ULTRAMAT 23

General

Overview

The ULTRAMAT 23 gas analyzer can measure up to 4 gas components at once: A maximum of three infrared sensitive gases such as CO, CO_2, NO, SO_2, CH_4 and in addition 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

Benefits

- AUTOCAL with ambient air (depends on measured component)
  High efficiency so no calibration gas and accessories required
- High selectivity by multiple layer detectors,
  e.g. small cross sensitivity to water vapor
- Cleanable sample cells,
  cost saving in further use in case of pollution
- Menu-assisted operation in plain text,
  operation control without manual, high operator safety
- Service information and log book,
  preventive maintenance; help for service and maintenance personnel, cost reduction
- Coded operator level against unauthorized access,
  increased safety
- Open interface architecture (RS 485, RS 232; PROFIBUS, SIPROM GA);
  simplified process integration, remote control

Application

Application areas

- 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.

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 13. BImSchV/27.BImSch 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 also with a PC using the SIPROM GA maintenance and servicing software. In addition, selected manufacturers of emission evaluation computers offer the possibility for downloading the drift data via the analyzer's serial interface and to automatically record and process 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

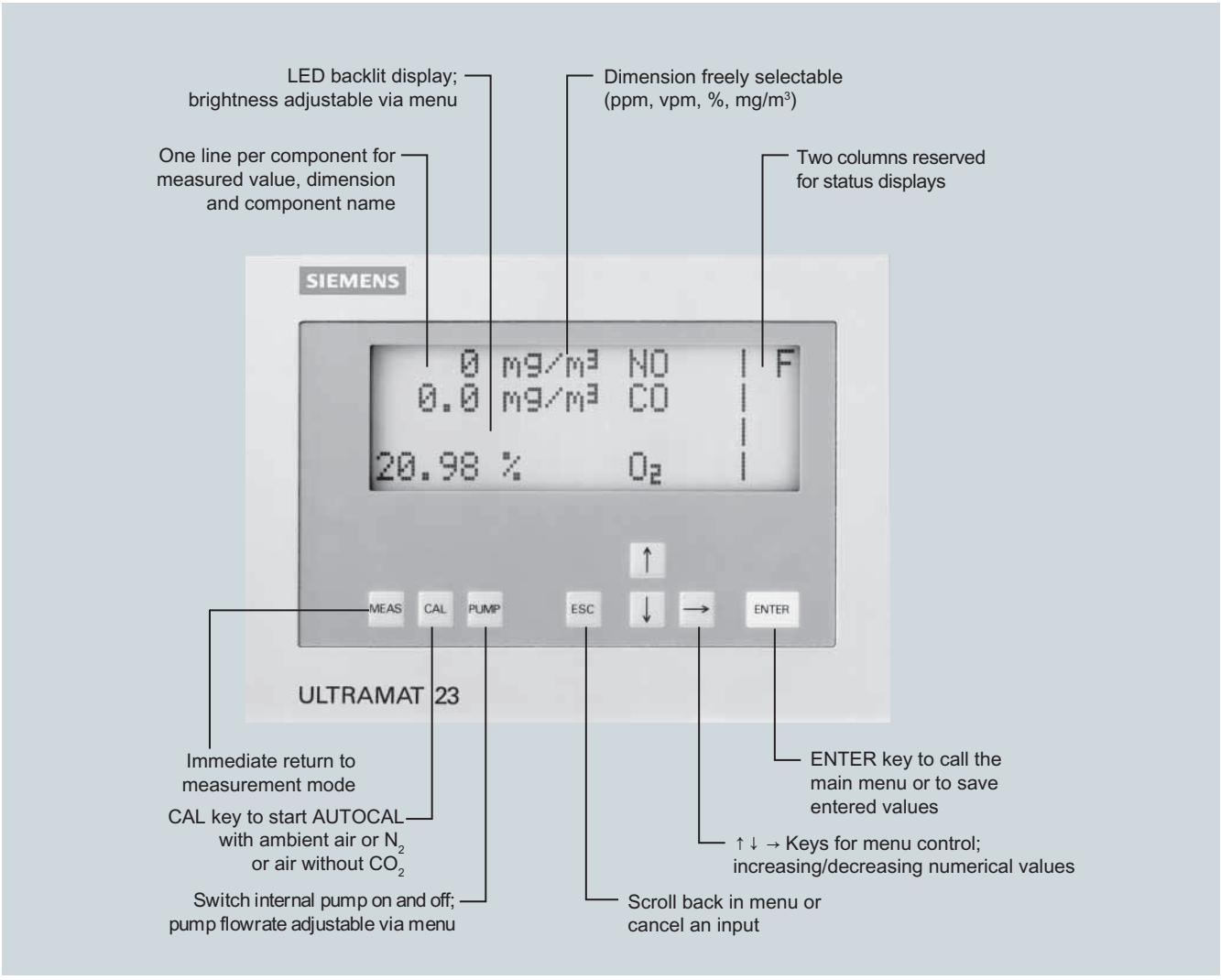
- Three binary inputs for sample gas pump On/Off, triggering of AUTOCAL and synchronization of several devices
- Eight relay outputs can be freely configured for fault, maintenance request, maintenance switch, limits, range identification and external solenoid valves
- Eight additional binary inputs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



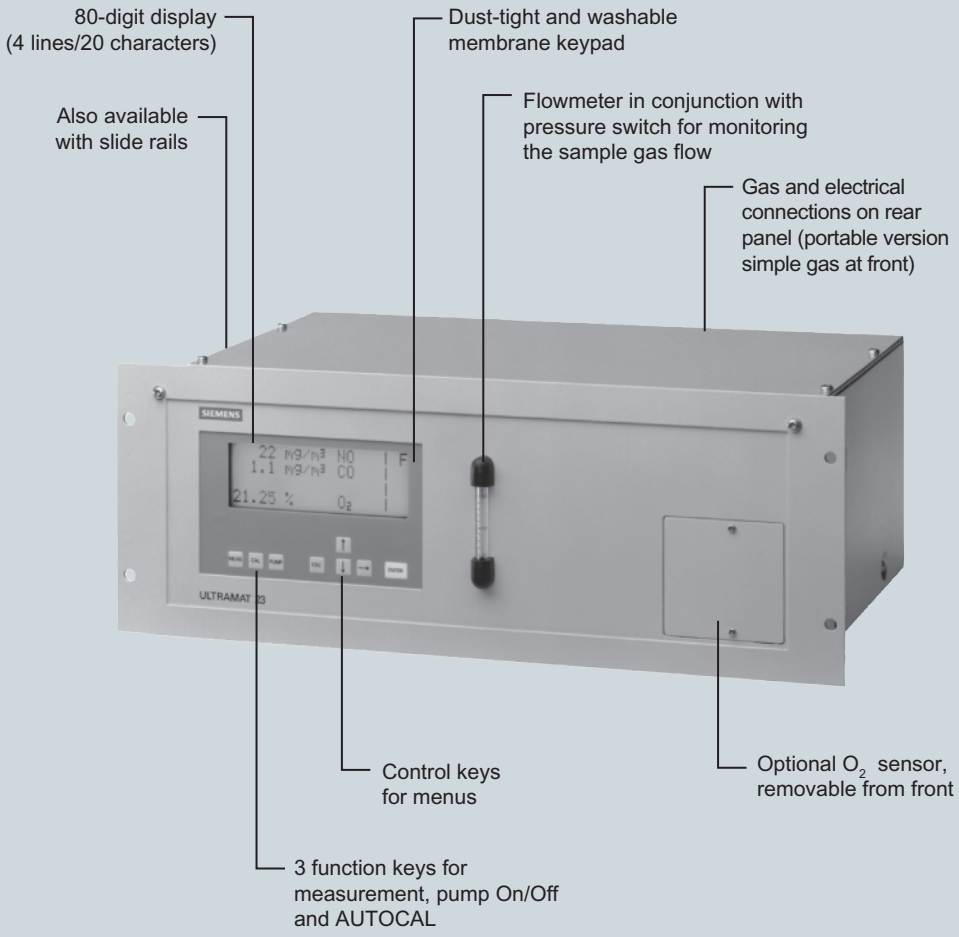
ULTRAMAT 23, membrane keyboard and graphic display

