Continuous Gas Analyzer, extractive

2

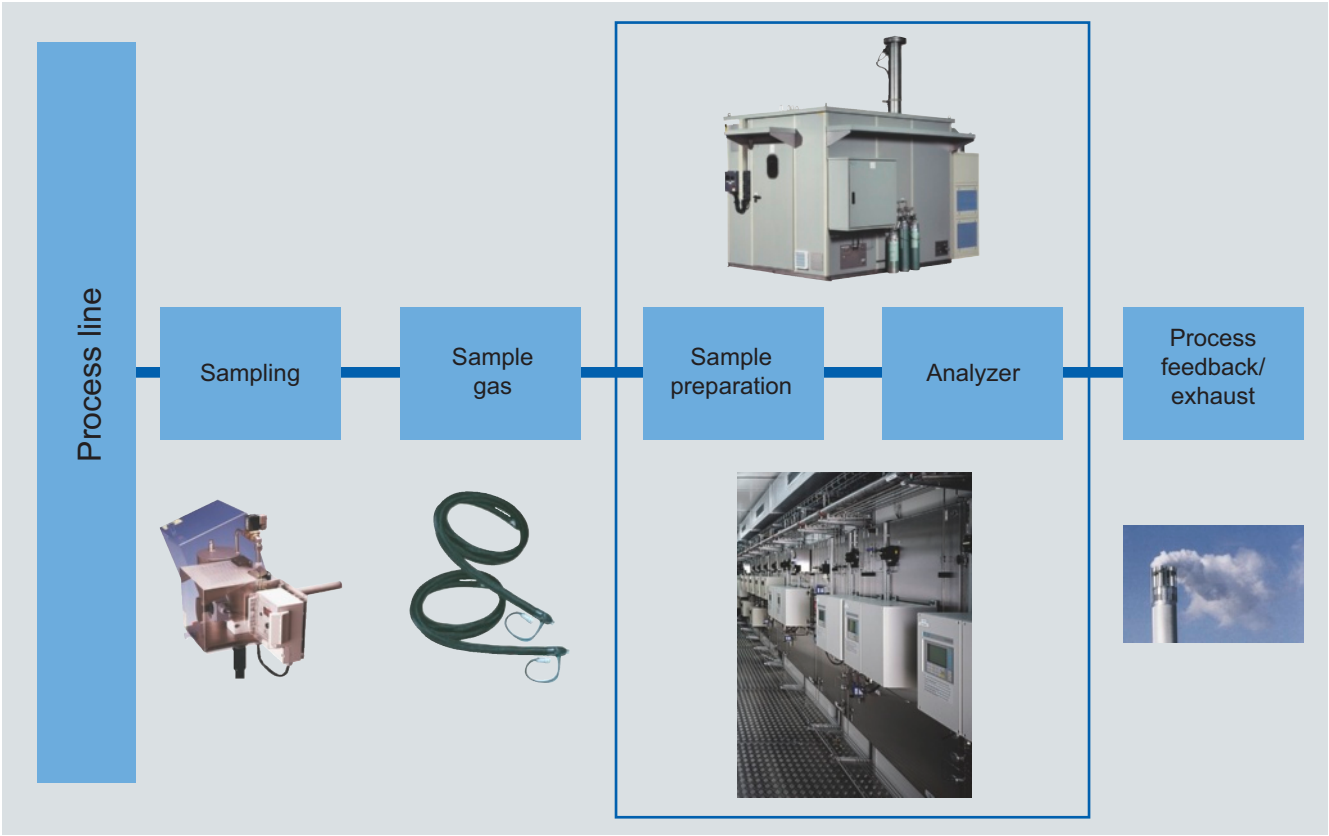
Introduction

Overview

Siemens process gas analyzers have been used in the process industry for more than 40 years, and are renowned for their quality, reliability and accuracy. The flexibility provided by the continuous process gas analyzers of Series 6 with respect to housing design, explosion protection, corrosion resistance and communications capability means that optimum solutions can be found for all applications.

Nowadays, the communications capability of analyzers is becoming increasingly important. Siemens process gas analyzers are an integral component of Siemens' "Totally Integrated Automation" concept which is globally unique. This concept permits design of uniform process communication from the operations management level down to the field level. The simple integration of analyzers into the host control systems is the basis for a uniform automation and analysis solution.

Many years of experience in the development and production of analyzers as well as in the planning and installation of analyzer systems distinguishes Siemens as a solution provider - reliable, innovative and with global presence.



Schematic representation of the measuring setup of extractive site installations

Extractive procedures for process gas analysis

Extractive process gas analyzers are used for continuous determination of the concentrations of one or more gases in a gas mixture. Determination of the concentration of gases in a process is used to control and monitor process flows, and is therefore decisive for the automation and optimization of processes and ensuring product quality. In addition, process gas analyzers are used to check emissions, thus making an important contribution to environmental protection, as well as for ensuring compliance with statutory directives.

With extractive measuring procedures, the sample to be analyzed is extracted from the process line and applied preconditioned to the analyzer via a sample line and a sample preparation system. This system, for example, adjusts the pressure, temperature and flow of the sample, and frees the sample gas of dust and moisture if necessary. This guarantees that the measurement can be carried out under defined conditions. Furthermore, the analyzer is protected from damaging influences.

Various measuring procedures with different physical and electrochemical methods are used depending on the type of components to be measured and the measuring point. The "Series 6" range from Siemens includes a number of extractive measuring procedures with uniform housing and operating concepts. Each instrument provides peak analytical performances for its class:

- **ULTRAMAT 6**
  For highly-selective measurement of infrared-active components such as CO, CO_2, NO, SO_2, NH_3, H_2O, CH_4 and other hydrocarbons. The ULTRAMAT 6 is a high-end analyzer in 19" format or in a sturdy field housing for use in harsh atmospheres. The field of application basically comprises all types of emission measurements up to use in processes. These serve to control production processes and guarantee product quality, even in the presence of highly corrosive gases.
- **ULTRAMAT 23**
  The ULTRAMAT 23 is an innovative multi-component gas analyzer for measuring up to three infrared-sensitive gases using the NDIR principle. Measurement of oxygen (O_2) is also possible through the use of electrochemical oxygen sensors or measuring cells operating according to the paramagnetic principle ("dumbbell"). The use of an additional electrochemical H_2S measuring cell permits use in biogas applications.
- **ULTRAMAT/OXYMAT 6**
  For combined measurement of infrared-active components and oxygen in complex applications.
- **OXYMAT 6**
  For measurement of oxygen concentration according to the paramagnetic principle in complex applications. The OXYMAT 6 measures oxygen according to the paramagnetic alternating pressure principle. This guarantees absolute linearity and allows the use of very small measuring ranges from 0 to 0.5 % (detection limit 50 ppm), ranges up to 0 to 100 %, and even 99.5 to 100 % in one unit.
  Suitable materials in the gas path even permit the analyzers to be used for measurement of corrosive gas mixtures. The detector unit does not come into contact with the sample gas, and therefore permits use in harsh atmospheres while simultaneously guaranteeing a long service life.
- **OXYMAT 61**
  For measurement of oxygen concentrations according to the paramagnetic principle in standard applications. Ambient air can be used as the reference gas for OXYMAT 61. This is supplied by a pump integrated in the analyzer enclosure.
- **OXYMAT 64**
  For measurement of oxygen concentrations in the trace range by means of ZrO_2 sensors. The OXYMAT 64 can be used to measure very small traces of oxygen, down to the smallest measuring range of 0 to 10 ppm. This is particularly interesting in systems for air separation. A catalytically inactive ZrO_2 sensor or a catalytically active ZrO_2 sensor can be selected, depending on the application.
- **CALOMAT 6**
  For determining the concentration of hydrogen and inert gases in binary mixtures through measurement of thermal conductivity. The CALOMAT 6 features a high dynamic measuring range (e.g. 0 … 1 % and 0 … 100 % H_2, parameterizable) and a short T90 time.
- **CALOMAT 62**
  The CALOMAT 62 is a thermal conductivity analyzer that has been specially designed for applications with corrosive gases. It is possible to directly measure the concentration of gas components such as Cl_2, HCl and NH_3, as well as e.g. H_2 and N_2 in a corrosive atmosphere.
- **FIDAMAT 6**
  For measurement of total hydrocarbons according to the flame ionization principle.
  The FIDAMAT versions feature a highly varied field of application. From monitoring for traces of hydrocarbons in ultra-pure gases - made possible by the high resolution and small differences in response factors - up to measurements of total hydrocarbons in the % range.
  The widely adjustable operating temperature for the sample gas path and detector also allows measurement of high-boiling mixtures and of hydrocarbons at water vapor concentrations up to 100 %.

Introduction

General information

Introducing flammable gases

Introducing frequently or permanently explosive gas/air mixtures to the gas analyzers mentioned in this chapter is not permitted.

The introduction of gases with flammable components at concentrations above the lower explosive limit (LEL) should only be carried out with analyzers fitted with piping. Purging of the enclosure as well as further measures must be provided depending on the application. An inert gas must be used for purging (see manual for further information).

Cross-sensitivity

Exact measurement results with regard to the technical specifications can only be expected if a sample gas is free to the greatest possible extent of gases exhibiting a cross-sensitivity with the measured component. The influences of these interfering components can be reduced using various measures. Please contact our specialists if you have any questions.

General installation conditions:

- Protected against low temperatures and thermal radiation (see technical specifications)
- Protected against temperature variations
- To achieve the best possible measuring quality, the installation location should be free from vibrations
- Protection of electronics from corrosive environments (use field devices with purging if necessary)
- Observation of directives for installation in hazardous areas (see manual)
- Observation of directives for measurement in the presence of toxic gases, provide purging of enclosure and further safety measures if necessary (see manual)

Calibration/adjustment

Calibration of the Series 6 gas analyzers using zero gas and calibration gas should be carried out at least every 14 days.

Standard	Zero gas N_2 (5.0)
Calibration gas	Sample gas with approx. 60 … 90 % of measuring range in residual N_2 (5.0)

Note: With OXYMAT 6, the zero gas and the reference gas must be the same.

- Pre-purging of sample gas path via the sample gas inlet with nitrogen (N_2, quality 5.0), duration: min. 1 min, one further minute in addition for each 10 m of sample gas line.
- Calibration gases for zero point adjustment (Series 6)
  Sufficient supply of inert gas via the sample gas inlet (free from measured component and free from gases with a cross-influence on the measured component), usually N_2, quality 5.0.
- Gases for calibration of deflection (Series 6 except CALOMAT 62)
  Connection of calibration gas via the sample gas inlet (approx. 60 to 90 % of the measuring range of the measured component with inert gas as the residual gas (e.g. N_2, quality 5.0)).

You can find details on FIDAMAT 6, OXYMAT 64 and ULTRAMAT 23 (AUTOCAL) in the chapters describing the respective device.

- Gases for calibration of the CALOMAT 62
  Since every residual gas (including nitrogen) has a specific thermal conductivity, the gases used for calibrating the zero point and full-scale values of the CALOMAT 62 must take this into account. When calibrating e.g. H_2 in HCl, HCl can be used as the zero gas (or an appropriate substitute in accordance with the data sheet enclosed with the device) and H_2 in HCl (or a substitute gas) as the span gas.

Notes

- The analyzers in the basic version are set to a cross-influence of water vapor with a dew point of 4 °C (standard cooler temperature for sample preparation).
- When calibrating with zero gas and span gas, these must be connected via the sample gas cooler analogous to the sample gases to allow correct adjustment.
- In special cases (test measurements or long-term adjustments), it is recommendable to connect the calibration gases via a humidifier upstream of the cooler to avoid "drying-out" of the gas cooler and thus changes in the concentration of the water vapor.
- Correction of cross-interference which may be activated for a gas is canceled for the duration of a calibration procedure (zero point and sensitivity).

Explosion protection

Refer to the separate manuals, references and standards concerning the topic of explosion protection.

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

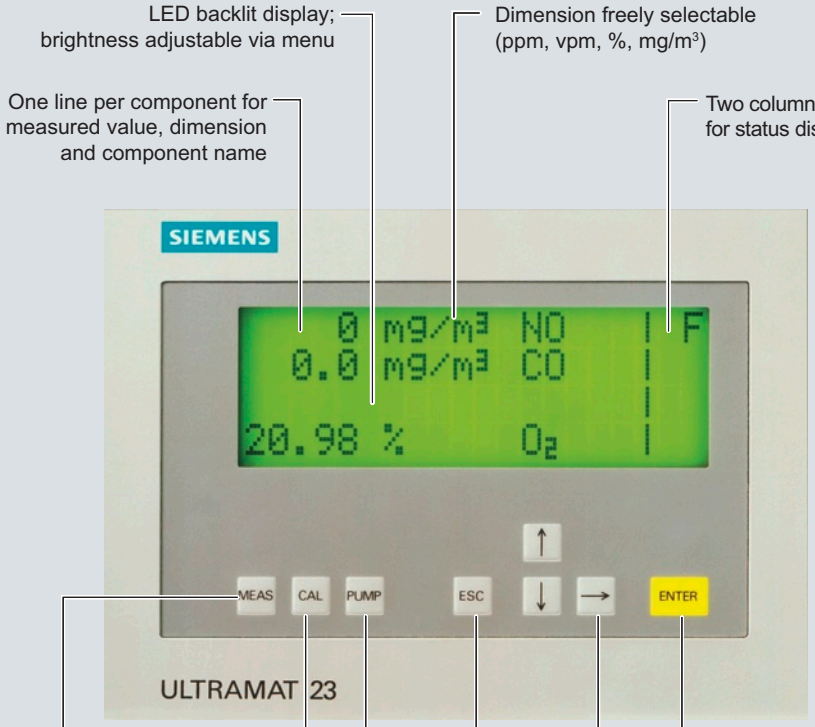
- Three binary inputs for sample gas pump On/Off, triggering of AUTOCAL and synchronization of several devices
- Eight relay outputs can be freely configured for fault, maintenance request, maintenance switch, limits, measuring range identification and external solenoid valves
- Eight additional binary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



