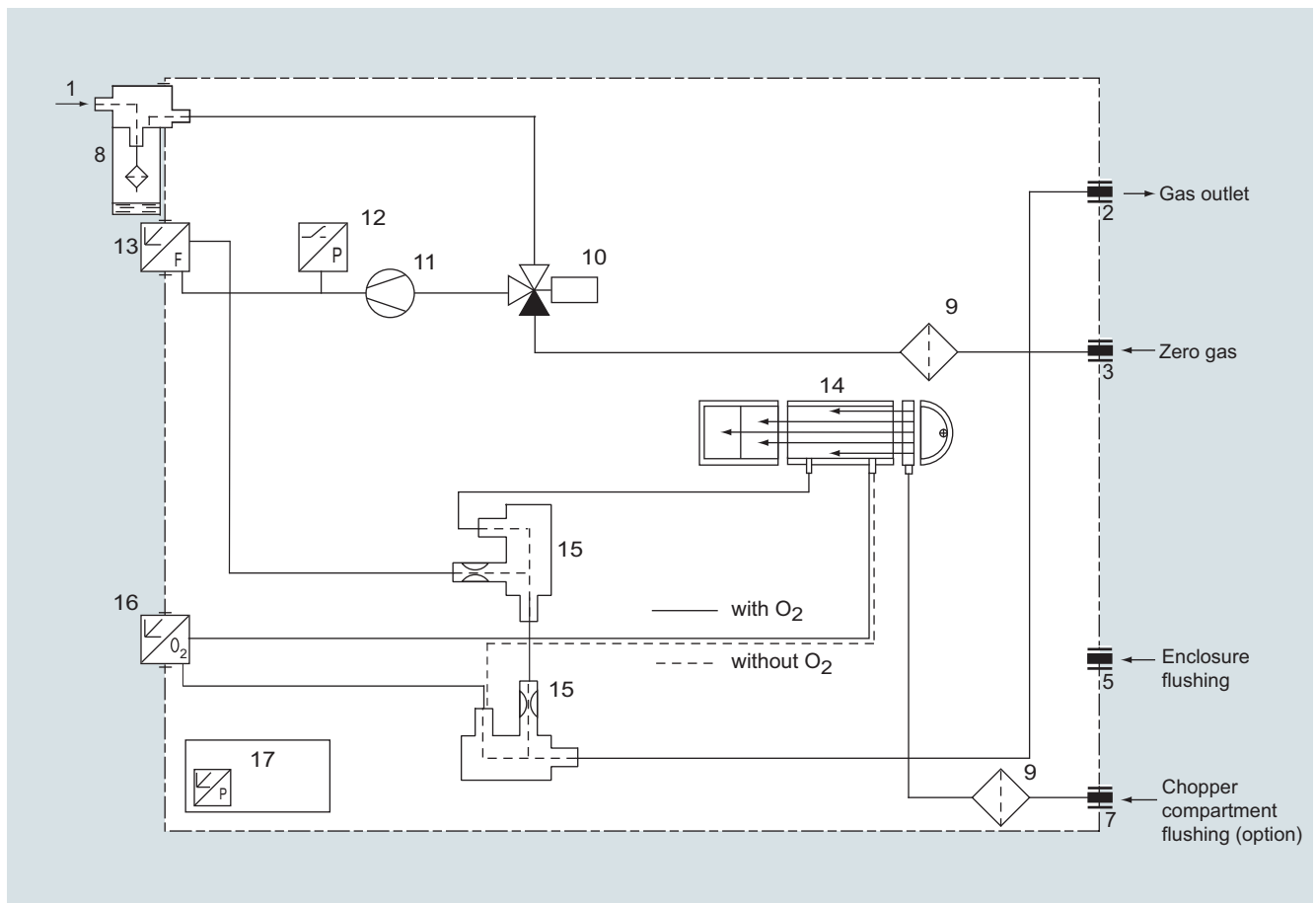
## ULTRAMAT 23

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#### Gas path

##### Legend for the gas path figures

1	Inlet for sample gas/calibration gas	11	Sample gas pump
2	Gas outlet	12	Pressure switch
3	Inlet for AUTOCAL/zero gas or inlet for sample gas/calibration gas (channel 2)	13	Flow indicator
4	Gas outlet (channel 2)	14	Analyzer unit
5	Enclosure purging	15	Safety condensation trap
6	Enclosure purging	16	Oxygen sensor (electrochemical)
7	Inlet of atmospheric pressure sensor	17	Atmospheric pressure sensor
8	Inlet of chopper compartment purging	18	Hydrogen sulfide sensor
9	Condensation trap with filter	19	Oxygen measuring cell (paramagnetic)
10	Safety fine filter	20	UV photometer (UV module)

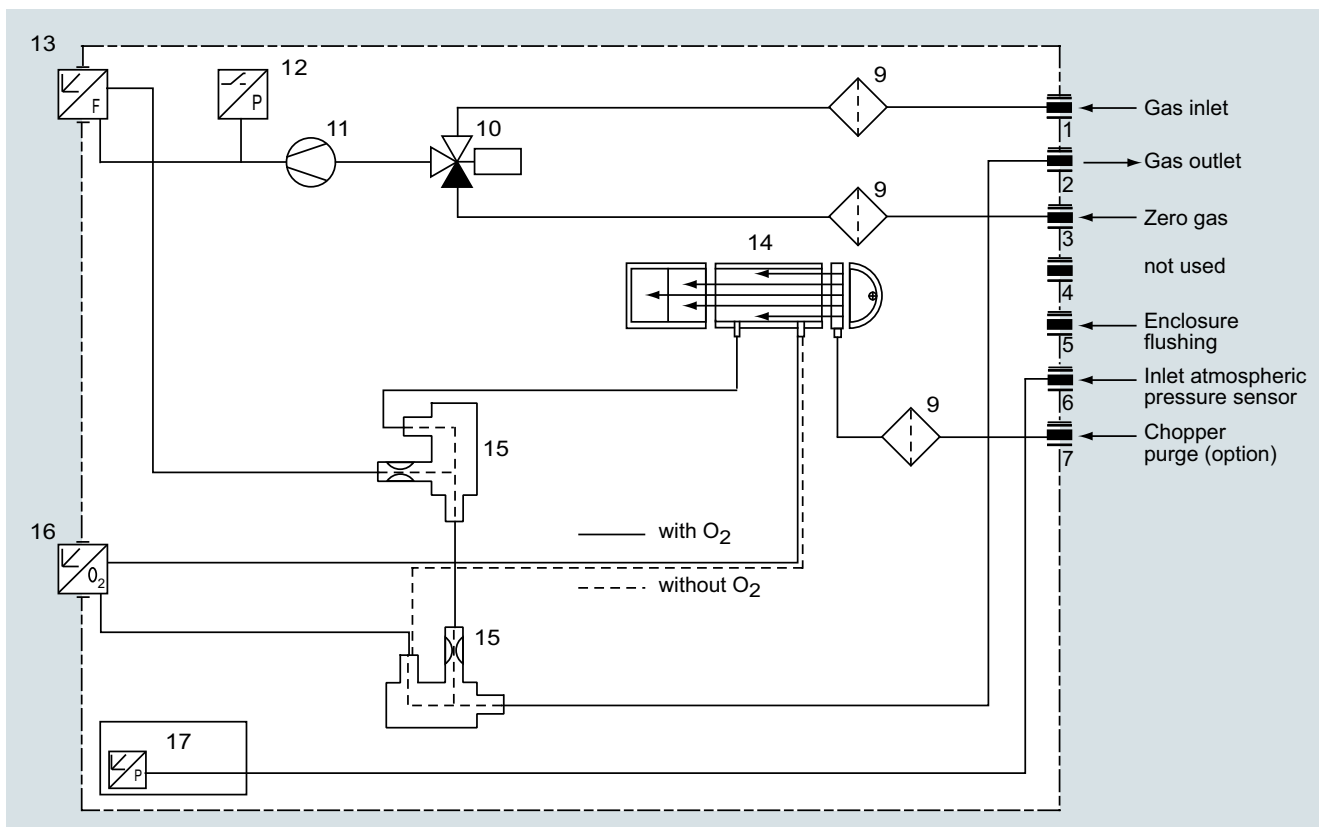


ULTRAMAT 23, portable, in sheet-steel housing with internal sample gas pump, condensation trap with safety filter on front plate, optional oxygen measurement

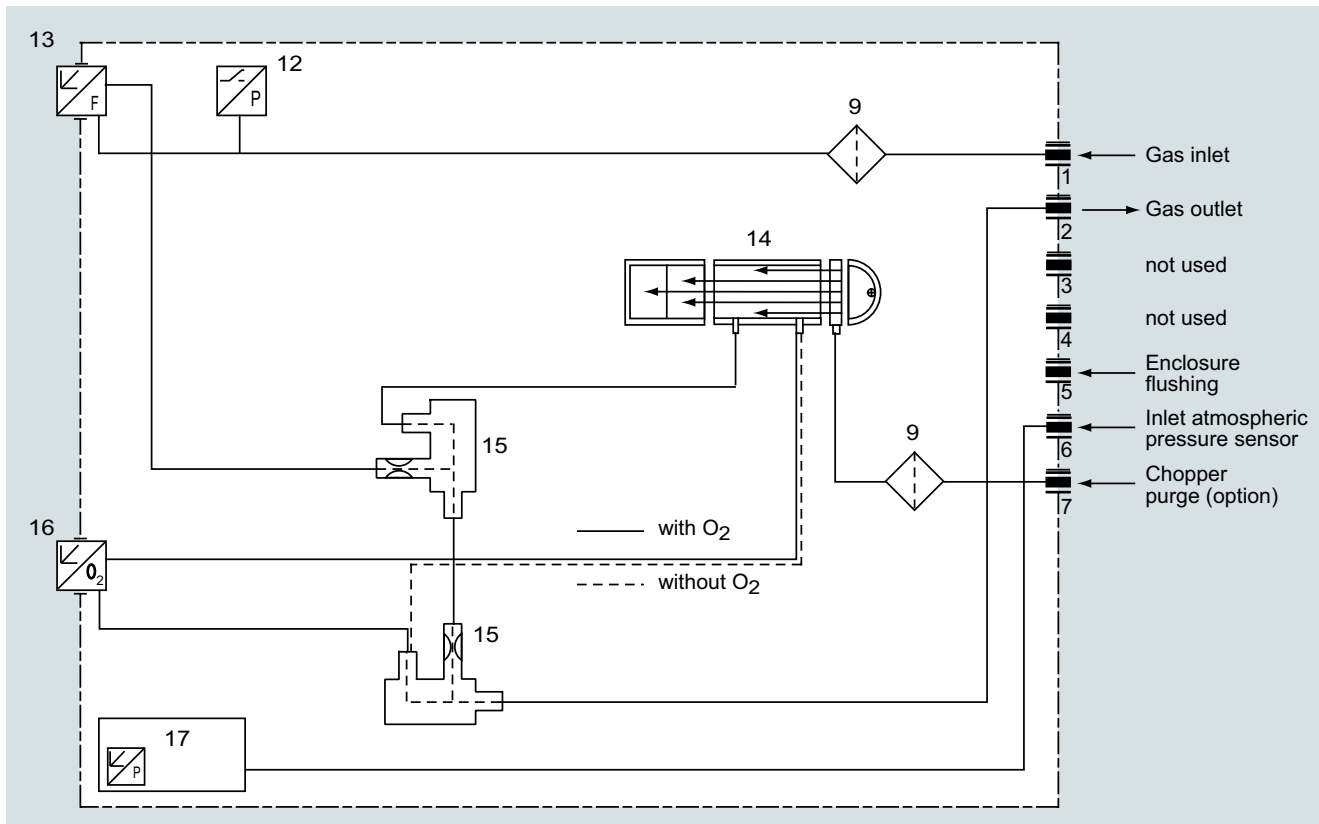
# Extractive continuous process gas analysis ULTRAMAT 23

## General information

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ULTRAMAT 23, 19" rack-mounted enclosure with internal sample gas pump; optional oxygen measurement



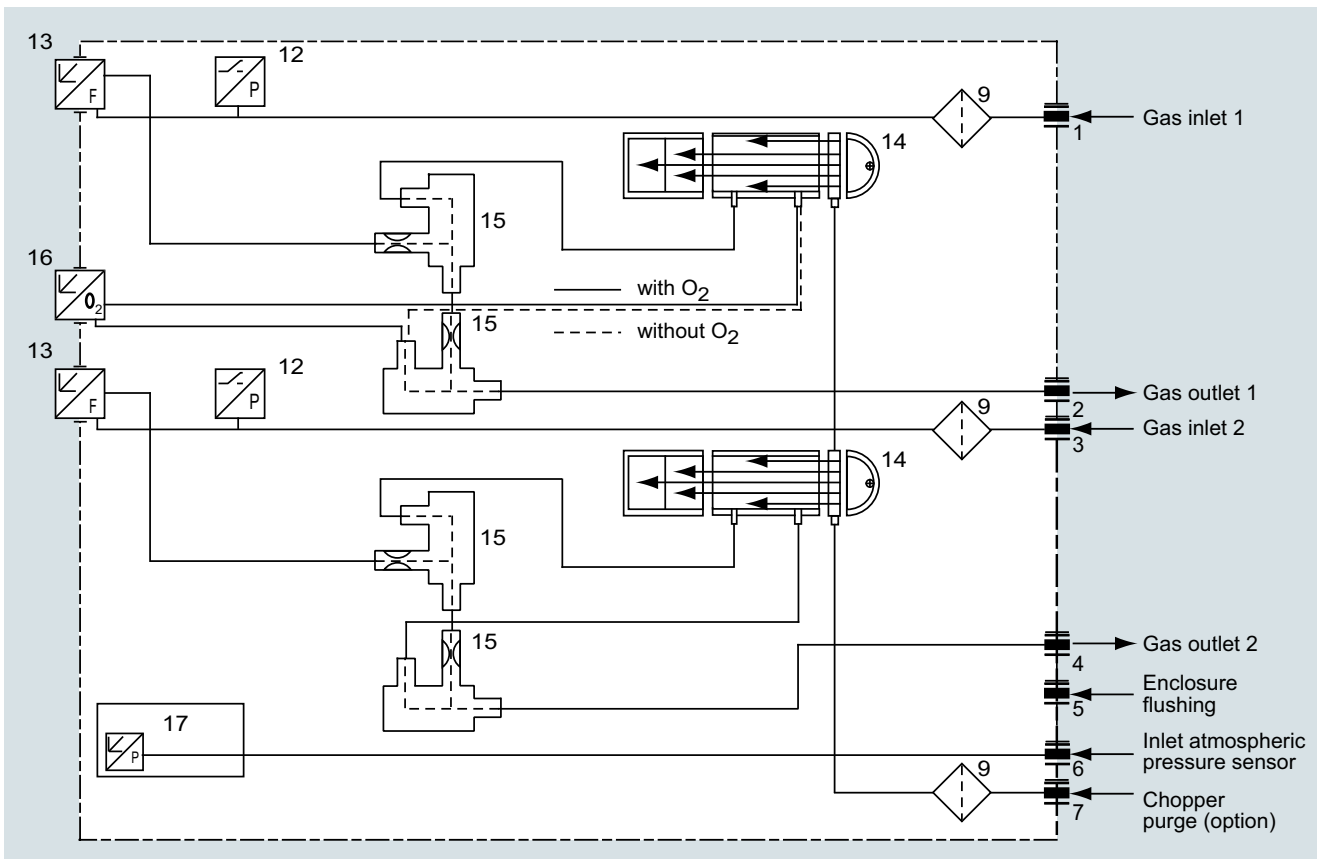
ULTRAMAT 23, 19" rack-mounted enclosure without internal sample gas pump; optional oxygen measurement