General

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



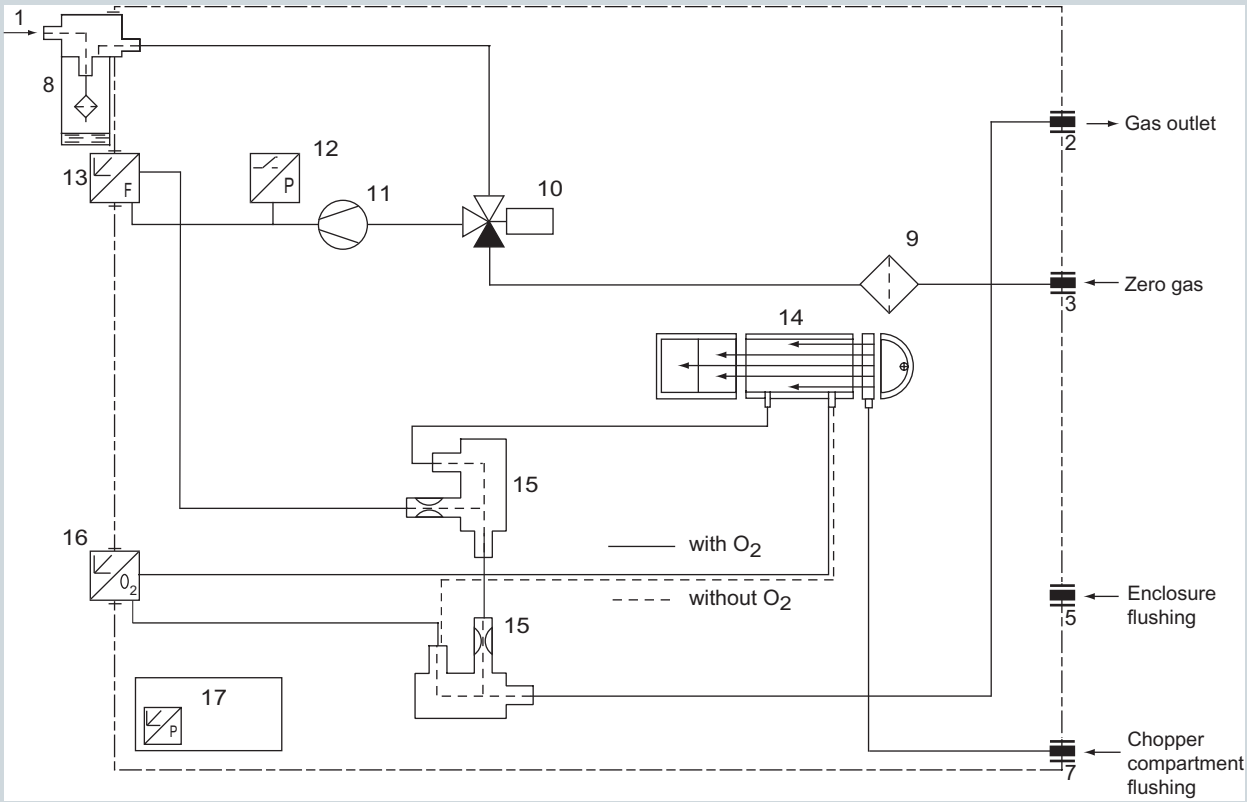
ULTRAMAT 23, design

General

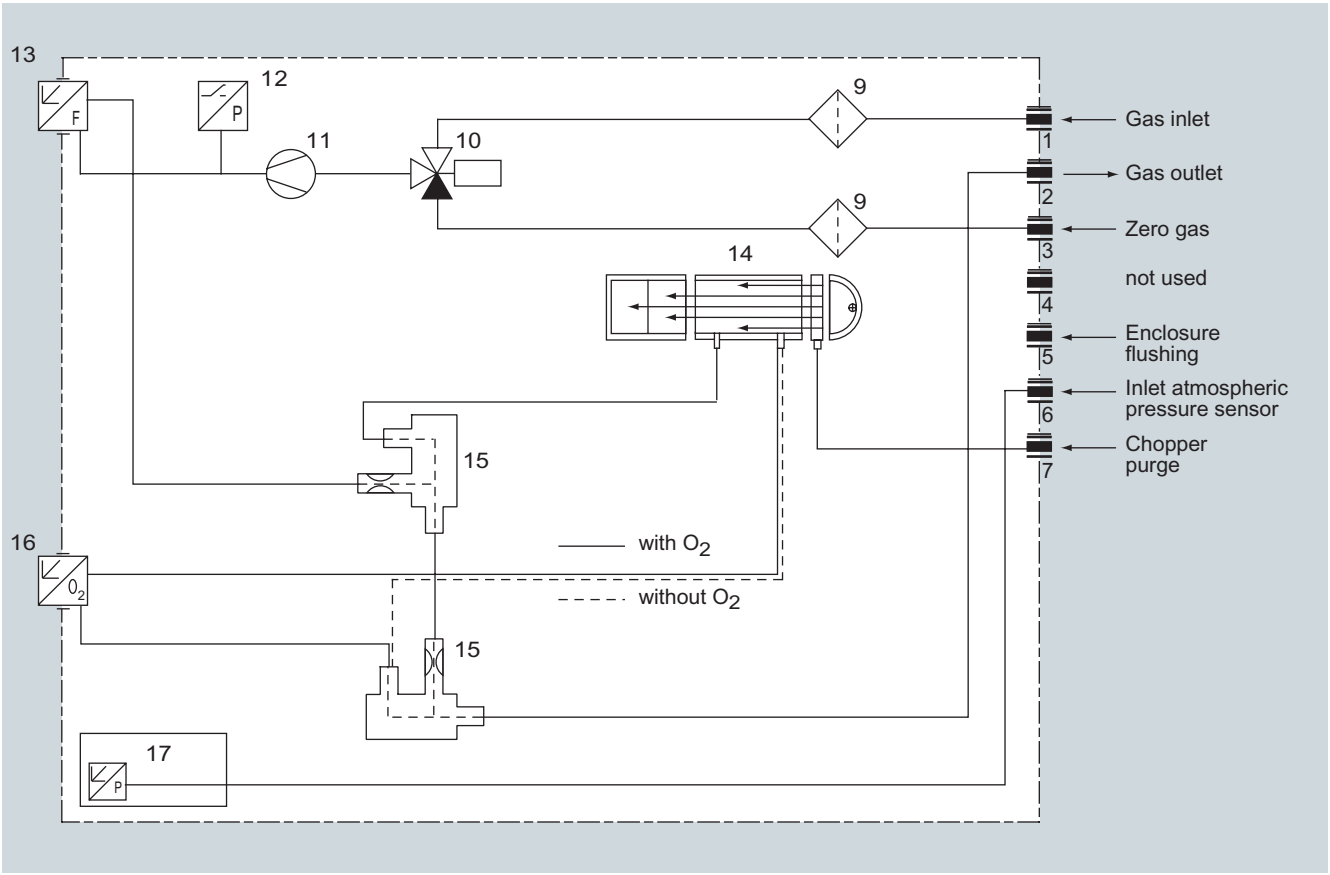
Gas path

Legend for the gas path figures

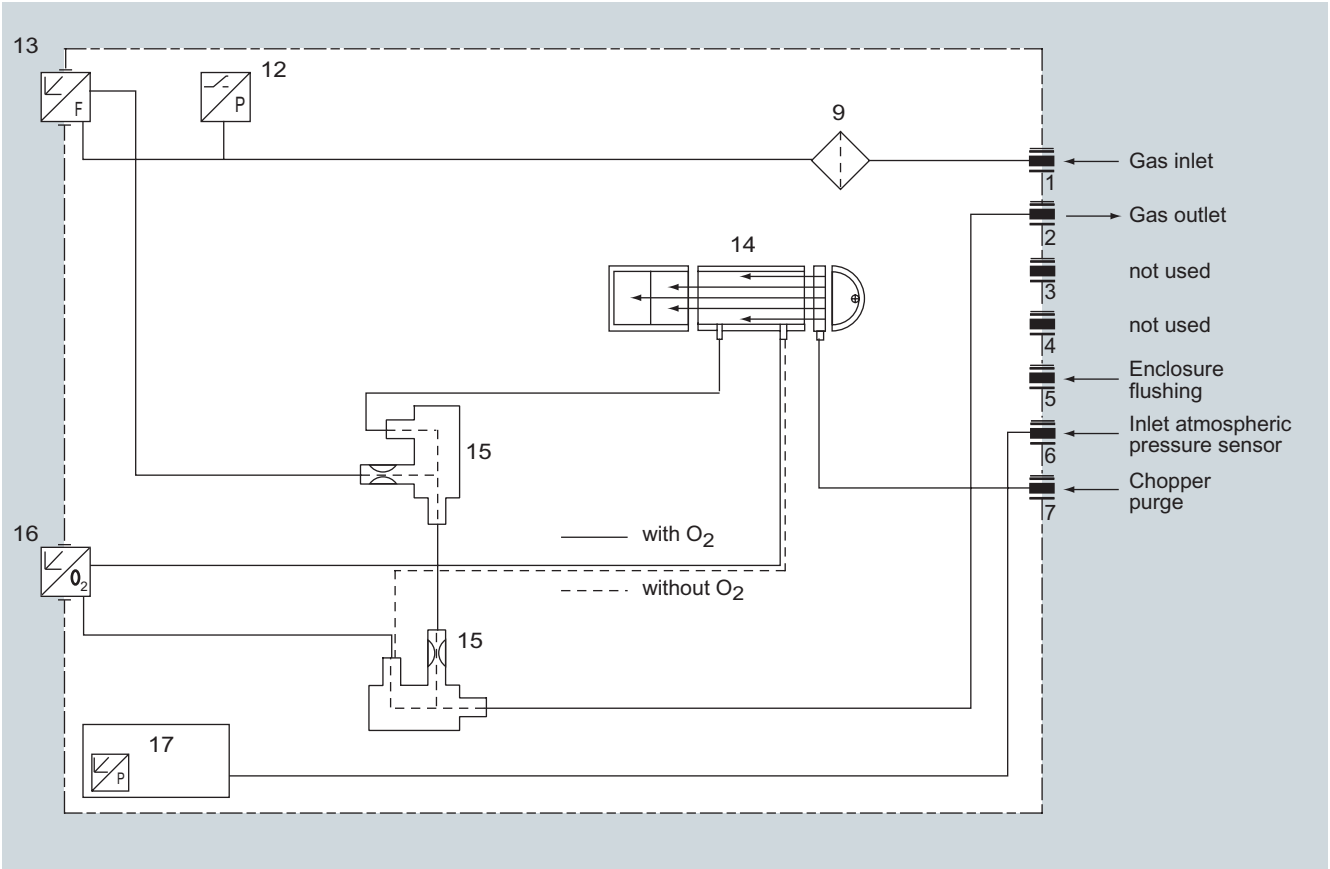
1	Inlet for sample gas/calibration gas	9	Safety fine filter
2	Gas outlet	10	Solenoid valve
