Overview

Up to four gas components can be measured simultaneously with the ULTRAMAT 23 gas analyzer: up to three infrared-active gases such as CO, CO_2, NO, SO_2, CH_4, plus O_2 with an electrochemical oxygen measuring cell.

ULTRAMAT 23 basic versions for:

- 1 infrared gas component with/without oxygen measurement
- 2 infrared gas components with/without oxygen measurement
- 3 infrared gas components with/without oxygen measurement

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_2 and CH_4), plus O_2 and H_2S with electrochemical measuring cells.

With the ULTRAMAT 23 gas analyzer with paramagnetic oxygen cell, up to four gas components can be measured continuously: three infrared-active gases, plus O_2 ("dumbbell" measuring cell).

Benefits

- AUTOCAL with ambient air (dependent on the measured component)
  Highly cost effective because calibration gases are not required
- High selectivity thanks to multi-layer detectors, e.g. low cross-sensitivity to water vapor
- Sample chambers can be cleaned as required on site
  Cost savings due to reuse after contamination
- Menu-assisted operation in plaintext
  Operator control without manual, high level of operator safety
- Service information and logbook
  Preventive maintenance; help for service and maintenance personnel, cost savings
- Coded operator level 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 important components, including H_2S
- Long service life of the H_2S 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_4), is permissible (TÜV certificate)

General information

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_x measurement before and after the NO_x converter.
  The ULTRAMAT 23 gas analyzer can be used in emission measuring systems and for process and safety monitoring.
- TÜV version/QAL/MCERTS
  TÜV-approved versions of the ULTRAMAT 23 are available for measurement of CO, NO, SO_2 and O_2 according to 13th BImSchV/27th BImSchV/30th BImSchV (N_2O) and TA Luft.
  Smallest TÜV-approved and permitted measuring ranges:
  - 1- and 2-component analyzer
    CO: 0 to 150 mg/m^3
    NO: 0 to 100 mg/m^3
    SO_2: 0 to 400 mg/m^3
  - 3-component analyzer
    CO: 0 to 250 mg/m^3
    NO: 0 to 400 mg/m^3
    SO_2: 0 to 400 mg/m^3

All larger measuring ranges are also approved.

Furthermore, the TÜV-approved versions of the ULTRAMAT 23 comply with the requirements of EN 14956 and 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 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 it in the evaluation computer.

- Version with reduced 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 flushing: consumption 100 ml/min (upstream pressure: approx. 3 000 hPa)

Design

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets, with or without telescopic rails
- 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

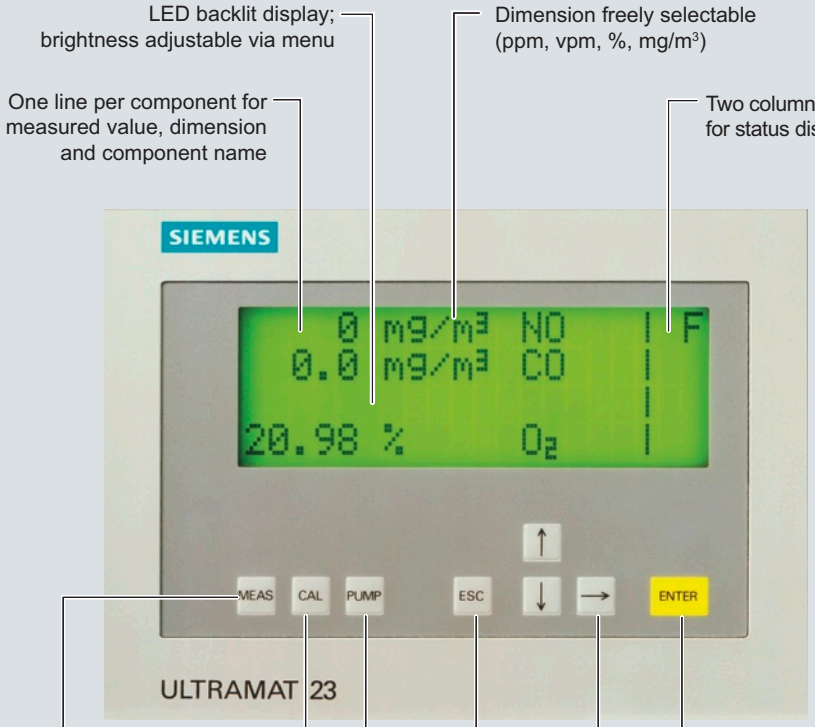
- Three binary inputs for sample gas pump On/Off, triggering of AUTOCAL and synchronization of several devices
- Eight relay outputs can be freely configured for fault, maintenance request, maintenance switch, limits, measuring range identification and external solenoid valves
- Eight additional binary 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
- SIPRO GA software as service and maintenance tool



LED backlit display; brightness adjustable via menu

Dimension freely selectable (ppm, vpm, %, mg/m³)

One line per component for measured value, dimension and component name

Two columns reserved for status displays

Immediate return to measurement mode

CAL key to start AUTOCAL with ambient air or N_2 or air without CO_2

Switch internal pump on and off; pump flowrate adjustable via menu

Scroll back in menu or cancel an input

↑↓ → Keys for menu control; increasing/decreasing numerical values

ENTER key to call the main menu or to save entered values

ULTRAMAT 23, membrane keyboard and graphic display

General information

Designs – parts wetted by sample gas

Gas path		19" rack unit	Desktop unit
With hoses	Condensation trap/gas inlet	-	PA (polyamide)
	Condensation trap	-	PE (polyethylene)
	Gas connections 6 mm	PA (polyamide)	PA (polyamide)
	Gas connections ¼"	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		
	• Body	Aluminum	Aluminum
	• Lining	Aluminum	Aluminum
	• Fitting	Stainless steel, mat. no. 1.4571	Stainless steel, mat. no. 1.4571
	• Window	CaF_2	CaF_2
	• Adhesive	E353	E353
	• O-ring	FPM (Viton)	FPM (Viton)
With pipes, only available in version "without pump"	Gas connections 6 mm / ¼"	Stainless steel, mat. no. 1.4571	
	Pipes	Stainless steel, mat. no. 1.4571	
	Analyzer chamber		
	• Body	Aluminum	
	• Lining	Aluminum	
	• Fitting	Stainless steel, mat. no. 1.4571	
	• Window	CaF_2	
	• Adhesive	E353	
	• O-ring	FPM (Viton)	

ULTRAMAT 23 also available as bench-top unit:
- 2 handles on top cover
- 4 rubber feet for setting up
- No mounting frame