# Extractive continuous process gas analysis

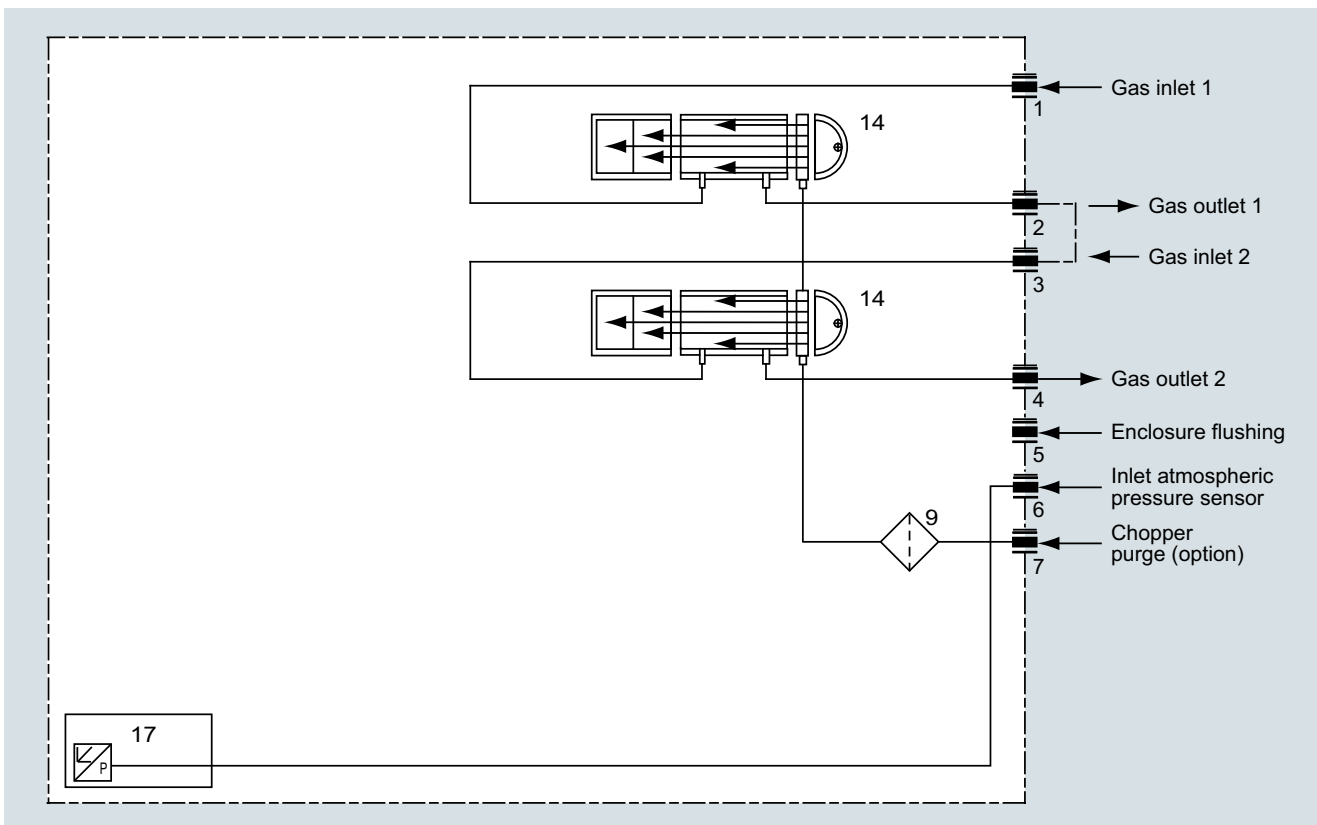
## ULTRAMAT 23

### General information

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ULTRAMAT 23, 19" rack unit housing without internal sample gas pump, with separate gas path for the 2nd measured component or for the 2nd and 3rd measured component, optional oxygen measurement



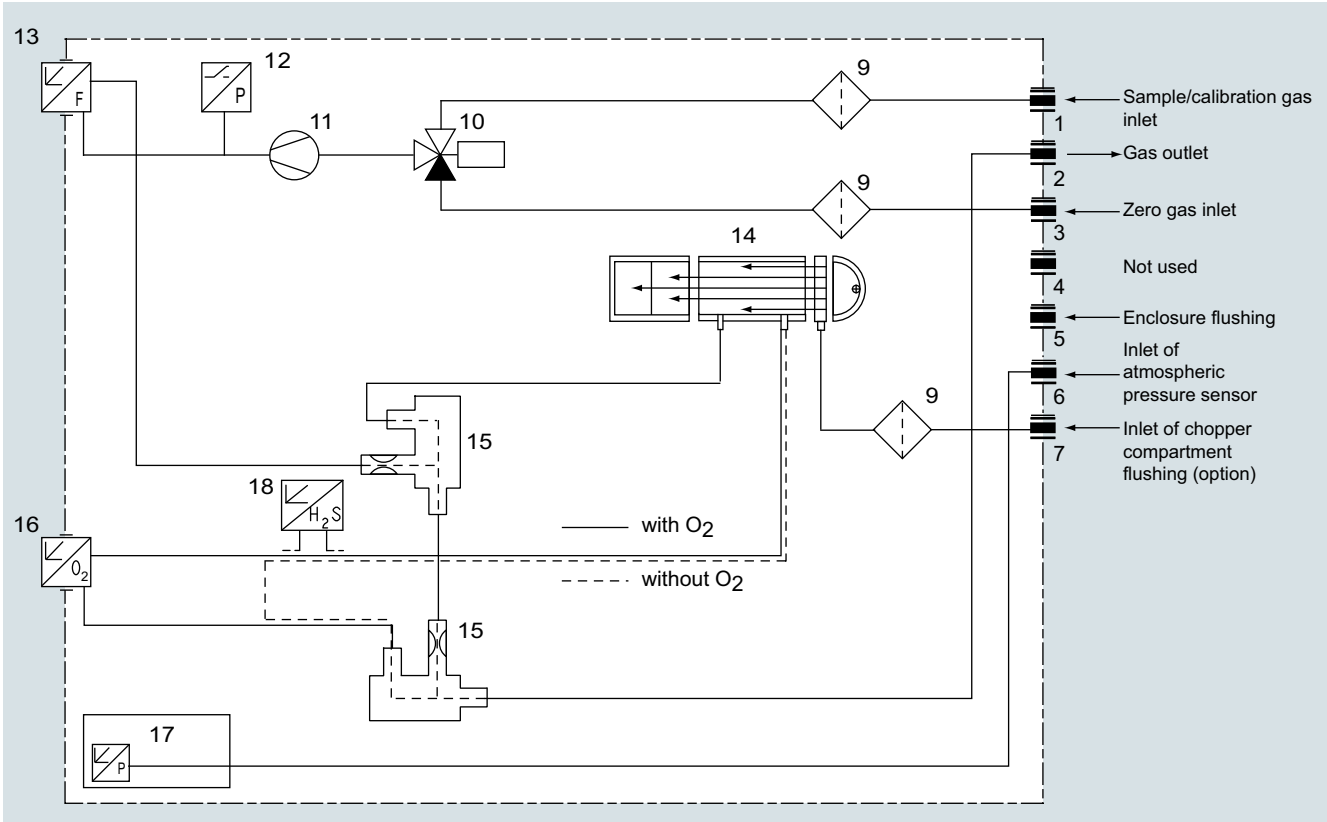
ULTRAMAT 23, 19" rack-mounted enclosure, sample gas path version in pipes, separate gas path, always without sample gas pump, without safety filter and without safety condensation trap



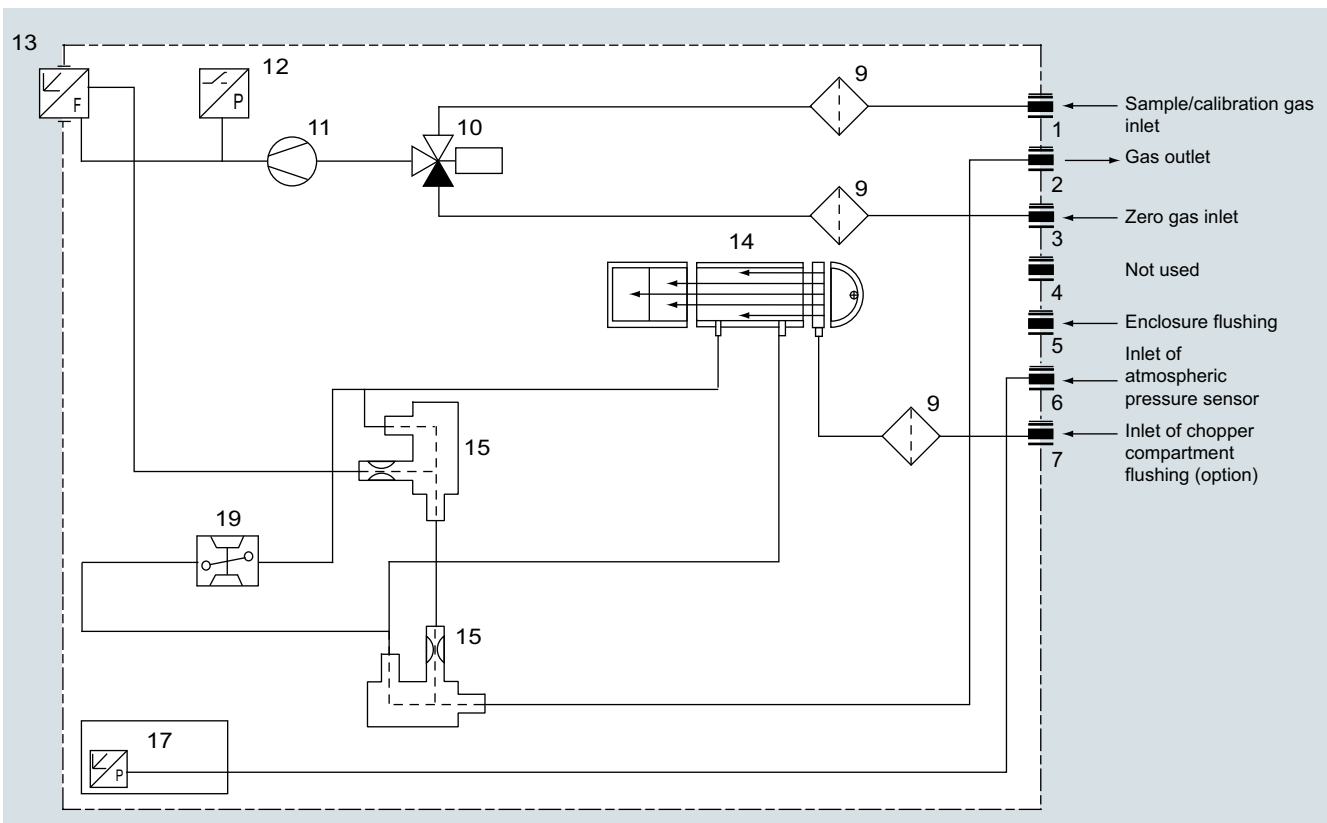
# Extractive continuous process gas analysis ULTRAMAT 23

## General information

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ULTRAMAT 23, 19" rack-mounted enclosure with internal sample gas pump and H<sub>2</sub>S sensor



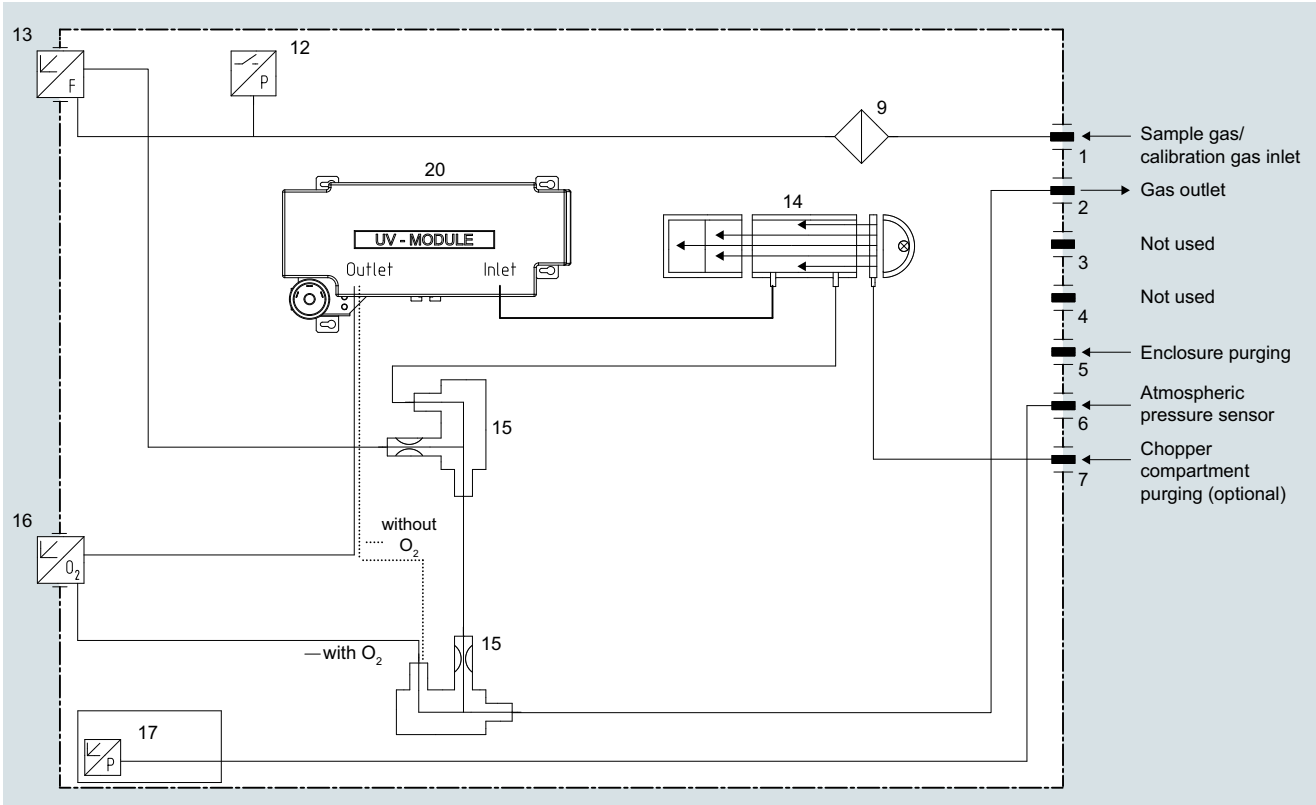
ULTRAMAT 23, 19" rack-mounted enclosure with internal sample gas pump and paramagnetic oxygen measurement

# Extractive continuous process gas analysis

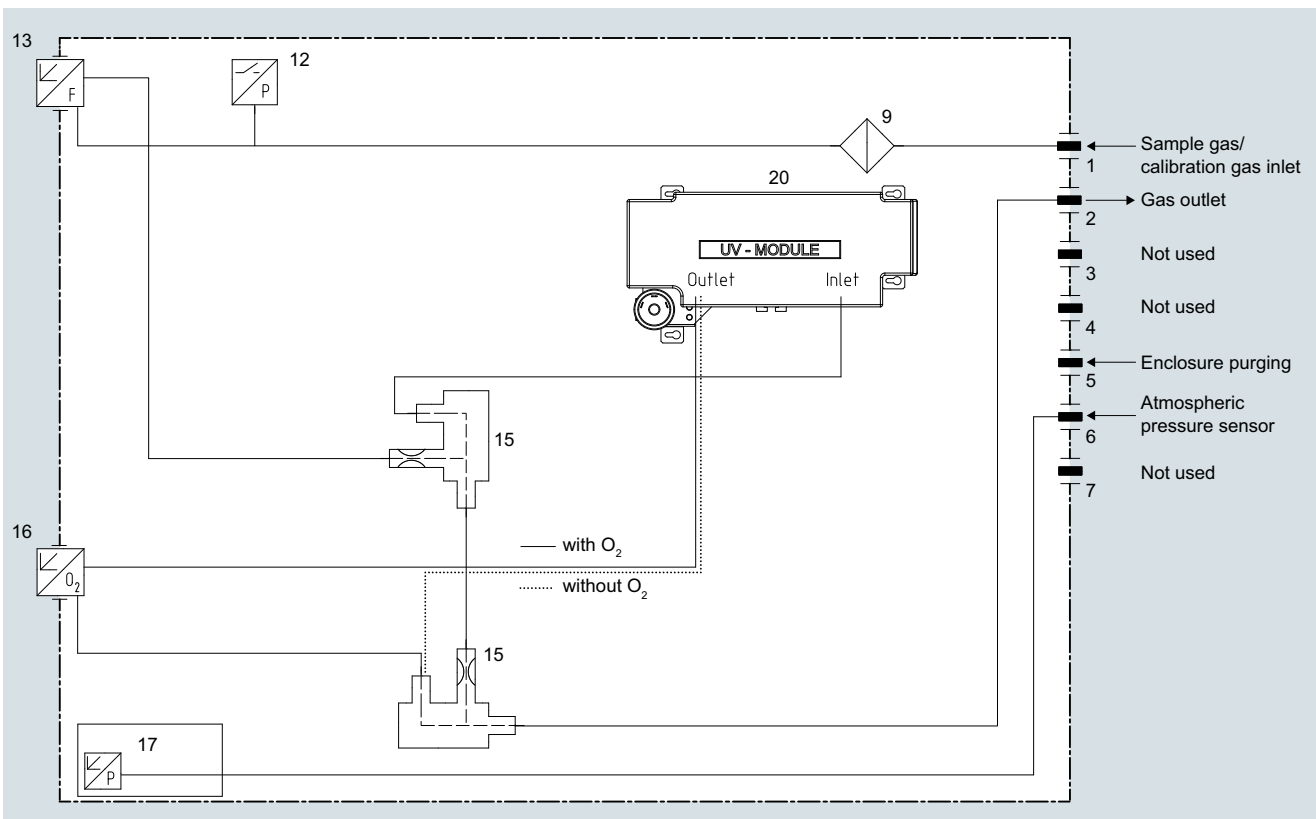
## ULTRAMAT 23

### General information

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ULTRAMAT 23, 19" rack unit enclosure with IR detector, UV photometer (UV module); optional oxygen measurement



ULTRAMAT 23, 19" rack-mounted enclosure with UV photometer (UV module); optional oxygen measurement

### Function

The ULTRAMAT 23 uses multiple independent measuring principles which work selectively.

#### Infrared measurement

The measuring principle of the ULTRAMAT 23 is based on the molecule-specific absorption of bands of infrared radiation, which in turn is based on the "single-beam procedure". A radiation source (7) operating at 600 °C emits infrared radiation, which is then modulated by a chopper (5) at 8 1/3 Hz.

The IR radiation passes through the sample chamber (4), into which sample gas is flowing, and its intensity is weakened as a function of the concentration of the measured component.

The receiver chamber - set up as a two- or three-layer detector - is filled with the component to be measured.