3	Inlet for AUTOCAL/zero gas or inlet for sample gas/calibration gas (channel 2)	11	Sample gas pump
		12	Pressure switch
4	Gas outlet (channel 2)	13	Flow indicator
5	Enclosure flushing	14	Analyzer unit
6	Inlet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



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

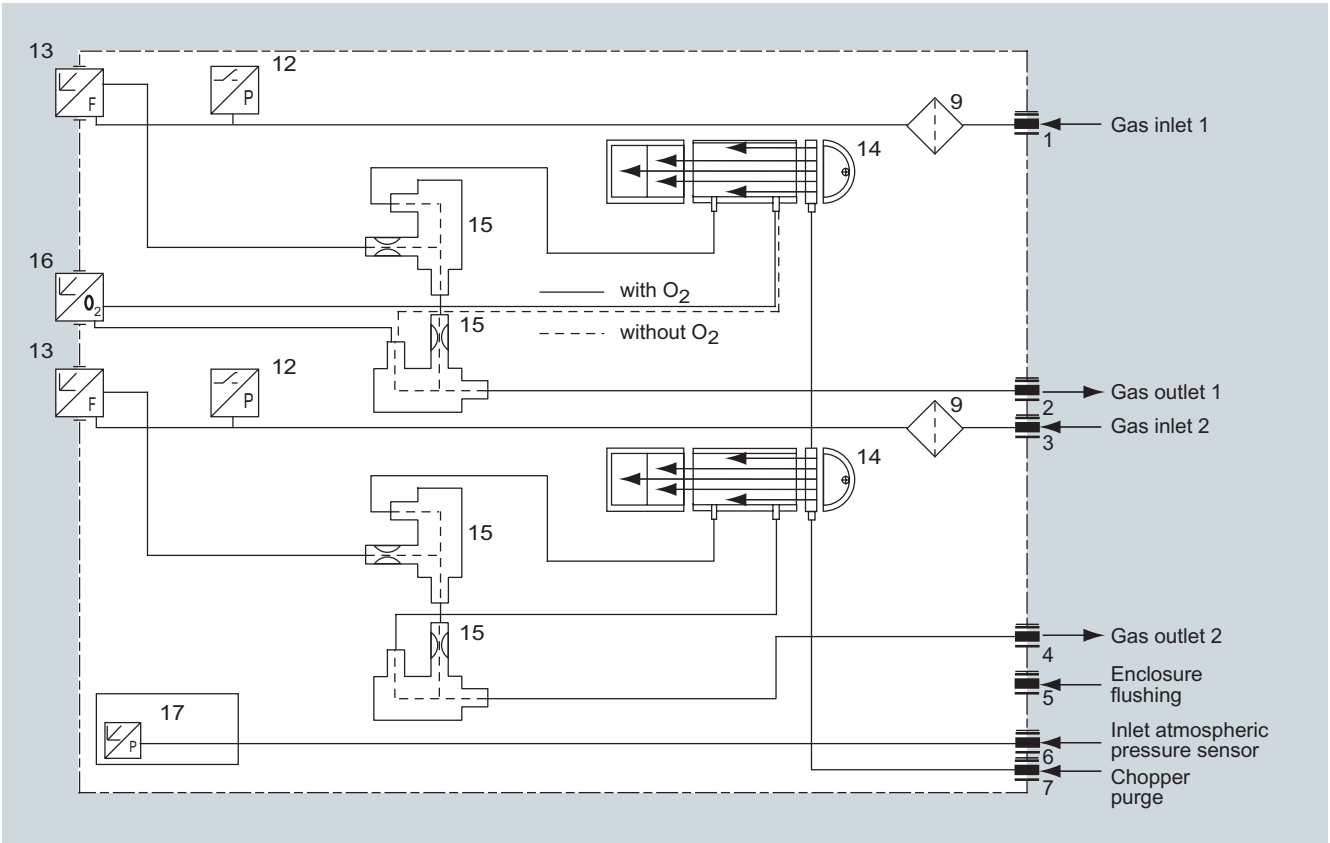


ULTRAMAT 23, 19" rack unit with internal sample gas pump, optional oxygen measurement