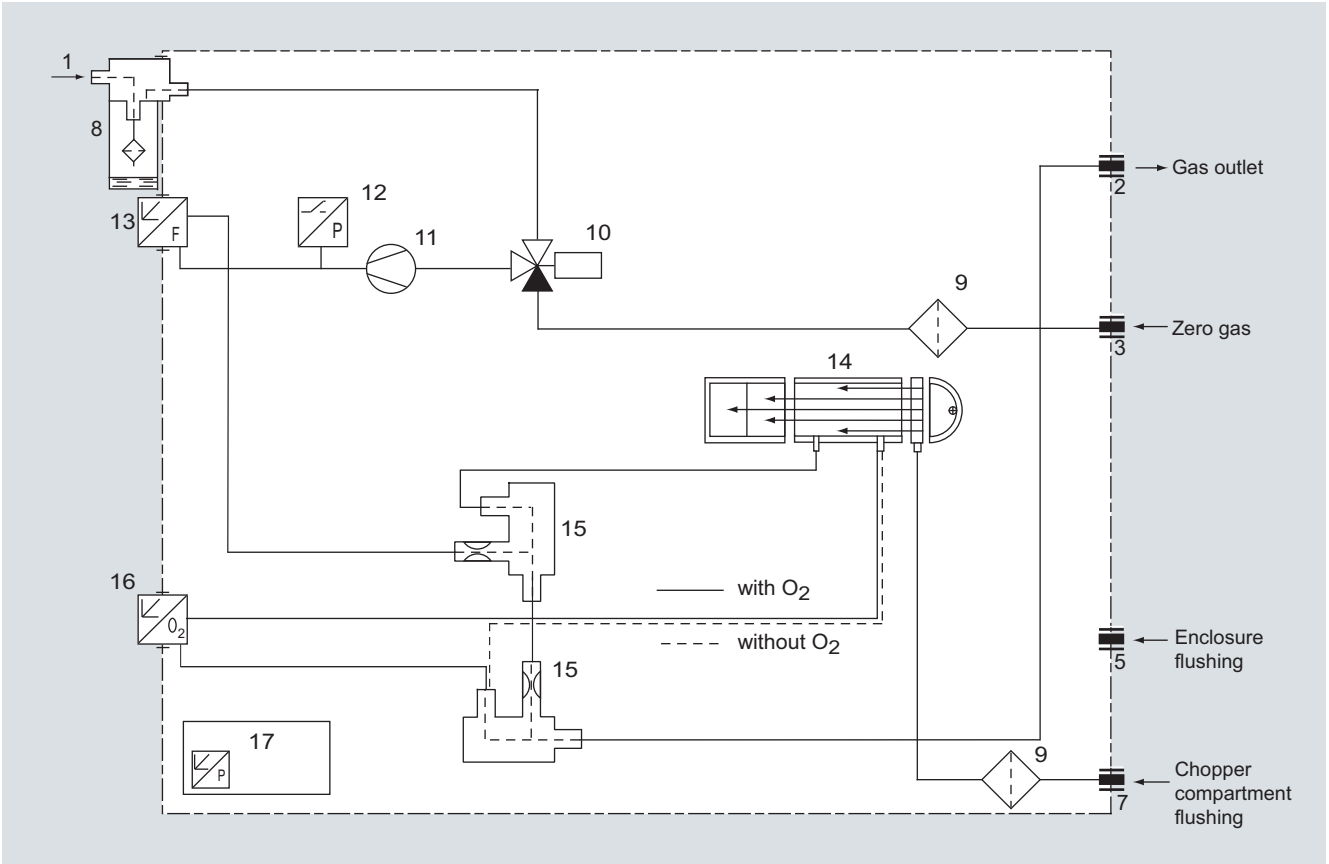
ULTRAMAT 23, design

General information

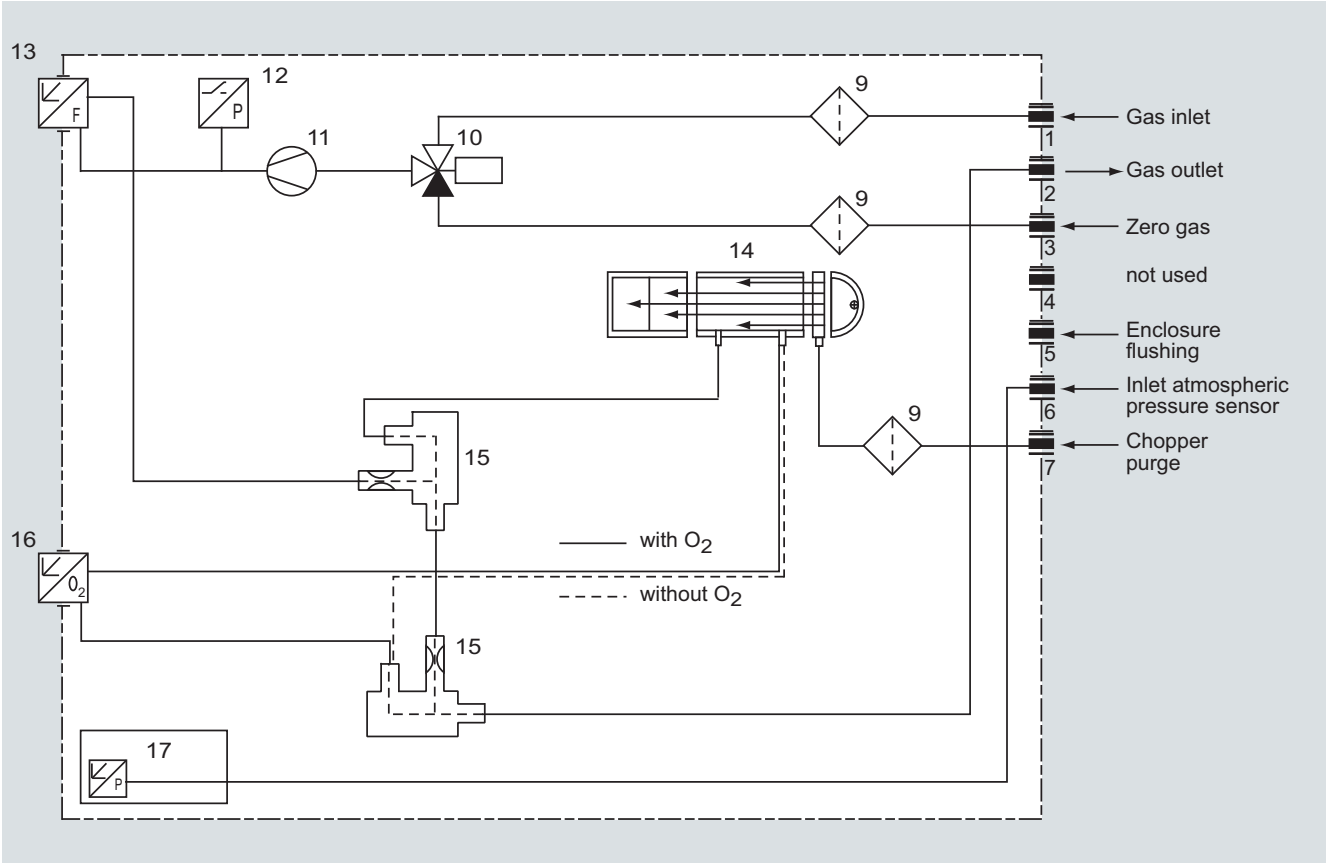
Gas path

Legend for the gas path figures

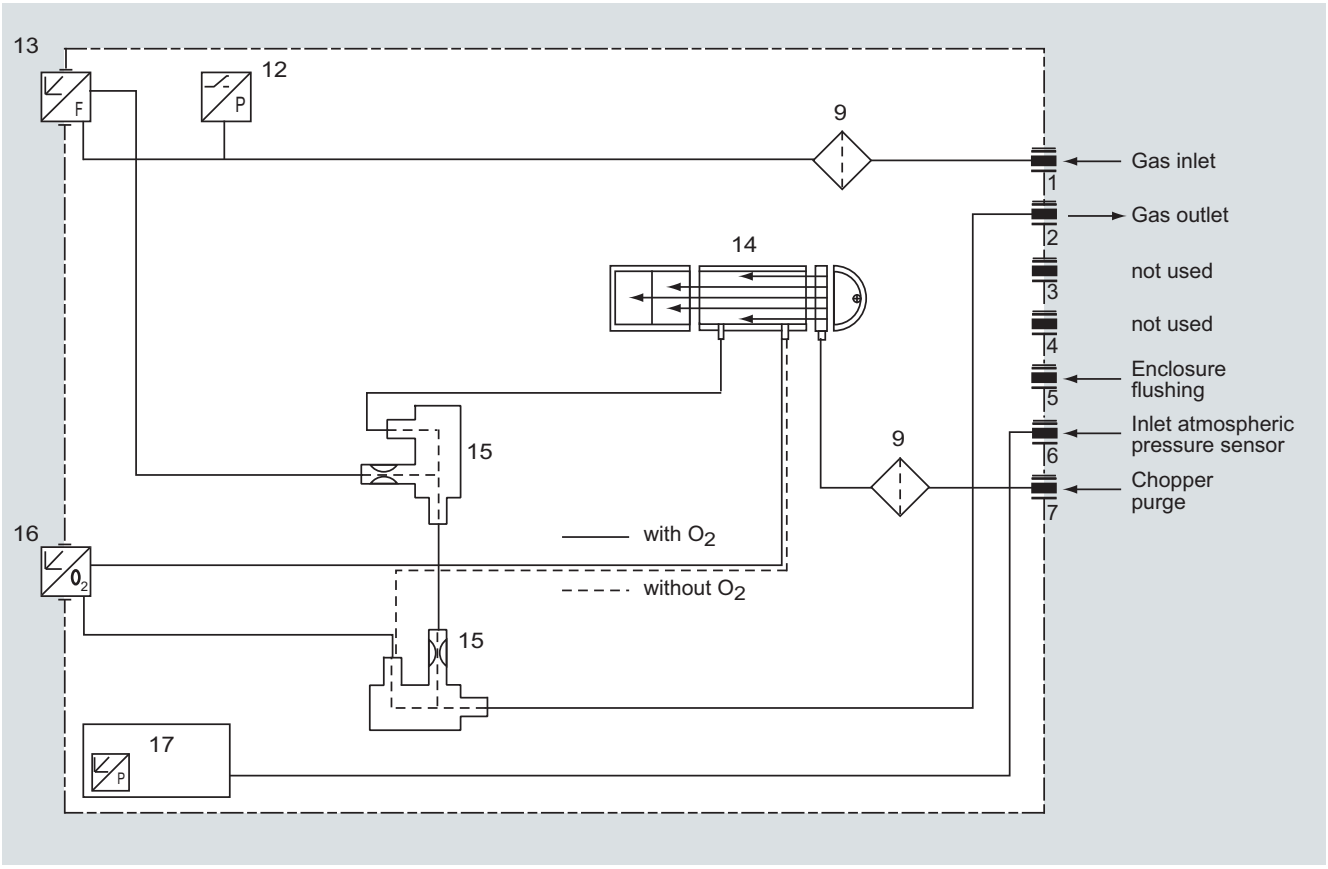
1	Inlet for sample gas/calibration gas	10	Solenoid valve
2	Gas outlet	11	Sample gas pump
3	Inlet for AUTOCAL/zero gas or inlet for sample gas/calibration gas (channel 2)	12	Pressure switch
		13	Flow indicator
4	Gas outlet (channel 2)	14	Analyzer unit
5	Enclosure flushing	15	Safety condensation trap
6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



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

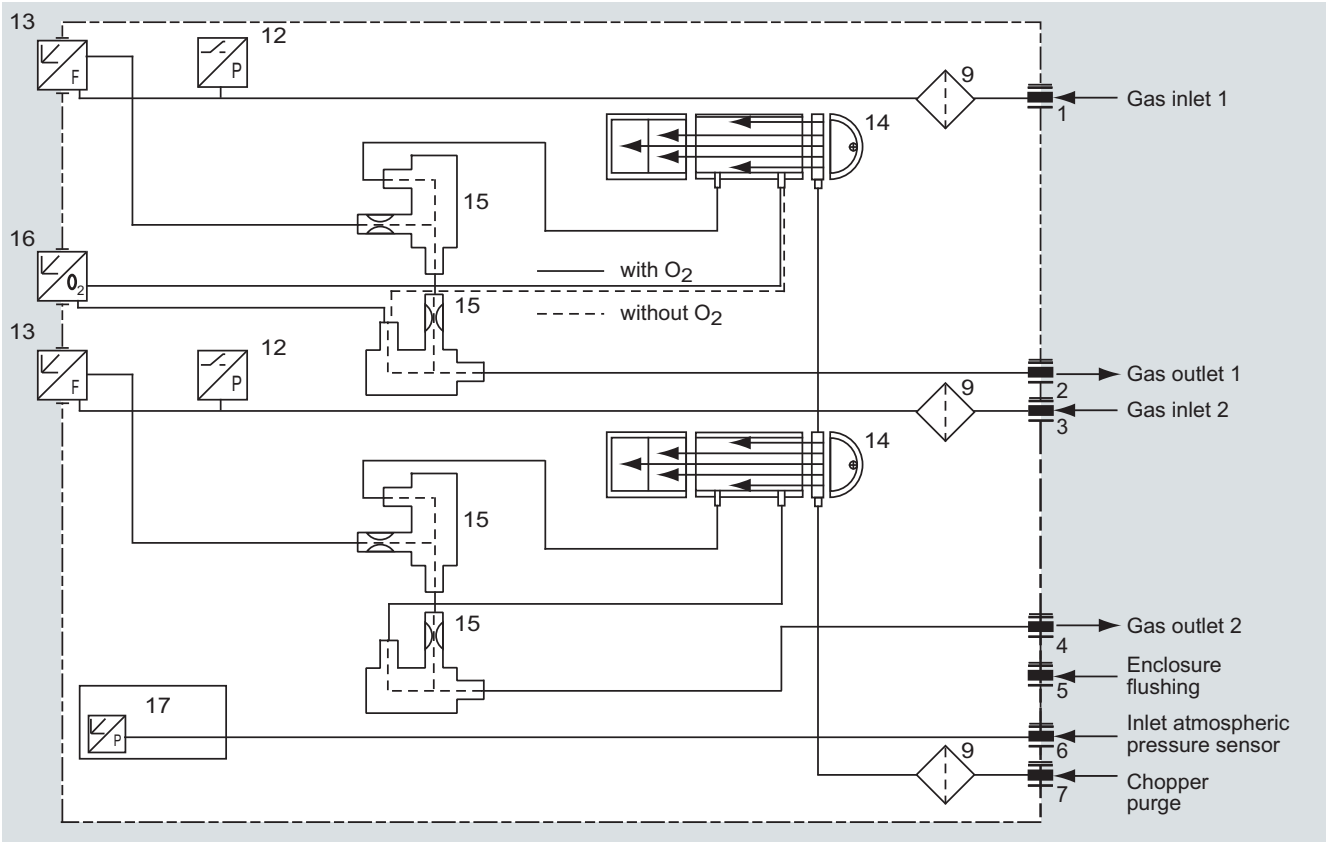


ULTRAMAT 23, 19" rack unit enclosure with internal sample gas pump, optional oxygen measurement

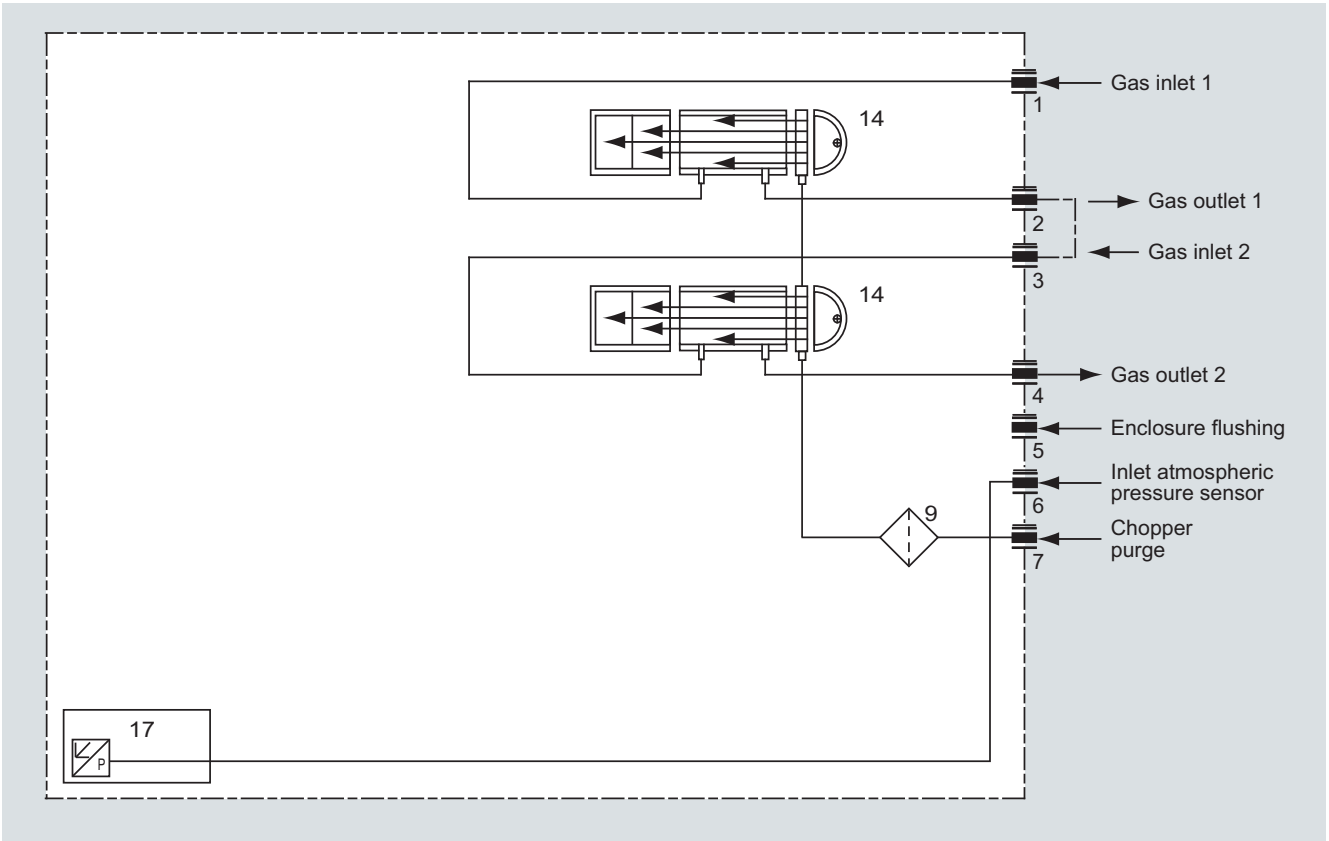


ULTRAMAT 23, 19" rack unit enclosure without internal sample gas pump, optional oxygen measurement