The first detector layer (11) primarily absorbs energy from the central sections of the sample gas IR bands. Energy from the peripheral sections of the bands is absorbed by the second (2) and third (12) detector layers.

The microflow sensor generates a pneumatic connection between the upper layer and the lower layers. Negative feedback from the upper and lower layers leads to an overall narrowing of the spectral sensitivity band. The volume of the third layer and, therefore, the absorption of the bands, can be varied using a "slide switch" (10), thereby increasing the selectivity of each individual measurement.

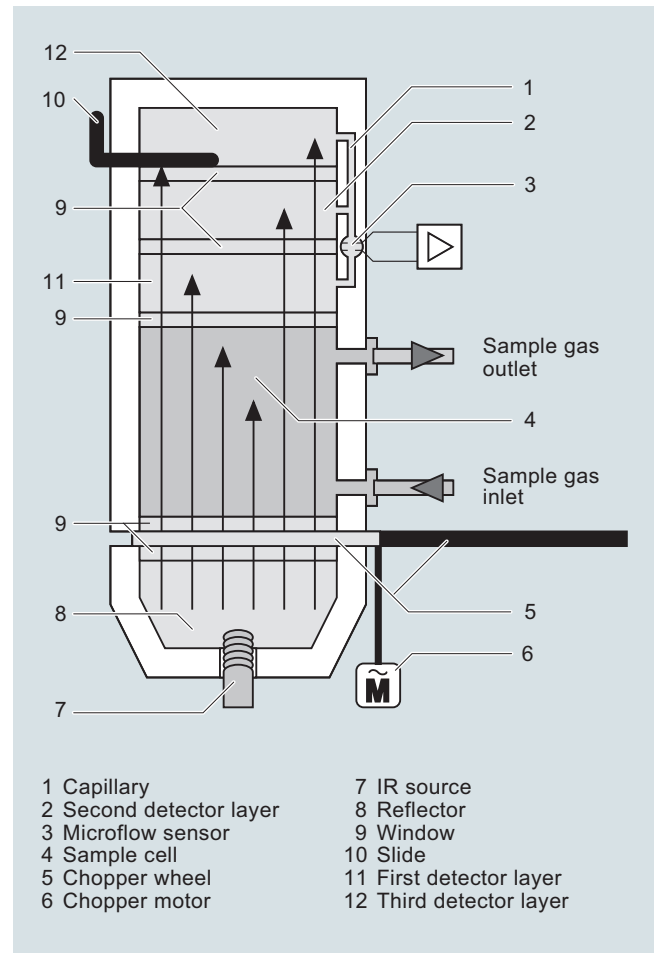
The rotating chopper (5) generates a pulsating flow in the receiver chamber that the microflow sensor (3) converts into an electrical signal.

The microflow sensor consists of two nickel-plated grids heated to approximately 120 °C, which, along with two supplementary resistors, form a Wheatstone bridge. The pulsating flow together with the dense arrangement of the Ni grids causes 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 must be fed into the analyzers free of dust. Condensation in the sample chambers must be prevented. Therefore, the use of gas modified for the measuring task is necessary in most application cases.

As far as possible, the ambient air of the analyzer should also not have a large concentration of the gas components to be measured.



ULTRAMAT 23, principle of operation of the infrared channel (example with three-layer detector)

## Extractive continuous process gas analysis

### ULTRAMAT 23

#### General information

##### Automatic calibration with air (AUTOCAL)

The ULTRAMAT 23 can be calibrated using, for example, ambient air. During this process (between 1 and 24 hours (adjustable), 0 = no AUTOCAL), the chamber is purged with air. The detector then generates the largest signal  $U_0$  (no pre-absorption in the sample chamber). This signal is used as the reference signal for zero point calibration, and also serves as the initial value for calculating the full-scale value in the manner described below.

As the concentration of the measured component increases, so too does absorption in the sample chamber. As a result of this preabsorption, the detectable radiation energy in the detector decreases, and thus also the signal voltage. For the single-beam procedure of the ULTRAMAT 23, the mathematical relationship between the concentration of the measured component and the measured voltage can be approximately expressed as the following exponential function:

$$U = U_0 \cdot e^{-kc}$$

c Concentration

k Device-specific constant

$U_0$  Basic signal with zero gas (sample gas without measured component)

U Detector signal

Changes in the radiation power, contamination of the sample chamber, or aging of the detector components have the same effect on both  $U_0$  and U, and result in the following:

$$U' = U'_0 \cdot e^{-kc}$$

Apart from being dependent on concentration c, the measured voltage thus changes continuously as the IR source ages, or with persistent contamination.

Each AUTOCAL thus tracks the total characteristic according to the currently valid value. Temperature and pressure influences are also compensated in this way.

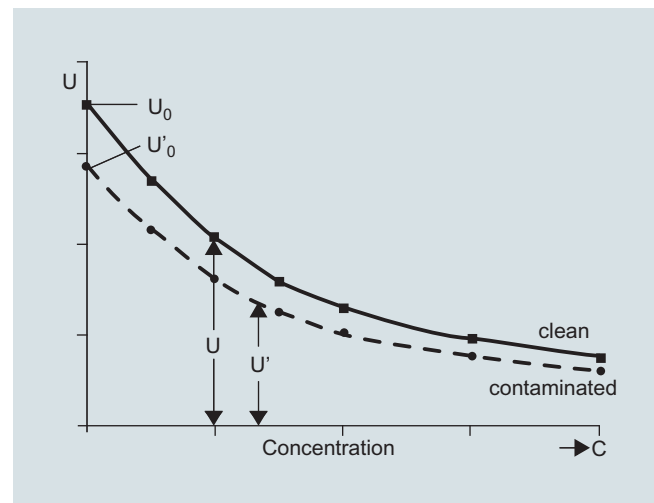
The influences of contamination and aging, as mentioned above, have a negligible influence on the measurement as long as  $U'$  remains in a certain tolerance range monitored by the unit.

The tolerance range between two or more AUTOCALs can be individually configured on the ULTRAMAT 23 and an alarm message output. An alarm message is output when the value falls below the original factory setting of  $U_0 < 50\% U$ . In most cases, this is due to the sample chamber being contaminated.

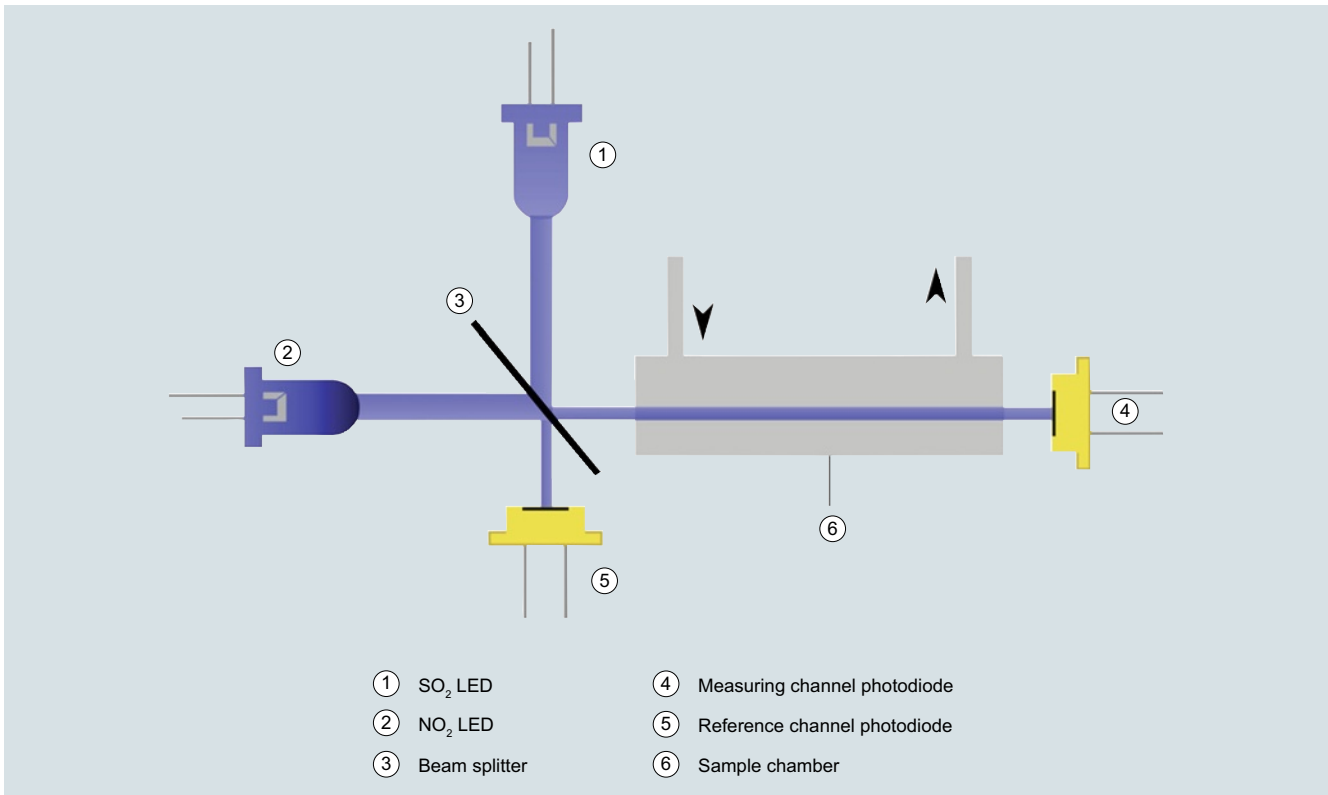
##### Calibration

The units can be set to automatically calibrate the zero point every 1 to 24 hours, using ambient air or nitrogen. The calibration point for the IR-sensitive components is calculated mathematically from the newly determined  $U'_0$  and the device-specific parameters stored as default values. We recommend checking the calibration point once a year using a calibration gas. (For details on TÜV measurements, see Table "Calibration intervals (TÜV versions)" under Selection and ordering data).

If an electrochemical sensor is installed, it is recommendable to use air for the AUTOCAL. In addition to calibration of the zero point of the IR-sensitive components, it is then also possible to simultaneously calibrate the calibration point of the electrochemical  $O_2$  sensor automatically. The characteristic of the  $O_2$  sensor is sufficiently stable following the single-point calibration. The zero point of the electrochemical sensor only needs be checked once a year by connecting nitrogen.



Calibration

**Ultraviolet measurement**


ULTRAMAT 23, ultraviolet measurement principle

This measuring principle is also based on the molecule-specific absorption of bands of ultraviolet radiation using a double-beam photometer.

The light source is a solid-state diode (LED) based on AlGaIn or InGaIn semiconductors (1). To improve the signal evaluation, the light source is operated as a pulsed light source.

The ultraviolet radiation is collimated and first passes through a beam splitter (3), which generates two identically sized ray bundles (measuring and reference radiation). The measuring ray bundle passes through the sample chamber (6) into which the sample gas is flowing, and is attenuated as a function of the concentration of the measured component. This attenuation is evaluated according to the Lambert-Beer absorption law.

The measuring radiation is recorded by a photodiode (4) downstream of the sample chamber into which the sample gas is flowing (measuring signal). Likewise, the reference radiation is recorded by a second photodiode (5, reference signal). The ratio of measured signal and reference signal is used to calculate the concentration of the gas component.

The beam splitter also enables the coupling of a second light source (2) for measuring a second gas component. In this way, the absorption of sulfur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>) is measured in alternating cycles and converted into continuous concentration values in sensor-level electronics. Additional sample gas applications are possible through a suitable selection of LEDs.

## Extractive continuous process gas analysis

### ULTRAMAT 23

#### General information

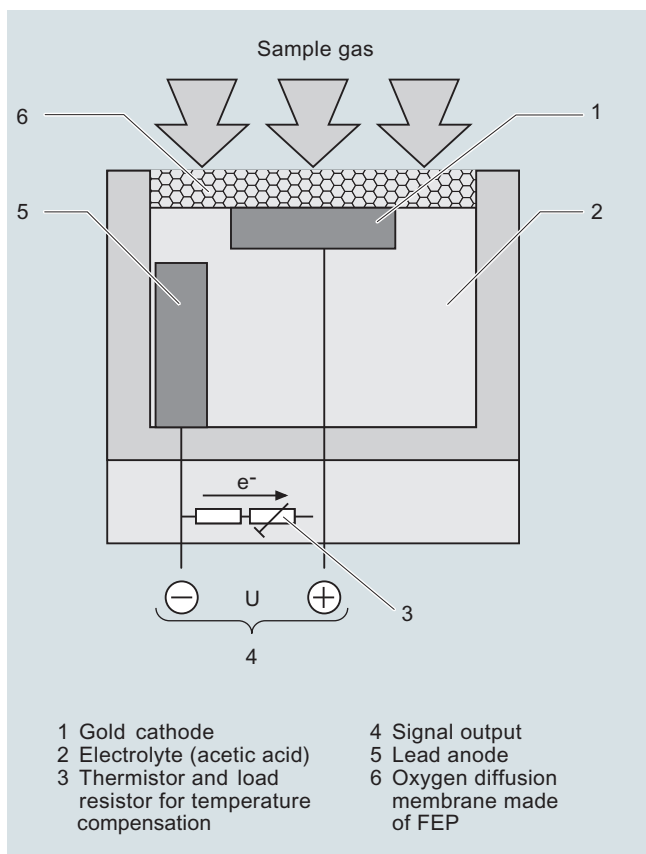
##### Oxygen measurement

The oxygen sensor operates according to the principle of a fuel cell. The oxygen is converted at the boundary layer between the cathode and electrolyte. An electron emission current flows between the lead anode and cathode and via a resistor, where a measured voltage is present. This measured voltage is proportional to the concentration of oxygen in the sample gas.

The oxygen electrolyte used is less influenced by interference influences (particularly  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{H}_2$  and  $\text{CH}_4$ ) than other sensor types.

##### Note

The oxygen sensor can be used for concentrations of both  $> 1\%$  and  $< 1\%$   $\text{O}_2$ . In the event of sudden changes from high concentrations to low concentrations ( $< 1\%$ ), the sensor will, however, require longer running-in times to get a constant measured value. This is to be taken into consideration when switching between measuring points in particular, and appropriate rinsing times are to be set.



ULTRAMAT 23, operating principle of the oxygen sensor

##### Electrochemical sensor for $\text{H}_2\text{S}$ determination

The hydrogen sulfide enters through the diffusion barrier (gas diaphragm) into the sensor and is oxidized at the working electrode. A reaction in the form of a reduction of atmospheric oxygen takes place on the counter electrode. The transfer of electrons can be tapped on the connector pins as a current which is directly proportional to the gas concentration.

##### Calibration

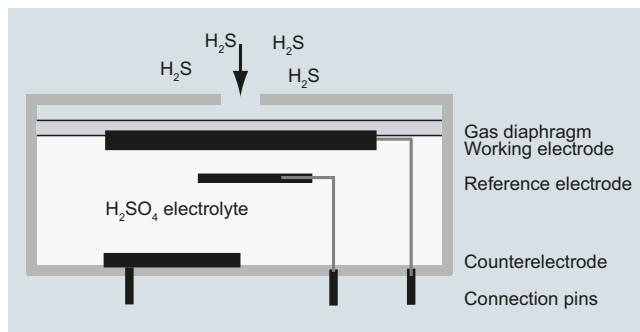
The zero point is automatically recalibrated by the AUTOCAL function when connecting e.g. nitrogen or air. It is recommendable to check the calibration point monthly using calibration gas (45 to 50 vpm).

The AUTOCAL (with ambient air, for example) must be performed every hour. In so doing, you must ensure that the ambient air is saturated in accordance with a dew point of  $11\text{ }^\circ\text{C}$ .

If this cannot be constantly ensured with dry ambient air, the adjustment gas must be fed through a humidifier and subsequently through a cooler (dew point  $11\text{ }^\circ\text{C}$ ).

If the accompanying gas contains the following components, the hydrogen sulfide sensor must not be used:

- Compounds containing chlorine
- Compounds containing fluorine
- Heavy metals
- Aerosols
- Alkaline components
- $\text{NH}_3 > 5\text{ vpm}$



Operating principle of the  $\text{H}_2\text{S}$  sensor

### Paramagnetic oxygen cell

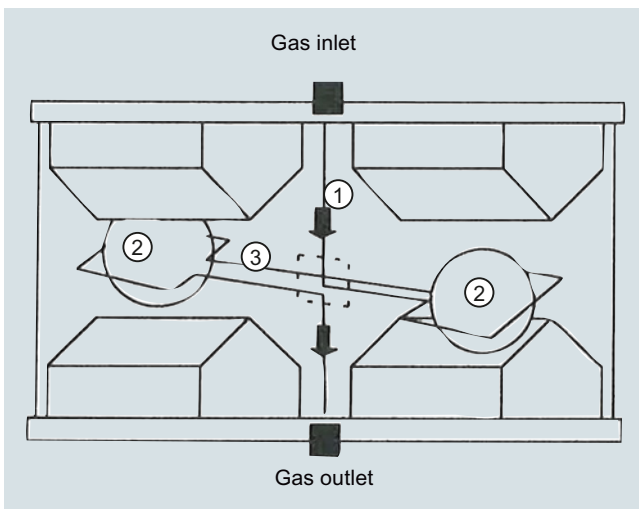
In contrast to other gases, oxygen is highly paramagnetic. This property is used as the basis for the method of measurement.