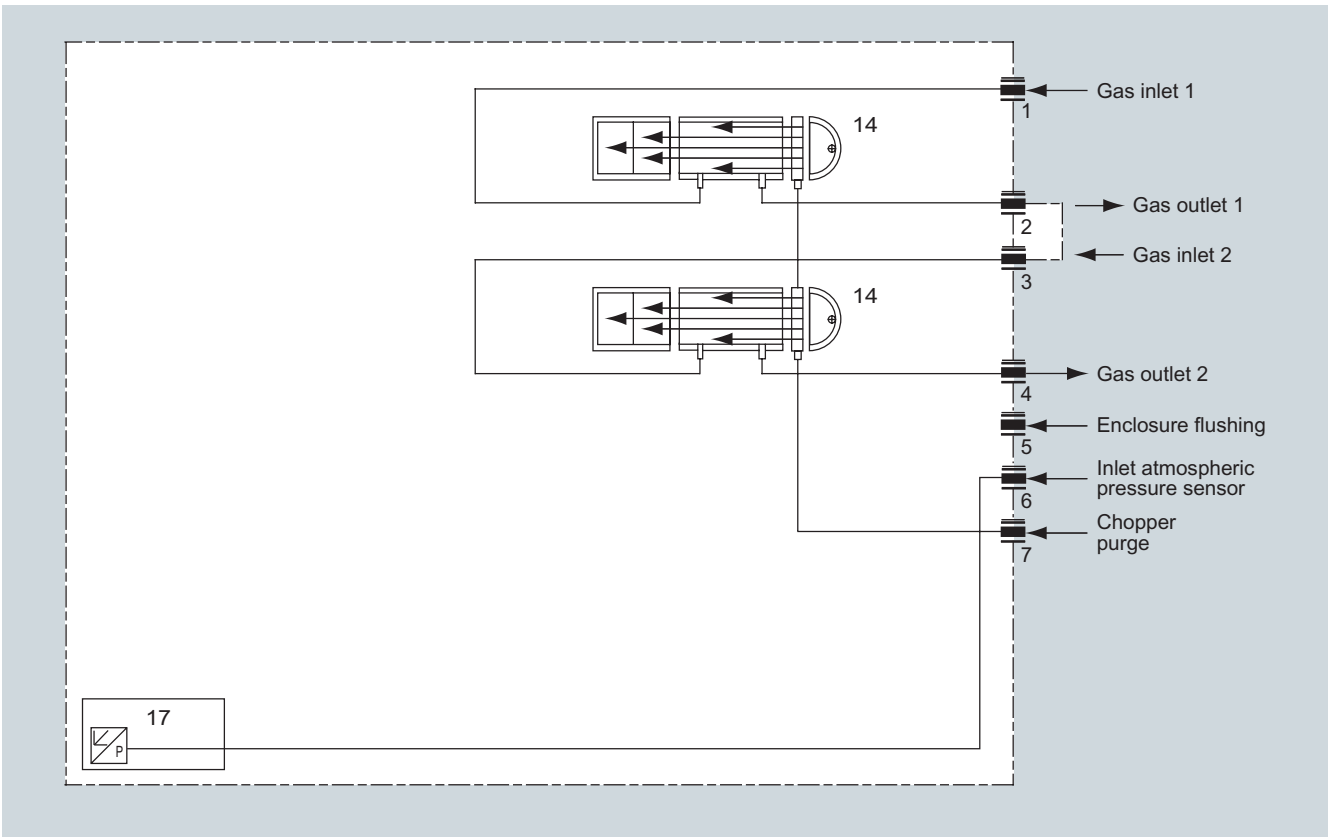


ULTRAMAT 23, 19" rack unit without internal sample gas pump, optional oxygen measurement

General



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

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.

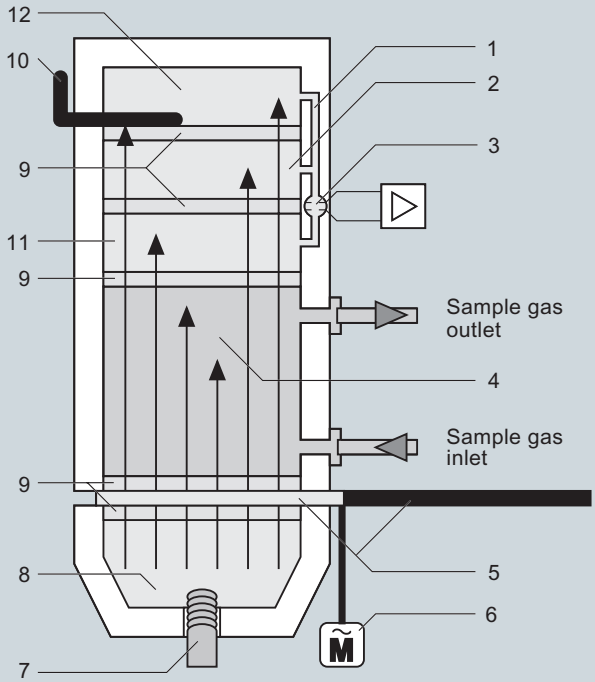
The rotating chopper (5) generates a pulsating flow in the sample chamber that the microflow sensor (3) converts into an electrical signal.

The microflow sensor consists of two nickel-plated grids heated to approximately 120 °C, which, along with two supplementary resistors, form a Wheatstone bridge. Combined with the dense arrangement of the nickel-plated grids, the pulsating nature of the flow causes a change in the 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)

General

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 measured component increases, so too does absorption in the sample chamber. As a result of this pre-absorption, 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 Unit-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:

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

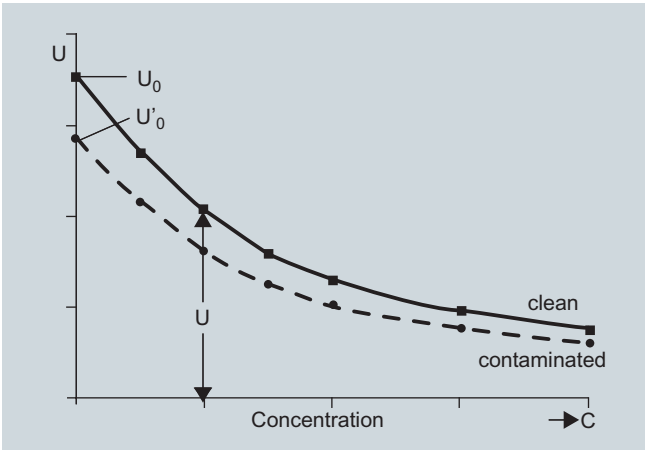
Apart from being dependent on concentration c, the measured voltage thus changes continuously as the IR source ages, or with persistent contamination.

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, 2, 3 ... 24 hours using ambient air. Calibration with a calibration gas is not necessary, as the calibration curve is calculated using the new $\mathbf{U'_0}$ value.

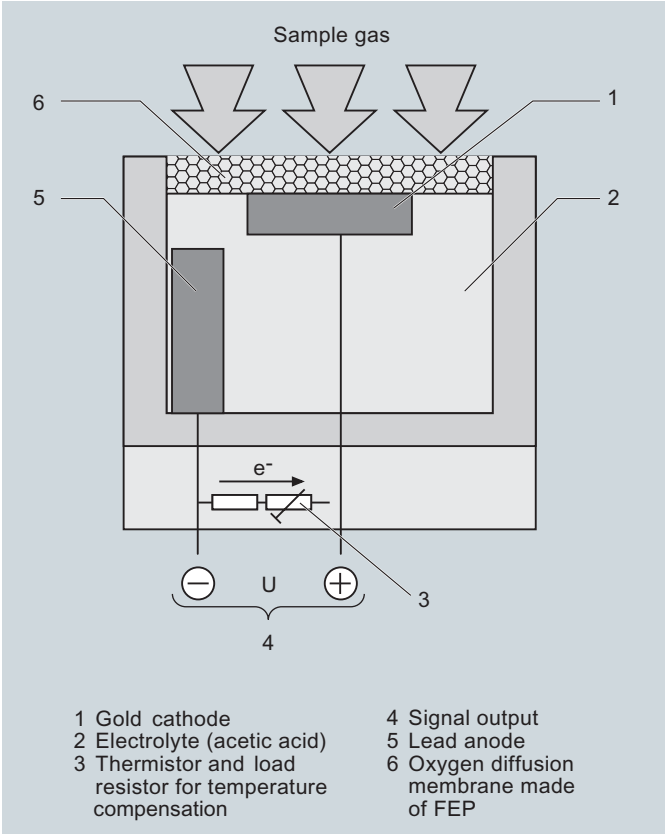


Calibration

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.



ULTRAMAT 23, principle of operation of the oxygen measuring cell

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 range 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

Technical specifications

General	
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 mark in accordance with EN 50081-1, EN 50082-2
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
Auxiliary power	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, potential-free, 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) to 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 to +60 °C
Permissible ambient humidity	< 90% RH (relative humidity) during storage and transportation
Permissible pressure fluctuations	700 to 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 to 120 l/h (1.1 to 2 l/min)
Sample gas temperature	0 to 50 °C
Sample gas humidity	< 90% RH (relative humidity), non-condensing

19" rack unit and portable version

Technical data, infrared channel	
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 to 99.9 s
Measuring response	
Output signal fluctuation	< ±1% of the current measuring range (see label)
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	
Temperature	Max. 2% of the smallest possible measuring range according to label per 10 K with an AUTOCAL cycle time of 6 h
Atmospheric pressure	< 0.2% of the current measuring range per 1% pressure change
Auxiliary power	< 0.1% of the current measuring range with a change of ±10%

Technical data, oxygen channel	
Measuring ranges	0 … 5% to 0 … 25% O_2, parameterizable
Service life	Approximately 2 years at 21% O_2; continuous duty < 0,5% O_2 will destroy the measuring cell
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	
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	
Oxygen content	Intermittent operation < 0.5% O_2 leads to falsification of the measured value
Carrier gases	The oxygen sensor must not be used if the residual gas contains the following components: H_2S, 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).