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

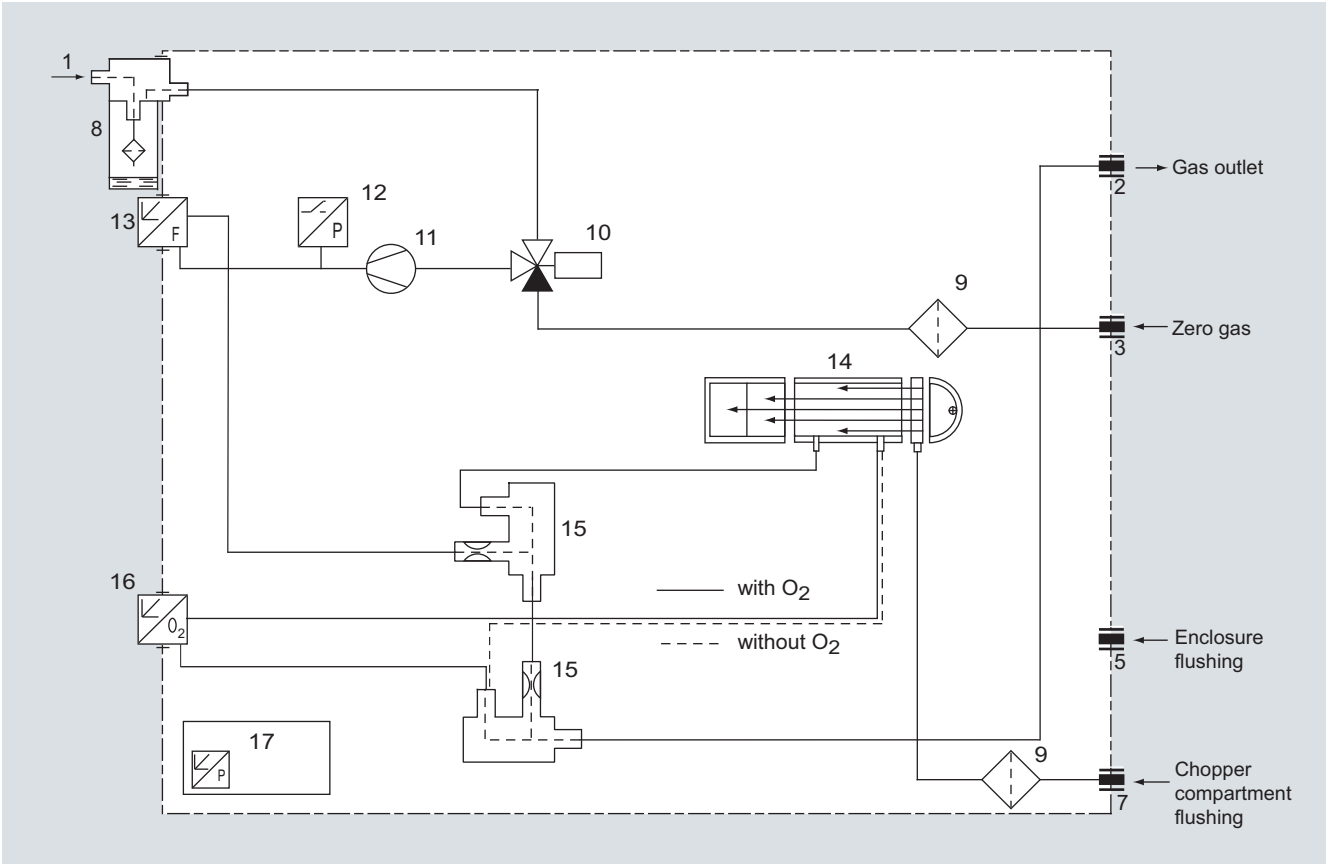
ULTRAMAT 23, design

General information

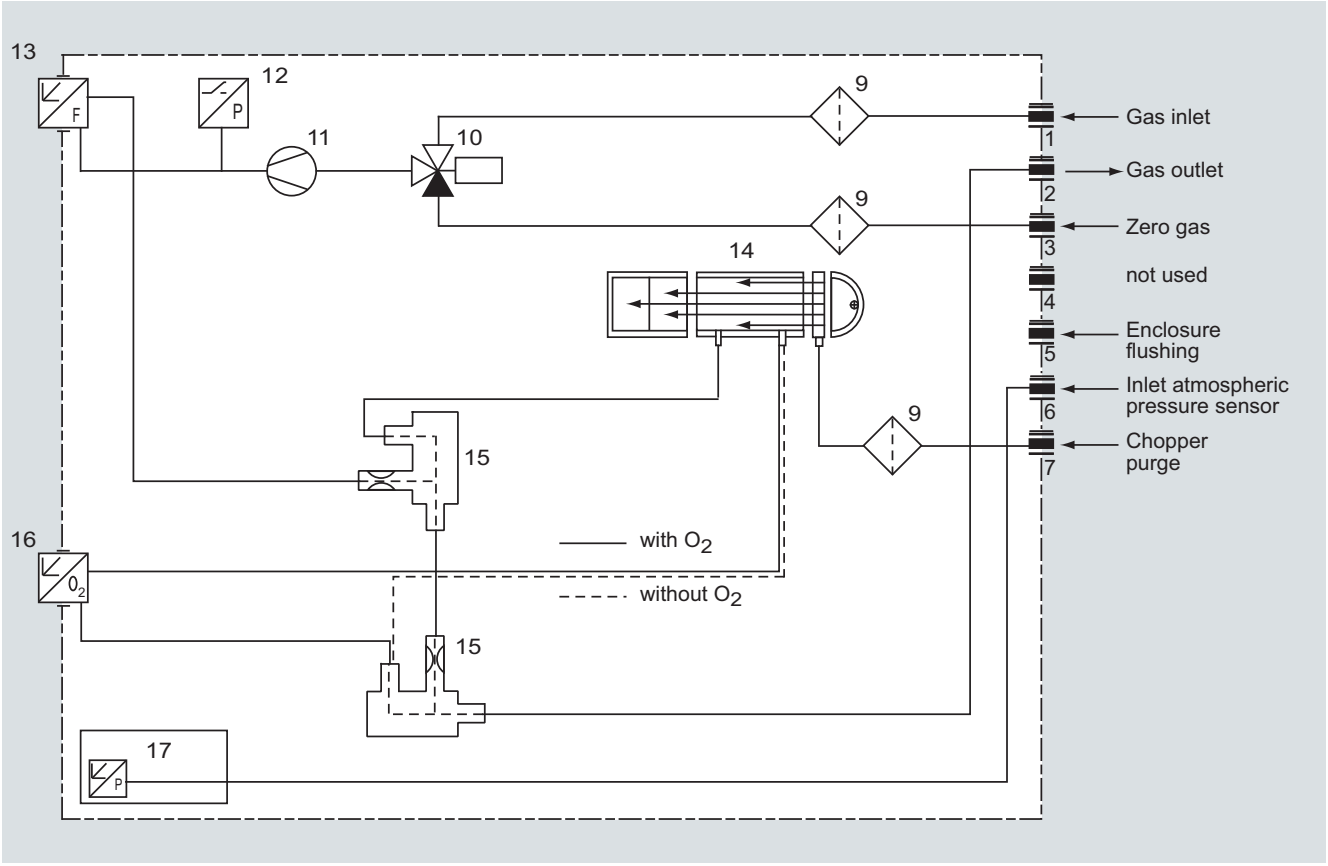
Gas path

Legend for the gas path figures

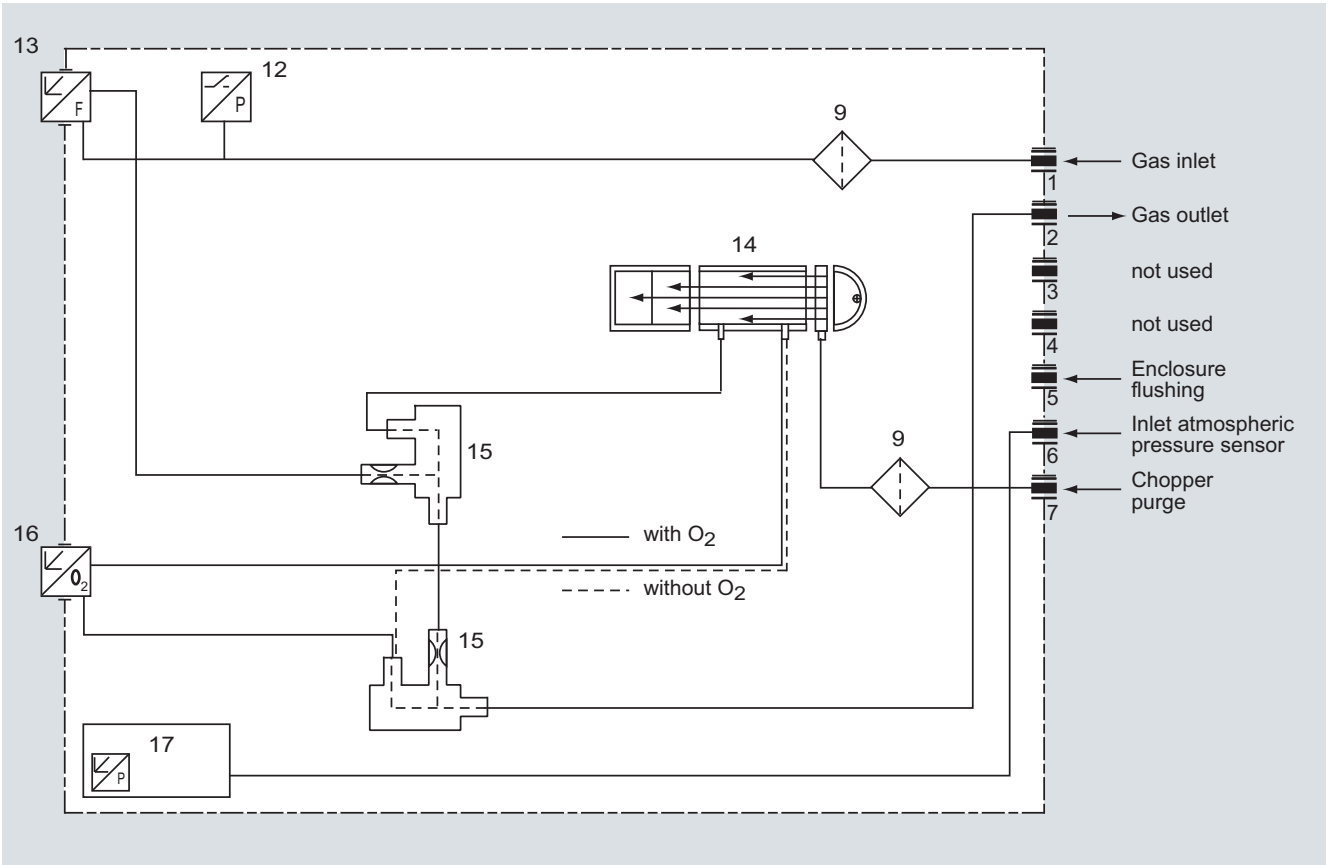
1	Inlet for sample gas/calibration gas	10	Solenoid valve
2	Gas outlet	11	Sample gas pump
3	Inlet for AUTOCAL/zero gas or inlet for sample gas/calibration gas (channel 2)	12	Pressure switch
		13	Flow indicator
4	Gas outlet (channel 2)	14	Analyzer unit
5	Enclosure flushing	15	Safety condensation trap
6	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

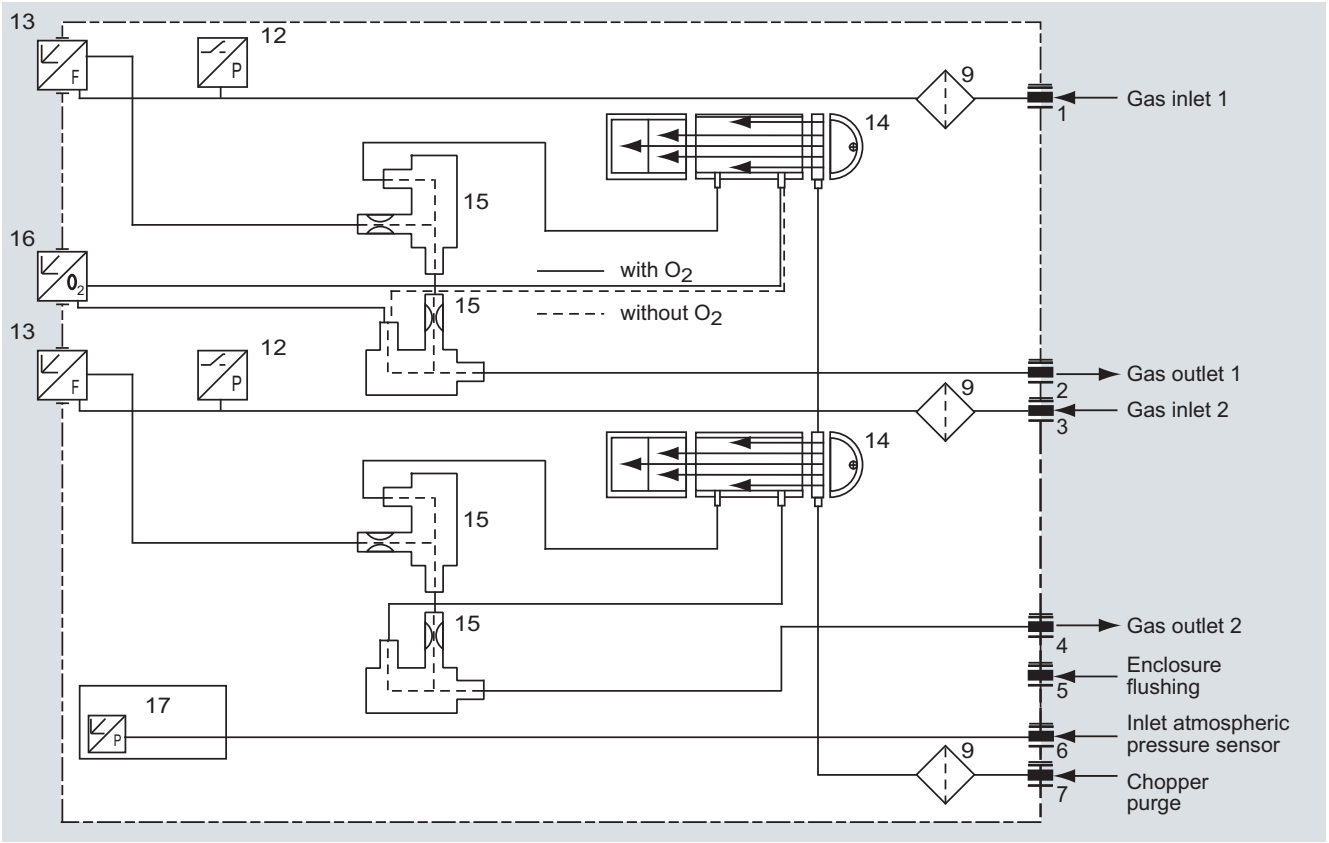


ULTRAMAT 23, 19" rack unit enclosure with internal sample gas pump, optional oxygen measurement