Two permanent magnets generate an inhomogeneous magnetic field in the measuring cell. If oxygen molecules flow into the measuring cell (1), they are drawn into the magnetic field. This results in the two diamagnetic hollow spheres (2) being displaced out of the magnetic field. This rotary motion is recorded optically, and serves as the input variable for control of a compensation flow. This generates a torque opposite to the rotary motion around the two hollow spheres by means of a wire loop (3). The compensation current is proportional to the concentration of oxygen.

#### Calibration

The calibration point is calibrated with the AUTOCAL function when processing air (corresponding to calibration with the electrochemical O<sub>2</sub> sensor). In order to comply with the technical data, the zero point of the paramagnetic measuring cell must be calibrated with nitrogen weekly in the case of measuring ranges < 5% or every two months in the case of larger measuring ranges.

Alternatively, inert gases (such as nitrogen) can be used for AUTOCAL. As the limit point of the measuring range remains largely stable, an annual limit point adjustment will suffice.



Operating principle of the paramagnetic oxygen cell

# Extractive continuous process gas analysis

## ULTRAMAT 23

### General information

#### Cross-interferences, paramagnetic oxygen cells

Accompanying gas	Formula	Deviation at 20 °C	Deviation at 50 °C
Acetaldehyde	C <sub>2</sub> H <sub>4</sub> O	-0.31	-0.34
Acetone	C <sub>3</sub> H <sub>6</sub> O	-0.63	-0.69
Acetylene, ethyne	C <sub>2</sub> H <sub>2</sub>	-0.26	-0.28
Ammonia	NH <sub>3</sub>	-0.17	-0.19
Argon	Ar	-0.23	-0.25
Benzene	C <sub>6</sub> H <sub>6</sub>	-1.24	-1.34
Bromine	Br <sub>2</sub>	-1.78	-1.97
Butadiene	C <sub>4</sub> H <sub>6</sub>	-0.85	-0.93
n-butane	C <sub>4</sub> H <sub>10</sub>	-1.1	-1.22
Iso-butylene	C <sub>4</sub> H <sub>8</sub>	-0.94	-1.06
Chlorine	Cl <sub>2</sub>	-0.83	-0.91
Diacetylene	C <sub>4</sub> H <sub>2</sub>	-1.09	-1.2
Dinitrogen monoxide	N <sub>2</sub> O	-0.2	-0.22
Ethane	C <sub>2</sub> H <sub>6</sub>	-0.43	-0.47
Ethyl benzene	C <sub>8</sub> H <sub>10</sub>	-1.89	-2.08
Ethylene, ethene	C <sub>2</sub> H <sub>4</sub>	-0.2	-0.22
Ethylene glycol	C <sub>2</sub> H <sub>6</sub> O <sub>2</sub>	-0.78	-0.88
Ethylene oxide	C <sub>2</sub> H <sub>4</sub> O	-0.54	-0.6
Furan	C <sub>4</sub> H <sub>4</sub> O	-0.9	-0.99
Helium	He	0.29	0.32
n-hexane	C <sub>6</sub> H <sub>14</sub>	-1.78	-1.97
Hydrogen chloride, hydrochloric acid	HCl	-0.31	-0.34
Hydrogen fluoride, hydrofluoric acid	HF	0.12	0.14
Carbon dioxide	CO <sub>2</sub>	-0.27	-0.29
Carbon monoxide	CO	-0.06	-0.07
Krypton	Kr	-0.49	-0.54
Methane	CH <sub>4</sub>	-0.16	-0.17
Methanol	CH <sub>4</sub> O	-0.27	-0.31
Methylene chloride	CH <sub>2</sub> Cl <sub>2</sub>	-1	-1.1
Monosilane, silane	SiH <sub>4</sub>	-0.24	-0.27
Neon	Ne	0.16	0.17
n-octane	C <sub>8</sub> H <sub>18</sub>	-2.45	-2.7
Phenol	C <sub>6</sub> H <sub>6</sub> O	-1.4	-1.54
Propane	C <sub>3</sub> H <sub>8</sub>	-0.77	-0.85
Propylene, propene	C <sub>3</sub> H <sub>6</sub>	-0.57	-0.62
Propylene chloride	C <sub>3</sub> H <sub>7</sub> Cl	-1.42	-1.44
Propylene oxide	C <sub>3</sub> H <sub>6</sub> O	-0.9	-1
Oxygen	O <sub>2</sub>	100	100
Sulfur dioxide	SO <sub>2</sub>	-0.18	-0.2
Sulfur hexafluoride	SF <sub>6</sub>	-0.98	-1.05
Hydrogen sulfide	H <sub>2</sub> S	-0.41	-0.43
Nitrogen	N <sub>2</sub>	0	0
Nitrogen dioxide	NO <sub>2</sub>	5	16
Nitrogen monoxide	NO	42.7	43

Accompanying gas	Formula	Deviation at 20 °C	Deviation at 50 °C
Styrene	C <sub>8</sub> H <sub>8</sub>	-1.63	-1.8
Toluene	C <sub>7</sub> H <sub>8</sub>	-1.57	-1.73
Vinyl chloride	C <sub>2</sub> H <sub>3</sub> Cl	-0.68	-0.74
Vinyl fluoride	C <sub>2</sub> H <sub>3</sub> F	-0.49	-0.54
Water (vapor)	H <sub>2</sub> O	-0.03	-0.03
Hydrogen	H <sub>2</sub>	0.23	0.26
Xenon	Xe	-0.95	-1.02

Cross-sensitivities (with accompanying gas concentration 100%)

#### ULTRAMAT 23 essential characteristics

- Practically maintenance-free thanks to AUTOCAL with ambient air (or with N<sub>2</sub>, only for units without an oxygen sensor); both the zero point and the sensitivity are calibrated in the process
- Calibration with calibration gas only required every twelve months, depending on the application
- Two measuring ranges per component can be set within specified limits; all measuring ranges linearized; autoranging with measuring range identification
- Automatic correction of variations in atmospheric pressure
- Sample gas flow monitoring; error message output if flow < 1 l/min (only with Viton sample gas path)
- Maintenance demanded
- Two freely configurable undershooting or overshooting limit values per measured component



### Technical specifications

#### 19" rack unit and portable version

<b>General information</b>	
Measured components	Maximum of 4
Measuring ranges	2 per measured component
Display	LCD with LED backlighting and contrast control; function keys; 80 characters (4 lines/20 characters)
Operating position	Front wall, vertical
Conformity	CE marking EN 61000-6-2, EN 61000-6-4
<b>Design, enclosure</b>	
Weight	Approximately 10 kg
Degree of protection, 19" rack unit and desktop model	<ul style="list-style-type: none"> <li>• 7MB2335, 7MB2337 and 7MB2338: IP20 according to EN 60529</li> <li>• 7MB2355, 7MB2357 and 7MB2358: IP40 according to EN 60529</li> </ul>
<b>Electrical characteristics</b>	
EMC interference immunity (electromagnetic compatibility)	In accordance with standard requirements of NAMUR NE21 or EN 61326-1
Safety extra-low voltage (SELV) with safe isolation	
Auxiliary power	<ul style="list-style-type: none"> <li>• 100 V AC, +10%/-15%, 50 Hz</li> <li>• 120 V AC, +10%/-15%, 50 Hz</li> <li>• 200 V AC, +10%/-15%, 50 Hz</li> <li>• 230 V AC, +10%/-15%, 50 Hz</li> <li>• 100 V AC, +10%/-15%, 60 Hz</li> <li>• 120 V AC, +10%/-15%, 60 Hz</li> <li>• 230 V AC, +10%/-15%, 60 Hz</li> </ul>
Power consumption	Approx. 60 VA
<b>Electrical inputs and outputs</b>	
Analog output	Per component, 0/2/4 ... 20 mA, NAMUR, isolated, max. load 750 Ω
Relay outputs	8, with changeover contacts, freely configurable, e.g. for measuring range identification; 24 V AC/DC/1 A load, potential-free, non-sparking
Digital inputs	3, dimensioned for 24 V, potential-free <ul style="list-style-type: none"> <li>• Pump</li> <li>• AUTOCAL</li> <li>• Synchronization</li> </ul>
Serial interface	RS 485
AUTOCAL function	Automatic unit calibration with ambient air (depending on measured component); adjustable cycle time from 0 (1) ... 24 hours
Options	Add-on electronics, each with 8 additional digital inputs and relay outputs, e.g. for triggering of automatic calibration and for PROFIBUS PA or PROFIBUS DP
<b>Climatic conditions</b>	
Permissible ambient temperature	
• During operation	<ul style="list-style-type: none"> <li>• +5 ... 45 °C (IR detector, O<sub>2</sub>)</li> <li>• +5 ... 40 °C (H<sub>2</sub>S sensor)</li> <li>• +15 ... 35 °C (UV photometer)</li> </ul>
• During storage and transportation	<ul style="list-style-type: none"> <li>• -25 ... 60 °C (IR detector, O<sub>2</sub>, UV photometer)</li> <li>• -10 ... 60 °C (H<sub>2</sub>S sensor)</li> </ul>
Permissible ambient humidity	< 90% RH (relative humidity) during storage and transportation
Permissible pressure fluctuations	<ul style="list-style-type: none"> <li>• 600 ... 1 200 hPa (IR detector, O<sub>2</sub>, UV photometer)</li> <li>• 750 ... 1 200 hPa (H<sub>2</sub>S sensor)</li> </ul>

<b>Gas inlet conditions</b>	
Sample gas pressure	
• Without pump	Unpressurized (< 1 200 hPa, absolute)
• With pump	Depressurized suction mode, factory preset with 2 m hose at sample gas outlet; full-scale value calibration necessary under different restrictor conditions (800 ... 1 050 hPa, absolute)
Sample gas flow	72 ... 120 l/h (1.2 ... 2 l/min)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Sample gas humidity	< 90% RH (relative humidity), non-condensing

#### Infrared channel

So that the technical data can be complied with, a cycle time of ≤ 24 hours must be activated for the AUTOCAL. The cycle time of the AUTOCAL function must be ≤ 6 hours when measuring small NO and SO<sub>2</sub> measuring ranges (≤ 400 mg/m<sup>3</sup>) on TÜV/QAL-certified systems.

Measuring ranges	See ordering data
Chopper compartment flushing	Upstream pressure approximately 3 000 hPa; purging gas consumption approximately 100 ml/min
<b>Time response</b>	
Warm-up period	Approx. 30 min (at room temperature); the technical specification will be met after 2 h
Delayed display (T <sub>90</sub> time)	Dependent on length of analyzer chamber, sample gas line and configurable attenuation
Damping (electrical time constant)	Configurable from 0 ... 99.9 s
<b>Measuring response</b>	
Output signal fluctuation	Based on sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature < ± 1% of the current measuring range (see rating plate)
Detection limit	1% of the current measuring range
Linearity error	<ul style="list-style-type: none"> <li>• In the largest possible measuring range: &lt; ± 1% of the measuring range full scale value</li> <li>• In the smallest possible measuring range: &lt; ± 2% of the measuring range full scale value</li> </ul>
Repeatability	≤ ± 1% of the current measuring range
<b>Drift</b>	
Zero point	≤ 1% of the current measuring range/week
Full-scale value drift	≤ 1% of the current measuring range/week
<b>Influencing variables</b>	
Temperature	Based on sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature Max. 2% of the smallest possible measuring range according to rating plate per 10 K with an AUTOCAL cycle time of 6 h
Atmospheric pressure	< 0.2% of the current measuring range per 1% pressure variation
Auxiliary power	< 0.1% of the current measuring range with a change of ± 10%

# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

#### Oxygen channel (electrochemical)

Measuring ranges	0 ... 5 % to 0 ... 25 % O <sub>2</sub> , configurable
Service life	Approx. 2 years with 21% O <sub>2</sub>
Detection limit	1% of the current measuring range
Time response	
Delayed display (T <sub>90</sub> time)	Dependent on dead time and configurable attenuation, not > 30 s at approximately 1.2 l/min sample gas flow
<b>Measuring response</b>	Based on sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature
Output signal fluctuation	< ± 0.5% of the current measuring range
Linearity error	< ± 0.2% of the current measuring range
Repeatability	≤ 0.05% O <sub>2</sub>
Drift	
• With AUTOCAL	Negligible
<b>Influencing variables</b>	Based on sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature
Temperature	< ± 0.5% O <sub>2</sub> per 20 K, relating to a measured value at 20 °C
Atmospheric pressure	< 0.2% of the measured value per 1% pressure variation
Accompanying gases	The oxygen sensor must not be used if the accompanying gas contains the following components: Chlorine or fluorine compounds, heavy metals, aerosols, mercaptans, alkaline components (such as NH <sub>3</sub> in % range)
Typical combustion exhaust gases	Influence: < 0.05% O <sub>2</sub>
Humidity	H <sub>2</sub> O dew point ≥ 2 °C; the oxygen sensor must not be used with dry sample gases (however, no condensation either)

#### Ultraviolet photometer

To ensure compliance with the technical specifications, a cycle time of ≤ 24 hours must be activated for the AUTOCAL. The technical specifications are based on a sample gas pressure of 1 013 ± 5 hPa absolute, a sample gas flow of 1.2 ± 0.2 l/min and an ambient temperature of 25 ± 2 °C. They apply to the SO<sub>2</sub> and NO<sub>2</sub> sample gas components.

<b>Measuring ranges</b>	The measuring ranges are calibrated with a certified calibration gas, whereby a concentration specification in ppm in accordance with EN1343 must be converted to the unit mg/m <sup>3</sup> at a reference temperature of 0 °C and a reference pressure of 1 013 hPa.
SO <sub>2</sub>	
• Smallest measuring range	0 ... 50 mg/m <sup>3</sup>
• Largest measuring range	0 ... 1 250 mg/m <sup>3</sup>
NO <sub>2</sub>	
• Smallest measuring range	0 ... 50 mg/m <sup>3</sup>
• Largest measuring range	0 ... 1 250 mg/m <sup>3</sup>

<b>Time response</b>	
Warm-up period	30 min The technical specification will be met after 2 h
Response time (T <sub>90</sub> time)	Dependent on the external gas preparation, the length of the sample gas feed line and the configurable damping (see below) of the analyzer. <b>Note:</b> SO <sub>2</sub> is highly soluble in water! ≤ 30 s after sample gas input at a damping of ≤ 12 s
Damping (electronic time constant)	0 ... 99.9 s, can be set
<b>Measuring response</b>	
Output signal fluctuation	≤ 1% of set full-scale value
Detection limit	1% of set full-scale value or: • 1 mg/m <sup>3</sup> (SO <sub>2</sub> ) • 0.8 mg/m <sup>3</sup> (NO <sub>2</sub> ) This corresponds to 0.4 ppm for both components
Linearity error	
• In the largest measuring range	≤ 1% of set full-scale value
• In the smallest measuring range	≤ 2% of set full-scale value
Repeatability	≤ 1% of set full-scale value
<b>Influencing variables</b>	
Temperature error	≤ 4% of smallest full-scale value/10 K in ambient temperature range of 5 ... 45 °C
Air pressure	≤ 1% of set full-scale value per 1% pressure change
Auxiliary power supply	≤ 0.1% of set full-scale value with a change of ±10%
Drift (zero point and full-scale value)	
• AUTOCAL activated	Negligible depending on the cycle time setting
• AUTOCAL deactivated	
- NO <sub>2</sub>	≤ 0.85 mg/m <sup>3</sup> /day
- SO <sub>2</sub>	≤ 1.25 mg/m <sup>3</sup> /day
<b>Note</b>	It can take up to 12 hours after the device is put into operation before these values are reached.
Accompanying gases	
• Humidity up to 20 °C dew point	Negligible
• CO <sub>2</sub> ≤ 16% vol	Negligible
• Exclusions	• Sulfur compounds other than SO <sub>2</sub> • Halogen compounds • Chlorine • Acetone • Ozone

### H<sub>2</sub>S channel for measuring ranges of 5 ... 50 vpm

Measured components	Maximum of 4, comprising up to 2 infrared-sensitive gases, an oxygen component and a hydrogen sulfide component
Measuring ranges	
• Smallest measuring range	0 ... 5 vpm
• Largest measuring range	0 ... 50 vpm
Service life of the sensor	Approx. 12 months
Permissible atmospheric pressure	750 ... 1 200 hPa
Permissible operating temperature	5 ... 40 °C (41 ... 104 °F)
<b>Operating mode</b>	<ul style="list-style-type: none"> <li>• Continuous measurement between 0 and 12.5 vpm</li> <li>• Discontinuous measurement between 12.5 and 50 vpm</li> </ul>
<b>Influencing variables</b>	
Accompanying gases	<p>The hydrogen sulfide sensor must not be used if the accompanying gas contains the following components:</p> <ul style="list-style-type: none"> <li>• Compounds containing chlorine</li> <li>• Compounds containing fluorine</li> <li>• Heavy metals</li> <li>• Aerosols</li> <li>• Alkaline components (e.g. NH<sub>3</sub> &gt; 5 vpm)</li> </ul>
Cross-interferences (interfering gases)	<p>1 360 vpm SO<sub>2</sub> result in a cross-interference of &lt; 20 vpm H<sub>2</sub>S</p> <p>180 vpm NO result in a cross-interference of &lt; 150 vpm H<sub>2</sub>S</p> <p>No cross-interference of CH<sub>4</sub>, CO<sub>2</sub> and H<sub>2</sub> (1 000 vpm)</p>
Temperature	< 3% /10 K referred to full-scale value
Atmospheric pressure	< 0.2% of the measured value per 1% pressure variation
<b>Measuring response</b>	
Delayed display (T90 time)	< 40 s with sample gas flow of approx. 1 ... 1.2 l/min
Output signal noise	< 2% of smallest measuring range with an attenuation constant of 30 s
Display resolution	< 0.01 vpm H <sub>2</sub> S
Output signal resolution	< 1% of smallest measuring range with an attenuation constant of 30 s
Repeatability	< 4% of smallest measuring range
Drift	< 1% of the current measuring range per month

### Paramagnetic oxygen cell

Measured components	Maximum of 4, comprising up to 3 infrared-sensitive gases and an oxygen component
Measuring ranges	<p>2 per component</p> <ul style="list-style-type: none"> <li>• Min. 0 ... 2% vol O<sub>2</sub></li> <li>• Max. 0 ... 100% vol O<sub>2</sub></li> <li>• Suppressed measuring range possible; e.g. 95 ... 100%</li> </ul>
Permissible operating temperature	5 ... 45 °C (41 ... 113 °F)
Cross-interferences (interfering gases)	See "Paramagnetic oxygen cell cross-interference" table (page 1/214)
Zero point drift	<ul style="list-style-type: none"> <li>• Measuring range 2%: max. 0.1% with weekly zero adjustment</li> <li>• Measuring range 5%: max. 0.1% with weekly zero adjustment</li> <li>• Measuring range 25% or greater: max. 0.5% with monthly zero adjustment</li> </ul>
Measured-value drift	Negligible with AUTOCAL
Temperature error	<p>&lt; 2%/10 K referred to measuring range 5%</p> <p>&lt; 5%/10 K referred to measuring range 2%</p>
Humidity error for N <sub>2</sub> with 90% relative humidity after 30 min	< 0.6% at 50 °C
Atmospheric pressure	< 0.2% of measured value per 1% pressure variation
Delayed display (T90 time)	< 60 s
Output signal noise	< 1% of smallest measuring range
Repeatability	< 1% of the current measuring range

# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

1

#### Selection and ordering data

#### Article No.

#### ULTRAMAT 23 gas analyzer

For measuring 1 infrared component, UV components, oxygen and hydrogen sulfide

7MB2335- - - - - A A

Cannot be combined

Click on the Article No. for the online configuration in the PIA Life Cycle Portal.