Selection and ordering data			Order No.	
ULTRAMAT 23 gas analyzer for measuring 1 infrared component and oxygen			**7MB2335-** ■■■■ **0 -** ■ **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%, TÜV version		**R**	
0 ... 100 mg/m³	0 ... 750 mg/m³		**T**	
0 ... 150 mg/m³	0 ... 750 mg/m³		**U**	
0 ... 250 mg/m³	0 ... 1 250 mg/m³		**V**	
0 ... 400 mg/m³	0 ... 2 000 mg/m³		**W**	
0 ... 50 vpm	0 ... 2 500 vpm		**X**	
Oxygen measurement[5]				
Without O_2 sensor			**0**	
With O_2 sensor (cannot be combined with stainless steel piping)			**1**	**1**
Auxiliary power				
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

Further versions	Order code
Add "-**Z**" to Order No. and specify Order code	
Supplementary electronics with 8 binary inputs/outputs, PROFIBUS PA interface	**A12**
Supplementary electronics with 8 binary inputs/outputs, PROFIBUS DP interface	**A13**
Telescopic rails (2 units), 19" rack unit version only	**A31**
Set of Torx screwdrivers, ball allen screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Gas path for short response time	**C01**
Chopper compartment purging for 6 mm gas connection	**C02**
Chopper compartment purging for ¼" gas connection	**C03**
Software for converting mg/m^3 to ppm under standard conditions (p = 1 013 hPa, 273 K)	**D15**
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**
Retrofit kits	
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
Supplementary electronics with 8 binary inputs/outputs and PROFIBUS PA	**A5E00056834**
Supplementary electronics with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057159**

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. 300 kPa required for measuring ranges below 0.1% CO_2), to be ordered as a supplementary item (see Order code C02/C03)
7) Not suitable for use with emission measurements since the cross-sensitivity is too high
8) CO_2 measurement in residual 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

7MB2337- ■■■■ **0 -** ■■■■ 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	

1st 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%, TÜV version	R
0 ... 100 mg/m³	0 ... 750 mg/m³	T
0 ... 150 mg/m³	0 ... 750 mg/m³	U
0 ... 250 mg/m³	0 ... 1 250 mg/m³	V
0 ... 400 mg/m³	0 ... 2 000 mg/m³	W
0 ... 50 vpm	0 ... 2 500 vpm	X

Oxygen measurement[5]	
Without O_2 sensor	0
With O_2 sensor (cannot be combined with stainless steel piping)	1

Auxiliary power	
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

2nd 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, Y[10]	S
SF_6	H	V

Footnotes: See next page.

19" rack unit and portable version

Selection and ordering data		Order No.	
ULTRAMAT 23 gas analyzer for measuring 2 infrared components and oxygen		**7MB2337-** ■■■■ **0 -** ■■■■	cannot be combined
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/m^3	0 ... 750 mg/m^3	**T**	
0 ... 150 mg/m^3	0 ... 750 mg/m^3	**U**	
0 ... 250 mg/m^3	0 ... 1 250 mg/m^3	**V**	
0 ... 400 mg/m^3	0 ... 2 000 mg/m^3	**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**

Further versions	Order code
Add "-Z" to Order No. and specify Order code	
Supplementary electronics with 8 binary inputs/outputs, PROFIBUS PA interface	**A12**
Supplementary electronics with 8 binary inputs/outputs, PROFIBUS DP interface	**A13**
Stainless steel (mat. no. 1.4571) connection pipe, 6 mm, complete with screwed gland (cannot be combined with Viton screwed gland)	**A27**
Stainless steel (mat. no. 1.4571) connection pipe, ¼", complete with screwed gland (cannot be combined with Viton screwed gland)	**A29**
Telescopic rails (2 units, 19" rack unit version only)	**A31**
Set of Torx screwdrivers, Allen screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Gas path for short response time	**C01**
Chopper compartment purging for 6 mm gas connection	**C02**
Chopper compartment purging for ¼" gas connection	**C03**
Software for converting mg/m^3 to ppm under standard conditions (p = 1 013 hPa, 273 K)	**D15**
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**

Retrofit kits	
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
Supplementary electronics with 8 binary inputs/outputs and PROFIBUS PA	**A5E00056834**
Supplementary electronics with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057159**

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. 300 kPa required for measuring ranges below 0.1% CO_2), to be ordered as a supplementary item (see Order code C02/C03)
7) Not suitable for use with emission measurements since the cross-sensitivity is too high
8) CO_2 measurement in residual gas Ar or Ar/He (3:1); forming gas
9) Only in conjunction with Viton hose
10) Only in conjunction with CO_2 measuring range 0 ... 5% to 0 ... 25% (CP)

Selection and ordering data

Order No.

ULTRAMAT 23 gas analyzer
for measuring 3 infrared components and oxygen

7MB2338- ■■■■ **0 -** ■■■■ 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, sep.	Without[2]	6	6
¼" pipe	Stainless steel, mat. no. 1.4571, sep.	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	

1st and 2nd infrared measured component

Measured component	Smallest measuring range	Largest measuring range		
CO NO	0 ... 500 vpm 0 ... 500 vpm	0 ... 2 500 vpm 0 ... 2 500 vpm	AA	
CO NO	0 ... 2 000 vpm 0 ... 1 000 vpm	0 ... 10 000 vpm 0 ... 5 000 vpm	AB	
CO NO	0 ... 1 000 vpm 0 ... 1 000 vpm	0 ... 5 000 vpm 0 ... 5 000 vpm	AC	
CO NO	0 ... 1% 0 ... 1 000 vpm	0 ... 5% 0 ... 5000 vpm	AD	
CO NO	0 ... 250 mg/m³ 0 ... 400 mg/m³	0 ... 1 250 mg/m³ 0 ... 2 000 mg/m³ TÜV version	AK	
CO CO_2	0 ... 10% 0 ... 10%	0 ... 50% 0 ... 50%	BA	
CO CO_2	0 ... 10% 0 ... 0.5%	0 ... 50% 0 ... 2.5%	BB	
CO CO_2	0 ... 20% 0 ... 20%	0 ... 100% 0 ... 100%	BD	
CO_2 CO	0 ... 5% 0 ... 100 vpm	0 ... 25% 0 ... 500 vpm	BJ	
CO_2 CO	0 ... 10% 0 ... 0.5%	0 ... 50% 0 ... 2.5%	BK	
CO CO_2	0 ... 75 mg/m³ 0 ... 5%	0 ... 750 mg/m³ 0 ... 25%	BL	
CO_2 CH_4	0 ... 5% 0 ... 1%	0 ... 25% 0 ... 5%	CA	
CO_2 CH_4	0 ... 5% 0 ... 2%	0 ... 25% 0 ... 10%	CB	
CO_2 NO	0 ... 5% 0 ... 500 vpm	0 ... 25% 0 ... 2 500 vpm	DC	

Oxygen measurement[5]

Without O_2 sensor		0	
With O_2 sensor (cannot be combined with stainless steel piping)		1	1

Auxiliary power

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

3rd 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[7]	E, S[10] (biomass)	S
SF_6	H	V

Footnotes: See next page.

19" rack unit and portable version

Selection and ordering data		Order No.	
ULTRAMAT 23 gas analyzer for measuring 3 infrared components and oxygen		**7MB2338-** ■■■■ **0 -** ■■■■	cannot be combined
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/m^3	0 ... 500 mg/m^3	**S**	
0 ... 150 mg/m^3	0 ... 750 mg/m^3	**U**	
0 ... 250 mg/m^3	0 ... 1 250 mg/m^3	**V**	
0 ... 400 mg/m^3	0 ... 2 000 mg/m^3	**W**	
0 ... 50 vpm	0 ... 2 500 vpm	**X**	
Operating software, documentation[3]			
German			**0**
English			**1**
French			**2**
Spanish			**3**
Italian			**4**