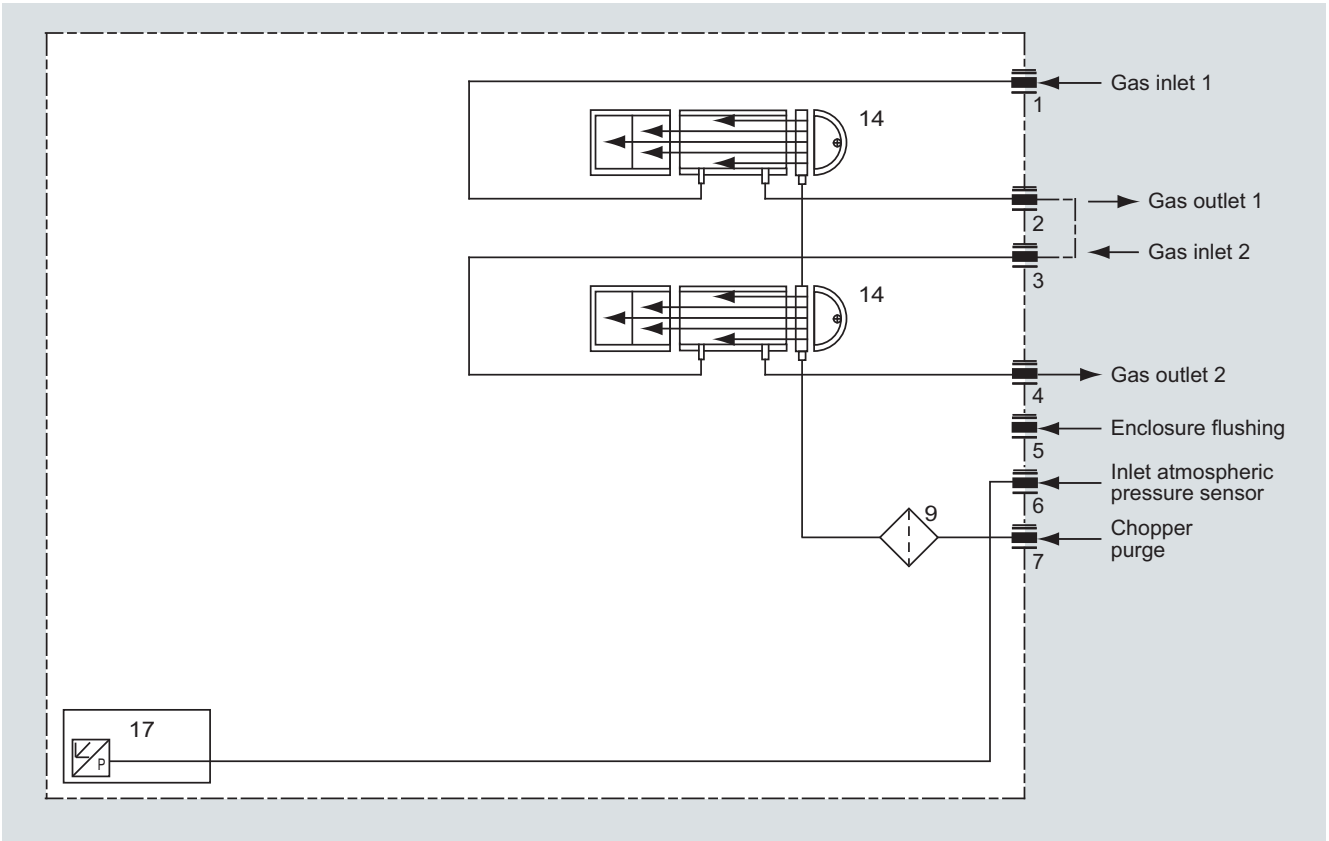


ULTRAMAT 23, 19" rack unit enclosure without internal sample gas pump, optional oxygen measurement

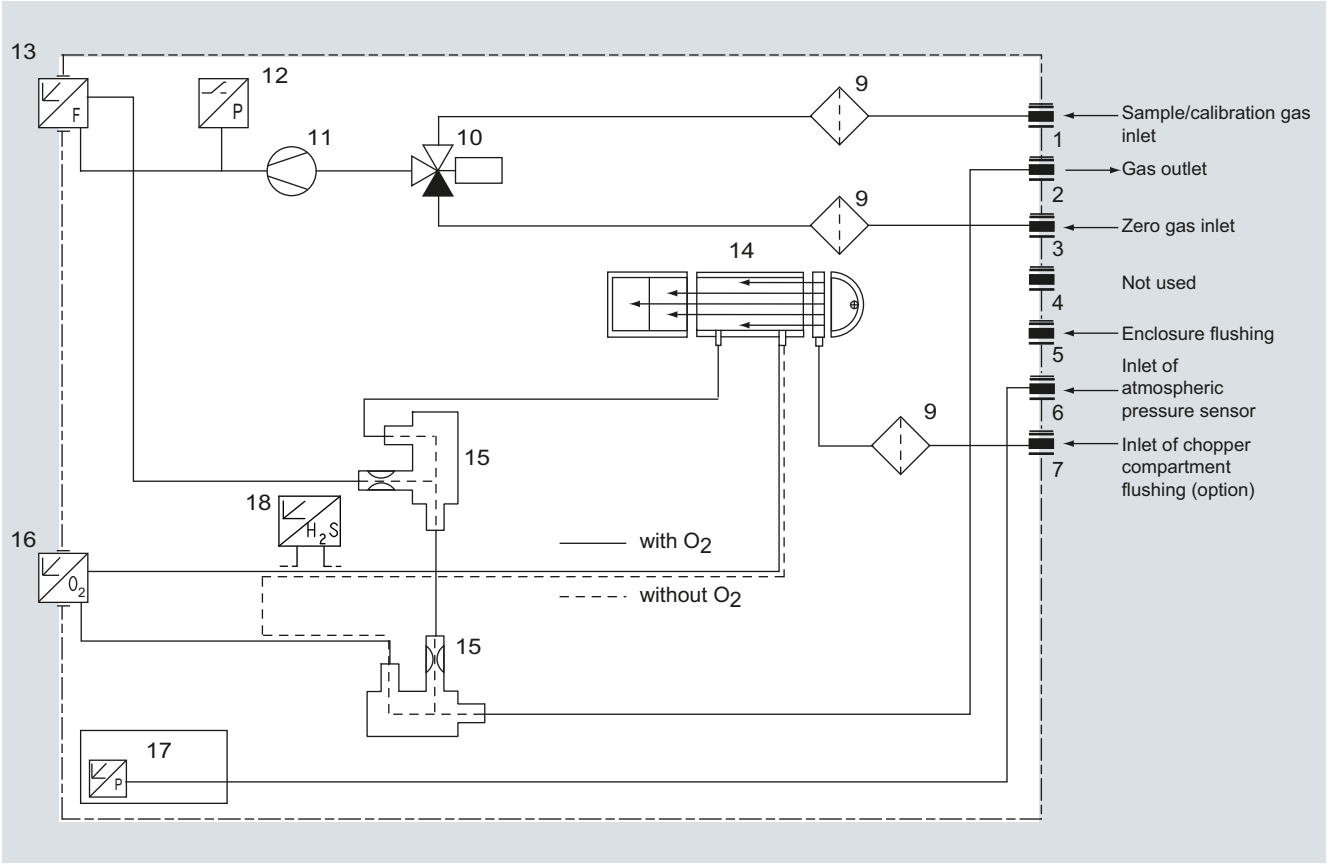
General information



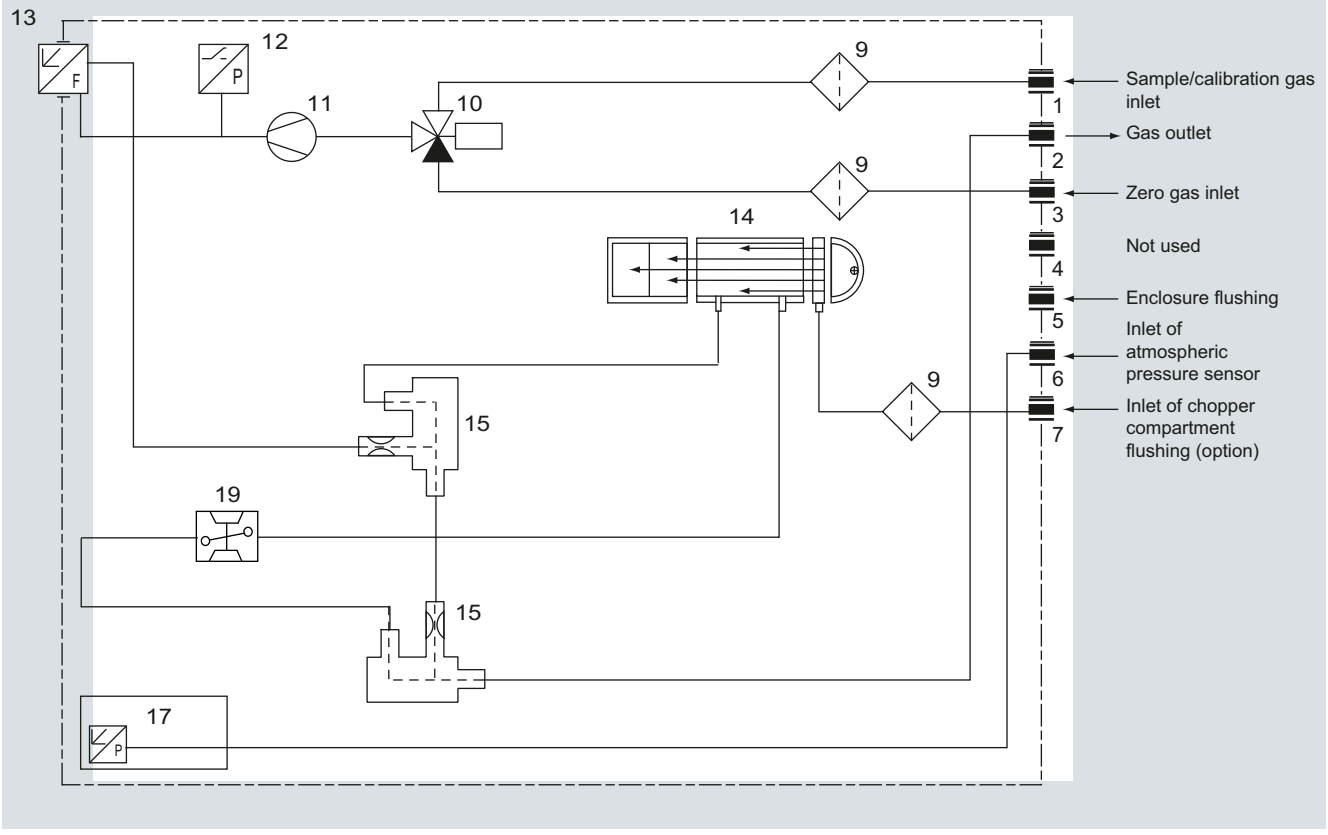
ULTRAMAT 23, 19" rack unit enclosure without internal sample gas pump, with separate gas path for the 2nd measured component or for the 2nd and 3rd measured components, optional oxygen measurement



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.

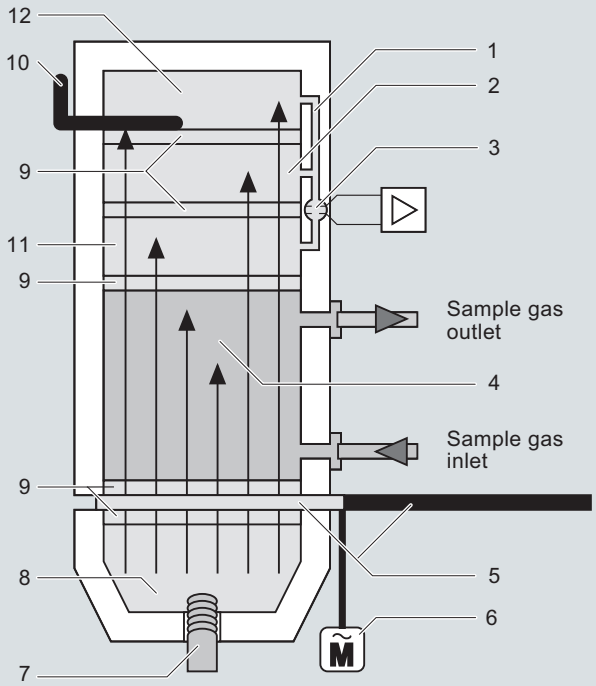
The rotating chopper (5) generates a pulsating flow in the sample chamber that the microflow sensor (3) converts into an electrical signal.

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.

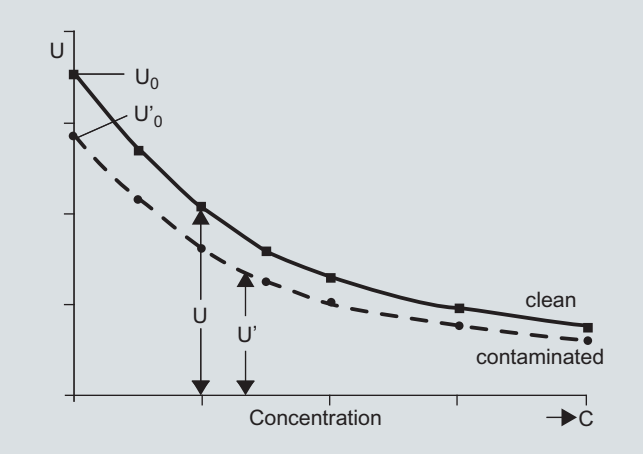
Each AUTOCAL tracks the total characteristic until the currently valid value, thereby compensating for temperature and pressure influences.