#### Enclosure, version and gas paths

19" rack unit for installation in cabinets

Gas connections	Gas path	Internal sample gas pump
6 mm pipe	Viton	Without <sup>(2)</sup>
¼" pipe	Viton	Without <sup>(2)</sup>
6 mm pipe	Viton	With
¼" pipe	Viton	With
6 mm pipe	Stainless steel, mat. no. 1.4571	Without <sup>(2)</sup>
¼" pipe	Stainless steel, mat. no. 1.4571	Without <sup>(2)</sup>

0
1
2
3
6
7
8

6 6 → E20  
7 7 → E20  
8 8 → E20

Portable, in sheet steel enclosure, 6 mm gas connections, Viton gas path, with integrated sample gas pump, condensation trap with safety filter on the front plate

#### Measured component

Measured component	Possible with measuring range identification
CO	D, E, F, G ... R, U, X
CO <sub>2</sub> <sup>1)</sup>	D <sup>6)</sup> , G <sup>6)</sup> , H <sup>6)</sup> , J <sup>6)</sup> , K ... R
CH <sub>4</sub>	E, H, L, N, P, R
C <sub>2</sub> H <sub>4</sub>	K
C <sub>6</sub> H <sub>14</sub>	K
SO <sub>2</sub> <sup>13)</sup>	B <sup>10)</sup> , F ... L, S <sup>12)</sup> , T <sup>11)</sup> , W
NO	E, G ... J, T, V, W
N <sub>2</sub> O <sup>7)</sup>	E
SF <sub>6</sub>	H

A
C
D
F
M
N
P
S
V

#### Smallest measuring range

#### Largest measuring range

0 ... 200 mg/m <sup>3</sup>	0 ... 1 000 mg/m <sup>3</sup>
0 ... 50 vpm	0 ... 250 vpm
0 ... 100 vpm	0 ... 500 vpm
0 ... 150 vpm	0 ... 750 vpm
0 ... 200 vpm	0 ... 1 000 vpm
0 ... 500 vpm	0 ... 2 500 vpm
0 ... 1 000 vpm	0 ... 5 000 vpm
0 ... 2 000 vpm	0 ... 10 000 vpm
0 ... 0.5 %	0 ... 2.5 %
0 ... 1 %	0 ... 5 %
0 ... 2 %	0 ... 10 %
0 ... 5 %	0 ... 25 %
0 ... 10 %	0 ... 50 %
0 ... 20 %	0 ... 100 %
0 ... 50 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>
0 ... 100 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>
0 ... 150 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>
0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>
0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>
0 ... 50 vpm	0 ... 2 500 vpm

B
D
E
F
G
H
J
K
L
M
N
P
Q
R
S
T
U
V
W
X

#### Oxygen measurement<sup>5)</sup>

Without O <sub>2</sub> sensor	0
With electrochemical O <sub>2</sub> sensor	1
With paramagnetic oxygen measuring cell	8

1
8
8
8

#### Hydrogen sulfide measurement

Without	6
With H <sub>2</sub> S sensor 0 ... 5/50 vpm	7

7
7
7

#### Power supply

100 V AC, 50 Hz
120 V AC, 50 Hz
200 V AC, 50 Hz
230 V AC, 50 Hz
100 V AC, 60 Hz
120 V AC, 60 Hz
230 V AC, 60 Hz

0
1
2
3
4
5
6

#### Operating software, documentation<sup>3)</sup>

German
English
French
Spanish
Italian

0
1
2
3
4

Footnotes: See next page.

### Selection and ordering data

<i>Additional versions</i>	Order code
Add "-Z" to Article No. and specify Order code	
Add-on electronics with 8 digital inputs/outputs, PROFIBUS PA interface	A12
Add-on electronics with 8 digital inputs/outputs, PROFIBUS DP interface	A13
IEC plug, 37-pin sub-D connector, 9-pin sub-D connector	A33
TAG labels (specific lettering based on customer information)	B03
Clean for O <sub>2</sub> service (specially cleaned gas path)	B06
Gas path for short response time <sup>9)</sup>	C01
Chopper compartment purging for 6 mm gas connection	C02
Chopper compartment purging for 1/4" gas connection	C03
Presetting to reference temperature 0 °C for conversion into mg/m <sup>3</sup> , applies to all components	D15
IEC Ex: Ex ec ic nC IIC T4 Gc	E20
ATEX: II 3G Ex ec ic nC IIC T4 Gc	
CSA:	
• Class I, Div. 2, Gps ABCD, T4	
• Class I, Zone 2 Ex nA ic nC II T4Gc	
Introduction of flammable gases is not permitted	
Measuring range indication in plain text <sup>4)</sup>	Y11
Measurement of CO <sub>2</sub> in forming gas <sup>8)</sup> (only in conjunction with measuring range 0 to 20/0 to 100 %)	Y14
<i>Accessories</i>	Article No.
CO <sub>2</sub> absorber cartridge	7MB1933-8AA
RS 485/Ethernet converter	A5E00852383
RS 485/RS 232 converter	C79451-Z1589-U1
RS 485/USB converter	A5E00852382
Add-on electronics with 8 digital inputs/outputs and PROFIBUS PA	A5E00056834
Add-on electronics with 8 digital inputs/outputs and PROFIBUS DP	A5E00057159
Set of Torx screwdrivers	A5E34821625

<sup>1)</sup> For measuring ranges below 1 %, a CO<sub>2</sub> absorber cartridge can be used for setting the zero point (see accessories)

<sup>2)</sup> Without separate zero gas input or solenoid valve

<sup>3)</sup> User language can be changed

<sup>4)</sup> Standard setting: smallest measuring range, largest measuring range

<sup>5)</sup> O<sub>2</sub> sensor/O<sub>2</sub> measuring cell in gas path of infrared measured component 1

<sup>6)</sup> With chopper compartment purging (N<sub>2</sub> approx. 3 000 hPa required for measuring ranges below 0.1 % CO<sub>2</sub>), to be ordered separately (see order code C02 or C03)

<sup>7)</sup> Not suitable for use with emission measurements since the cross-sensitivity is too high

<sup>8)</sup> CO<sub>2</sub> measurement in accompanying gas Ar or Ar/He (3:1); forming gas

<sup>9)</sup> Only for version with Viton hose

<sup>10)</sup> Maximum possible AUTOCAL cycle ≤ 6 h, constant ambient conditions (max. deviation ±1 °C (1.8 °F)): see table "Calibration intervals, standard devices", page 1/230.

<sup>11)</sup> Maximum possible AUTOCAL cycle ≤ 3 h, constant ambient conditions (max. deviation ±1 °C (1.8 °F)): see table "Calibration intervals, standard devices", page 1/230.

<sup>12)</sup> Measured with UV technology

<sup>13)</sup> When measuring range identification "S" selected: parallel measurement of SO<sub>2</sub> and NO<sub>2</sub> with UV photometer

# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

1

#### Selection and ordering data

#### Article No.

#### ULTRAMAT 23 gas analyzer

7MB2337-

For measuring 2 infrared components, UV components, oxygen and hydrogen sulfide

0 1 2 3 4 5 6 7 8

Cannot be combined

Click on the Article No. for the online configuration in the PIA Life Cycle Portal.

#### Enclosure, version and gas paths

19" rack unit for installation in cabinets

Gas connections      Gas paths      Internal sample gas pump

6 mm pipe	Viton, not separate	Without <sup>(2)</sup>	0
1/4" pipe	Viton, not separate	Without <sup>(2)</sup>	1
6 mm pipe	Viton, not separate	With	2
1/4" pipe	Viton, not separate	With	3
6 mm pipe	Viton, separate	Without <sup>(2)</sup>	4
1/4" pipe	Viton, separate	Without <sup>(2)</sup>	5
6 mm pipe	Stainless steel, mat. no. 1.4571, separate	Without <sup>(2)</sup>	6
1/4" pipe	Stainless steel, mat. no. 1.4571, separate	Without <sup>(2)</sup>	7

4 → A27, A29  
5 → A27, A29

6 6  
7 7

Portable, in sheet steel enclosure, 6 mm gas connections, Viton gas path, with integrated sample gas pump, condensation trap with safety filter on the front plate

8

8 8 8 → E20

#### 1st infrared measured component

Measured component      Possible with measuring range identification

CO	D, E, F, G ... R, U, X
CO <sub>2</sub> <sup>1)</sup>	D <sup>(6)</sup> , G <sup>(6)</sup> , H <sup>(6)</sup> , J <sup>(6)</sup> , K ... R
CH <sub>4</sub>	E, H, L, N, P, R
C <sub>2</sub> H <sub>4</sub>	K
C <sub>6</sub> H <sub>14</sub>	K
SO <sub>2</sub>	B <sup>(1)</sup> , F ... L, T <sup>(2)</sup> , W
NO	E, G ... J, T, V, W
N <sub>2</sub> O <sup>(7)</sup>	E
SF <sub>6</sub>	H

A  
C  
D  
F  
M  
N  
P  
S  
V

N  
P

#### Smallest measuring range

#### Largest measuring range

0 ... 200 mg/m <sup>3</sup>	0 ... 1 000 mg/m <sup>3</sup>
0 ... 50 vpm	0 ... 250 vpm
0 ... 100 vpm	0 ... 500 vpm
0 ... 150 vpm	0 ... 750 vpm
0 ... 200 vpm	0 ... 1 000 vpm
0 ... 500 vpm	0 ... 2 500 vpm
0 ... 1 000 vpm	0 ... 5 000 vpm
0 ... 2 000 vpm	0 ... 10 000 vpm
0 ... 0.5 %	0 ... 2.5 %
0 ... 1 %	0 ... 5 %
0 ... 2 %	0 ... 10 %
0 ... 5 %	0 ... 25 %
0 ... 10 %	0 ... 50 %
0 ... 20 %	0 ... 100 %
0 ... 100 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>
0 ... 150 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>
0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>
0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>
0 ... 50 vpm	0 ... 2 500 vpm

B  
D  
E  
F  
G  
H  
J  
K  
L  
M  
N  
P  
Q  
R  
T  
U  
V  
W  
X

#### Oxygen measurement<sup>(5)</sup>

Without O<sub>2</sub> sensor  
With electrochemical O<sub>2</sub> sensor  
With paramagnetic oxygen measuring cell

0  
1  
8

1  
8 8

8

#### Hydrogen sulfide measurement

Without  
With H<sub>2</sub>S sensor 0 ... 5/50 vpm

6  
7

7 7 7

#### Power supply

100 V AC, 50 Hz  
120 V AC, 50 Hz  
200 V AC, 50 Hz  
230 V AC, 50 Hz  
100 V AC, 60 Hz  
120 V AC, 60 Hz  
230 V AC, 60 Hz

0  
1  
2  
3  
4  
5  
6

# Extractive continuous process gas analysis ULTRAMAT 23

19" rack unit and portable version

1

Selection and ordering data		Article No.	
<b>ULTRAMAT 23 gas analyzer</b> For measuring 2 infrared components, UV components, oxygen and hydrogen sulfide		7MB2337-	Cannot be combined
<b>2nd infrared measured component</b>			
<u>Measured component</u>	<u>Possible with measuring range identification</u>		
CO	D, E, F, G ... R, U, X	A	A
CO <sub>2</sub> <sup>1)</sup>	D <sup>6)</sup> , G <sup>6)</sup> , H <sup>6)</sup> , J <sup>6)</sup> , K ... R	C	C
CH <sub>4</sub>	E, H, L, N, P, R	D	D
C <sub>2</sub> H <sub>4</sub>	K	F	F
C <sub>6</sub> H <sub>14</sub>	K	M	M
SO <sub>2</sub> <sup>14)</sup>	B <sup>11)</sup> , F ... L, S <sup>13)</sup> , T <sup>12)</sup> , W	N	
NO	E, G ... J, T, V, W	P	P
N <sub>2</sub> O	E <sup>7)</sup> , Y <sup>10)</sup>	S	S
SF <sub>6</sub>	H	V	V
<u>Smallest measuring range</u>	<u>Largest measuring range</u>		
0 ... 200 mg/m <sup>3</sup>	0 ... 1 000 mg/m <sup>3</sup>	B	
0 ... 50 vpm	0 ... 250 vpm	D	
0 ... 100 vpm	0 ... 500 vpm	E	
0 ... 150 vpm	0 ... 750 vpm	F	
0 ... 200 vpm	0 ... 1 000 vpm	G	
0 ... 500 vpm	0 ... 2 500 vpm	H	
0 ... 1 000 vpm	0 ... 5 000 vpm	J	
0 ... 2 000 vpm	0 ... 10 000 vpm	K	
0 ... 0,5 %	0 ... 2,5 %	L	
0 ... 1 %	0 ... 5 %	M	
0 ... 2 %	0 ... 10 %	N	
0 ... 5 %	0 ... 25 %	P	
0 ... 10 %	0 ... 50 %	Q	
0 ... 20 %	0 ... 100 %	R	
0 ... 50 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>	S	S
0 ... 100 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>	T	
0 ... 150 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>	U	
0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>	V	
0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>	W	
0 ... 50 vpm	0 ... 2 500 vpm	X	
0 ... 500 vpm	0 ... 5 000 vpm	Y	
<u>Operating software, documentation<sup>3)</sup></u>			
German		0	
English		1	
French		2	
Spanish		3	
Italian		4	

Footnotes: See next page.

# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

#### Selection and ordering data

<i>Additional versions</i>	Order code
Add "-Z" to Article No. and specify Order code	
Add-on electronics with 8 digital inputs/outputs, PROFIBUS PA interface	<b>A12</b>
Add-on electronics with 8 digital inputs/outputs, PROFIBUS DP interface	<b>A13</b>
Stainless steel (mat. no. 1.4571) connection pipe, 6 mm, complete with screwed gland (cannot be combined with Viton hose)	<b>A27</b>
Stainless steel (mat. no. 1.4571) connection pipe, 1/4", complete with screwed gland (cannot be combined with Viton hose)	<b>A29</b>
IEC plug, 37-pin sub-D connector, 9-pin sub-D connector	<b>A33</b>
TAG labels (specific lettering based on customer information)	<b>B03</b>
Clean for O <sub>2</sub> service (specially cleaned gas path)	<b>B06</b>
Gas path for short response time <sup>9)</sup>	<b>C01</b>
Chopper compartment purging for 6 mm gas connection	<b>C02</b>
Chopper compartment purging for 1/4" gas connection	<b>C03</b>
Application with paramagnetic oxygen measuring cell and separate gas path	<b>C11</b>
Presetting to reference temperature 0 °C for conversion into mg/m <sup>3</sup> , applies to all components	<b>D15</b>
IEC Ex: Ex ec ic nC IIC T4 Gc	<b>E20</b>
ATEX: II 3G Ex ec ic nC IIC T4 Gc	
CSA:	
• Class I, Div. 2, Gps ABCD, T4	
• Class I, Zone 2 Ex nA ic nC II T4Gc	
Introduction of flammable gases is not permitted	
Measuring range indication in plain text <sup>4)</sup>	<b>Y11</b>
Measurement of CO <sub>2</sub> in forming gas <sup>8)</sup> (only in conjunction with measuring range 0 to 20/0 to 100 %)	<b>Y14</b>
<i>Accessories</i>	Article No.
CO <sub>2</sub> absorber cartridge	<b>7MB1933-8AA</b>
RS 485/Ethernet converter	<b>A5E00852383</b>
RS 485/RS 232 converter	<b>C79451-Z1589-U1</b>
RS 485/USB converter	<b>A5E00852382</b>
Add-on electronics with 8 digital inputs/outputs and PROFIBUS PA	<b>A5E00056834</b>
Add-on electronics with 8 digital inputs/outputs and PROFIBUS DP	<b>A5E00057159</b>
Set of Torx screwdrivers	<b>A5E34821625</b>

<sup>1)</sup> For measuring ranges below 1 %, a CO<sub>2</sub> absorber cartridge can be used for setting the zero point (see accessories)

<sup>2)</sup> Without separate zero gas input or solenoid valve

<sup>3)</sup> User language can be changed

<sup>4)</sup> Standard setting: smallest measuring range, largest measuring range

<sup>5)</sup> O<sub>2</sub> sensor/O<sub>2</sub> measuring cell in gas path of infrared measured component 1

<sup>6)</sup> With chopper compartment purging (N<sub>2</sub> approx. 3 000 hPa required for measuring ranges below 0.1 % CO<sub>2</sub>), to be ordered separately (see order code C02 or C03)

<sup>7)</sup> Not suitable for use with emission measurements since the cross-sensitivity is too high

<sup>8)</sup> CO<sub>2</sub> measurement in accompanying gas Ar or Ar/He (3:1); forming gas

<sup>9)</sup> Only for version with Viton hose

<sup>10)</sup> Only in conjunction with CO<sub>2</sub> measuring range 0 to 5 % to 0 to 25 % (CP)

<sup>11)</sup> Maximum possible AUTOCAL cycle ≤ 6 h, constant ambient conditions (max. deviation ±1 °C (1.8 °F): see table "Calibration intervals, standard devices", page 1/230.

<sup>12)</sup> Maximum possible AUTOCAL cycle ≤ 3 h, constant ambient conditions (max. deviation ±1 °C (1.8 °F): see table "Calibration intervals, standard devices", page 1/230.

<sup>13)</sup> Measured with UV technology

<sup>14)</sup> When measuring range identification "S" selected: parallel measurement of SO<sub>2</sub> and NO<sub>2</sub> with UV photometer



# Extractive continuous process gas analysis ULTRAMAT 23

19" rack unit and portable version

Selection and ordering data			Article No.	
<b>ULTRAMAT 23 gas analyzer</b> For measuring 3 infrared components, UV components, oxygen or 2 infrared components and UV components ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.			7MB2338-  6 -  Cannot be combined	
<b>Enclosure, version and gas paths</b> 19" rack unit for installation in cabinets				
Gas connections	Gas paths	Internal sample gas pump		
6 mm pipe	Viton, not separate	Without <sup>(2)</sup>	0	
¼" pipe	Viton, not separate	Without <sup>(2)</sup>	1	
6 mm pipe	Viton, not separate	With	2	
¼" pipe	Viton, not separate	With	3	
6 mm pipe	Viton, separate	Without <sup>(2)</sup>	4	4 → A27, A29
¼" pipe	Viton, separate	Without <sup>(2)</sup>	5	5 → A27, A29
6 mm pipe	Stainless steel, mat. no. 1.4571, separate	Without <sup>(2)</sup>	6	6
¼" pipe	Stainless steel, mat. no. 1.4571, separate	Without <sup>(2)</sup>	7	7
Portable, in sheet steel enclosure, 6 mm gas connections, Viton gas path, with integrated sample gas pump, condensation trap with safety filter on the front plate			8	8 → E20
<b>1st and 2nd infrared measured component</b>				
Measured component	Smallest measuring range	Largest measuring range		
CO	0 ... 500 vpm	0 ... 2 500 vpm	AA	
NO	0 ... 500 vpm	0 ... 2 500 vpm	AB	
CO	0 ... 2 000 vpm	0 ... 10 000 vpm	AC	
NO	0 ... 1 000 vpm	0 ... 5 000 vpm	AD	
CO	0 ... 1 000 vpm	0 ... 5 000 vpm	AK	
NO	0 ... 1 000 vpm	0 ... 5 000 vpm	BA	
CO	0 ... 1 %	0 ... 5 %	BB	
NO	0 ... 1 000 vpm	0 ... 5000 vpm	BD	
CO	0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>	BJ	
NO	0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>	BK	
CO	0 ... 10 %	0 ... 50 %	CA	
CO <sub>2</sub>	0 ... 10 %	0 ... 50 %	CB	
CO	0 ... 10 %	0 ... 50 %	DC	
CO <sub>2</sub>	0 ... 0.5 %	0 ... 2.5 %		
CO	0 ... 20 %	0 ... 100 %		
CO <sub>2</sub>	0 ... 20 %	0 ... 100 %		
CO <sub>2</sub>	0 ... 5 %	0 ... 25 %		
CO	0 ... 100 vpm	0 ... 500 vpm		
CO <sub>2</sub>	0 ... 10 %	0 ... 50 %		
CO	0 ... 0.5 %	0 ... 2.5 %		
CO <sub>2</sub>	0 ... 5 %	0 ... 25 %		
CH <sub>4</sub>	0 ... 1 %	0 ... 5 %		
CO <sub>2</sub>	0 ... 5 %	0 ... 25 %		
CH <sub>4</sub>	0 ... 2 %	0 ... 10 %		
CO <sub>2</sub>	0 ... 5 %	0 ... 25 %		
NO	0 ... 500 vpm	0 ... 2 500 vpm		
<b>Oxygen measurement<sup>(5)</sup></b>				
Without O <sub>2</sub> sensor			0	
With electrochemical O <sub>2</sub> sensor			1	1
With paramagnetic oxygen measuring cell			8	8 8
<b>Power supply</b>				
100 V AC, 50 Hz			0	
120 V AC, 50 Hz			1	
200 V AC, 50 Hz			2	
230 V AC, 50 Hz			3	
100 V AC, 60 Hz			4	
120 V AC, 60 Hz			5	
230 V AC, 60 Hz			6	

Footnotes: See page 1/225.

# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

1

#### Selection and ordering data

#### Article No.

#### ULTRAMAT 23 gas analyzer

For measuring 3 infrared components, UV components, oxygen or 2 infrared components and UV components

7MB2338-

6 -

Cannot be combined

#### 3rd infrared measured component

Measured component	Possible with measuring range identification
CO	D, E, F, G ... R, U, X
CO <sub>2</sub> <sup>1)</sup>	D <sup>6)</sup> , G <sup>6)</sup> , H <sup>6)</sup> , J <sup>6)</sup> , K ... R
CH <sub>4</sub>	E, H, L, N, P, R
C <sub>2</sub> H <sub>4</sub>	K
C <sub>6</sub> H <sub>14</sub>	K
SO <sub>2</sub> <sup>13)</sup>	B <sup>1)</sup> , F ... L, T <sup>12)</sup> , W
NO	E, G ... J, V, W
N <sub>2</sub> O	E <sup>7)</sup> , Y <sup>10)</sup>
SF <sub>6</sub>	H

Smallest measuring range	Largest measuring range
0 ... 200 mg/m <sup>3</sup>	0 ... 1 000 mg/m <sup>3</sup>
0 ... 50 vpm	0 ... 250 vpm
0 ... 100 vpm	0 ... 500 vpm
0 ... 150 vpm	0 ... 750 vpm
0 ... 200 vpm	0 ... 1 000 vpm
0 ... 500 vpm	0 ... 2 500 vpm
0 ... 1 000 vpm	0 ... 5 000 vpm
0 ... 2 000 vpm	0 ... 10 000 vpm
0 ... 0,5 %	0 ... 2,5 %
0 ... 1 %	0 ... 5 %
0 ... 2 %	0 ... 10 %
0 ... 5 %	0 ... 25 %
0 ... 10 %	0 ... 50 %
0 ... 20 %	0 ... 100 %
0 ... 50 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>
0 ... 100 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>
0 ... 150 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>
0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>
0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>
0 ... 50 vpm	0 ... 2 500 vpm
0 ... 500 vpm	0 ... 5 000 vpm

#### Operating software, documentation<sup>3)</sup>

German  
English  
French  
Spanish  
Italian

Footnotes: See page 1/225.

A  
C  
D  
F  
M  
N  
P  
S  
VB  
D  
E  
F  
G  
H  
J  
K  
L  
M  
N  
P  
Q  
R  
S  
T  
U  
V  
W  
X  
Y0  
1  
2  
3  
4

### Selection and ordering data

<i>Additional versions</i>	Order code
Add "-Z" to Article No. and specify Order code	
Add-on electronics with 8 digital inputs/outputs, PROFIBUS PA interface	<b>A12</b>
Add-on electronics with 8 digital inputs/outputs, PROFIBUS DP interface	<b>A13</b>
Stainless steel (mat. no. 1.4571) connection pipe, 6 mm, complete with screwed gland (cannot be combined with Viton hose)	<b>A27</b>
Stainless steel (mat. no. 1.4571) connection pipe, 1/4", complete with screwed gland (cannot be combined with Viton hose)	<b>A29</b>
IEC plug, 37-pin sub-D connector, 9-pin sub-D connector	<b>A33</b>
TAG labels (specific lettering based on customer information)	<b>B03</b>
Clean for O <sub>2</sub> service (specially cleaned gas path)	<b>B06</b>
Gas path for short response time <sup>9)</sup>	<b>C01</b>
Chopper compartment purging for 6 mm gas connection	<b>C02</b>
Chopper compartment purging for 1/4" gas connection	<b>C03</b>
Application with paramagnetic oxygen measuring cell and separate gas path	<b>C11</b>
Presetting to reference temperature 0 °C for conversion into mg/m <sup>3</sup> , applies to all components	<b>D15</b>
IEC Ex: Ex ec ic nC IIC T4 Gc	<b>E20</b>
ATEX: II 3G Ex ec ic nC IIC T4 Gc	
CSA:	
• Class I, Div. 2, Gps ABCD, T4	
• Class I, Zone 2 Ex nA ic nC II T4Gc	
Introduction of flammable gases is not permitted	
Measuring range indication in plain text <sup>4)</sup>	<b>Y11</b>
Measurement of CO <sub>2</sub> in forming gas <sup>8)</sup> (only in conjunction with measuring range 0 to 20/0 to 100 %)	<b>Y14</b>
<i>Accessories</i>	Article No.
CO <sub>2</sub> absorber cartridge	<b>7MB1933-8AA</b>
RS 485/Ethernet converter	<b>A5E00852383</b>
RS 485/RS 232 converter	<b>C79451-Z1589-U1</b>
RS 485/USB converter	<b>A5E00852382</b>
Add-on electronics with 8 digital inputs/outputs and PROFIBUS PA	<b>A5E00056834</b>
Add-on electronics with 8 digital inputs/outputs and PROFIBUS DP	<b>A5E00057159</b>
Set of Torx screwdrivers	<b>A5E34821625</b>

<sup>1)</sup> For measuring ranges below 1 %, a CO<sub>2</sub> absorber cartridge can be used for setting the zero point (see accessories)

<sup>2)</sup> Without separate zero gas input or solenoid valve

<sup>3)</sup> User language can be changed

<sup>4)</sup> Standard setting: smallest measuring range, largest measuring range

<sup>5)</sup> O<sub>2</sub> sensor/O<sub>2</sub> measuring cell in gas path of infrared measured component 1

<sup>6)</sup> With chopper compartment purging (N<sub>2</sub> approx. 3 000 hPa required for measuring ranges below 0.1 % CO<sub>2</sub>), to be ordered separately (see order code C02 or C03)

<sup>7)</sup> Not suitable for use with emission measurements since the cross-sensitivity is too high

<sup>8)</sup> CO<sub>2</sub> measurement in accompanying gas Ar or Ar/He (3:1); forming gas

<sup>9)</sup> Only for version with Viton hose

<sup>10)</sup> Only in combination with CO<sub>2</sub>/NO, measuring range 0 to 5/25 %, 0 to 500/5 000 vpm [-DC-]

<sup>11)</sup> Maximum possible AUTOCAL cycle ≤ 6 h, constant ambient conditions (max. deviation ±1 °C (1.8 °F)); see table "Calibration intervals, standard devices", page 1/230.

<sup>12)</sup> Maximum possible AUTOCAL cycle ≤ 3 h, constant ambient conditions (max. deviation ±1 °C (1.8 °F)); see table "Calibration intervals, standard devices", page 1/230.

<sup>13)</sup> When measuring range identification "S" selected: parallel measurement of SO<sub>2</sub> and NO<sub>2</sub> with UV photometer

**Extractive continuous process gas analysis****ULTRAMAT 23****19" rack unit and portable version**

1

**Selection and ordering data****Article No.****Gas analyzer ULTRAMAT 23 - TÜV version**

For measuring 1 infrared component, UV components and oxygen

7MB2355-000006-0000AA

Cannot be combined

➤ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.

**Enclosure, version and gas paths**

19" rack unit for installation in cabinets

Gas connections

6 mm

Gas paths

FPM (Viton)

Internal sample gas pump

without

0

Measured component

CO

CO<sub>2</sub>SO<sub>2</sub><sup>1)</sup>

NO

Possible with measuring range identification

G, J

P

F, G, H, W

F, G, H, U, V, W

A

C

N

P

Smallest measuring range

0 ... 150 vpm

0 ... 200 vpm

0 ... 500 vpm

0 ... 1 000 vpm

0 ... 5 %

0 ... 50 mg/m<sup>3</sup>0 ... 150 mg/m<sup>3</sup>0 ... 250 mg/m<sup>3</sup>0 ... 400 mg/m<sup>3</sup>Largest measuring range

0 ... 750 vpm

0 ... 1 000 vpm

0 ... 2 500 vpm

0 ... 5 000 vpm

0 ... 25 %

0 ... 1 250 mg/m<sup>3</sup>0 ... 750 mg/m<sup>3</sup>0 ... 1 250 mg/m<sup>3</sup>0 ... 2 000 mg/m<sup>3</sup>

TÜV: see table "TÜV, 1 and 2-component analyzer" page 1/229

only in conjunction with order code T13/T23/T33

F

G

H

J

P

S

U

V

W

Oxygen measurementWithout O<sub>2</sub> sensorWith electrochemical O<sub>2</sub> sensor

With paramagnetic oxygen measuring cell

0

1

8

Power supply

230 V AC, 50 Hz

3

Operating software, documentation

German

English

French

Spanish

Italian

0

1

2

3

4

<sup>1)</sup> When measuring range identification "S" selected: parallel measurement of SO<sub>2</sub> and NO<sub>2</sub> with UV photometer

**Selection and ordering data****Additional versions****Order code**

Add "-Z" to Article No. and specify Order code

Add-on electronics with 8 digital inputs/outputs, PROFIBUS PA interface

Add-on electronics with 8 digital inputs/outputs, PROFIBUS DP interface

IEC plug, 37-pin sub-D connector, 9-pin sub-D connector

O<sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>O<sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>, greater measuring rangeO<sub>2</sub> electrochemical, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>O<sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>, greater measuring rangeWithout O<sub>2</sub>, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>Without O<sub>2</sub>, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>, greater measuring rangeSO<sub>2</sub> with measuring range 0 ... 400/7000 mg/m<sup>3</sup>

A12

A13

A33

T13

T14

T23

T24

T33

T34

Y15

# Extractive continuous process gas analysis

## ULTRAMAT 23

19" rack unit and portable version

1

Selection and ordering data			Article No.	
<b>Gas analyzer ULTRAMAT 23 - TÜV version</b> For measuring 2 infrared components, UV components and oxygen ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.			7MB2357- 6 -	
<b>Enclosure, version and gas paths</b> 19" rack unit for installation in cabinets			Cannot be combined	
<u>Gas connections</u>	<u>Gas paths</u>	<u>Internal sample gas pump</u>		
6 mm	FPM (Viton, not separate)	without	0	
<b>1st infrared measured component</b>				
<u>Measured component</u>	<u>Possible with measuring range identification</u>			
CO	G, J		A	
CO <sub>2</sub>	P		C	
SO <sub>2</sub>	F, G, H, W		N	
NO	F, G, H, U, V, W		P	
<u>Smallest measuring range</u>	<u>Largest measuring range</u>			
0 ... 150 vpm	0 ... 750 vpm		F	
0 ... 200 vpm	0 ... 1 000 vpm		G	
0 ... 500 vpm	0 ... 2 500 vpm		H	
0 ... 1 000 vpm	0 ... 5 000 vpm		J	
0 ... 5 %	0 ... 25 %		P	
0 ... 150 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>		U	
0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>		V	
0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>		W	
<u>Oxygen measurement</u> Without O <sub>2</sub> sensor With electrochemical O <sub>2</sub> sensor With paramagnetic oxygen measuring cell			0 1 8	
<u>Power supply</u> 230 V AC, 50 Hz			3	
<b>2nd infrared measured component</b>				
<u>Measured component</u>	<u>Possible with measuring range identification</u>			
CO	G, J		A	
CO <sub>2</sub>	P		C	
SO <sub>2</sub> <sup>1)</sup>	F, G, H, W		N	
NO	F, G, H, U, V, W		P	
<u>Smallest measuring range</u>	<u>Largest measuring range</u>			
0 ... 150 vpm	0 ... 750 vpm		F	
0 ... 200 vpm	0 ... 1 000 vpm		G	
0 ... 500 vpm	0 ... 2 500 vpm		H	
0 ... 1 000 vpm	0 ... 5 000 vpm		J	
0 ... 5 %	0 ... 25 %		P	
0 ... 50 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>		S	
0 ... 150 mg/m <sup>3</sup>	0 ... 750 mg/m <sup>3</sup>		U	
0 ... 250 mg/m <sup>3</sup>	0 ... 1 250 mg/m <sup>3</sup>		V	
0 ... 400 mg/m <sup>3</sup>	0 ... 2 000 mg/m <sup>3</sup>		W	
<u>Operating software, documentation</u> German English French Spanish Italian			0 1 2 3 4	

1) When measuring range identification "S" selected: parallel measurement of SO<sub>2</sub> and NO<sub>2</sub> with UV photometer

Selection and ordering data	Order code
<u>Additional versions</u>	
Add "-Z" to Article No. and specify Order code	
Add-on electronics with 8 digital inputs/outputs, PROFIBUS PA interface	A12
Add-on electronics with 8 digital inputs/outputs, PROFIBUS DP interface	A13
IEC plug, 37-pin sub-D connector, 9-pin sub-D connector	A33
O <sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m <sup>3</sup>	T13
O <sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m <sup>3</sup> , greater measuring range	T14
O <sub>2</sub> electrochemical, suitability-tested EN 15267, IR measuring range in mg/m <sup>3</sup>	T23
O <sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m <sup>3</sup> , greater measuring range	T24
Without O <sub>2</sub> , suitability-tested EN 15267, IR measuring range in mg/m <sup>3</sup>	T33
Without O <sub>2</sub> , suitability-tested EN 15267, IR measuring range in mg/m <sup>3</sup> , greater measuring range	T34
SO <sub>2</sub> with measuring range 0 ... 400/7000 mg/m <sup>3</sup>	Y15

# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

1

#### Selection and ordering data

##### Gas analyzer ULTRAMAT 23 - TÜV version

For measuring 3 infrared components, UV components, oxygen or 2 infrared components and UV components

➤ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.