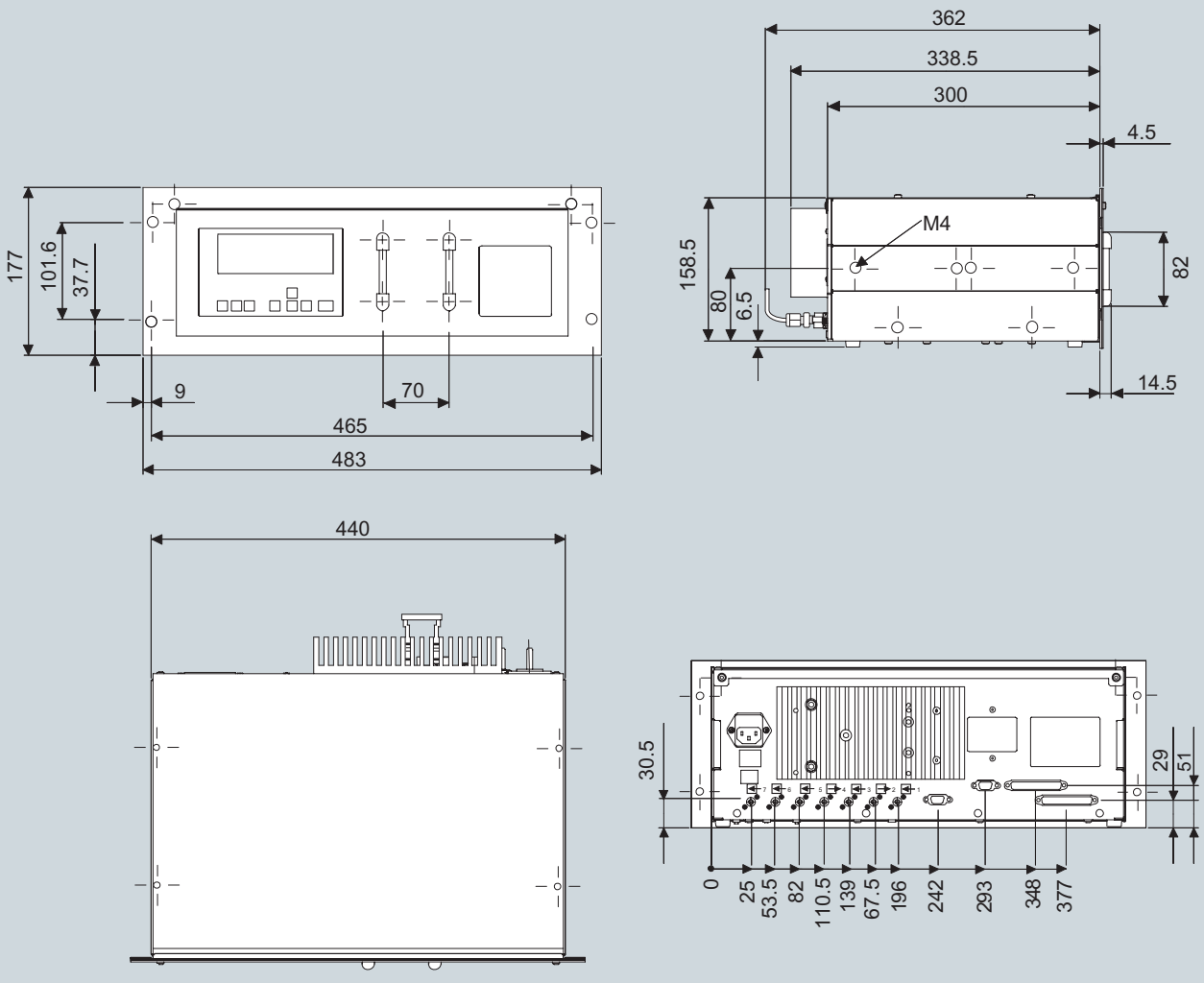
Further versions	Order code
Add **"-Z"** to Order No. and specify Order code	
Supplementary electronics with 8 binary inputs/outputs, PROFIBUS PA interface	**A12**
Supplementary electronics with 8 binary inputs/outputs, PROFIBUS DP interface	**A13**
Stainless steel (mat. no. 1.4571) connection pipe, 6 mm, complete with screwed gland (cannot be combined with Viton screwed gland)	**A27**
Stainless steel (mat. no. 1.4571) connection pipe, ¼", complete with screwed gland (cannot be combined with Viton screwed gland)	**A29**
Telescopic rails (2 units, 19" rack unit version only)	**A31**
Set of Torx screwdrivers, Allen 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**
Software for converting mg/m^3 to ppm under standard conditions (p = 1 013 hPa, 273 K)	**D15**
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**

Retrofit kits	
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
Supplementary electronics with 8 binary inputs/outputs and PROFIBUS PA	**A5E00056834**
Supplementary electronics with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057159**

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. 300 kPa required for measuring ranges below 0.1% CO_2), to be ordered as a supplementary item (see Order code C02/C03)
7) Not suitable for use with emission measurements since the cross-sensitivity is too high
8) CO_2 measurement in residual gas Ar or Ar/He (3:1); forming gas
9) Only for version with Viton hose
10) Only in combination with CO/CO_2, measuring range 0 ... 75/750 mg/m^3, 0 ... 5/25% [-BL-]

Dimensional drawings

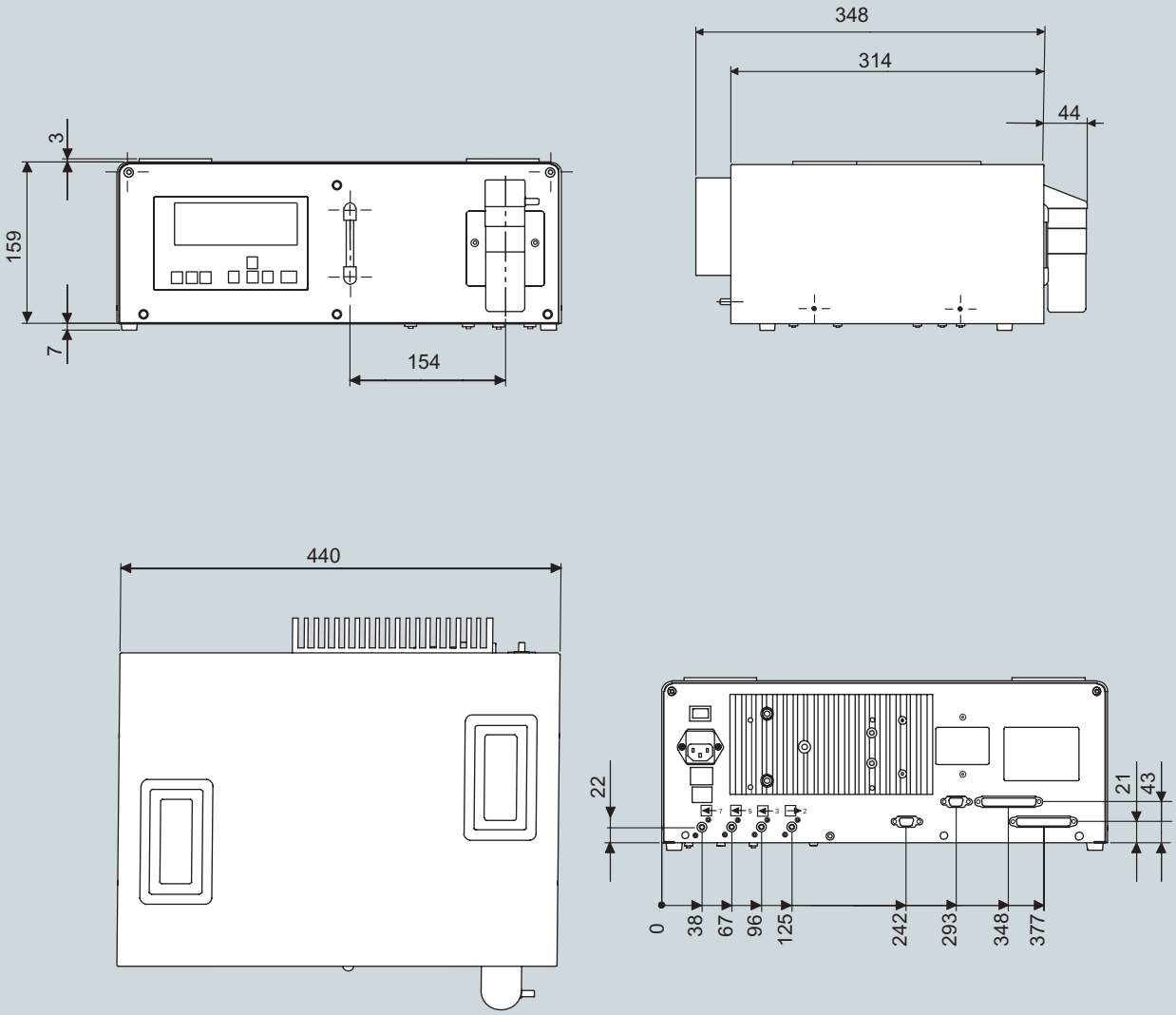


Gas connections: stubs diam. 6 mm or ¼"