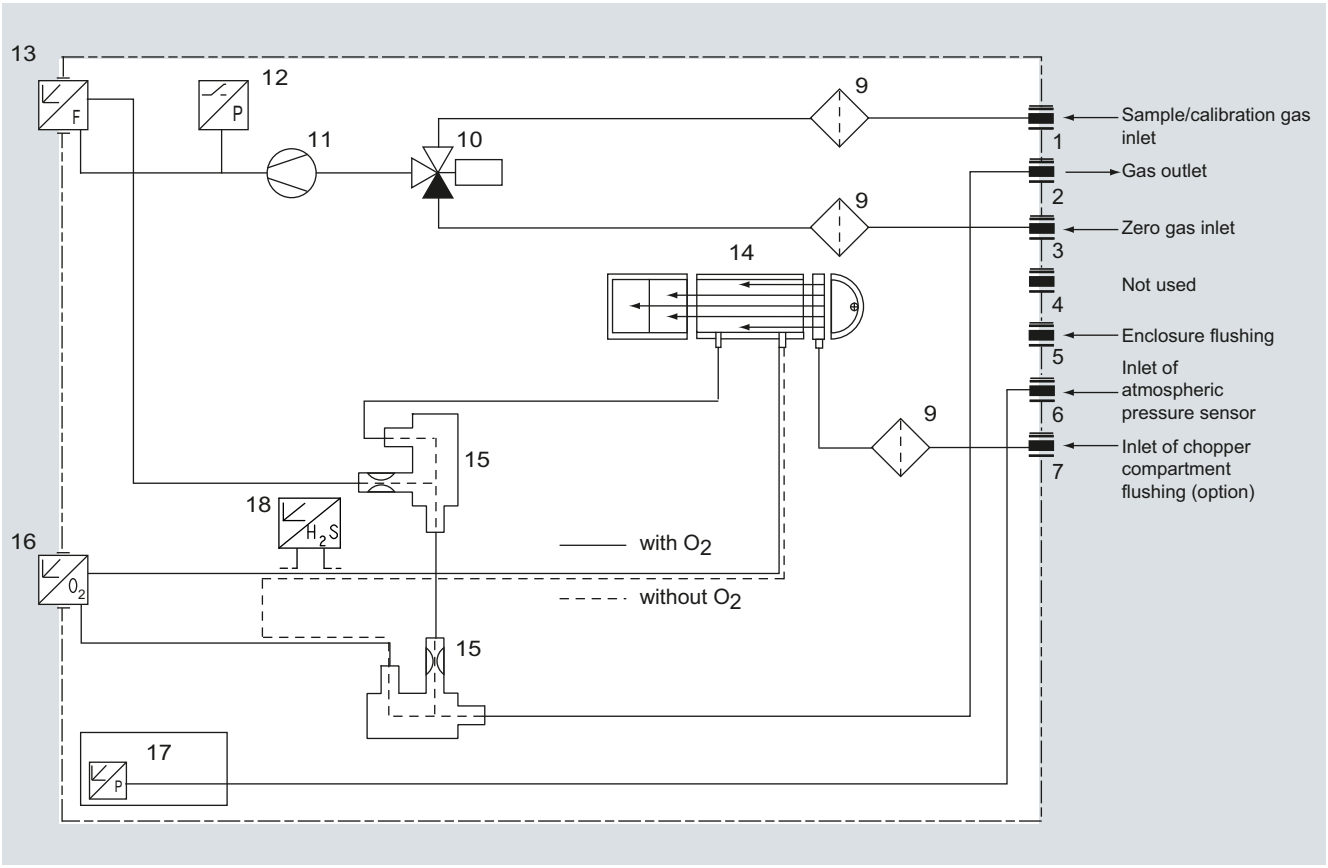
General information



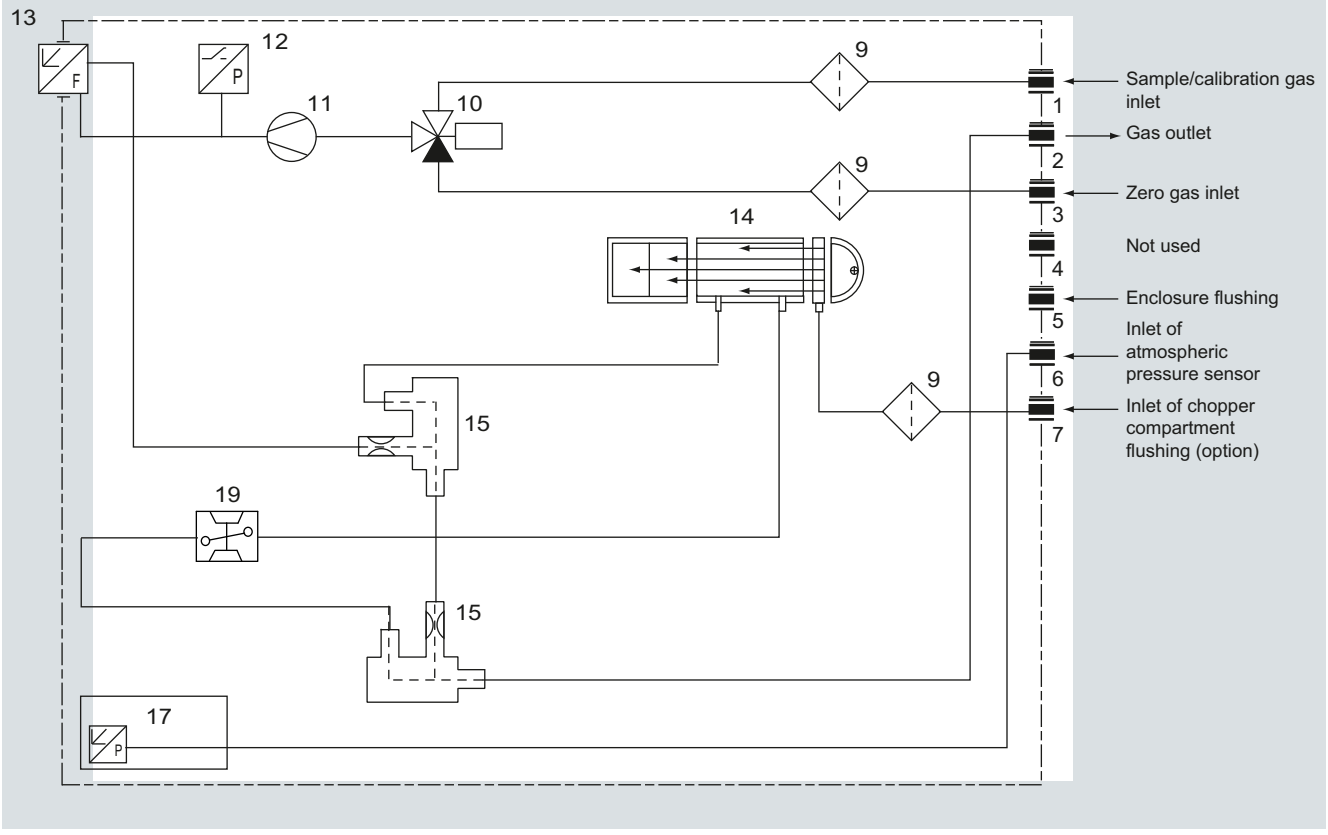
ULTRAMAT 23, 19" rack unit enclosure without internal sample gas pump, with separate gas path for the 2nd measured component or for the 2nd and 3rd measured components, optional oxygen measurement



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



ULTRAMAT 23, 19" rack unit enclosure with internal sample gas pump and H_2S sensor



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

General information

Function

The ULTRAMAT 23 uses two 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". An IR 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 sample 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 layer 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.

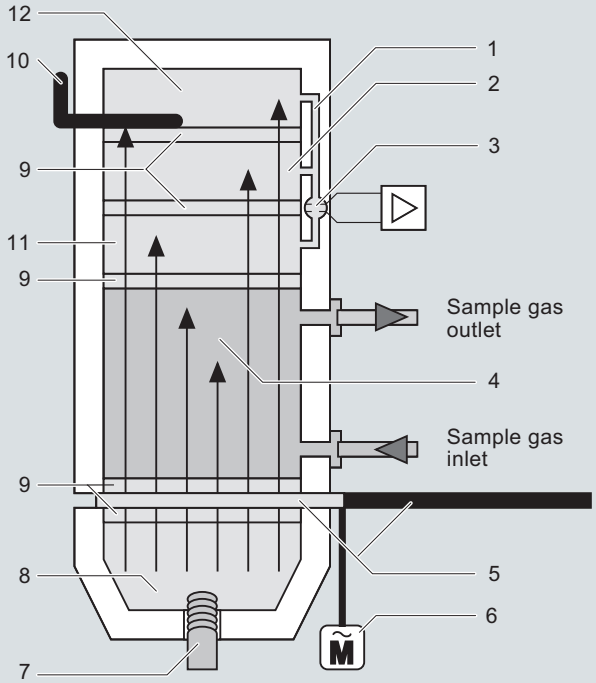
The rotating chopper (5) generates a pulsating flow in the sample chamber that the microflow sensor (3) converts into an electrical signal.

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 should be prevented from occurring in the sample chambers. 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 not have a large concentration of the gas components to be measured.



1 Capillary
2 Second detector layer
3 Microflow sensor
4 Sample cell
5 Chopper wheel
6 Chopper motor
7 IR source
8 Reflector
9 Window
10 Slide
11 First detector layer
12 Third detector layer

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

Automatic calibration with air

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 shown 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 ageing 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.

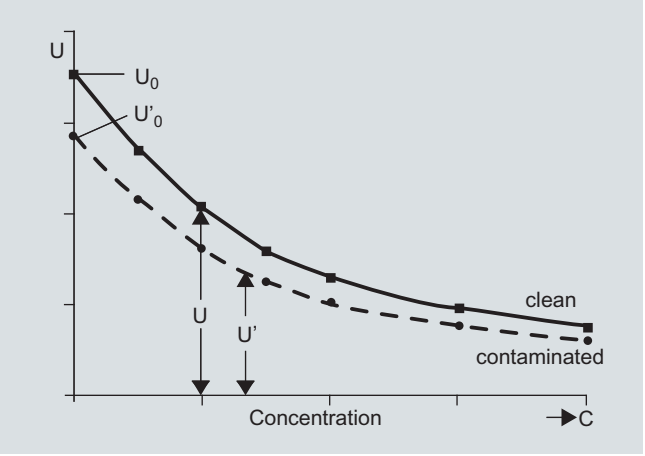
Each AUTOCAL tracks the total characteristic until the currently valid value, thereby compensating for temperature and pressure influences.