##### Enclosure, version and gas paths

19" rack unit for installation in cabinets

##### Gas connections

6 mm

##### Gas paths

FPM (Viton, not separate)

##### Internal sample gas pump

without

##### 1st and 2nd infrared measured component

##### Measured component

CO

NO

##### Smallest measuring range

0 ... 250 mg/m<sup>3</sup>

0 ... 400 mg/m<sup>3</sup>

##### Largest measuring range

0 ... 1 250 mg/m<sup>3</sup>

0 ... 2 000 mg/m<sup>3</sup>

##### Oxygen measurement

Without O<sub>2</sub> sensor

With electrochemical O<sub>2</sub> sensor

With paramagnetic oxygen measuring cell

##### Power supply

230 V AC, 50 Hz

##### 3rd infrared measured component

##### Measured component

SO<sub>2</sub><sup>1)</sup>

##### Possible with measuring range identification

F, G, H, W

##### Smallest measuring range

0 ... 150 vpm

0 ... 200 vpm

0 ... 500 vpm

0 ... 50 mg/m<sup>3</sup>

0 ... 400 mg/m<sup>3</sup>

##### Largest measuring range

0 ... 750 vpm

0 ... 1 000 vpm

0 ... 2 500 vpm

0 ... 1 250 mg/m<sup>3</sup>

0 ... 2 000 mg/m<sup>3</sup>

TÜV: see table "TÜV, 3-component analyzer" page 1/229

##### Operating software, documentation

German

English

French

Spanish

Italian

#### Article No.

7MB2358-

0 1 2 3 4

Cannot be combined

6 -

0

A K

0

1

8

3

N

F

G

H

S

W

0

1

2

3

4

<sup>1)</sup> When measuring range identification "S" selected: parallel measurement of SO<sub>2</sub> and NO<sub>2</sub> with UV photometer

#### Selection and ordering data

##### Additional versions

Add "-Z" to Article No. and specify Order code

Add-on electronics with 8 digital inputs/outputs, PROFIBUS PA interface

Add-on electronics with 8 digital inputs/outputs, PROFIBUS DP interface

IEC plug, 37-pin sub-D connector, 9-pin sub-D connector

O<sub>2</sub> paramagnetic, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>

O<sub>2</sub> electrochemical, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>

Without O<sub>2</sub>, suitability-tested EN 15267, IR measuring range in mg/m<sup>3</sup>

SO<sub>2</sub> with measuring range 0 ... 400/7000 mg/m<sup>3</sup>

#### Order code

A12

A13

A33

T13

T23

T33

Y15

### TÜV, 1 and 2-component analyzer

Only in conjunction with order code T13/T23/T33

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 ...
F				400 mg/m <sup>3</sup>	2 000 mg/m <sup>3</sup>	1 000 mg/m <sup>3</sup>
G		200 mg/m <sup>3</sup>	1 250 mg/m <sup>3</sup>	500 mg/m <sup>3</sup>	2 500 mg/m <sup>3</sup>	1 250 mg/m <sup>3</sup>
H				1 400 mg/m <sup>3</sup>	7 000 mg/m <sup>3</sup>	
S				75 mg/m <sup>3</sup>	1 250 mg/m <sup>3</sup>	

Only in conjunction with order code T14/T24/T34

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 ...
H					600 mg/m <sup>3</sup>	3 000 mg/m <sup>3</sup>
J		1 250 mg/m <sup>3</sup>	6 000 mg/m <sup>3</sup>			

#### Ordering example

ULTRAMAT 23, TÜV  
 IR component: CO  
 Measuring range: 0 to 200 / 1 250 mg/m<sup>3</sup>  
 with electrochem. O<sub>2</sub> sensor  
 230 V AC; German  
**7MB2355-0AG16-3AA0-Z +T23**

### TÜV, 3-component analyzer

(only in conjunction with order code T13/T23/T33)

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 ...
F				400 mg/m <sup>3</sup>	2 000 mg/m <sup>3</sup>	
G				500 mg/m <sup>3</sup>	2 500 mg/m <sup>3</sup>	
H				1 400 mg/m <sup>3</sup>	7 000 mg/m <sup>3</sup>	

#### Ordering example

ULTRAMAT 23, TÜV  
 IR component: CO/NO + SO<sub>2</sub>  
 Measuring range: CO: 0 to 250 / 1 250 mg/m<sup>3</sup>, NO: 0 to 400 / 2 000 mg/m<sup>3</sup>, SO<sub>2</sub>: 0 to 400 / 2 000 mg/m<sup>3</sup>  
 with paramagnetic oxygen measuring cell  
 230 V AC; German  
**7MB2358-0AK86-3NF0-Z +T13**

**Extractive continuous process gas analysis****ULTRAMAT 23****19" rack unit and portable version****Ordering notes**

Special selection rules must be observed when measuring some components.

Measured component N<sub>2</sub>O

7MB2335, 7MB2337 and 7MB2338

(application: Si chip production)

- Measuring range 0 to 100 / 500 vpm (MB designation "E")
- Can only be used to measure N<sub>2</sub>O in ultra-pure gases

7MB2337 and 7MB2338

(application: measurement in accordance with the requirements of the Kyoto protocol)

- Measuring range 0 to 500 / 5 000 vpm (MB designation "Y")
- Requires simultaneous measurement of CO<sub>2</sub> for correction of cross-interference

7MB2337-\*CP\*6-\*SY\* or

7MB2338-\*DC\*6-\*SY\* (including NO measurement)

7MB2337 and 7MB2338

(application with paramagnetic oxygen measuring cell and separate gas path)

7MB2337-4\*\*86-\*\*\*\* - Z + C11

7MB2337-5\*\*86-\*\*\*\* - Z + C11

7MB2338-4\*\*86-\*\*\*\* - Z + C11

7MB2338-5\*\*86-\*\*\*\* - Z + C11

Measured component SF<sub>6</sub>

7MB2335, 7MB2337 and 7MB2338

(application: Si chip production)

- Measuring range 0 to 500 / 2 500 vpm (MB designation "H")
- Can only be used to measure SF<sub>6</sub> in inert gases

	Calibration with calibration gas		Comment (keep to technical specs)
	Zero point	Calibration point	
	Weeks		
IR components	0	52	
O <sub>2</sub> - electrical chemical sensor	52	0	
O <sub>2</sub> paramagnetic Cell	1	0	at MB < 5 %
	8	0	at MB > 5 %
O <sub>2</sub> paramagnetic Cell	0	52	at MB < 5 %
	0	52	at MB > 5 %
H <sub>2</sub> S sensor	0	4	

0 = with AutoCal, with ambient air or N<sub>2</sub>, every 3 ... 24h - depending on measuring range

Calibration intervals, standard devices

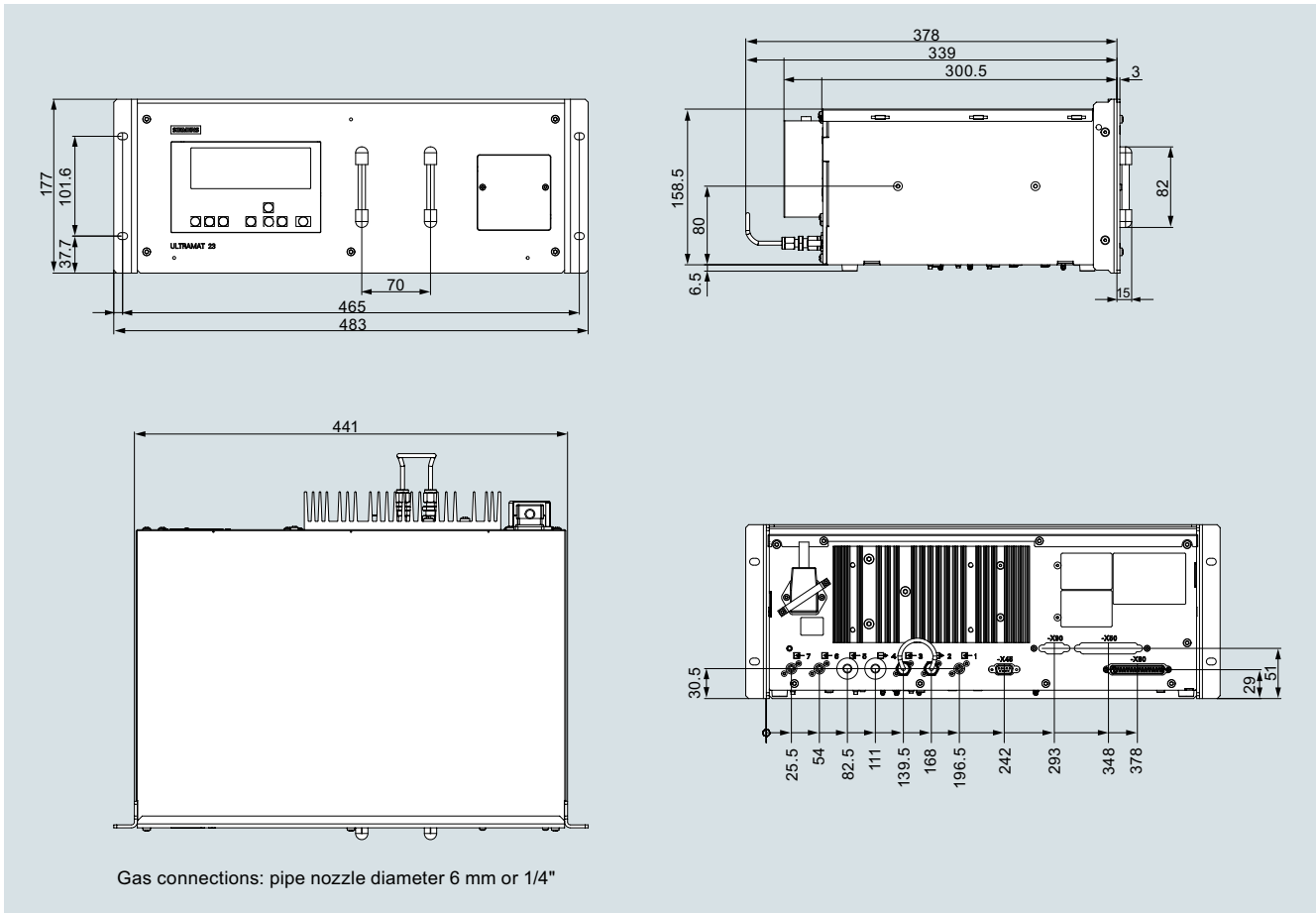


# Extractive continuous process gas analysis ULTRAMAT 23

19" rack unit and portable version

1

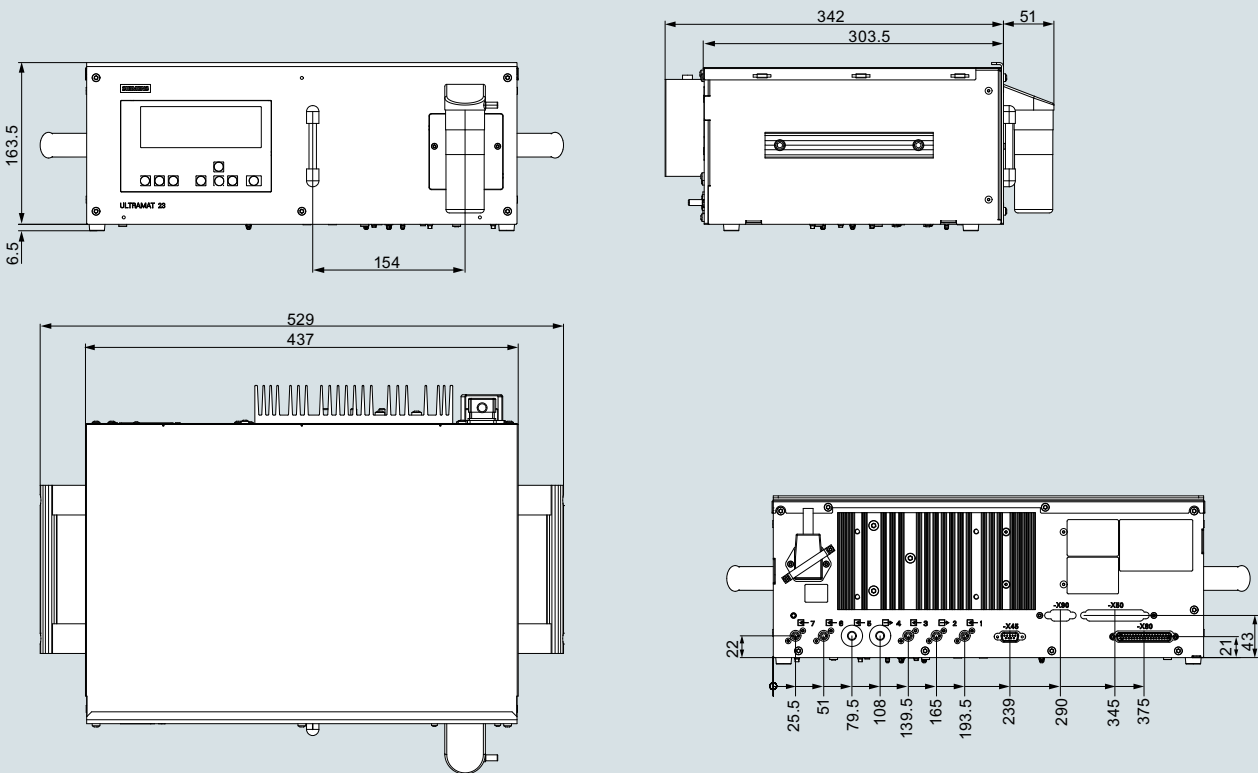
## Dimensional drawings



ULTRAMAT 23, 19" rack unit, dimensions in mm

# Extractive continuous process gas analysis ULTRAMAT 23

## 19" rack unit and portable version

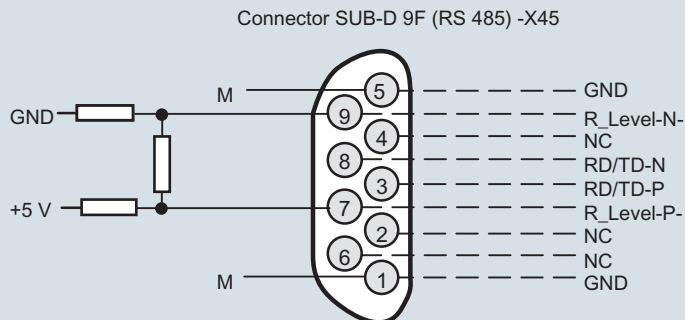


Gas connections: pipe nozzle diameter 6 mm or 1/4"