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.

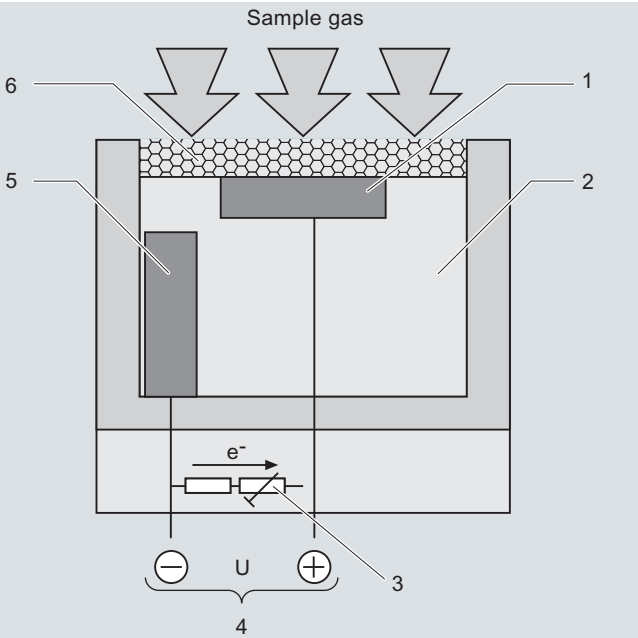


Calibration

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

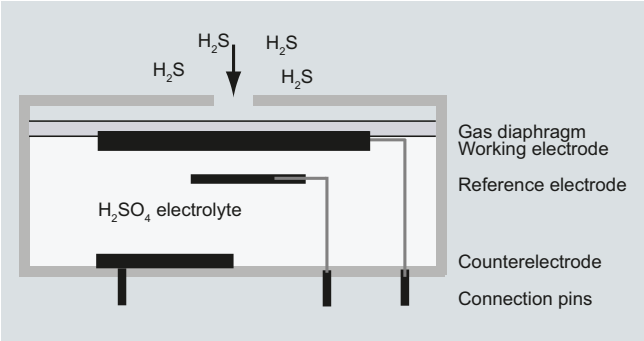
General information

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).



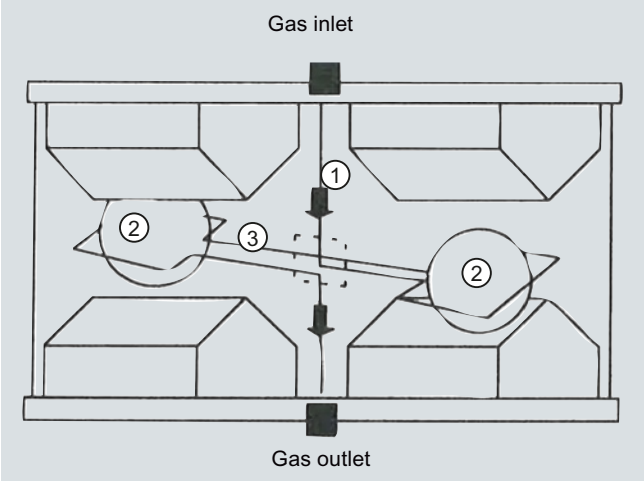
Operating principle of the H_2S sensor

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		**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			**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.	
ULTRAMAT 23 gas analyzer for measuring 2 infrared components and oxygen		D)	**7MB2337-** ■■■■ - ■■■■	Cannot be combined
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
for measuring 3 infrared components and oxygen — D) **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, 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			**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**	
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)

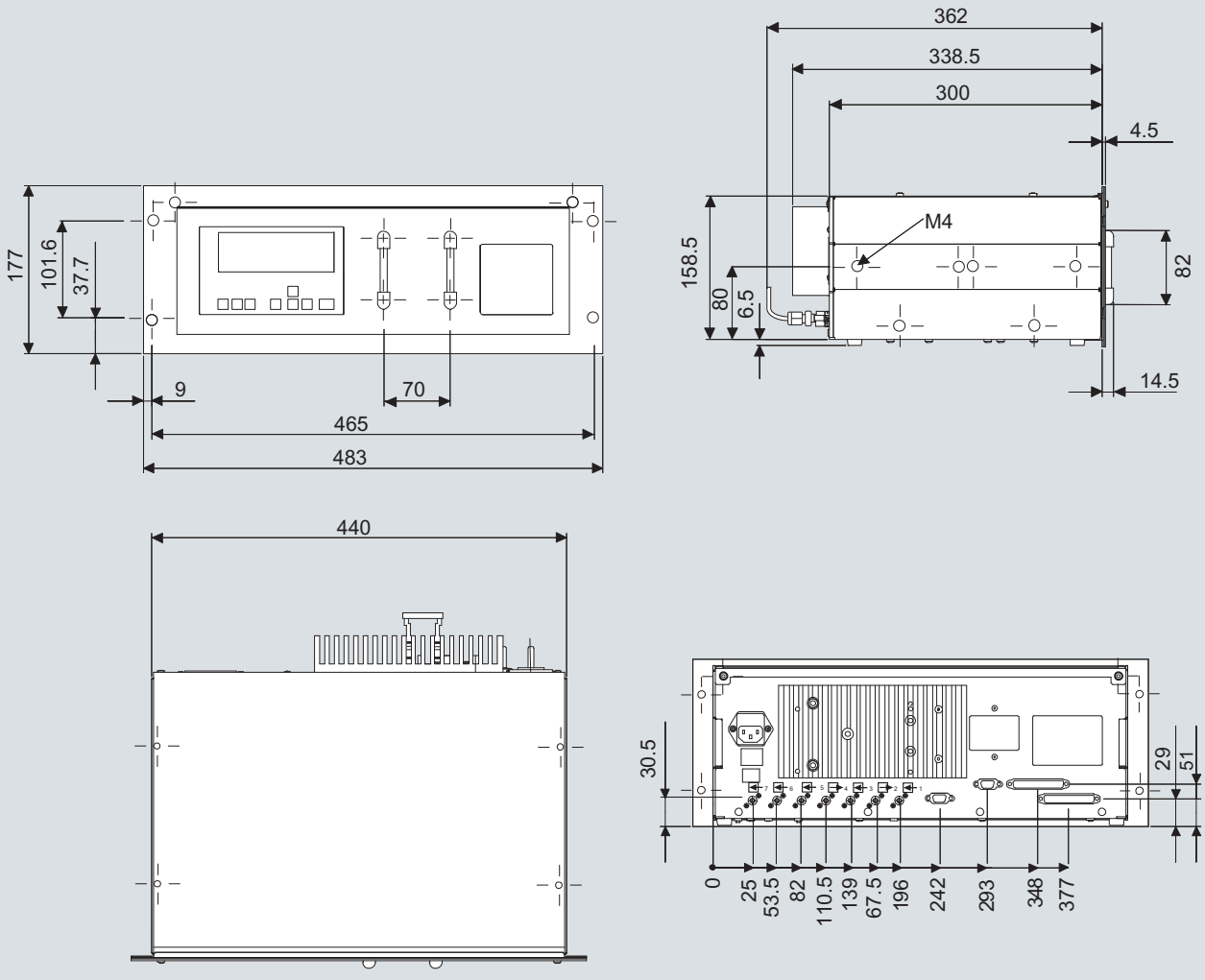
- Measuring range 0 to 500 / 2 500 ppm (MB designation "H")
- Can only be used to measure SF6 in inert gases