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

The tolerance "clamping width" between two or more AUTOCALs can be individually parameterized on the ULTRAMAT 23 and an alarm message output. A fault 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.

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. It is recommendable to check 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 such that the zero point of the electrochemical sensor needs only be checked once a year by connecting nitrogen.

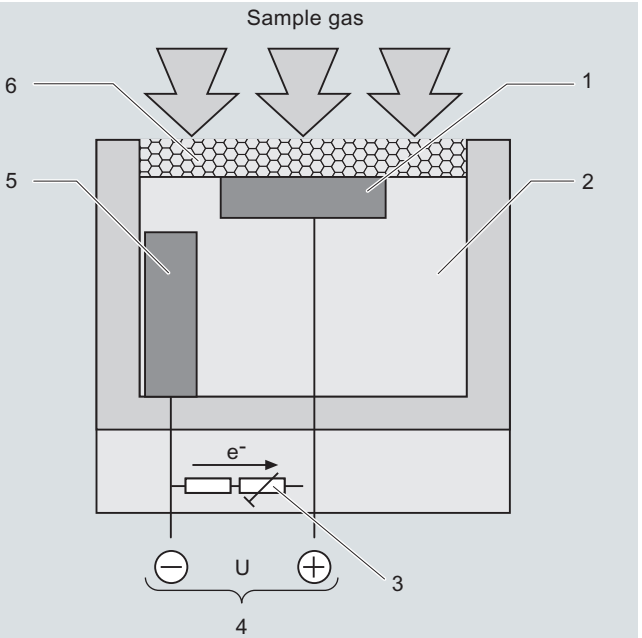


Calibration

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 CO_2, CO, H_2 and CH_4) than other sensor types.



1 Gold cathode
2 Electrolyte (acetic acid)
3 Thermistor and load resistor for temperature compensation
4 Signal output
5 Lead anode
6 Oxygen diffusion membrane made of FEP

ULTRAMAT 23, principle of operation of the oxygen sensor

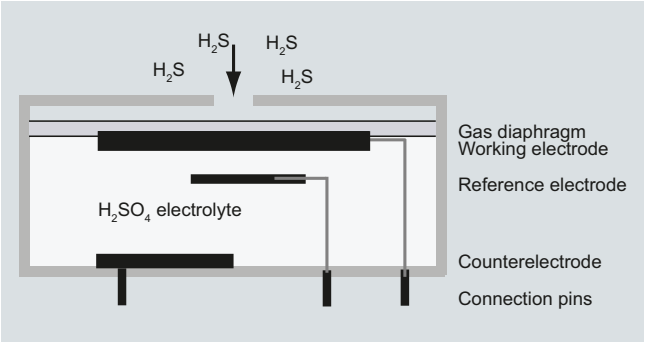
General information

Electrochemical sensor for H_2S 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 after 3 months using calibration gas (1 000 to 3 000 vpm).



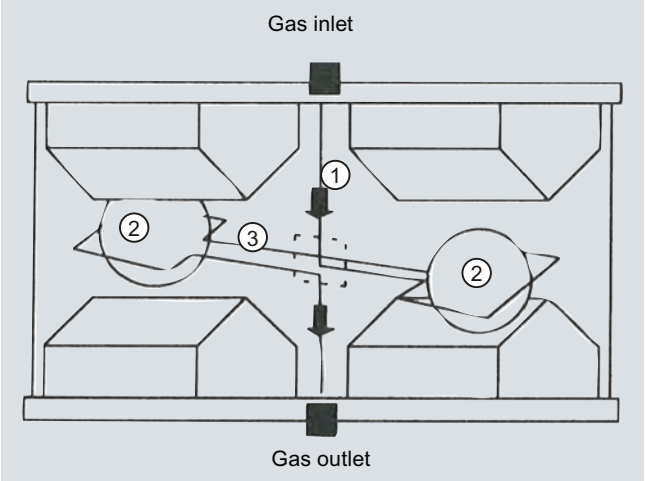
Operating principle of the H_2S sensor

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.

The calibration point is calibrated using the AUTOCAL function by connecting oxygen (analogous to calibration of the electrochemical O_2 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.



Operating principle of the paramagnetic oxygen cell

Accompanying gas	Formula	Deviation at 20 °C	Deviation at 50 °C
Acetaldehyde	C_2H_4O	-0.31	-0.34
Acetone	C_3H_6O	-0.63	-0.69
Acetylene, ethyne	C_2H_2	-0.26	-0.28
Ammonia	NH_3	-0.17	-0.19
Argon	Ar	-0.23	-0.25
Benzene	C_6H_6	-1.24	-1.34
Bromine	Br_2	-1.78	-1.97
Butadiene	C_4H_6	-0.85	-0.93
n-butane	C_4H_{10}	-1.1	-1.22
Iso-butylene	C_4H_8	-0.94	-1.06
Chlorine	Cl_2	-0.83	-0.91
Diacetylene	C_4H_2	-1.09	-1.2
Dinitrogen monoxide	N_2O	-0.2	-0.22
Ethane	C_2H_6	-0.43	-0.47
Ethyl benzene	C_8H_{10}	-1.89	-2.08
Ethylene, ethene	C_2H_4	-0.2	-0.22
Ethylene glycol	$C_2H_6O_2$	-0.78	-0.88
Ethylene oxide	C_2H_4O	-0.54	-0.6
Furan	C_4H_4O	-0.9	-0.99
Helium	He	0.29	0.32
n-hexane	C_6H_{14}	-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_2	-0.27	-0.29
Carbon monoxide	CO	-0.06	-0.07
Krypton	Kr	-0.49	-0.54
Methane	CH_4	-0.16	-0.17
Methanol	CH_4O	-0.27	-0.31
Methylene chloride	CH_2Cl_2	-1	-1.1
Monosilane, silane	SiH_4	-0.24	-0.27
Neon	Ne	0.16	0.17
n-octane	C_8H_{18}	-2.45	-2.7
Phenol	C_6H_6O	-1.4	-1.54
Propane	C_3H_8	-0.77	-0.85
Propylene, propene	C_3H_6	-0.57	-0.62
Propylene chloride	C_3H_7Cl	-1.42	-1.44
Propylene oxide	C_3H_6O	-0.9	-1
Oxygen	O_2	100	100
Sulfur dioxide	SO_2	-0.18	-0.2
Sulfur hexafluoride	SF_6	-0.98	-1.05
Hydrogen sulfide	H_2S	-0.41	-0.43
Nitrogen	N_2	0	0
Nitrogen dioxide	NO_2	5	16

Accompanying gas	Formula	Deviation at 20 °C	Deviation at 50 °C
Nitrogen monoxide	NO	42.7	43
Styrene	C_8H_8	-1.63	-1.8
Toluene	C_7H_8	-1.57	-1.73
Vinyl chloride	C_2H_3Cl	-0.68	-0.74
Vinyl fluoride	C_2H_3F	-0.49	-0.54
Water (vapor)	H2O	-0.03	-0.03
Hydrogen	H_2	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_2, 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 request alert
- Two freely configurable undershooting or overshooting limit values per measured component

19" rack unit and portable version

Technical specifications

General information	
Measured components	Maximum of 4, comprising three infrared-sensitive gases and oxygen
Measuring ranges	Two 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 symbol EN 61000-6-2, EN 61000-6-4
Design, enclosure	
Weight	Approximately 10 kg
Degree of protection, 19" rack unit and desktop model	IP20 according to EN 60529
Electrical characteristics	
EMC (**E**lectro**m**agnetic **C**ompatibility) (safety extra-low voltage (SELV) with safety isolation)	In accordance with standard requirements of NAMUR NE21 (08/98) or EN 50081-1, EN 50082-2
Power supply	100 V AC, +10 %/-15 %, 50 Hz, 120 V AC, +10 %/-15 %, 50 Hz, 200 V AC, +10 %/-15 %, 50 Hz, 230 V AC, +10 %/-15 %, 50 Hz, 100 V AC, +10 %/-15 %, 60 Hz, 120 V AC, +10 %/-15 %, 60 Hz, 230 V AC, +10 %/-15 %, 60 Hz
Power consumption	Approx. 60 VA
Electrical inputs and outputs	
Analog output	Per component, 0/2/4 up to 20 mA, NAMUR, isolated, max. load 750 Ω
Relay outputs	8, with changeover contacts, freely parameterizable, e.g. for measuring range identification; 24 V AC/DC/1 A load, potential-free, non-sparking
Binary inputs	3, dimensioned for 24 V, potential-free • Pump • AUTOCAL • Synchronization
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 binary inputs and relay outputs for e.g. triggering of automatic calibration and for PROFIBUS PA or PROFIBUS DP

Climatic conditions	
Permissible ambient temperature	
• During operation	5 … 45 °C
• During storage and transportation	-20 ... +60 °C
Permissible ambient humidity	< 90 % RH (relative humidity) during storage and transportation
Permissible pressure fluctuations	600 … 1 200 hPa
Gas inlet conditions	
Sample gas pressure	
• Without pump	Unpressurized (< 1 200 hPa, absolute)
• With pump	Depressurized suction mode, set in factory with 2 m hose at sample gas outlet; full-scale value calibration necessary under different venting conditions
Sample gas flow	72 … 120 l/h (1.2 … 2 l/min)
Sample gas temperature	Min. 0 to max. 50 °C, but above the dew point
Sample gas humidity	< 90 % RH (relative humidity), non-condensing

Technical data, 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_2 measuring ranges (≤ 400 mg/m³) 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
Dynamic response	
Warm-up period	Approximately 30 min (at room temperature) (the technical specification will be met after 2 hours)
Delayed display (T_{90}-time)	Dependent on length of analyzer chamber, sample gas line and parameterizable damping
Damping (electrical time constant)	Parameterizable from 0 … 99.9 s
Measuring response (relating to sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature)	
Output signal fluctuation	< ± 1 % of the current measuring range (see rating plate)
Detection limit	1 % of the current measuring range
Linearity error	• In largest possible measuring range: < ± 1 % of the full-scale value • In smallest possible measuring range: < ± 2 % of the full-scale value
Repeatability	≤ ± 1 % of the current measuring range
Drift	
Zero point	
• With AUTOCAL	Negligible
• Without AUTOCAL	< 2 % of the current measuring range/week
Full-scale value drift	
• With AUTOCAL	Negligible
• Without AUTOCAL	< 2 % of the current measuring range/week
Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature)	
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 change
Power supply	< 0.1 % of the current measuring range with a change of ± 10 %

Technical data, oxygen channel (electrochemical)	
Measuring ranges	0 … 5 % … 0 … 25 % O_2, parameterizable
Service life	Approx. 2 years at 21 % O_2; continuous duty < 0.5 % O_2 will destroy the measuring cell
Detection limit	1 % of the current measuring range
Dynamic response	
Delayed display (T_{90}-time)	Dependent on dead time and parameterizable damping, not > 30 s at approximately 1.2 l/min sample gas flow
Measuring response (relating to 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_2
Drift	
• With AUTOCAL	Negligible
• Without AUTOCAL	1 % O_2/year in air, typical
Temperature	< ± 0.5 % O_2 per 20 K, relating to a measured value at 20 °C
Atmospheric pressure	< 0.2 % of the measured value per 1 % pressure change
Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 1.0 l/min sample gas flow and 25 °C ambient temperature)	
Oxygen content	Intermittent operation < 0.5 % O_2 leads to falsification of the measured value
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_3 in % range)
Typical combustion exhaust gases	Influence: < 0.05 % O_2
Humidity	H_2O dew point ≥ 2 °C; the oxygen sensor must not be used with dry sample gases (however, no condensation either)