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

ULTRAMAT 23, 19" unit, dimensions in mm

19" rack unit and portable version

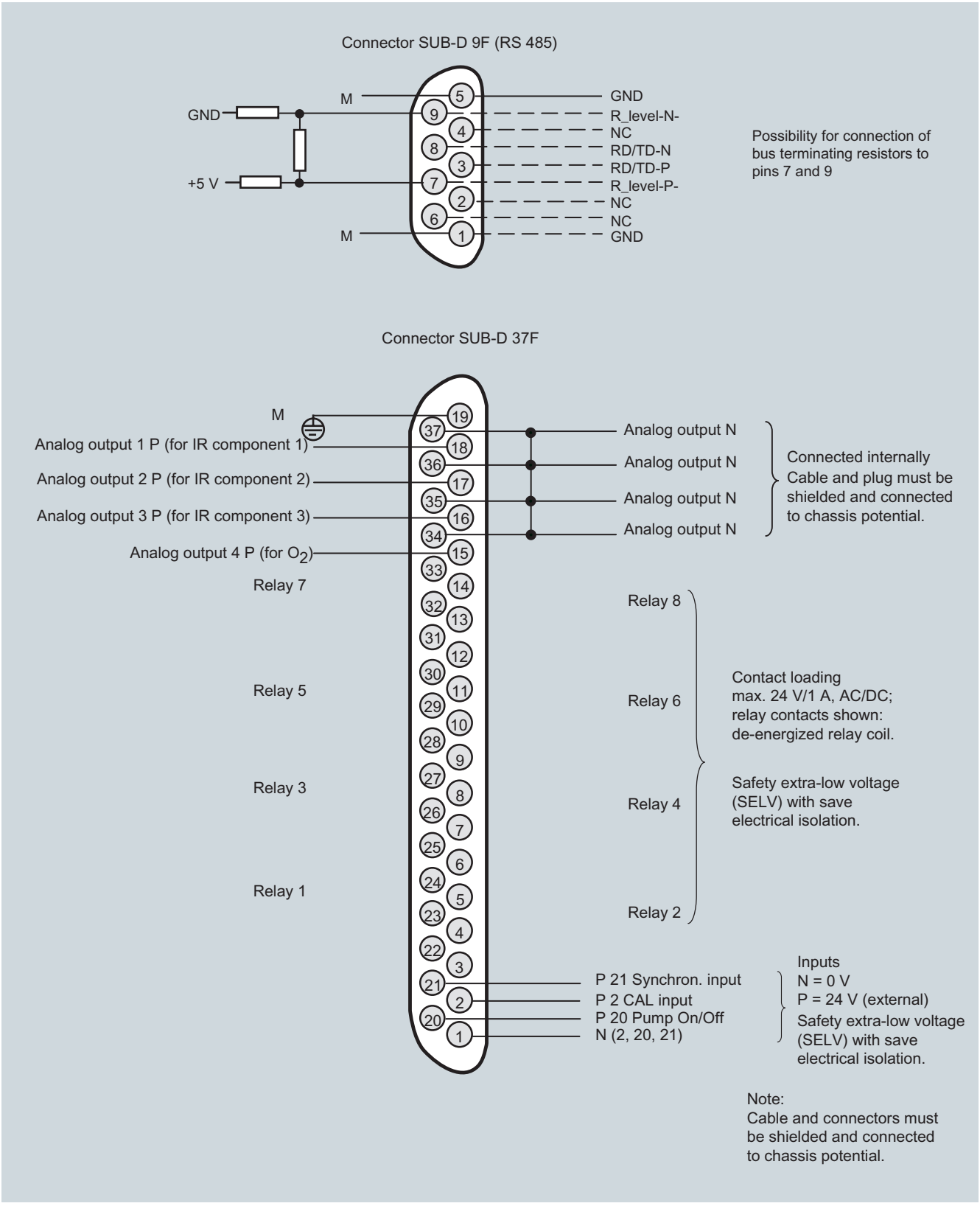


Gas connections: stubs diam. 6 mm

ULTRAMAT 23, desktop unit, dimensions in mm

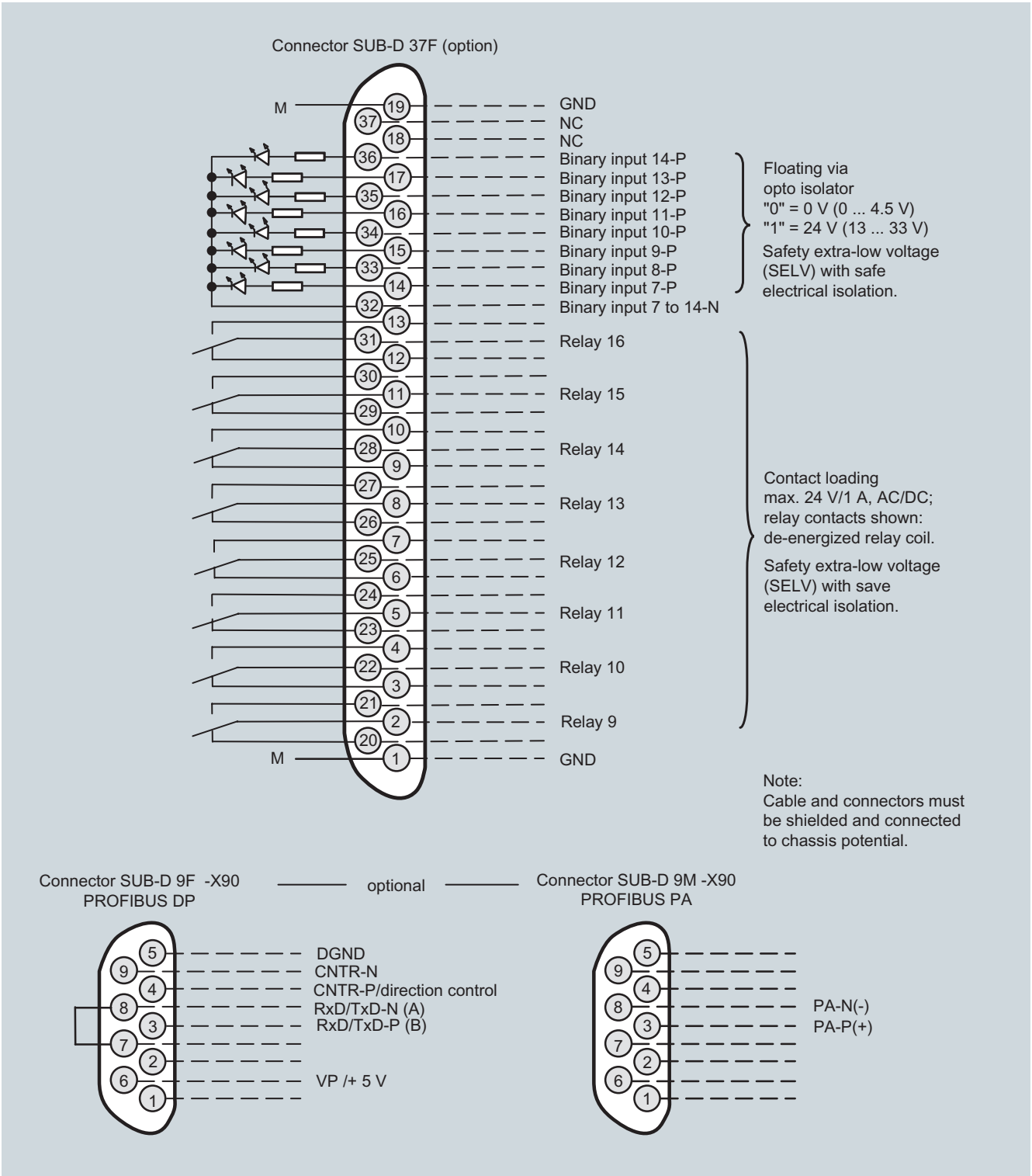
Schematics

Pin assignment (electrical and gas connections)