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

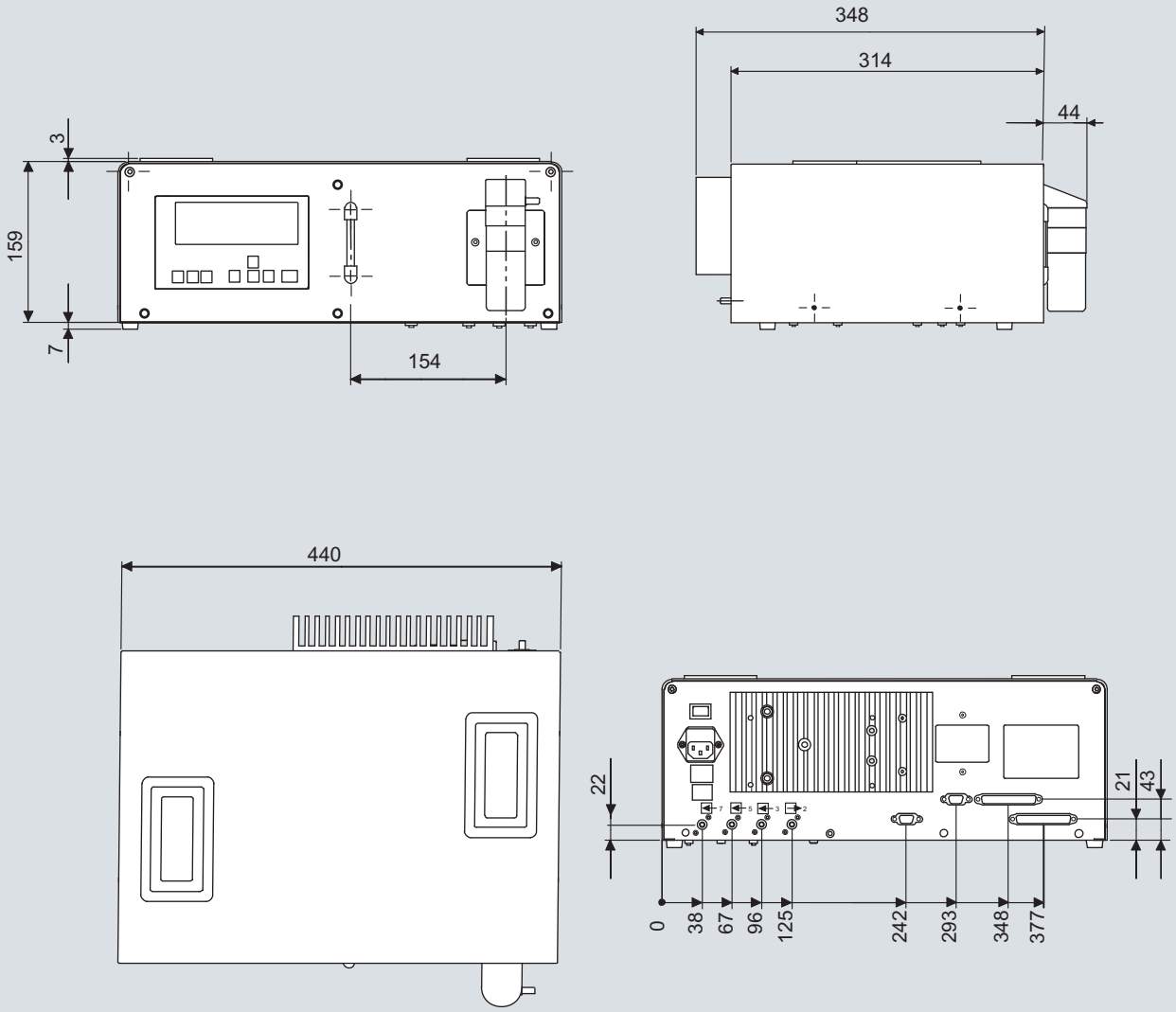
Dimensional drawings



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



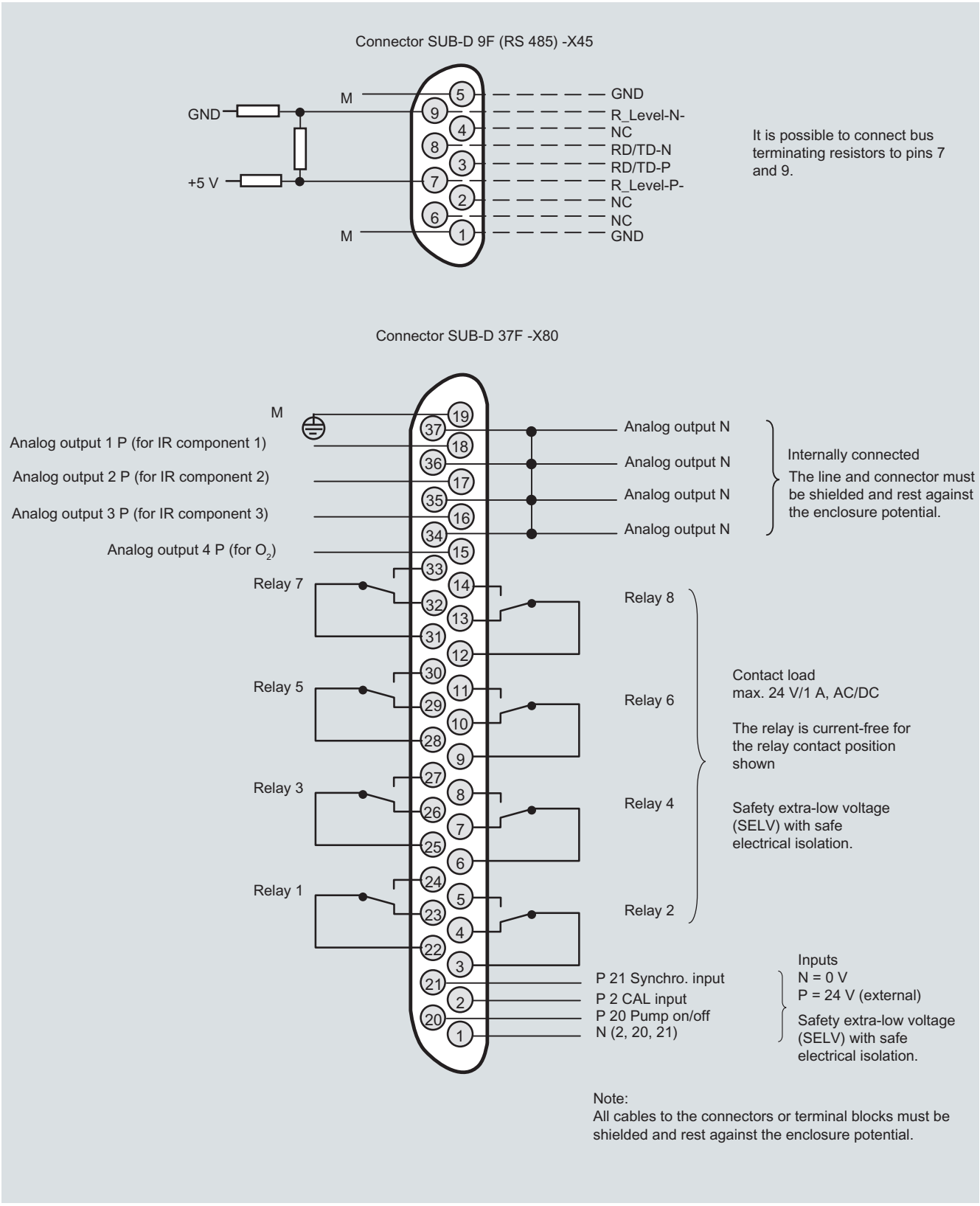
Gas connections: stubs diam. 6 mm

ULTRAMAT 23, desktop unit, dimensions in mm

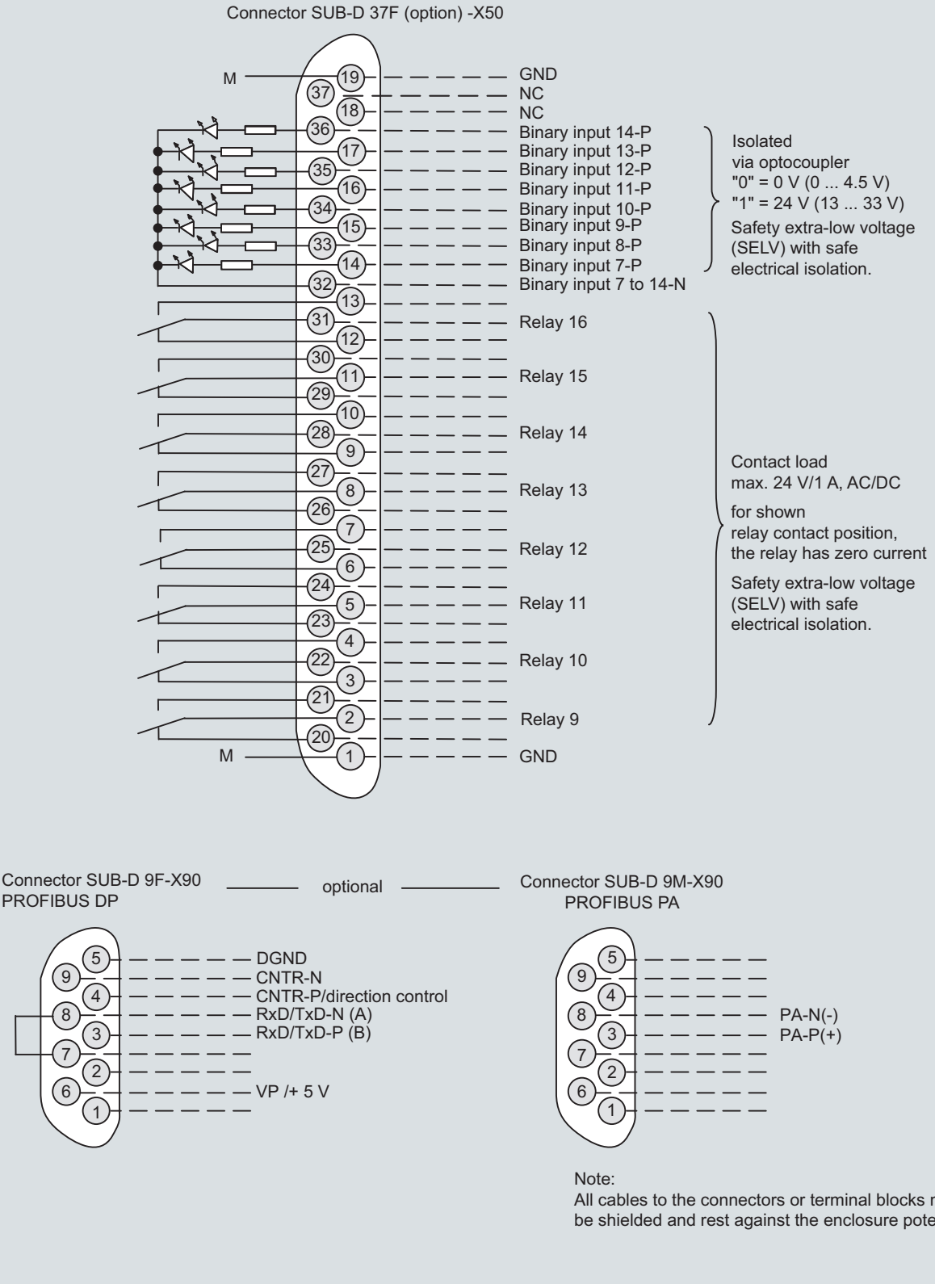
2

Schematics

Pin assignment (electrical and gas connections)



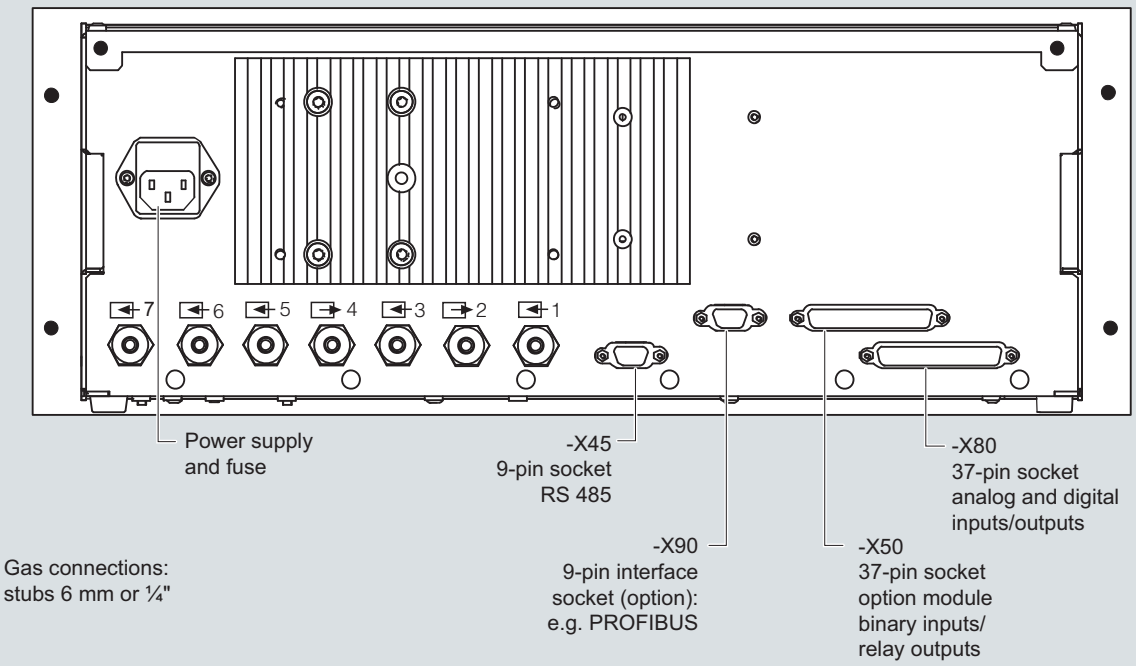
ULTRAMAT 23, pin assignment (standard)



ULTRAMAT 23, pin assignment of the optional PROFIBUS interface board

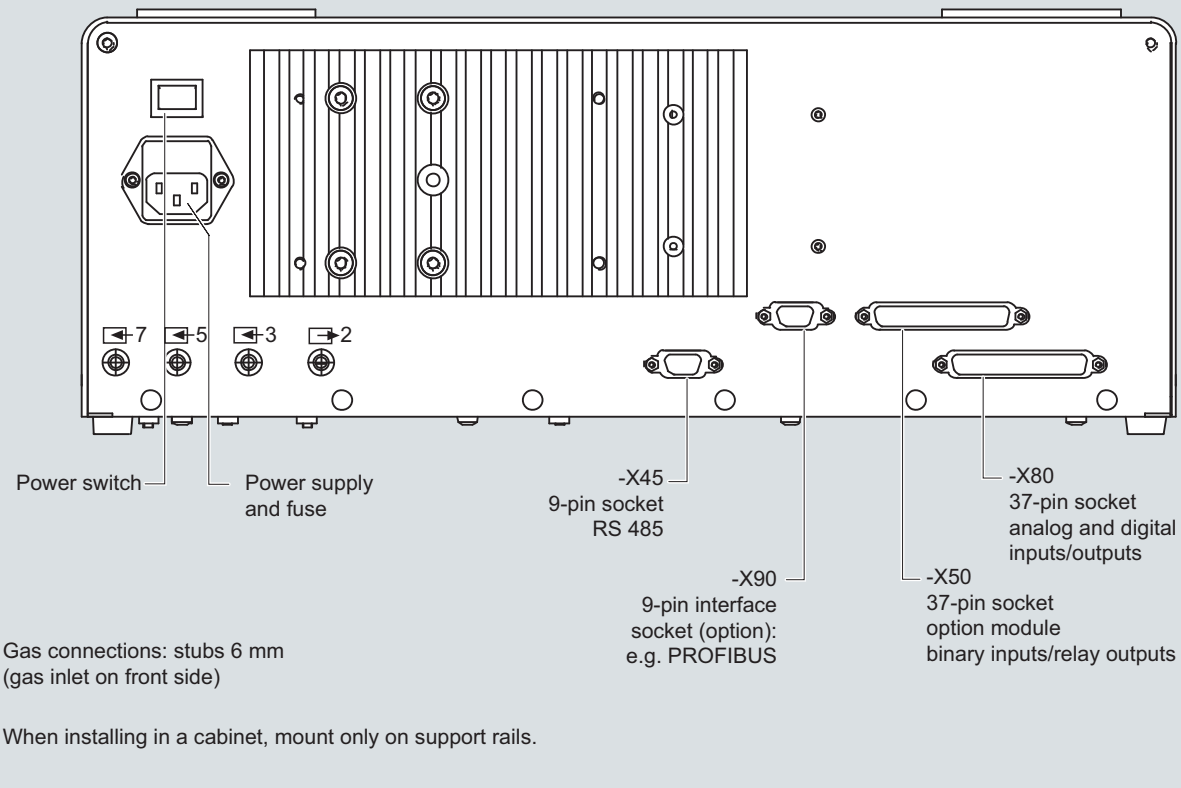
19" rack unit and portable version

19" unit

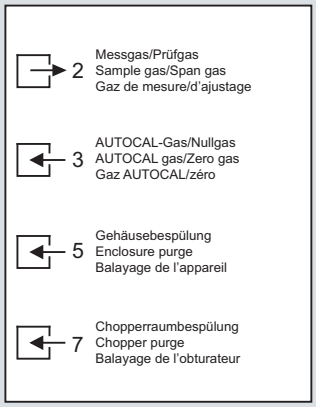


ULTRAMAT 23, 19" unit, e.g. one infrared component with oxygen measurement

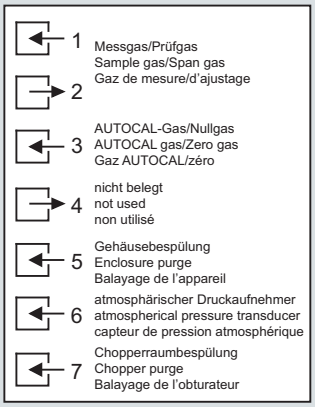
Desktop unit



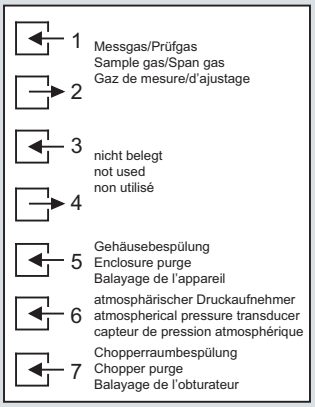
ULTRAMAT 23, portable unit, in sheet-steel housing, gas and electrical connections



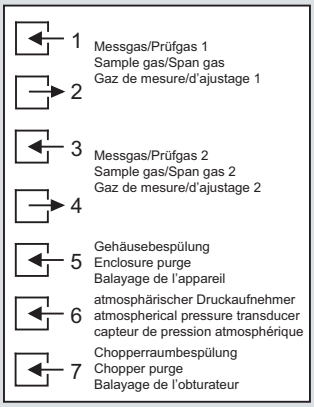
Key to symbols
ULTRAMAT 23
portable, in sheet-steel housing



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

Overview

The ULTRAMAT 6 single-channel or dual-channel gas analyzers operate according to the NDIR two-beam alternating light principle and measure gases highly selectively whose absorption bands lie in the infrared wavelength range from 2 to 9 µm, such as CO, CO_2, NO, SO_2, NH_3, H_2O as well as CH_4 and other hydrocarbons.

Single-channel analyzers measure up to 2 gas components, dual-channel analyzers up to 4 gas components simultaneously.

Benefits

- High selectivity with double-layer detector and optical coupler
  - Reliable measurements even in complex gas mixtures
- Low detection limits
  - Measurements with low concentrations
- Corrosion-resistant materials in gas path (option)
  - Measurement possible in highly corrosive sample gases
- Analyzer cells can be cleaned as required on site
  - Cost savings due to reuse after contamination
- Electronics and physics: gas-tight isolation, purging is possible, IP65
  - Long service life even in harsh environments
- Heated versions (option)
  - Use also in presence of gases condensing at low temperature
- EEx(p) for zones 1 and 2 (according to ATEX 2G and ATEX 3G)

Application

Areas of application

- Measurement for boiler control in incineration plants
- Emission measurements in incineration plants
- Measurement in the automotive industry (test benches)
- Warning equipment
- Process gas concentrations in chemical plants
- Trace measurements in pure gas processes
- Environmental protection
- TLV (Threshold Limit Value) monitoring at the workplace
- Quality monitoring
- Ex versions for analyzing flammable and non-flammable gases or vapors for use in hazardous areas

Special versions

Special applications

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

TÜV version/QAL

TÜV-approved versions are available for measurement of CO, NO and SO_2 according to 13th and 17th BImSchV and TA Luft. Smallest TÜV-approved and permitted measuring ranges:

- 1-component analyzer
  CO: 0 to 50 mg/m^3
  NO: 0 to 100 mg/m^3
  SO_2: 0 to 75 mg/m^3
- 2-component analyzer (series connection)
  CO: 0 to 75 mg/m^3
  NO: 0 to 200 mg/m^3.
  Furthermore, the TÜV-approved versions of the ULTRAMAT 6 comply with the requirements of EN 14956 and QAL 1 in accordance with EN 14181. Conformity of the analyzers with both standards is TÜV-certified.
  The analyzer drift can be determined in accordance with EN 14181 (QAL 3) either 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.