19" rack unit and portable version

Technical data, H_2S channel	
Measured components	Maximum of four, comprising one or two infrared-sensitive gases, one oxygen component and one hydrogen sulfide component
Measuring ranges of H_2S sensor MB 5000	
• Smallest measuring range	0 ... 500 vpm
• Largest measuring range	0 ... 5 000 vpm
Service life of the sensor	Approx. 12 months
Permissible ambient pressure	750 ... 1 200 hPa
Permissible operating temperature	5 ... 40 °C (41 ... 104 °F)
Influencing variables	
Accompanying gases	The hydrogen sulfide sensor must not be used if the accompanying gas contains the following components: • Compounds containing chlorine • Compounds containing fluorine • Heavy metals • Aerosols • Alkaline components (e.g. NH_3 > 5 %)
Cross-inference (interfering gases)	100 ppm SO_2 result in a cross-interference of < 30 ppm H_2S
Drift	< 1 % per month
Temperature	< 3 %/10 K referred to full-scale value
Atmospheric pressure	< 0.2 % of the measured value per 1 % pressure change
Measuring response	
Delayed display (T90 time)	< 80 s with sample gas flow of approx. 1 ... 1.2 l/min
Output signal noise	< 15 ppm H_2S
Display resolution	< 0.2 % of the full-scale value
Output signal resolution	< 30 ppm H_2S
Repeatability	< 4 % referred to full-scale value

Technical data, paramagnetic oxygen cell	
Measured components	Maximum of four, comprising up to three infrared-sensitive gases and an oxygen component
Measuring ranges	Two per component • Min. 0 ... 2 % vol O_2 • Max. 0 ... 100 % vol O_2
Permissible ambient pressure	700 ... 1 200 hPa
Permissible operating temperature	5 ... 45 °C (41 ... 113 °F)
Cross-inference (interfering gases)	See Table "Cross-sensitivities"
Zero point drift	• Measuring range 2 %: max. 0.1 % with weekly zero adjustment • Measuring range 5 %: max. 0.1 % with weekly zero adjustment • Measuring range 25 % or greater: max. 0.5 % with monthly zero adjustment
Temperature error	< 2 %/10 K referred to measuring range 5 % < 5 %/10 K referred to measuring range 2 %
Humidity error for N2 with 90 % relative humidity after 30 min	< 0.6 % at 50 °C
Atmospheric pressure	< 0.2 % of measured value per 1 % pressure change
Delayed display (T90 time)	< 60 s
Output signal noise	< 1 % of smallest measuring range
Repeatability	< 1 % of smallest measuring range
Detection limit	0.02 % O_2 (measuring range 0 ... 2 %)

Selection and ordering data			Order No.	
ULTRAMAT 23 gas analyzer for measuring 1 infrared component and oxygen			D) **7MB2335-** ■■■■■ **-** ■ **A A** ■	Cannot be combined
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[2]	**0**	
¼" pipe	Viton	Without[2]	**1**	
6 mm pipe	Viton	With	**2**	
¼" pipe	Viton	With	**3**	
6 mm pipe	Stainless steel, mat. no. 1.4571	Without[2]	**6**	**6**
¼" pipe	Stainless steel, mat. no. 1.4571	Without[2]	**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 panel			**8**	
Measured component	Possible with measuring range identification			
CO	D, E, F, G ... R, U, X		**A**	
CO_2[1]	D[6], G[6], H[6], J[6], K ... R		**C**	
CH_4	E, H, L, N, P, R		**D**	
C_2H_4	K		**F**	
C_6H_{14}	K		**M**	
SO_2	F ... L, W		**N**	
NO	E, G ... J, T, V, W		**P**	
N_2O[7]	E		**S**	
SF_6	H		**V**	
Smallest measuring range	Largest measuring range			
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 ... 100 mg/m³	0 ... 750 mg/m³	TÜV version	**T**	
0 ... 150 mg/m³	0 ... 750 mg/m³	TÜV version	**U**	
0 ... 250 mg/m³	0 ... 1 250 mg/m³	TÜV version	**V**	
0 ... 400 mg/m³	0 ... 2 000 mg/m³	TÜV version	**W**	
0 ... 50 vpm	0 ... 2 500 vpm		**X**	
Oxygen measurement[5]				
Without O_2 sensor			**0**	
With O_2 sensor			**1**	**1**
With paramagnetic oxygen measuring cell			**8**	**8**
Hydrogen sulfide measurement				
Without			**0**	
With H_2S sensor 0 ... 500 / 5 000 ppm			**3**	**3**
Power supply				
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**	
Operating software, documentation[3]				
German			**0**	
English			**1**	
French			**2**	
Spanish			**3**	
Italian			**4**	

Footnotes: See next page.

19" rack unit and portable version

Selection and ordering data

Additional versions		Order code
Add "**-Z**" to Order No. and specify order code		
Add-on electronics with 8 binary inputs/outputs, PROFIBUS PA interface		**A12**
Add-on electronics with 8 binary inputs/outputs, PROFIBUS DP interface		**A13**
Telescopic rails (2 units), 19" rack unit version only		**A31**
Set of Torx screwdrivers		**A32**
TAG labels (specific inscription based on customer information)		**B03**
Gas path for short response time[9)]		**C01**
Chopper compartment purging for 6 mm gas connection		**C02**
Chopper compartment purging for ¼" gas connection		**C03**
Presetting to reference temperature 0 °C for conversion into mg/m³, applies to all components		**D15**
Certificate FM/CSA Class I, Div. 2, ATEX II 3 G		**E20**
Calibration interval 5 months (TÜV / QAL), measuring ranges:	CO: 0 ... 150 / 750 mg/m³ NO: 0 ... 100 / 750 mg/m³	**E50**
Measuring range indication in plain text[4)]		**Y11**
Measurement of CO_2 in forming gas[8)] (only in conjunction with measuring range 0 to 20/0 to 100%)		**Y14**
Accessories		**Order No.**
CO_2 absorber cartridge		**7MB1933-8AA**
Retrofitting sets		
RS 485/Ethernet converter		**A5E00852383**
RS 485/RS 232 converter		**C79451-Z1589-U1**
RS 485/USB converter		**A5E00852382**
Add-on electronics with 8 binary inputs/outputs and PROFIBUS PA		**A5E00056834**
Add-on electronics with 8 binary inputs/outputs and PROFIBUS DP		**A5E00057159**

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

1) For measuring ranges below 1%, a CO_2 absorber cartridge can be used for setting the zero point (see accessories)

2) Without separate zero gas input or solenoid valve

3) User language can be changed

4) Standard setting: smallest measuring range, largest measuring range

5) O_2 sensor in gas path of infrared measured component 1

6) With chopper compartment purging (N_2 approx. 3 000 hPa required for measuring ranges below 0.1% CO_2), to be ordered separately (see order code C02 or C03)

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

8) CO_2 measurement in accompanying gas Ar or Ar/He (3:1); forming gas

9) Only for version with Viton hose

Selection and ordering data			Order No.	
ULTRAMAT 23 gas analyzer for measuring 2 infrared components and oxygen			D) **7MB2337-** ■■■■ - ■■■■	Cannot be combined
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[2]	**0**	
¼" pipe	Viton, not separate	Without[2]	**1**	
6 mm pipe	Viton, not separate	With	**2**	
¼" pipe	Viton, not separate	With	**3**	
6 mm pipe	Viton, separate	Without[2]	**4**	**4 → A27, A29**
¼" pipe	Viton, separate	Without[2]	**5**	**5 → A27, A29**
6 mm pipe	Stainless steel, mat. no. 1.4571, separate	Without[2]	**6**	**6**
¼" pipe	Stainless steel, mat. no. 1.4571, separate	Without[2]	**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 panel			**8**	
1. infrared measured component				
Measured component	Possible with measuring range identification			
CO	D, E, F, G ... R, U, X		**A**	
CO_2[1]	D[6], G[6], H[6], J[6], K ... R		**C**	
CH_4	E, H, L, N, P, R		**D**	
C_2H_4	K		**F**	
C_6H_{14}	K		**M**	
SO_2	F ... L, W		**N**	
NO	E, G ... J, T, V, W		**P**	
N_2O[7]	E		**S**	
SF_6	H		**V**	
Smallest measuring range	Largest measuring range			
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 ... 100 mg/m³	0 ... 750 mg/m³	TÜV version	**T**	
0 ... 150 mg/m³	0 ... 750 mg/m³	TÜV version	**U**	
0 ... 250 mg/m³	0 ... 1 250 mg/m³	TÜV version	**V**	
0 ... 400 mg/m³	0 ... 2 000 mg/m³	TÜV version	**W**	
0 ... 50 vpm	0 ... 2 500 vpm		**X**	
Oxygen measurement[5]				
Without O_2 sensor			**0**	
With O_2 sensor			**1**	**1**
With paramagnetic oxygen measuring cell			**8**	**8**
Hydrogen sulfide measurement				
Without			**0**	
With H_2S sensor 0 ... 500 / 5 000 ppm			**3**	**3**
Power supply				
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**	

19" rack unit and portable version

Selection and ordering data			Order No.		Cannot be combined
ULTRAMAT 23 gas analyzer for measuring 2 infrared components and oxygen			D) **7MB2337-** ■■■■■ - ■■■■		
2. infrared measured component					
Measured component	Possible with measuring range identification				
CO	D, E, F, G ... R, U, X			**A**	
CO_2 [1]	D[6], G[6], H[6], J[6], K ... R			**C**	
CH_4	E, H, L, N, P, R			**D**	
C_2H_4	K			**F**	
C_6H_{14}	K			**M**	
SO_2	F ... L, W			**N**	
NO	E, G ... J, T, V, W			**P**	
N_2O	E[7], Y[10]			**S**	
SF_6	H			**V**	
Smallest measuring range	Largest measuring range				
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 ... 100 mg/m³	0 ... 750 mg/m³	TÜV version		**T**	
0 ... 150 mg/m³	0 ... 750 mg/m³	TÜV version		**U**	
0 ... 250 mg/m³	0 ... 1 250 mg/m³	TÜV version		**V**	
0 ... 400 mg/m³	0 ... 2 000 mg/m³	TÜV version		**W**	
0 ... 50 vpm	0 ... 2 500 vpm			**X**	
0 ... 500 vpm	0 ... 5 000 vpm			**Y**	
Operating software, documentation[3]					
German					**0**
English					**1**
French					**2**
Spanish					**3**
Italian					**4**

Footnotes: See next page.