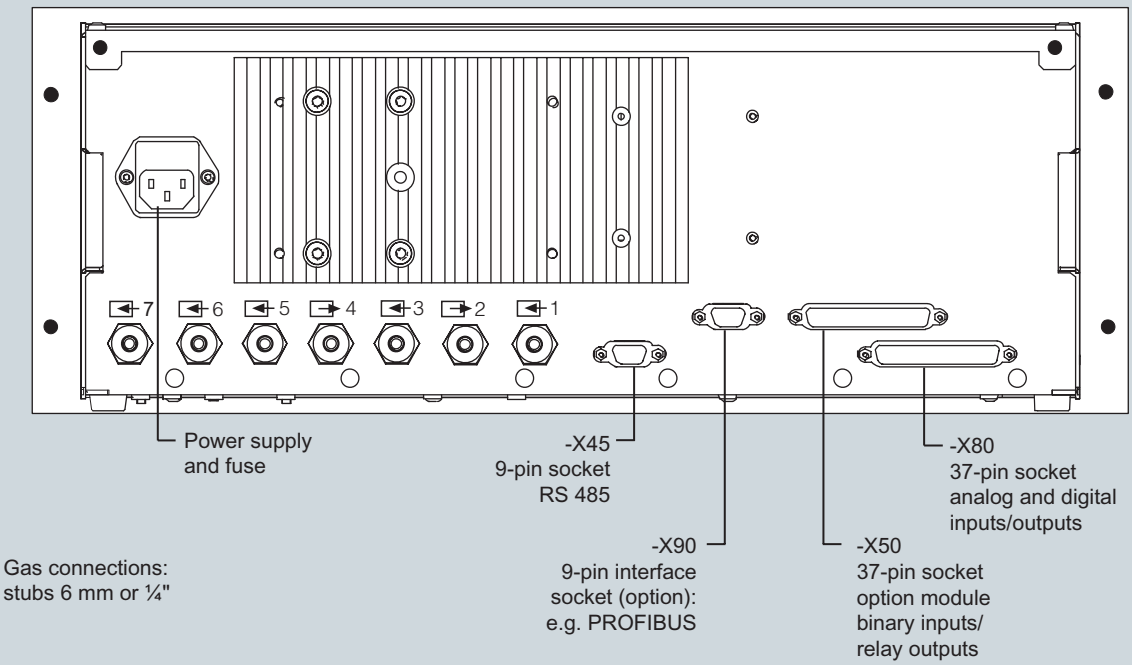
ULTRAMAT 23, pin assignment (standard)

19" rack unit and portable version



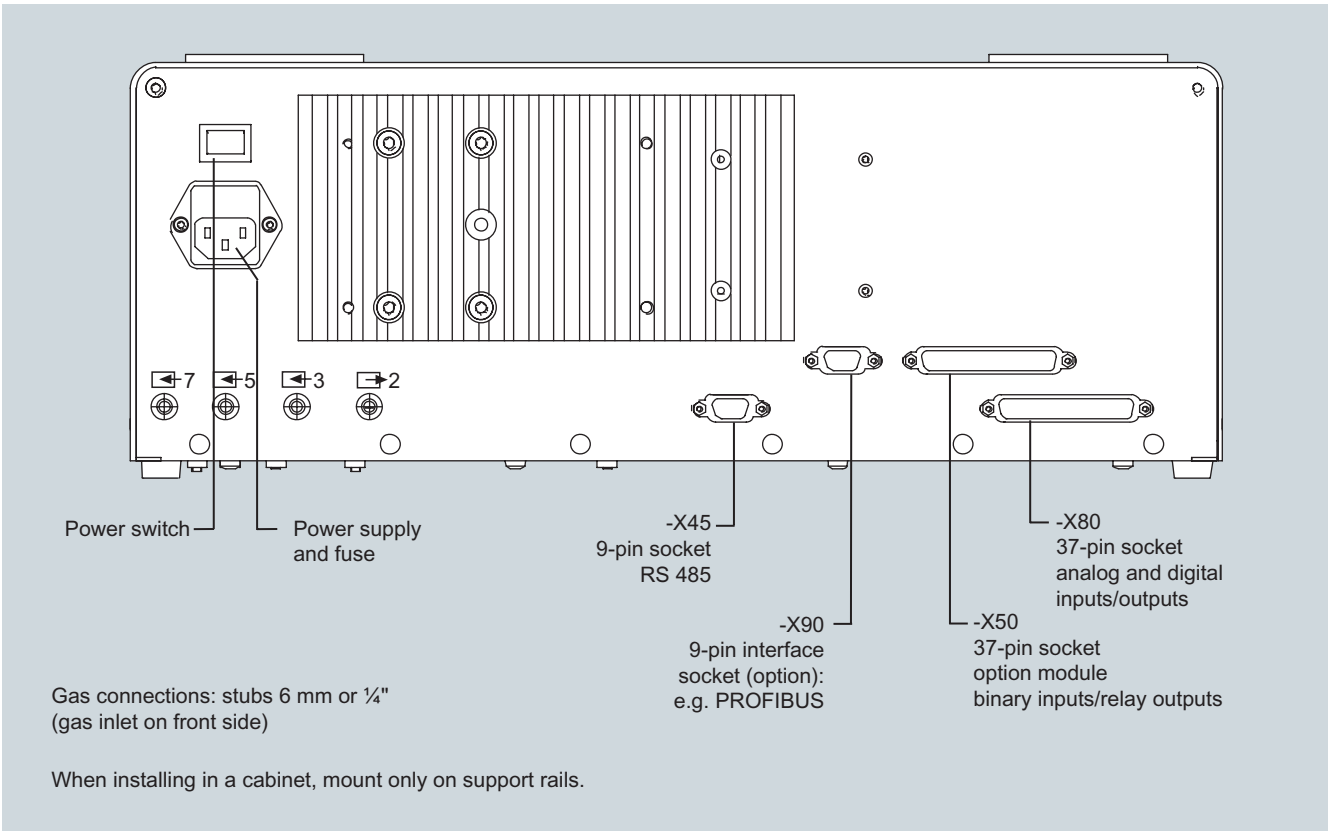
ULTRAMAT 23, pin assignment of the optional PROFIBUS interface board

19“ unit



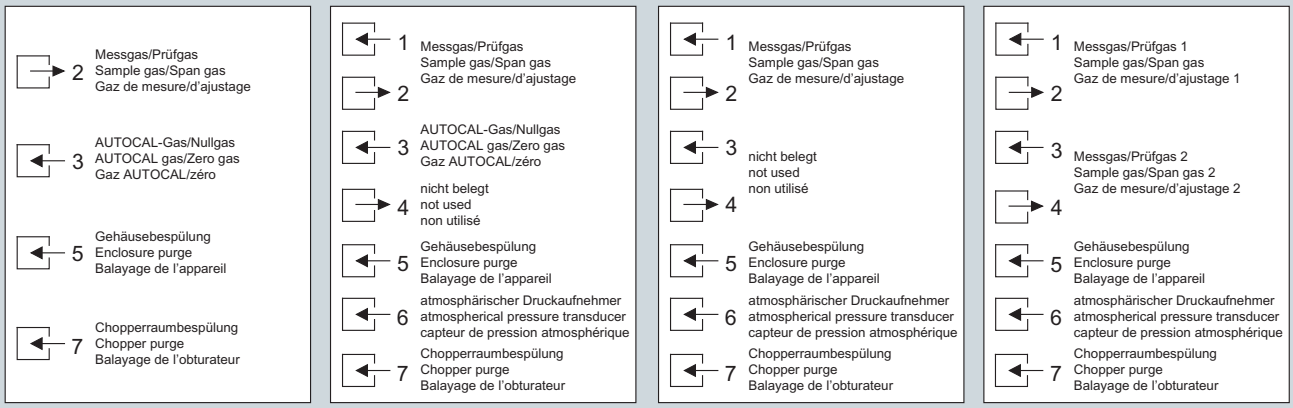
ULTRAMAT 23, 19“ unit, e.g. one infrared component with oxygen measurement

Desktop unit



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

19" rack unit and portable version



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

Equipment Manual	Order No.
ULTRAMAT 23	
Gas analyzer for IR-absorbing gases and oxygen	
• German	**C79000-G5200-C216**
• English	**C79000-G5276-C216**
• French	**C79000-G5277-C216**
• Spanish	**C79000-G5278-C216**
• Italian	**C79000-G5272-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, 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	A)	**C79451-A3494-D501**
Keypad	1	1		**C79451-A3492-B605**
LCD module	1	1		**C79451-A3494-B16**
Connector filter	-	1		**W75041-E5602-K2**
Line switch (portable analyzer)	-	1		**W75050-T1201-U101**
Fuse 220 V ... 240 V	2	4		**W79054-L1010-T630**
Fuse 100 V ... 120 V	2	4		**W79054-L1011-T125**
Miscellaneous				
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 (version with pump only)	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**

A) Subject to AL export regulations: N, ECCN: 3A991X
D) Subject to AL export regulations: 9I999, ECCN: N