Flow-type reference compartment

- The flow through the reference compartment should be adapted to the sample gas flow
- The gas supply of the reduced flow-type reference compartment should have an upstream pressure of 3 000 to 5 000 hPa (abs.). Then a restrictor will automatically adjust the flow to approximately 8 ml/min

Design

19" rack unit

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescopic rails
- Front plate for service purposes can be pivoted down (laptop connection)
- Internal gas paths: hose made of FKM (Viton) or pipe made of titanium or stainless steel
- Gas connections for sample gas inlet and outlet: pipe diameter 6 mm or 1/4"
- Flow indicator for sample gas on front plate (option)
- Pressure switch in sample gas path for flow monitoring (option)

Field device

- Two-door enclosure with gas-tight separation of analyzer and electronics sections from gas path
- Individually purgeable enclosure halves
- Parts in contact with sample gas can be heated up to 65 °C (option)
- Gas path: hose made of FKM (Viton) or pipe made of titanium or stainless steel (further materials possible as special applications)
- Gas connections for sample gas inlet and outlet: pipe union for pipe diameter 6 mm or 1/4"
- Purging gas connections: pipe diameter 10 mm or 3/8"

General information

Display and control panel

- Large LCD field for simultaneous display of:
  - Measured value (digital and analog displays)
  - Status bar
  - Measuring ranges
- Contrast of the LCD field adjustable via the menu
- Washable membrane keyboard with five softkeys
- Menu-driven operator control for parameterization, test functions, adjustment
- Operator support in plain text
- Graphic display of concentration trend; programmable time intervals
- Bilingual operating software:
  German/English, English/Spanish, French/English, Spanish/English, Italian/English

Input and outputs

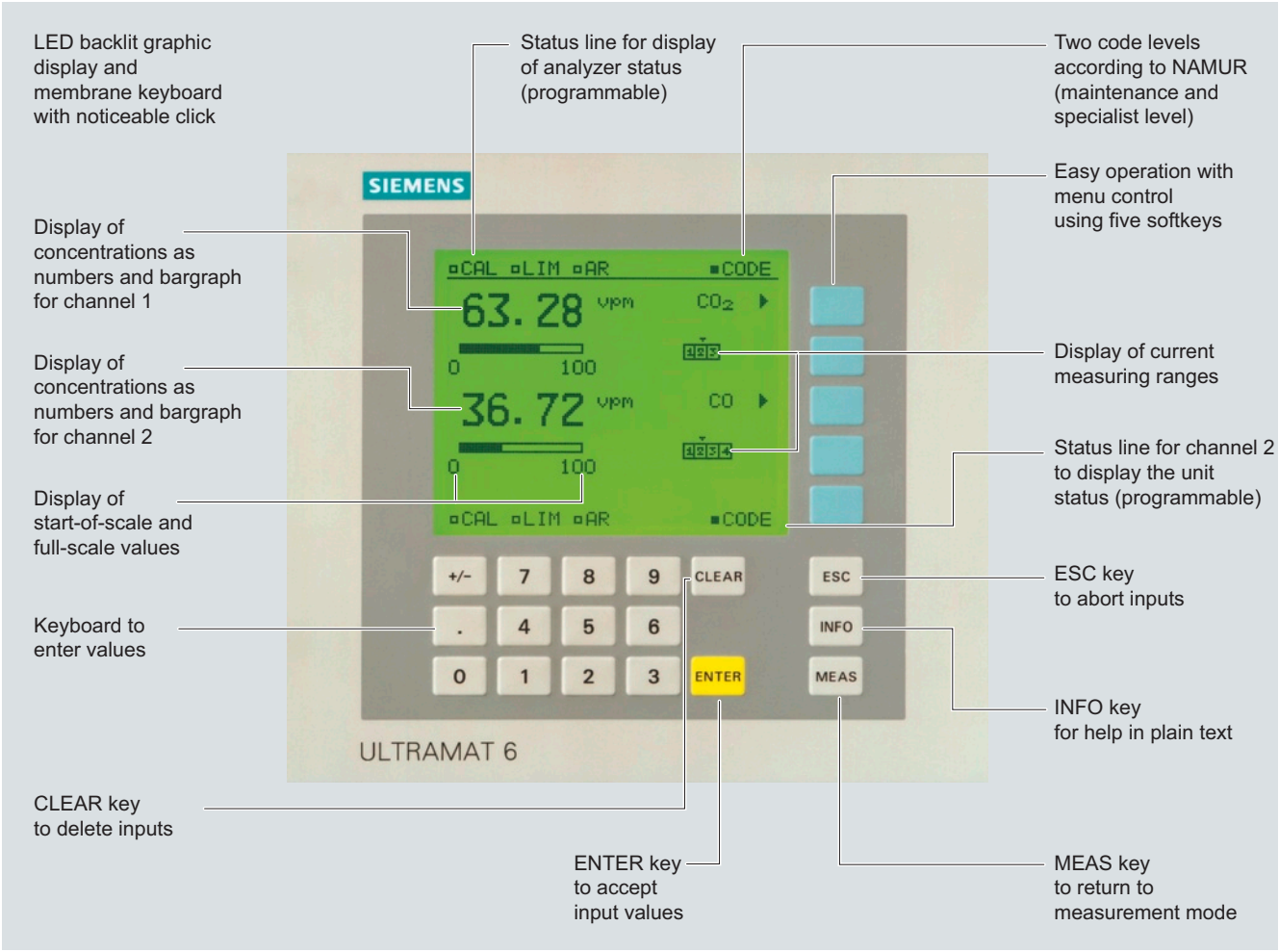
- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Two analog inputs freely configurable (e.g. correction of cross-interferences or external pressure sensor)
- Six binary inputs freely configurable (e.g. measurement range changeover, processing of external signals from the sample preparation)
- Six relay outputs freely configurable e.g. for fault, maintenance request, limit alarm, external solenoid valves)
- Expansion by eight additional binary inputs and eight additional relay outputs e.g. for autocalibration with up to four test gases

Communication

RS 485 present in the basic unit (connection at the rear; for the rack unit also behind the front plate).

Options

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



ULTRAMAT 6, membrane keyboard and graphic display

Designs – Parts wetted by sample gas, standard

Gas path		19" rack unit	Field device	Field device Ex
With hoses	Bushing	Stainless steel, mat. no. 1.4571		-
	Hose	FKM (e.g. Viton)		
	Sample chamber:			
	• Body	Aluminum		
	• Lining	Aluminum		
	• Fitting	Stainless steel, mat. no. 1.4571, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		
	• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		
With pipes	Bushing	Titanium		
	Pipe	Titanium, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		
	Sample chamber:			
	• Body	Aluminum		
	• Lining	Tantalum (only for cell length 20 ... 180 mm)		
	• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		
With pipes	Bushing	Stainless steel, mat. no. 1.4571		
	Pipe	Stainless steel, mat. no. 1.4571, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		
	Sample chamber:			
	• Body	Aluminum		
	• Lining	Aluminum or tantalum (tantalum only for cell length 20 ... 180 mm)		
	• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		

Options

Gas path		19" rack unit	Field device	Field device Ex
Flow indicator	Measurement pipe	Duran glass	-	-
	Variable area	Duran glass		
	Suspension boundary	PTFE (Teflon)		
	Angle pieces	FKM (e.g. Viton)		
Pressure switch	Membrane	FKM (e.g. Viton)	-	-
	Enclosure	PA 6.3T		

Versions – Parts wetted by sample gas, special applications (examples)

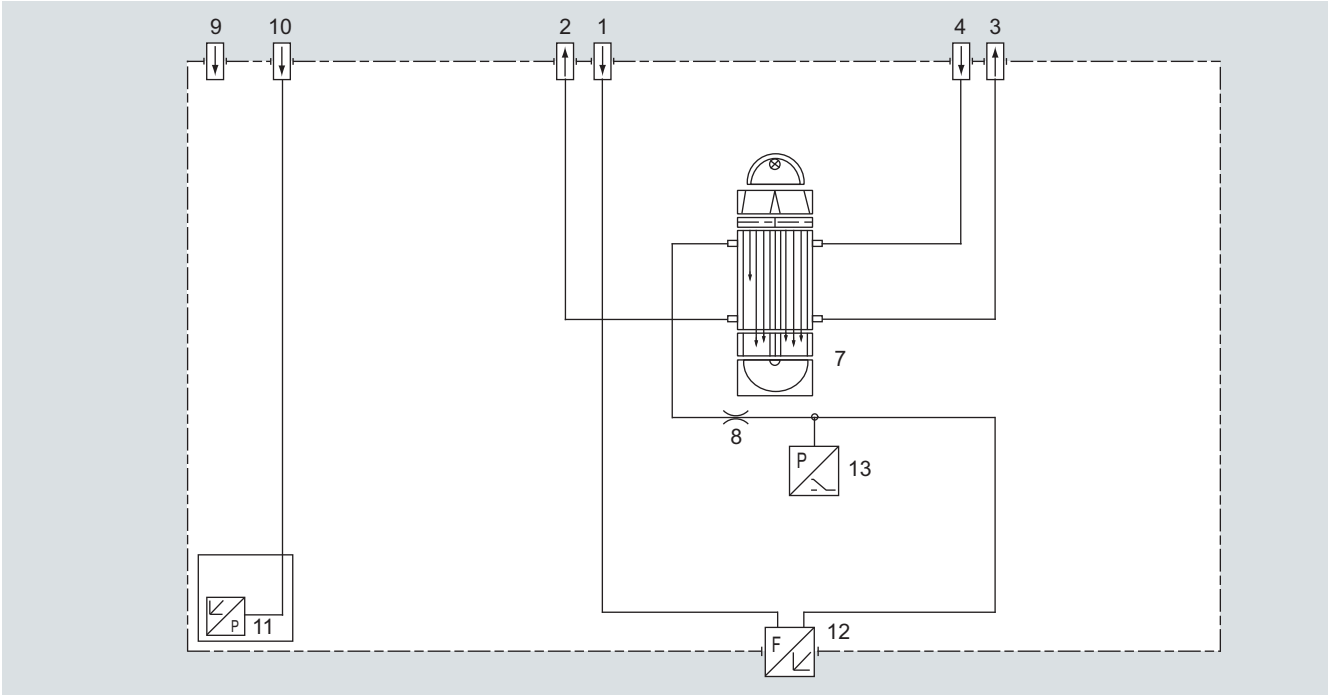
Gas path		19" rack unit	Field device	Field device Ex
With pipes	Bushing	e.g. Hastelloy C22		
	Pipe	e.g. Hastelloy C22, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		
	Sample chamber:			
	• Body	e.g. Hastelloy C22		
	• Window	CaF_2, without adhesive O-ring: FKM (e.g. Viton) or FFKM (Kalrez)		

General information

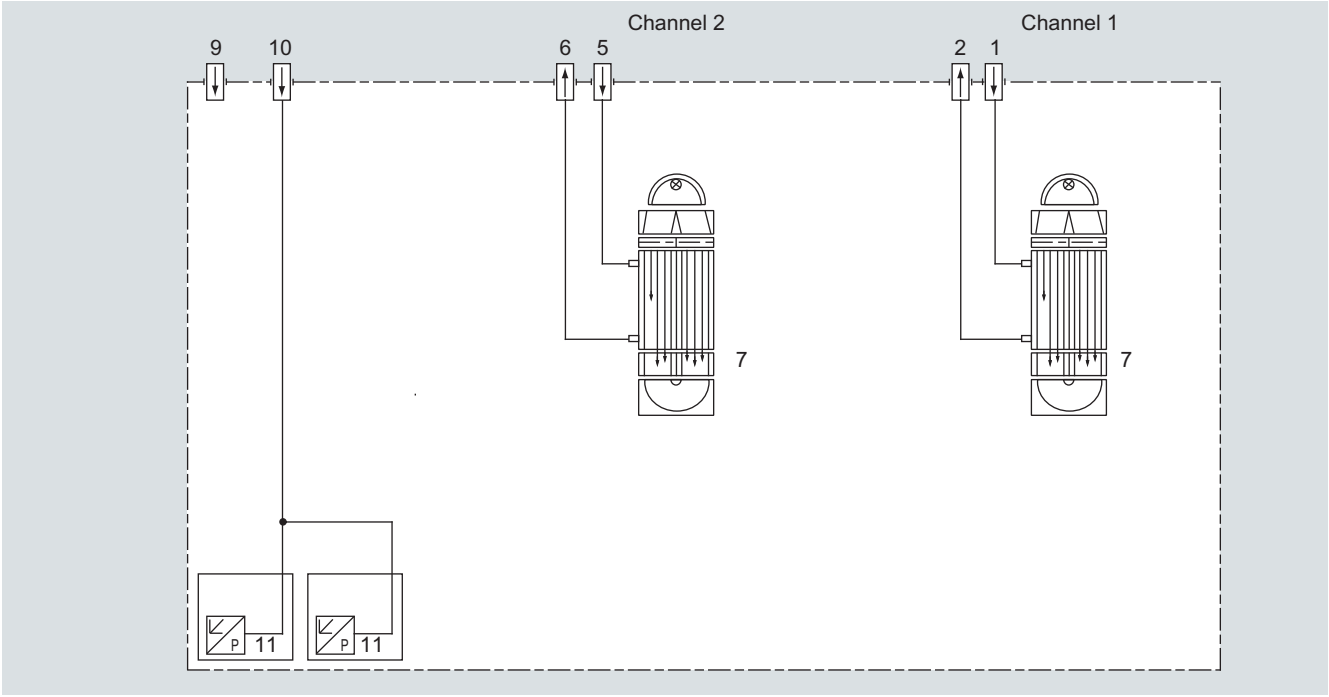
Gas path (19" rack unit)