ULTRAMAT 23, bench-top unit, dimensions in mm

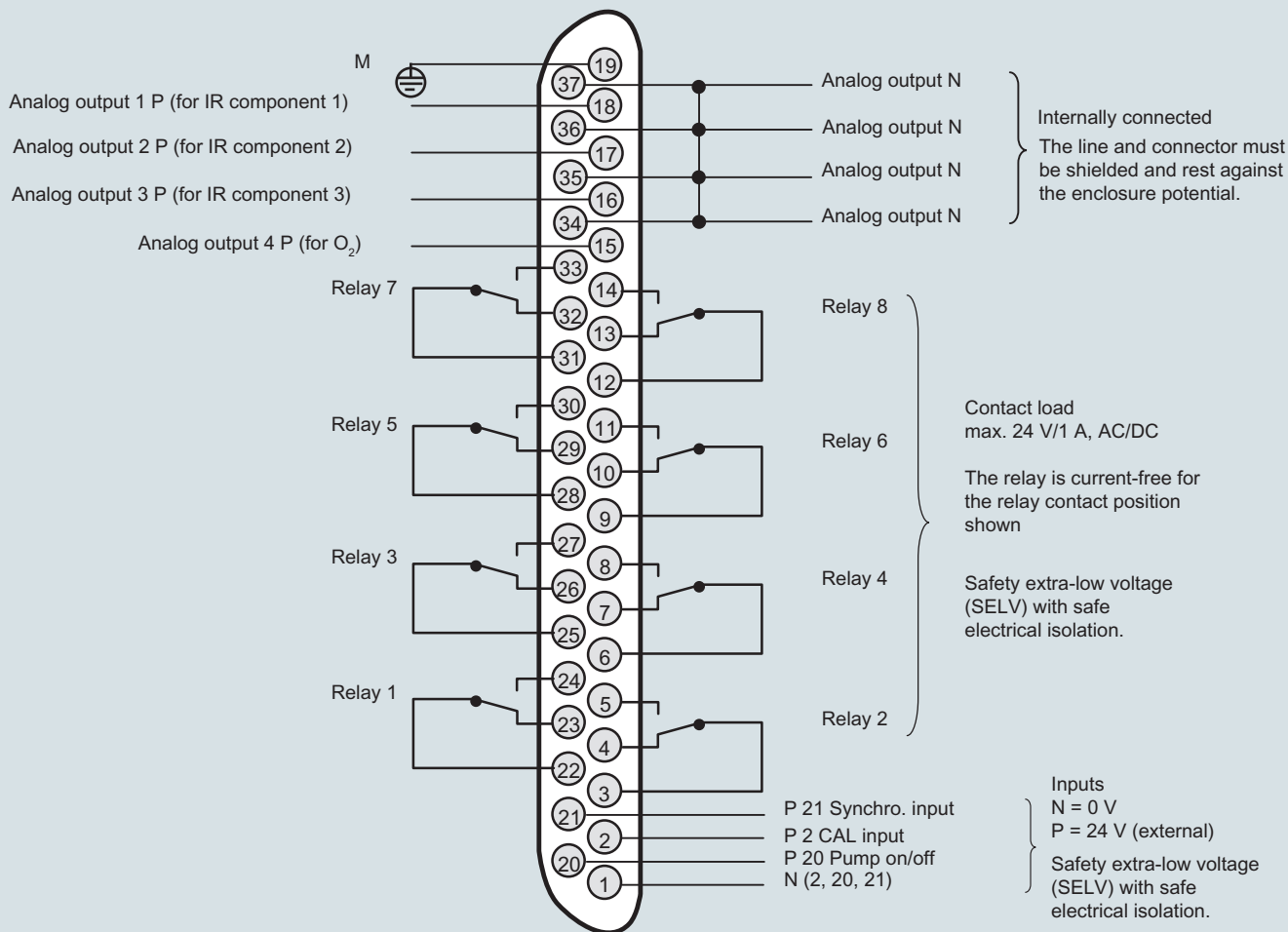
**Circuit diagrams**

**Pin assignment (electrical and gas connections)**



It is possible to connect bus terminating resistors to pins 7 and 9.

Connector SUB-D 37F -X80



Internally connected  
The line and connector must be shielded and rest against the enclosure potential.

Contact load  
max. 24 V/1 A, AC/DC  
The relay is current-free for the relay contact position shown  
Safety extra-low voltage (SELV) with safe electrical isolation.

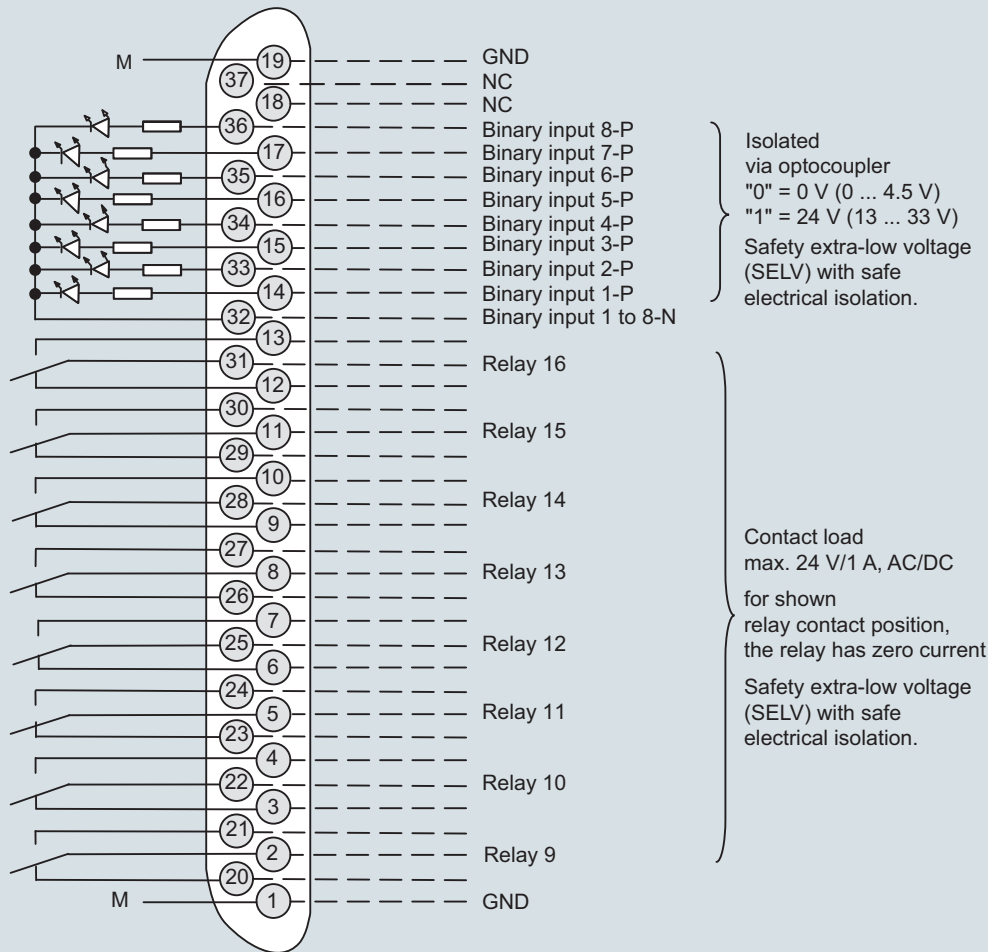
# Extractive continuous process gas analysis

## ULTRAMAT 23

### 19" rack unit and portable version

1

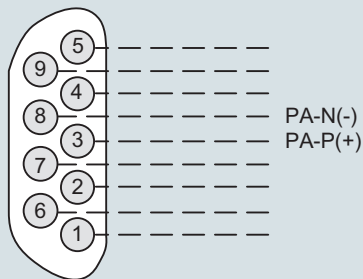
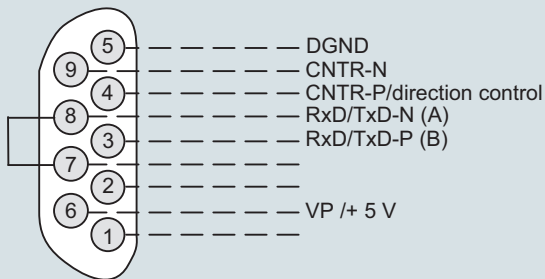
Connector SUB-D 37F (option) -X50



Connector SUB-D 9F-X90 PROFIBUS DP

optional

Connector SUB-D 9M-X90 PROFIBUS PA



Note:  
 All cables to the connectors or terminal blocks must be shielded and rest against the enclosure potential.

ULTRAMAT 23, pin assignment of optional PROFIBUS interface card

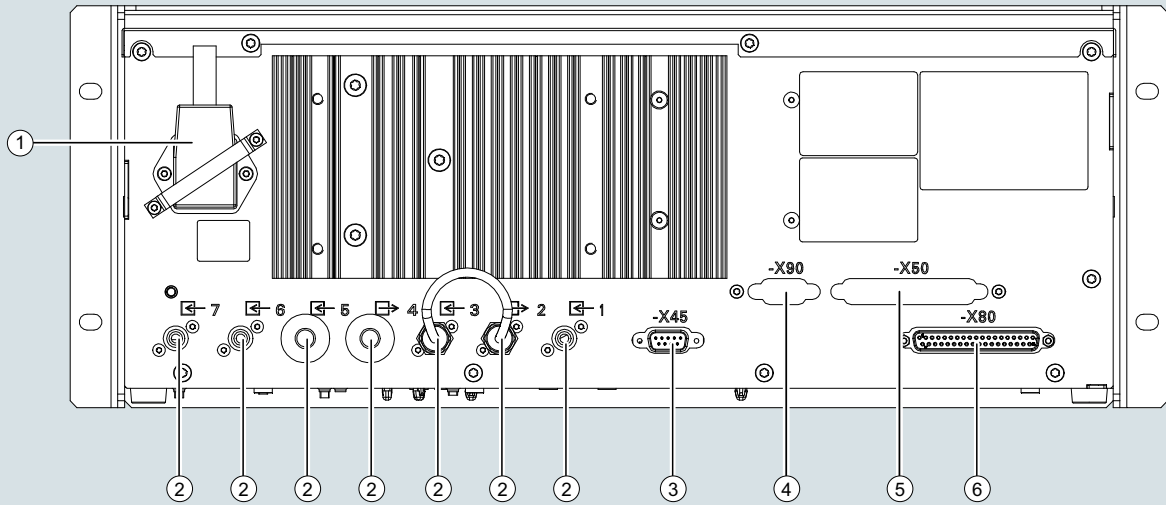
# Extractive continuous process gas analysis

## ULTRAMAT 23

19" rack unit and portable version

1

### 19" rack unit

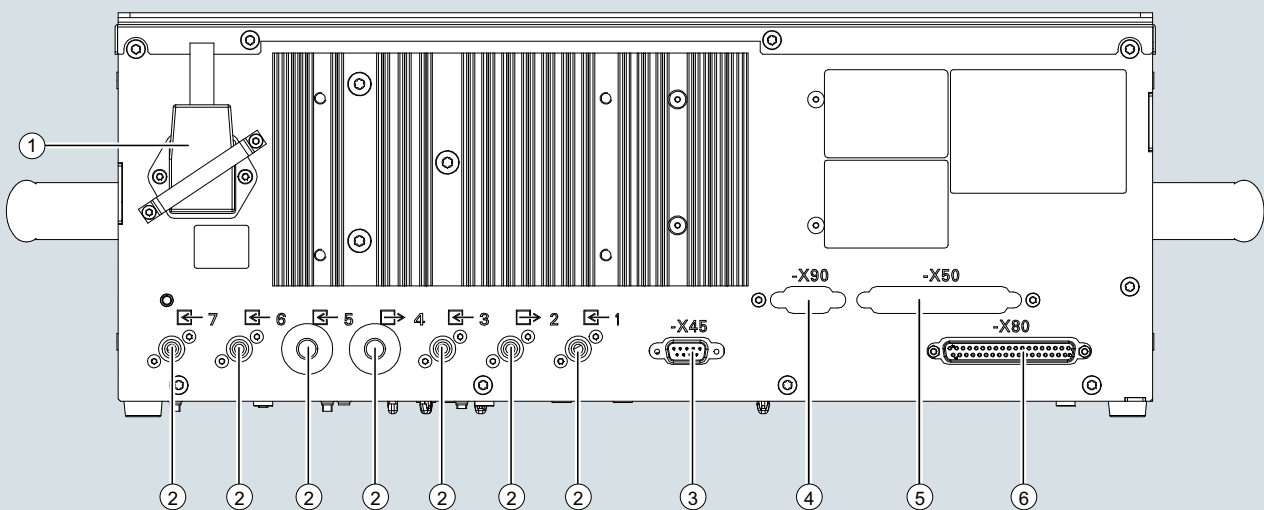


- ① Auxiliary power and fine fuse
- ② Gas connections: nozzles 6 mm or ¼"
- ③ -X45: ELAN (RS485) 9-pin connector
- ④ -X90: 9-pin interface connector (option board with PROFIBUS-DP/PA)
- ⑤ -X50: 37-pin connector: Option board; binary inputs/relay outputs
- ⑥ -X80: 37-pin connector: Analog and digital inputs and outputs

When installing in a cabinet: mount analyzer on support rails.

ULTRAMAT 23, 19" rack unit, e.g. an IR measured component with oxygen measurement

### Portable unit

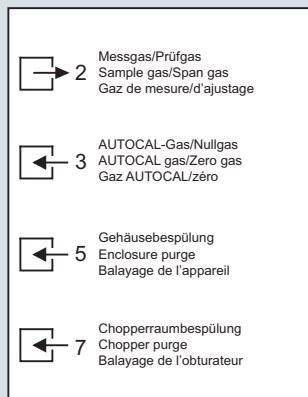


- ① Power connector
- ② Gas connections: nozzles 6 mm or ¼"
- ③ -X45: ELAN (RS485) 9-pin connector
- ④ -X90: 9-pin interface connector (option board with PROFIBUS-DP/PA)
- ⑤ -X50: 37-pin connector: Option board; binary inputs/relay outputs
- ⑥ -X80: 37-pin connector: Analog and digital inputs and outputs

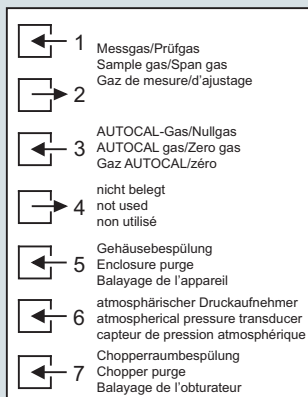
ULTRAMAT 23 portable, in sheet-steel enclosure, gas connections and electrical connections

**Extractive continuous process gas analysis****ULTRAMAT 23****19" rack unit and portable version**

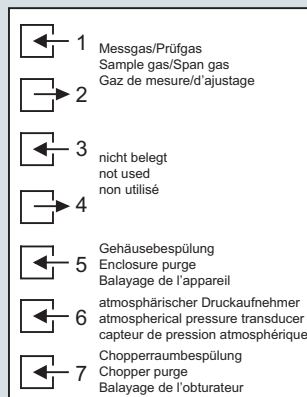
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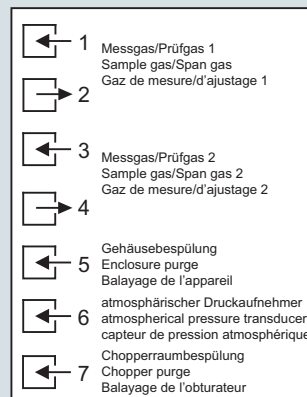
Key to symbols  
 ULTRAMAT 23  
 portable, in sheet-steel housing



Key to symbols  
 ULTRAMAT 23  
 19" rack unit  
 with sample gas pump



Key to symbols  
 ULTRAMAT 23  
 19" rack unit  
 without sample gas pump



Key to symbols  
 ULTRAMAT 23  
 19" rack unit  
 with two separate  
 gas paths or pipe version

ULTRAMAT 23, designation of the different labels

### More information

The complete documentation is available in various languages for downloading free of charge:

<http://www.siemens.com/processanalytics/documentation>

### Selection and ordering data

Description	Quantity for 2 years	Quantity for 5 years	Article No.
<b>Analyzer unit</b>			
O-ring for analyzer chamber: 180, 90, 60, 20 mm	2	4	<b>C71121-Z100-A99</b>
Chopper			
• With motor, for 1 IR channel (7MB23X5-...)	1	1	<b>C79451-A3468-B515</b>
• With motor, for 2 IR channels (7MB23X7-..., 7MB23X8-...)	1	1	<b>C79451-A3468-B516</b>
<b>Electronics</b>			
Motherboard, with firmware	-	1	<b>C79451-A3494-D501</b>
Keypad	1	1	<b>C79451-A3492-B605</b>
LCD module	1	1	<b>C79451-A3494-B16</b>
Connector filter	-	1	<b>W75041-E5602-K2</b>
Line switch (portable analyzer)	-	1	<b>W75050-T1201-U101</b>
Fusible element 220 ... 240 V	2	4	<b>W79054-L1010-T630</b>
Fusible element 100 ... 120 V	2	4	<b>W79054-L1011-T125</b>
<b>Other</b>			
Safety filter (zero gas), internal	2	2	<b>C79127-Z400-A1</b>
Safety filter (sample gas), internal	2	3	<b>C79127-Z400-A1</b>
Pressure switch	1	2	<b>C79302-Z1210-A2</b>
Flowmeter	1	2	<b>C79402-Z560-T1</b>
Set of gaskets for sample gas pump	2	5	<b>C79402-Z666-E20</b>
Condensation trap (for portable unit, in sheet steel enclosure)	1	2	<b>C79451-A3008-B43</b>
Filter (for portable unit, in sheet steel enclosure)	1	2	<b>C79451-A3008-B60</b>
Oxygen sensor	1	1	<b>C79451-A3458-B55</b>
Sample gas pump 50 Hz	1	1	<b>C79451-A3494-B10</b>
Sample gas pump 60 Hz	1	1	<b>C79451-A3494-B11</b>
Solenoid valve	1	1	<b>C79451-A3494-B33</b>