Additional versions	Order code
Add "-Z" to Order No. and specify Order code	
Add-on electronics with 8 binary inputs/outputs, PROFIBUS PA interface	**A12**
Add-on electronics with 8 binary inputs/outputs, PROFIBUS DP interface	**A13**
Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland (cannot be combined with Viton hose)	**A27**
Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland (cannot be combined with Viton hose)	**A29**
Telescopic rails (2 units, 19" rack unit version only)	**A31**
Set of Torx screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Gas path for short response time[9)]	**C01**
Chopper compartment purging for 6 mm gas connection	**C02**
Chopper compartment purging for ¼" gas connection	**C03**
Presetting to reference temperature 0 °C for conversion into mg/m³, applies to all components	**D15**
Measuring range indication in plain text[4)]	**Y11**
Certificate FM/CSA Class I, Div. 2, ATEX II 3 G	**E20**
Calibration interval 5 months (TÜV / QAL), measuring ranges: CO: 0 ... 150 / 750 mg/m³ NO: 0 ... 100 / 750 mg/m³	**E50**
Measurement of CO_2 in forming gas[8)] (only in conjunction with measuring range 0 ... 20/0 ... 100 %)	**Y14**
Accessories	**Order No.**
CO_2 absorber cartridge	**7MB1933-8AA**
Retrofitting sets	
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
Add-on electronics with 8 binary inputs/outputs and PROFIBUS PA	**A5E00056834**
Add-on electronics with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057159**

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

1) For measuring ranges below 1 %, a CO_2 absorber cartridge can be used for setting the zero point (see accessories)

2) Without separate zero gas input or solenoid valve

3) User language can be changed

4) Standard setting: smallest measuring range, largest measuring range

5) O_2 sensor in gas path of infrared measured component 1

6) With chopper compartment purging (N_2 approx. 3 000 hPa required for measuring ranges below 0.1 % CO_2), to be ordered separately (see order code C02 or C03)

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

8) CO_2 measurement in accompanying gas Ar or Ar/He (3:1); forming gas

9) Only for version with Viton hose

10) Only in conjunction with CO_2 measuring range 0 to 5 % to 0 to 25 % (CP)

19" rack unit and portable version

Selection and ordering data — **Order No.**

ULTRAMAT 23 gas analyzer — D) **7MB2338-** ■■■■ **0 -** ■■■■ — Cannot be combined
for measuring 3 infrared components and oxygen

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[2]	0	
¼" pipe	Viton, not separate	Without[2]	1	
6 mm pipe	Viton, not separate	With	2	
¼" pipe	Viton, not separate	With	3	
6 mm pipe	Viton, separate	Without[2]	4	4 → A27, A29
¼" pipe	Viton, separate	Without[2]	5	5 → A27, A29
6 mm pipe	Stainless steel, mat. no. 1.4571, separate	Without[2]	6	6
¼" pipe	Stainless steel, mat. no. 1.4571, separate	Without[2]	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 panel			8	

1. and 2nd infrared measured components

Measured component	Smallest measuring range	Largest measuring range		
CO NO	0 ... 500 vpm 0 ... 500 vpm	0 ... 2 500 vpm 0 ... 2 500 vpm	A A	
CO NO	0 ... 2 000 vpm 0 ... 1 000 vpm	0 ... 10 000 vpm 0 ... 5 000 vpm	A B	
CO NO	0 ... 1 000 vpm 0 ... 1 000 vpm	0 ... 5 000 vpm 0 ... 5 000 vpm	A C	
CO NO	0 ... 1 % 0 ... 1 000 vpm	0 ... 5 % 0 ... 5000 vpm	A D	
CO NO	0 ... 250 mg/m³ 0 ... 400 mg/m³	0 ... 1 250 mg/m³ 0 ... 2 000 mg/m³ TÜV version	A K	
CO CO_2	0 ... 10 % 0 ... 10 %	0 ... 50 % 0 ... 50 %	B A	
CO CO_2	0 ... 10 % 0 ... 0,5 %	0 ... 50 % 0 ... 2,5 %	B B	
CO CO_2	0 ... 20 % 0 ... 20 %	0 ... 100 % 0 ... 100 %	B D	
CO_2 CO	0 ... 5 % 0 ... 100 vpm	0 ... 25 % 0 ... 500 vpm	B J	
CO_2 CO	0 ... 10 % 0 ... 0,5 %	0 ... 50 % 0 ... 2,5 %	B K	
CO_2 CO	0 ... 5 % 0 ... 75 mg/m³	0 ... 25 % 0 ... 750 mg/m³	B L	
CO_2 CH_4	0 ... 5 % 0 ... 1 %	0 ... 25 % 0 ... 5 %	C A	
CO_2 CH_4	0 ... 5 % 0 ... 2 %	0 ... 25 % 0 ... 10 %	C B	
CO_2 NO	0 ... 5 % 0 ... 500 vpm	0 ... 25 % 0 ... 2 500 vpm	D C	

Oxygen measurement[5]	
Without O_2 sensor	0
With O_2 sensor	1
With paramagnetic oxygen measuring cell	8

Power supply	
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 2/28.

Selection and ordering data			Order No.	
ULTRAMAT 23 gas analyzer for measuring 3 infrared components and oxygen		D)	**7MB2338-** ■■■■ **0 -** ■■■■	Cannot be combined
3. infrared measured component				
Measured component	Possible with measuring range identification			
CO	D, E, F, G ... R, U, X		**A**	
CO_2 [1]	D[6], G[6], H[6], J[6], K ... R		**C**	
CH_4	E, H, L, N, P, R		**D**	
C_2H_4	K		**F**	
C_6H_{14}	K		**M**	
SO_2	F ... L, W		**N**	
NO	E, G ... J, V, W		**P**	
N_2O	E[7], S[10] (biomass), Y[11]		**S**	
SF_6	H		**V**	
Smallest measuring range	Largest measuring range			
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/m³	0 ... 500 mg/m³	TÜV version		**S**
0 ... 150 mg/m³	0 ... 750 mg/m³	TÜV version		**U**
0 ... 250 mg/m³	0 ... 1 250 mg/m³	TÜV version		**V**
0 ... 400 mg/m³	0 ... 2 000 mg/m³	TÜV version		**W**
0 ... 50 vpm	0 ... 2 500 vpm			**X**
0 ... 500 vpm	0 ... 5 000 vpm			**Y**
Operating software, documentation[3]				
German				**0**
English				**1**
French				**2**
Spanish				**3**
Italian				**4**

Footnotes: See page 2/28.

19" rack unit and portable version

Additional versions	Order code
Add "**-Z**" to Order No. and specify order code	
Add-on electronics with 8 binary inputs/outputs, PROFIBUS PA interface	**A12**
Add-on electronics with 8 binary inputs/outputs, PROFIBUS DP interface	**A13**
Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland (cannot be combined with Viton hose)	**A27**
Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland (cannot be combined with Viton hose)	**A29**
Telescopic rails (2 units, 19" rack unit version only)	**A31**
Set of Torx screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Gas path for short response time[9)]	**C01**
Chopper compartment purging for 6 mm gas connection	**C02**
Chopper compartment purging for ¼" gas connection	**C03**
Presetting to reference temperature 0 °C for conversion into mg/m³, applies to all components	**D15**
Certificate FM/CSA Class I, Div. 2, ATEX II 3 G	**E20**
Calibration interval 5 months (TÜV / QAL), measuring ranges: CO: 0 ... 150 / 750 mg/m³ NO: 0 ... 100 / 750 mg/m³	**E50**
Measuring range indication in plain text[4)]	**Y11**
Measurement of CO_2 in forming gas[8)] (only in conjunction with measuring range 0 ... 20/0 ... 100 %)	**Y14**
Accessories	**Order No.**
CO_2 absorber cartridge	**7MB1933-8AA**
Retrofitting sets	
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
Add-on electronics with 8 binary inputs/outputs and PROFIBUS PA	**A5E00056834**
Add-on electronics with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057159**

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

1) For measuring ranges below 1 %, a CO_2 absorber cartridge can be used for setting the zero point (see accessories)

2) Without separate zero gas input or solenoid valve

3) User language can be changed

4) Standard setting: smallest measuring range, largest measuring range

5) O_2 sensor in gas path of infrared measured component 1

6) With chopper compartment purging (N_2 approx. 3 000 hPa required for measuring ranges below 0.1 % CO_2), to be ordered separately (see order code C02 or C03)

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

8) CO_2 measurement in accompanying gas Ar or Ar/He (3:1); forming gas

9) Only for version with Viton hose

10) Only in conjunction with CO / CO_2, measuring range 0 to 75 / 750 mg/m³, 0 to 5 / 25 % [-BL-]

11) Only in conjunction with CO_2 / NO, measuring range 0 to 5 / 25 %, 0 to 500 / 5 000 vpm [-DC-]

Ordering notes

Special selection rules must be observed when measuring some components.

Measured component N_2O

7MB2335, 7MB2337 and 7MB2338
(application: Si chip production)

- Measuring range 0 to 100 / 500 ppm (MB designation "E")
- Can only be used to measure N_2O 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_2 for correction of cross-interference

7MB2337-*CP*0-*SY* or
7MB2338-*DC*0-*SY* (including NO measurement)

7MB2338
(application in accordance with the requirements of the 30th BImSchV, "biomass")

- Measuring range 0 to 50 / 500 mg/m³ (MB designation "S")
- Requires simultaneous measurement of CO_2 and CO for correction of cross-interference

7MB2338-*BL*0-*SS*

Measured component SF_6

7MB2335, 7MB2337 and 7MB2338
(application: SI chip production)

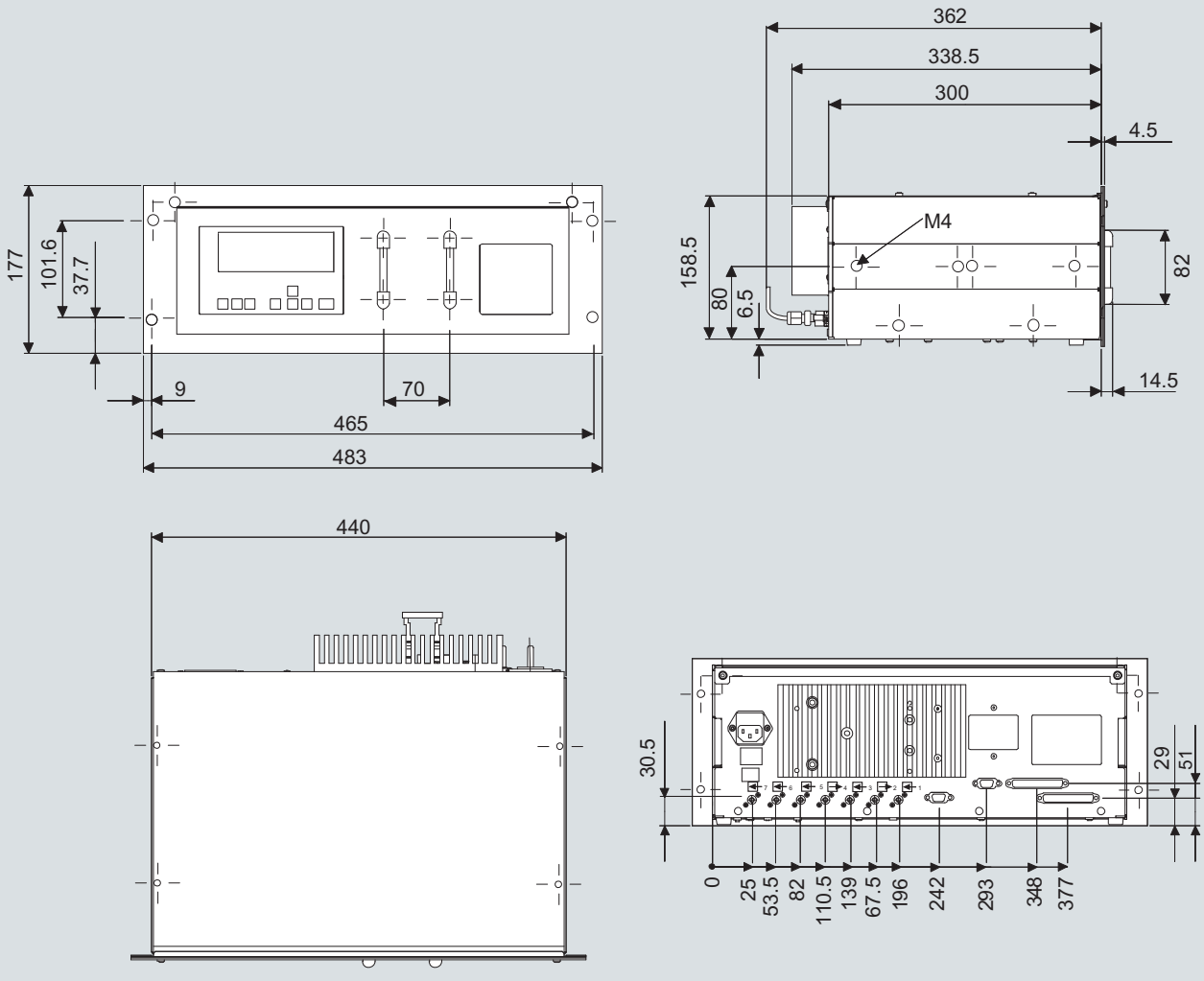
- Measuring range 0 to 500 / 2 500 ppm (MB designation "H")
- Can only be used to measure SF6 in inert gases