Legend for the gas path figures

1	Sample gas inlet channel 1	8	Restrictor
2	Sample gas outlet channel 1	9	Purge gas inlet
3	Reference gas outlet (option)	10	Gas inlet atmospheric pressure sensor
4	Reference gas inlet (option)	11	Atmospheric pressure sensor
5	Sample gas inlet channel 2	12	Flow indicator in sample gas path (option)
6	Sample gas outlet channel 2	13	Pressure switch in sample gas path (option)
7	IR physical system		



Gas path ULTRAMAT 6, single-channel unit, 19" unit, with flow-type reference cell (option)

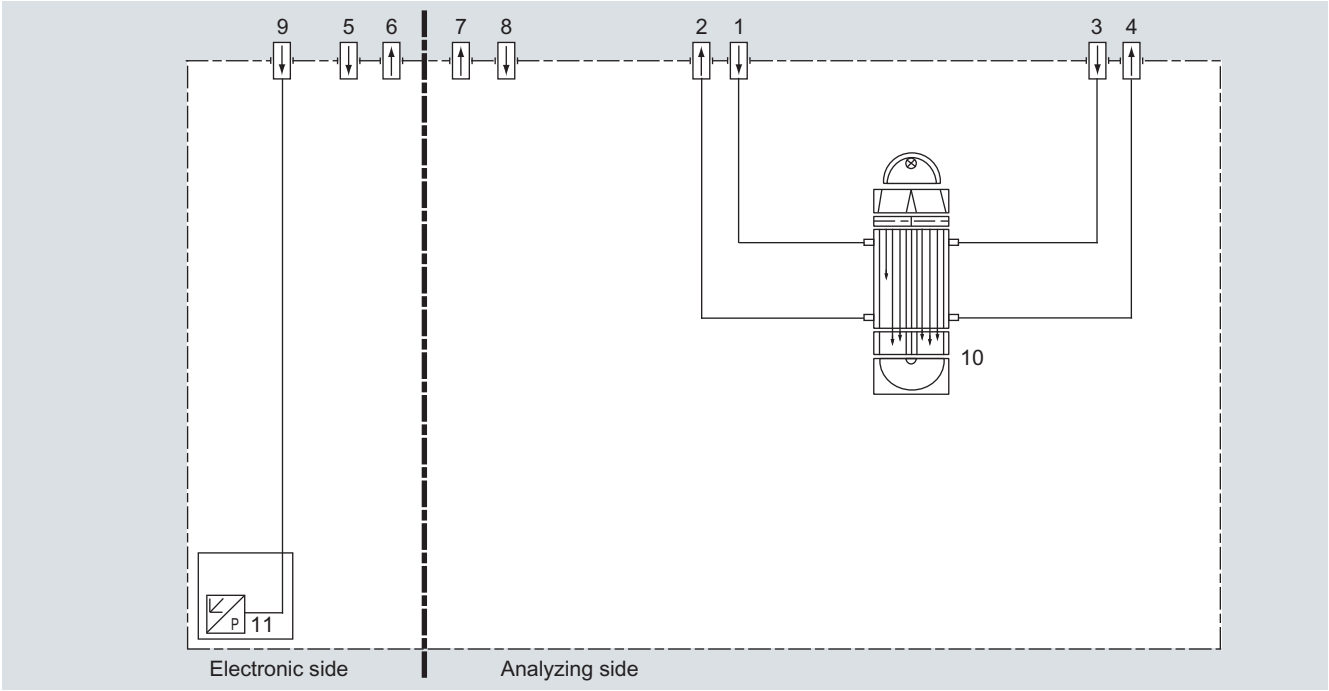


Gas path ULTRAMAT 6, dual-channel unit, 19" unit

Gas path (field device)

Legend for the gas path figures

1	Sample gas inlet	7	Purging gas outlet (analyzer side)
2	Sample gas outlet	8	Purging gas inlet (analyzer side)
3	Reference gas inlet (option)	9	Connection of atmospheric pressure sensor
4	Reference gas outlet (option)	10	IR physical system
5	Purging gas inlet (electronics side)	11	Atmospheric pressure sensor
6	Purging gas outlet (electronics side)		



Gas path ULTRAMAT 6, field unit, with flow-type reference cell (option)

General information

Function

Principle of operation

The ULTRAMAT 6 gas analyzer operates according to the infrared two-beam alternating light principle with double-layer detector and optical coupler.

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

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

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

The reference beam passes through a reference cell (8) filled with N_2 (a non-infrared-active gas) and reaches the right-hand side of the detector (11) practically unattenuated. The sample beam passes through the sample chamber (7) through which the sample gas flows and reaches the left-hand side of the detector (10) attenuated to a lesser or greater extent depending on the concentration of the sample gas. The detector is filled with a defined concentration of the gas component to be measured.

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

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

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

The microflow sensor consists of two nickel-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.

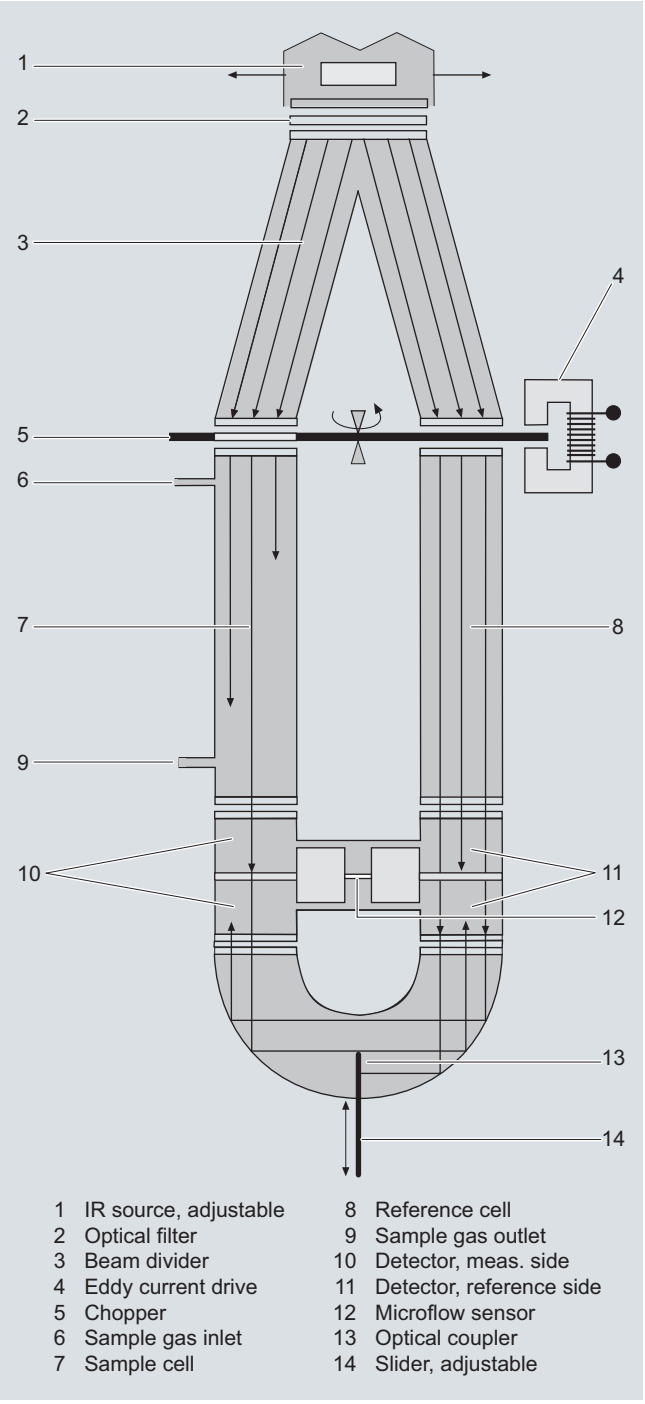
Notes

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.

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

Flow-type reference sides with reduced flow and an O_2 content > 70 % may only be used together with Y02 (Clean for O_2).



ULTRAMAT 6, principle of operation

Channels with electronically suppressed zero point only differ from the standard version in the measuring range parameterization.

Physically suppressed zeros can be provided as a special application.

Essential characteristics

- Dimension of measured value freely selectable (e.g. vpm, mg/m^3)
- Four freely-parameterizable measuring ranges per component
- Measuring ranges with suppressed zero point possible
- Measuring range identification
- Galvanically isolated signal output 0/2/4 to 20 mA per component
- Automatic or manual measuring range switchover selectable; remote switching is also possible
- Differential measuring ranges with flow-type reference cell
- Storage of measured values possible during adjustments
- Time constants selectable within wide limits (static/dynamic noise suppression); i.e. the response time of the analyzer or component can be matched to the respective measuring task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 6 measuring points (programmable)
- Measuring point identification
- Monitoring of sample gas flow (option)
- Internal pressure sensor for correction of variations in atmospheric pressure in the range 700 to 1 200 hPa absolute
- External pressure sensor can be connected for correction of variations in the process gas pressure in the range 700 to 1 500 hPa absolute (option)
- Two control levels with separate authorization codes to prevent unintentional and unauthorized inputs
- Automatic, parameterizable measuring range calibration
- Simple handling using a numerical membrane keyboard and operator prompting
- Operation based on NAMUR recommendation
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording
- Easy device replacement since electric connections can be simply disconnected from the device
- Sample chambers for use in presence of highly corrosive sample gases (e.g. tantalum layer or Hastelloy C22)

Additional features, dual-channel version

- Separate design of physical unit, electronics, inputs/outputs and power supply for each channel
- Display and operation via common LCD panel and keyboard
- Measurement channels 1 and 2 can be converted to series connection (linking of gas connections from channel 1 to channel 2 on rear)

19" rack unit

Technical specifications

General information

Measuring ranges	4, internally and externally switchable; autoranging is also possible
Smallest possible measuring range	Dependent on the application: e.g. CO: 0 … 10 vpm, CO_2: 0 … 5 vpm
Largest possible measuring span	Dependent on the application
Measuring range with suppressed zero point	Any zero point within 0 … 100 vol.% can be implemented; smallest possible span 20 %
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2

Influence of interfering gases must be considered separately

Design, enclosure

Weight	Approx. 15 kg (with one IR channel) Approx. 21 kg (with two IR channels)
Degree of protection	IP20 according to EN 60529

Electrical characteristics

EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	According to EN 61010-1, overvoltage category III
Power supply	100 … 120 V AC (nominal range of use 90 … 132 V), 47 … 63 Hz or 200 … 240 V AC (nominal range of use 180 … 264 V), 47 … 63 Hz
Power consumption	1-channel unit: Approx. 40 VA 2-channel unit: Approx. 70 VA
Fuse values	
• 100 ... 120 V	1 T/250 (7MB2121) 1.6 T/250 (7MB2123)
• 200 ... 240 V	0.63 T/250 (7MB2121) 1 T/250 (7MB2123)

Gas inlet conditions

Permissible sample gas pressure	
• With hoses	
- Without pressure switch	600 … 1 500 hPa (absolute)
- With pressure switch	700 … 1 300 hPa (absolute)
• With pipes (without pressure switch)	600 … 1 500 hPa (absolute)
Sample gas flow	18 … 90 l/h (0.3 … 1.5 l/min)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Sample gas humidity	< 90 % RH (relative humidity), or dependent on measuring task, non-condensing

Dynamic response

Warm-up period	At room temperature < 30 min (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)	0 … 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approximately 0.5 ... 5 s, depending on version
Time for device-internal signal processing	< 1 s

Pressure correction range

Pressure sensor	
• Internal	700 … 1 200 hPa absolute
• External	700 … 1 500 hPa absolute

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation	< ± 1 % of the smallest possible measuring range according to rating plate
Zero point drift	<± 1 % of the current measuring range/week
Measured-value drift	<± 1 % of the current measuring range/week
Repeatability	≤ 1 % of the current measuring range
Detection limit	1 % of the smallest possible measuring range
Linearity error	< 0.5 % of the full-scale value

Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Ambient temperature	< 1 % of current measuring range/10 K (with constant receiver cell temperature)
Sample gas pressure	• When pressure compensation has been switched on: < 0.15 % of the span/1 % change in atmospheric pressure • When pressure compensation has been switched off: < 1.5 % of the span/1 % change in atmospheric pressure
Sample gas flow	Negligible
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %
Environmental conditions	Application-specific measuring influences possible if ambient air contains measured components or cross interference-sensitive gases

Electrical inputs and outputs

Analog output	0/2/4 ... 20 mA, isolated; load ≤ 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated, non-sparking
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and accompanying gas influence correction (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs, also with PROFIBUS PA or PROFIBUS DP

Climatic conditions

Permissible ambient temperature	-30 ... +70 °C during storage and transportation, 5 ... 45 °C during operation
Permissible humidity	< 90 % RH (relative humidity) as annual average, during storage and transportation (dew point must not be undershot)