Calibration interval (TÜV versions)

Component	Smallest measuring range (TÜV)	Calibration interval	Remarks	Z suffix
CO	0 … 150 mg/m³	5 months	13./27. BImSchV	E50
CO	0 … 250 mg/m³	12 months	13./27. BImSchV	
NO	0 … 100 mg/m³	5 months	13./27. BImSchV	E50
NO	0 … 250 mg/m³	12 months	13./27. BImSchV	
SO_2	0 … 400 mg/m³	12 months	13./27. BImSchV	
N_2O	0 … 500 ppm		Kyoto protocol	
N_2O	0 … 50 mg/m³	6 months	30. BImSchV	

19" rack unit and portable version

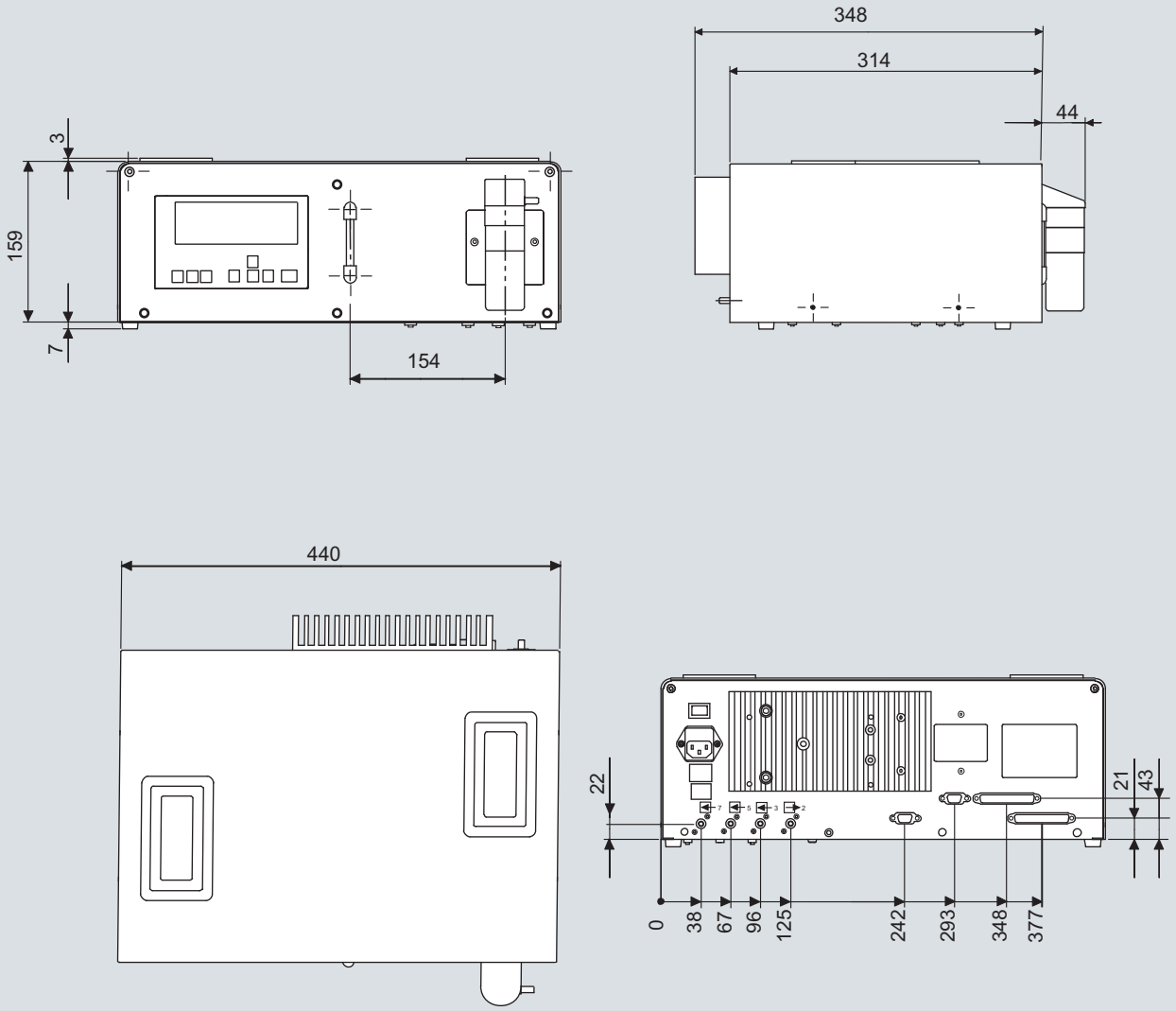
Dimensional drawings



Gas connections: stubs diam. 6 mm or ¼“

Caution: always install on supporting rails when mounted in bench-top housing or in cabinet

ULTRAMAT 23, 19“ unit, dimensions in mm



Gas connections: stubs diam. 6 mm

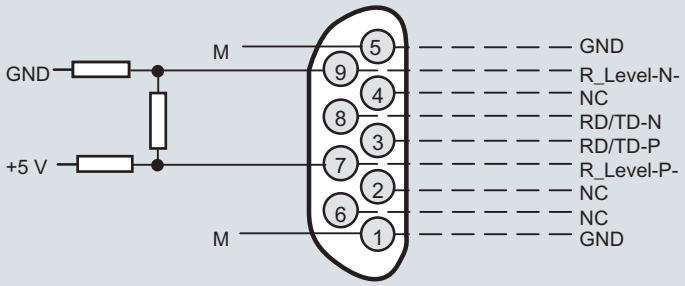
ULTRAMAT 23, desktop unit, dimensions in mm

2

Schematics

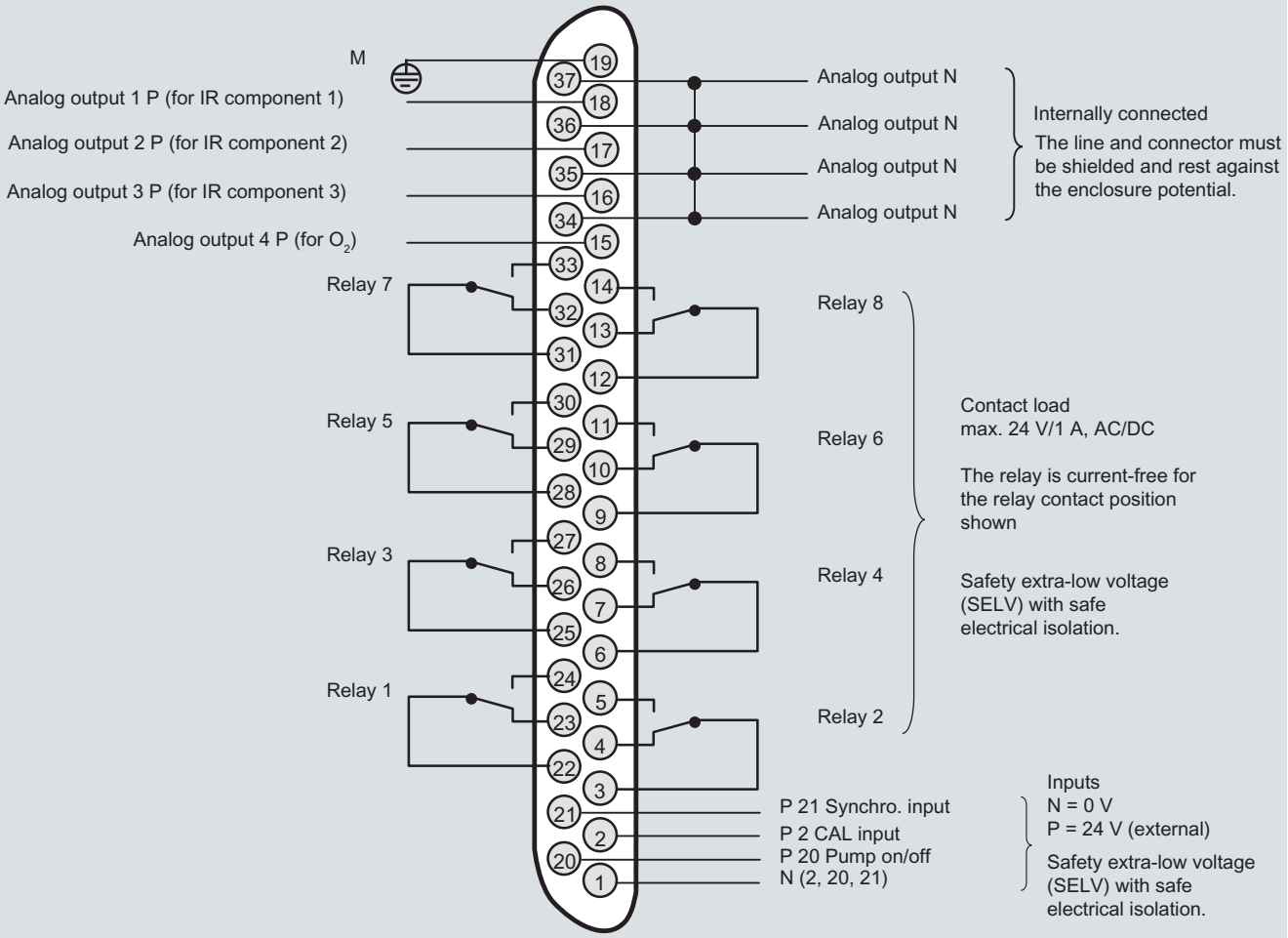
Pin assignment (electrical and gas connections)

Connector SUB-D 9F (RS 485) -X45



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

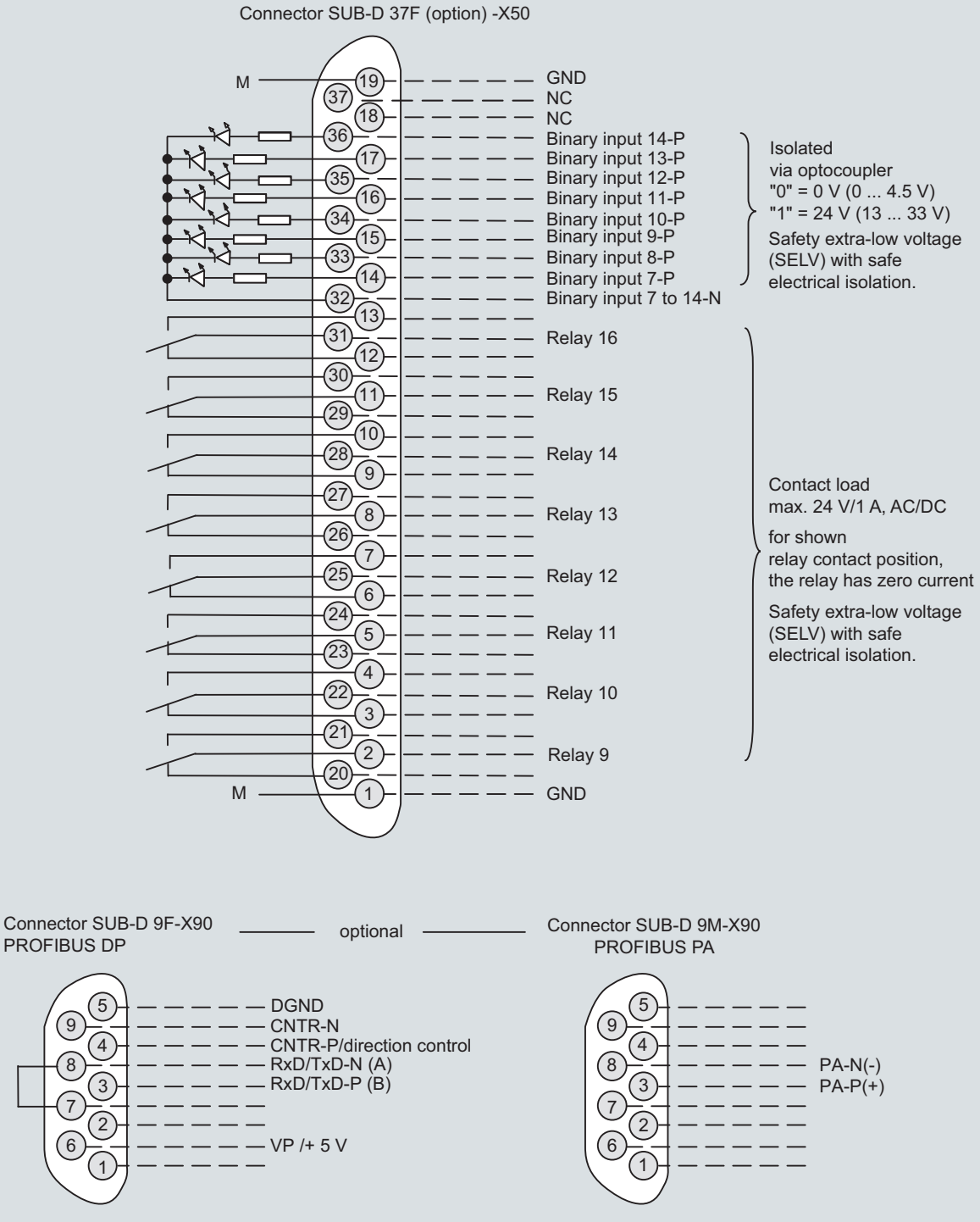
Safety extra-low voltage (SELV) with safe electrical isolation.

Inputs
N = 0 V
P = 24 V (external)

Safety extra-low voltage (SELV) with safe electrical isolation.

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

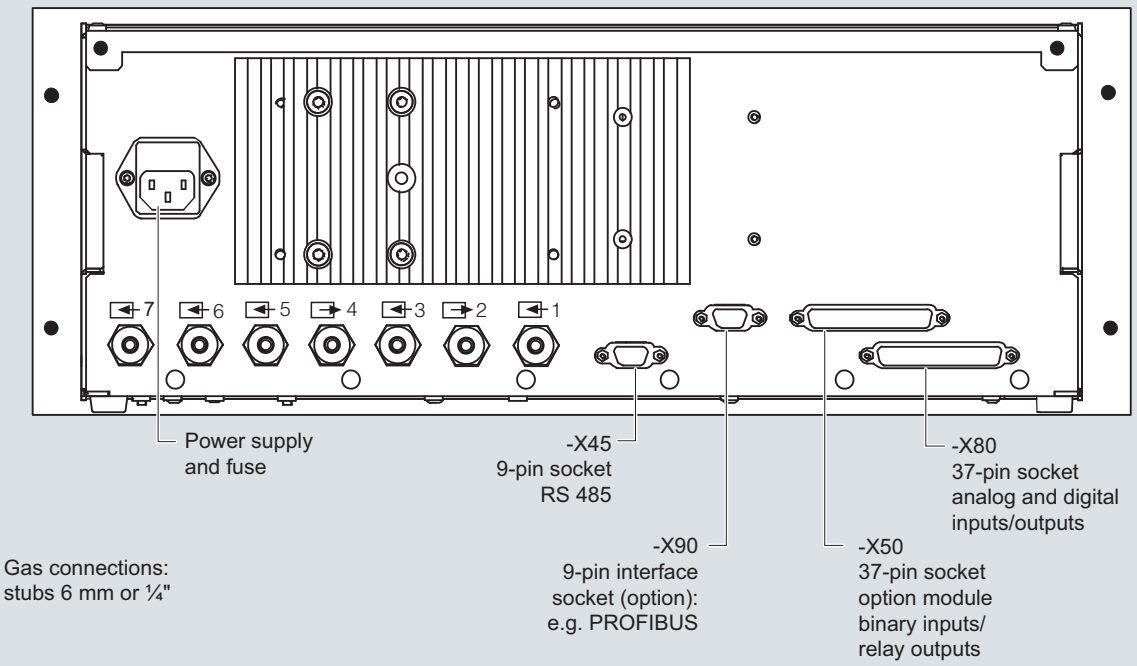
ULTRAMAT 23, pin assignment (standard)



ULTRAMAT 23, pin assignment of the optional PROFIBUS interface board

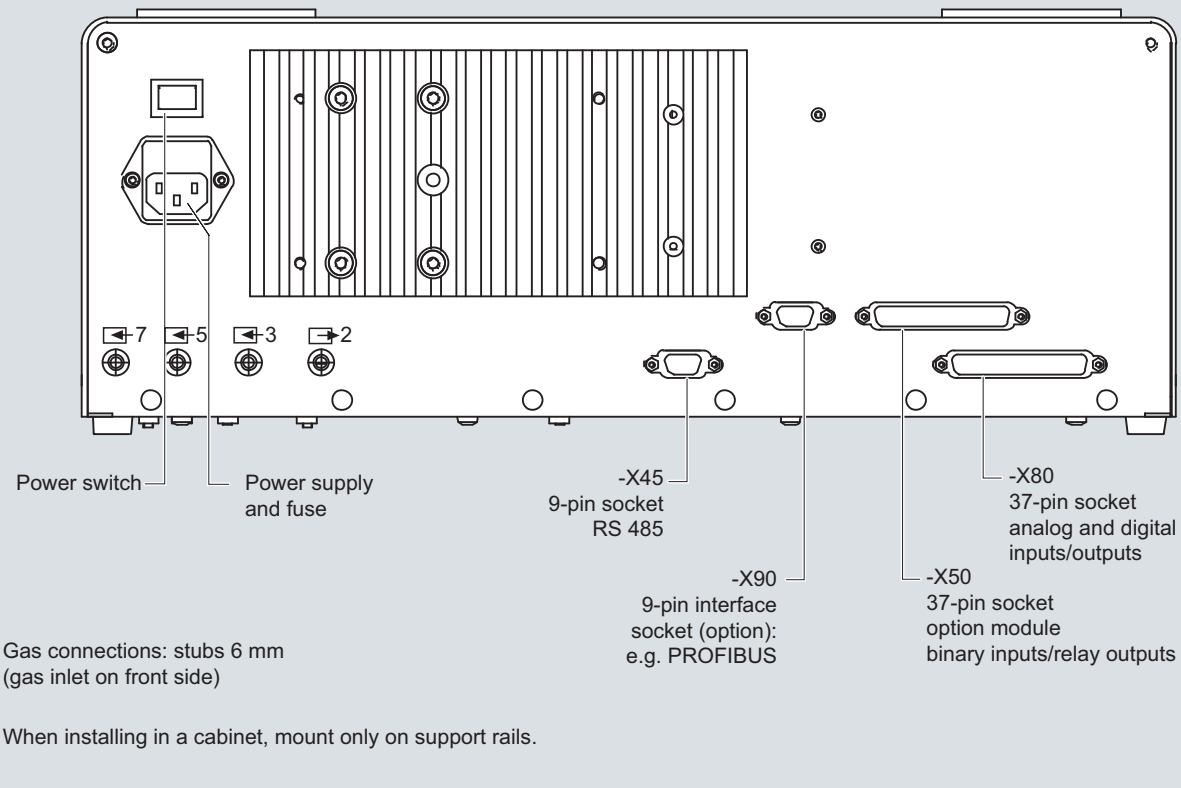
19" rack unit and portable version

19" unit

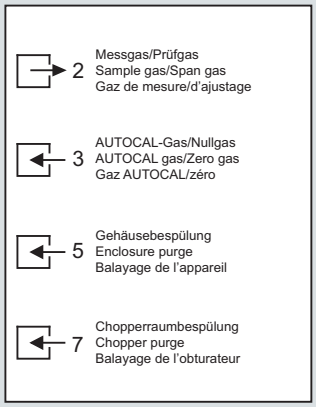


ULTRAMAT 23, 19" unit, e.g. one infrared component with oxygen measurement

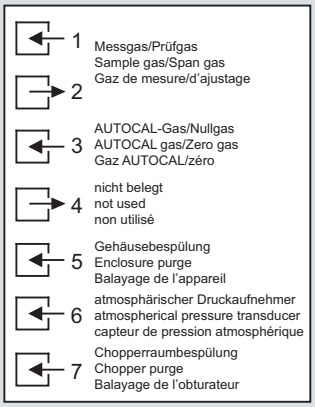
Desktop unit



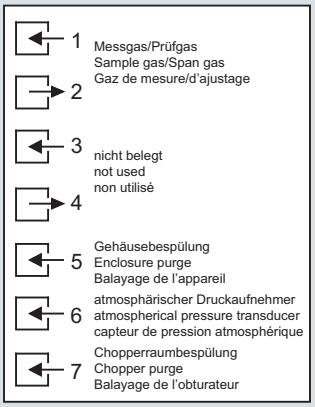
ULTRAMAT 23, portable unit, in sheet-steel housing, gas and electrical connections



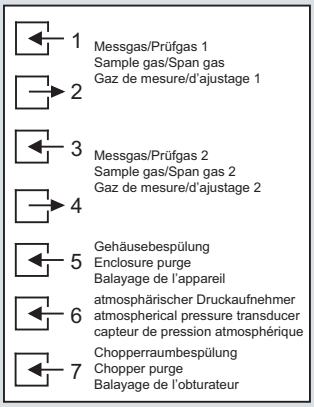
Key to symbols
ULTRAMAT 23
portable, in sheet-steel housing



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

Documentation

Selection and ordering data

Operating instructions	Order No.
ULTRAMAT 23	
Gas analyzer for IR-absorbing gases and oxygen	
• German	**C79000-B5200-C216**
• English	**C79000-B5276-C216**
• French	**C79000-B5277-C216**
• Spanish	**C79000-B5278-C216**
• Italian	**C79000-B5272-C216**

Suggestions for spare parts

Selection and ordering data

Description	Quantity for 2 years	Quantity for 5 years		Order No.
Analyzer unit				
O-ring for analyzer chamber: 180, 90, 60, 20 mm	2	4		**C71121-Z100-A99**
Chopper				
• With motor, for 1 IR channel (7MB2335-...)	1	1		**C79451-A3468-B515**
• With motor, for 2 IR channels (7MB2337-..., 7MB2338-...)	1	1		**C79451-A3468-B516**
Electronics				
Motherboard, with firmware	-	1	B)	**C79451-A3494-D501**
Keypad	1	1	D)	**C79451-A3492-B605**
LCD module	1	1		**C79451-A3494-B16**
Connector filter	-	1	F)	**W75041-E5602-K2**
Line switch (portable analyzer)	-	1		**W75050-T1201-U101**
Fusible element 220 ... 240 V	2	4		**W79054-L1010-T630**
Fusible element 100 ... 120 V	2	4		**W79054-L1011-T125**
Other				
Safety filter (zero gas), internal	2	2		**A5E00059149**
Safety filter (sample gas), internal	2	3		**C79127-Z400-A1**
Pressure switch	1	2		**C79302-Z1210-A2**
Flowmeter	1	2		**C79402-Z560-T1**
Set of gaskets for sample gas pump	2	5	D)	**C79402-Z666-E20**
Condensation trap (for portable unit, in sheet steel enclosure)	1	2		**C79451-A3008-B43**
Filter (for portable unit, in sheet steel enclosure)	1	2		**C79451-A3008-B60**
Oxygen sensor	1	1		**C79451-A3458-B55**
Sample gas pump 50 Hz	1	1		**C79451-A3494-B10**
Sample gas pump 60 Hz	1	1		**C79451-A3494-B11**
Solenoid valve	1	1		**C79451-A3494-B33**

B) Subject to export regulations AL: N, ECCN: 3A991X
D) Subject to export regulations AL: 9I999, ECCN: N
F) Subject to export regulations AL: N, ECCN: EAR99H