2

Selection and ordering data

Selection and ordering data			Order No.	Cannot be combined
ULTRAMAT 6 gas analyzer Single-channel 19" rack unit for installation in cabinets			D) **7MB2121-** ■■■■■ - ■AA■	
Gas connections for sample gas and reference gas				
Pipe with 6 mm outer diameter			0	0 → A21
Pipe with ¼" outer diameter			1	1 → A20
Measured component		Possible with measuring range identification		
CO		11 ... 30	A	
CO highly selective (with optical filter)		12 ... 30	B	
CO (TÜV; see Table "TÜV single component", page 2/53)			X	
CO_2		10 ... 30	C	
CH_4		13 ... 30	D	
C_2H_2		15 ... 30	E	
C_2H_4		15 ... 30	F	
C_2H_6		14 ... 30	G	
C_3H_6		14 ... 30	H	
C_3H_8		13 ... 30	J	
C_4H_6		15 ... 30	K	
C_4H_{10}		14 ... 30	L	
C_6H_{14}		14 ... 30	M	
SO_2 (TÜV; see Table "TÜV single component", page 2/53)		13 ... 30	N	
NO (TÜV; see Table "TÜV single component", page 2/53)		14 ... 20, 22	P	
NH_3 (dry)		14 ... 30	Q	Q
H_2O		17 ... 20, 22	R	R
N_2O		13 ... 30	S	
Smallest measuring range	Largest measuring range	Measuring range identification		
0 ... 5 vpm	0 ... 100 vpm	10	A	
0 ... 10 vpm	0 ... 200 vpm	11	B	
0 ... 20 vpm	0 ... 400 vpm	12	C	
0 ... 50 vpm	0 ... 1 000 vpm	13	D	
0 ... 100 vpm	0 ... 1 000 vpm	14	E	
0 ... 300 vpm	0 ... 3 000 vpm	15	F	
0 ... 500 vpm	0 ... 5 000 vpm	16	G	
0 ... 1 000 vpm	0 ... 10 000 vpm	17	H	
0 ... 3 000 vpm	0 ... 10 000 vpm	18	J	
0 ... 3 000 vpm	0 ... 30 000 vpm	19	K	
0 ... 5 000 vpm	0 ... 15 000 vpm	20	L	
0 ... 5 000 vpm	0 ... 50 000 vpm	21	M	
0 ... 1 %	0 ... 3 %	22	N	
0 ... 1 %	0 ... 10 %	23	P	
0 ... 3 %	0 ... 10 %	24	Q	
0 ... 3 %	0 ... 30 %	25	R	
0 ... 5 %	0 ... 15 %	26	S	
0 ... 5 %	0 ... 50 %	27	T	
0 ... 10 %	0 ... 30 %	28	U	
0 ... 10 %	0 ... 100 %	29	V	
0 ... 30 %	0 ... 100 %	30	W	
Internal gas paths	Sample chamber[1] (lining)	Reference chamber (flow-type)		
Hose made of FKM (Viton)	Aluminum	Non-flow-type	0	0 0 → A20, A21
	Aluminum	Flow-type	1	1
Pipe made of titanium	Tantalum	Non-flow-type	4	4 → A20, A21, Y02
	Tantalum	Flow-type	5	5 → Y02
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type	6	6 → A20, A21
	Tantalum	Non-flow-type	8	8 → A20, A21
With sample gas monitoring				
Hose made of FKM (Viton)	Aluminum	Non-flow-type	2	2 2 → A20, A21
	Aluminum	Flow-type	3	3

Footnotes: see next page

19" rack unit

Selection and ordering data		Order No.	
ULTRAMAT 6 gas analyzer Single-channel 19" rack unit for installation in cabinets	D)	**7MB2121-** ■■■■■- ■AA■	Cannot be combined
Add-on electronics			
Without		**0**	
AUTOCAL function			
• With 8 additional binary inputs/outputs		**1**	
• With serial interface for the automotive industry (AK)		**3**	**3 → E20**
• With 8 binary inputs/outputs, PROFIBUS PA interface		**6**	
• With 8 binary inputs/outputs, PROFIBUS DP interface		**7**	
Power supply			
100 ... 120 V AC, 47 ... 63 Hz		**0**	
200 ... 240 V AC, 47 ... 63 Hz		**1**	
Operating software and documentation			
German		**0**	
English		**1**	
French		**2**	
Spanish		**3**	
Italian		**4**	
Additional versions		**Order code**	
Add "-Z" to Order No. and specify Order code			
Flow-type reference cell with reduced flow, 6 mm		**A20**	
Flow-type reference cell with reduced flow, ¼"		**A21**	
Telescopic rails (2 units)		**A31**	
Set of Torx screwdrivers		**A32**	
TAG labels (specific inscription based on customer information)		**B03**	
Kalrez gaskets in sample gas path		**B04**	
FM/CSA certificate – Class I Div 2		**E20**	
Clean for O_2 service (specially cleaned gas path)		**Y02**	
Measuring range indication in plain text, if different from the standard setting		**Y11**	
Special setting (only in conjunction with an application no., e.g. extended measuring range)		**Y12**	
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)		**Y13**	
TÜV version acc. to 13th and 17th BImSchV		**Y17**	
Retrofitting sets		**Order No.**	
RS 485/Ethernet converter		**A5E00852383**	
RS 485/RS 232 converter		**C79451-Z1589-U1**	
RS 485/USB converter		**A5E00852382**	
AUTOCAL function with serial interface for the automotive industry (AK)		**C79451-A3480-D512**	
AUTOCAL function with 8 binary inputs/outputs		**C79451-A3480-D511**	
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA		**A5E00057307**	
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP		**A5E00057312**	

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

1) Only for cell length 20 to 180 mm

Selection and ordering data			Order No.		
ULTRAMAT 6 gas analyzer Two-channel 19" rack unit for installation in cabinets for measuring 2 IR components			D) **7MB2123-** ■■■■■ - ■■■■		Cannot be combined
Gas connections for sample gas and reference gas					
Pipe with 6 mm outer diameter			**0**		**0** → **A21, A41**
Pipe with ¼" outer diameter			**1**		**1** → **A20, A40**
Channel 1 Measured component		Possible with measuring range identification			
CO		11 ... 30	**A**		
CO highly selective (with optical filter)		12 ... 30	**B**		
CO (TÜV; see Table "TÜV single component", page 2/53)			**X**		
CO_2		10 ... 30	**C**		
CH_4		13 ... 30	**D**		
C_2H_2		15 ... 30	**E**		
C_2H_4		15 ... 30	**F**		
C_2H_6		14 ... 30	**G**		
C_3H_6		14 ... 30	**H**		
C_3H_8		13 ... 30	**J**		
C_4H_6		15 ... 30	**K**		
C_4H_{10}		14 ... 30	**L**		
C_6H_{14}		14 ... 30	**M**		
SO_2 (TÜV; see Table "TÜV single component", page 2/53)		13 ... 30	**N**		
NO (TÜV; see Table "TÜV single component", page 2/53)		14 ... 20, 22	**P**		
NH_3 (dry)		14 ... 30	**Q**		**Q**
H_2O		17 ... 20, 22	**R**		**R**
N_2O		13 ... 30	**S**		
Smallest measuring range	Largest measuring range	Measuring range identification			
0 ... 5 vpm	0 ... 100 vpm	10	**A**		
0 ... 10 vpm	0 ... 200 vpm	11	**B**		
0 ... 20 vpm	0 ... 400 vpm	12	**C**		
0 ... 50 vpm	0 ... 1 000 vpm	13	**D**		
0 ... 100 vpm	0 ... 1 000 vpm	14	**E**		
0 ... 300 vpm	0 ... 3 000 vpm	15	**F**		
0 ... 500 vpm	0 ... 5 000 vpm	16	**G**		
0 ... 1 000 vpm	0 ... 10 000 vpm	17	**H**		
0 ... 3 000 vpm	0 ... 10 000 vpm	18	**J**		
0 ... 3 000 vpm	0 ... 30 000 vpm	19	**K**		
0 ... 5 000 vpm	0 ... 15 000 vpm	20	**L**		
0 ... 5 000 vpm	0 ... 50 000 vpm	21	**M**		
0 ... 1 %	0 ... 3 %	22	**N**		
0 ... 1 %	0 ... 10 %	23	**P**		
0 ... 3 %	0 ... 10 %	24	**Q**		
0 ... 3 %	0 ... 30 %	25	**R**		
0 ... 5 %	0 ... 15 %	26	**S**		
0 ... 5 %	0 ... 50 %	27	**T**		
0 ... 10 %	0 ... 30 %	28	**U**		
0 ... 10 %	0 ... 100 %	29	**V**		
0 ... 30 %	0 ... 100 %	30	**W**		
Internal gas paths	Sample chamber[1] (lining)	Reference chamber (flow-type)			
Hose made of FKM (Viton)	Aluminum	Non-flow-type		**0**	**0** → **A20, A21, A40, A41**
	Aluminum	Flow-type		**1**	**1**
Pipe made of titanium	Tantalum	Non-flow-type		**4**	**4** → **A20, A21, A40, A41, Y02**
	Tantalum	Flow-type		**5**	**5** → **Y02**
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type		**6**	**6** → **A20, A21, A40, A41**
	Tantalum	Non-flow-type		**8**	**8** → **A20, A21, A40, A41**
With sample gas monitoring					
Hose made of FKM (Viton)	Aluminum	Non-flow-type		**2**	**2** → **A20, A21, A40, A41**
	Aluminum	Flow-type		**3**	**3**

[1] Only for cell length 20 to 180 mm

19" rack unit

Selection and ordering data		Order No.	
ULTRAMAT 6 gas analyzer Two-channel 19" rack unit for installation in cabinets for measuring 2 IR components	D)	**7MB2123-** ■■■■■ - ■■■■	Cannot be combined
Add-on electronics			
Without		0	
AUTOCAL function			
• With 8 additional binary inputs/outputs each for channel 1		1	
• With 8 additional binary inputs/outputs each for channel 2		2	
• With 8 additional binary inputs/outputs each for channel 1 and channel 2		3	
• With serial interface for the automotive industry (AK)		5	5 → E20
• With 8 additional binary inputs/outputs each for channel 1 and channel 2 and PROFIBUS PA interface		6	
• With 8 additional binary inputs/outputs each for channel 1 and channel 2 and PROFIBUS DP interface		7	
Power supply			
100 ... 120 V AC, 48 ... 63 Hz		0	
200 ... 240 V AC, 48 ... 63 Hz		1	
Channel 2 Measured component	Possible with measuring range identification		
CO	11 ... 30	A	
CO highly selective (with optical filter)	12 ... 30	B	
CO (TÜV; see Table "TÜV single component", page 2/53)		X	
CO_2	10 ... 30	C	
CH_4	13 ... 30	D	
C_2H_2	15 ... 30	E	
C_2H_4	15 ... 30	F	
C_2H_6	14 ... 30	G	
C_3H_6	14 ... 30	H	
C_3H_8	13 ... 30	J	
C_4H_6	15 ... 30	K	
C_4H_{10}	14 ... 30	L	
C_6H_{14}	14 ... 30	M	
SO_2 (TÜV; see Table "TÜV single component", page 2/53)	13 ... 30	N	
NO (TÜV; see Table "TÜV single component", page 2/53)	14 ... 20, 22	P	
NH_3 (dry)	14 ... 30	Q	Q
H_2O	17 ... 20, 22	R	R
N_2O	13 ... 30	S	
Smallest measuring range / Largest measuring range	Measuring range identification		
0 ... 5 vpm / 0 ... 100 vpm	10	A	
0 ... 10 vpm / 0 ... 200 vpm	11	B	
0 ... 20 vpm / 0 ... 400 vpm	12	C	
0 ... 50 vpm / 0 ... 1 000 vpm	13	D	
0 ... 100 vpm / 0 ... 1 000 vpm	14	E	
0 ... 300 vpm / 0 ... 3 000 vpm	15	F	
0 ... 500 vpm / 0 ... 5 000 vpm	16	G	
0 ... 1 000 vpm / 0 ... 10 000 vpm	17	H	
0 ... 3 000 vpm / 0 ... 10 000 vpm	18	J	
0 ... 3 000 vpm / 0 ... 30 000 vpm	19	K	
0 ... 5 000 vpm / 0 ... 15 000 vpm	20	L	
0 ... 5 000 vpm / 0 ... 50 000 vpm	21	M	
0 ... 1 % / 0 ... 3 %	22	N	
0 ... 1 % / 0 ... 10 %	23	P	
0 ... 3 % / 0 ... 10 %	24	Q	
0 ... 3 % / 0 ... 30 %	25	R	
0 ... 5 % / 0 ... 15 %	26	S	
0 ... 5 % / 0 ... 50 %	27	T	
0 ... 10 % / 0 ... 30 %	28	U	
0 ... 10 % / 0 ... 100 %	29	V	
0 ... 30 % / 0 ... 100 %	30	W	
Operating software and documentation			
German			0
English			1
French			2
Spanish			3
Italian			4

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

Selection and ordering data

Additional versions	**Order code**	Cannot be combined
Add "-Z" to Order No. and specify order codes.		
Flow-type reference cell with reduced flow, 6 mm (channel 1)	**A20**	
Flow-type reference cell with reduced flow, ¼" (channel 1)	**A21**	
Flow-type reference cell with reduced flow, 6 mm (channel 2)	**A40**	
Flow-type reference cell with reduced flow, ¼" (channel 2)	**A41**	
Connection pipes (can only be combined with the appropriate gas connection diameter and internal gas path materials)		
• Titanium connection pipe, 6 mm, complete with screwed gland, for sample gas side	**A22**	
• Titanium connection pipe, 6 mm, complete with screwed gland, for reference gas side	**A23**	
• Titanium connection pipe, ¼", complete with screwed gland, for sample gas side	**A24**	
• Titanium connection pipe, ¼", complete with screwed gland, for reference gas side	**A25**	
• Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland, for sample gas side	**A27**	
• Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland, for reference gas side	**A28**	
• Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland, for sample gas side	**A29**	
• Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland, for reference gas side	**A30**	
Telescopic rails (2 units)	**A31**	
Set of Torx screwdrivers	**A32**	
TAG labels (specific inscription based on customer information)	**B03**	
Kalrez gaskets in sample gas path (channel 1)	**B04**	
Kalrez gaskets in sample gas path (channel 2)	**B05**	
FM/CSA certificate – Class I Div 2	**E20**	
Clean for O_2 service (specially cleaned gas path; channels 1 + 2)	**Y02**	
Measuring range indication in plain text, if different from the standard setting	**Y11**	
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**	
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**	
TÜV version acc. to 13th and 17th BImSchV (1st channel)	**Y17**	
TÜV version acc. to 13th and 17th BImSchV (2nd channel)	**Y18**	

Retrofitting sets	**Order No.**
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with serial interface for the automotive industry (AK)	**C79451-A3480-D33**
AUTOCAL function with 8 binary inputs/outputs for channel 1 or channel 2	**C79451-A3480-D511**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA for channel 1 or channel 2	**A5E00057307**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP for channel 1 or channel 2	**A5E00057312**

19" rack unit

Selection and ordering data			Order No.		
ULTRAMAT 6 gas analyzer Single-channel or dual-channel 19" rack unit for installation in cabinets for measuring 2 or 3 IR components			D) **7MB2124-** ■■■■■ - ■■■■		Cannot be combined
Gas connections for sample gas and reference gas					
Pipe with 6 mm outer diameter			**0**		**0** → **A21, A41**
Pipe with ¼" outer diameter			**1**		**1** → **A20, A40**
Measured component	Smallest measuring range	Largest measuring range			
CO NO	0 ... 100 vpm 0 ... 100 vpm	0 ... 1 000 vpm 0 ... 1 000 vpm		**A A**	
CO NO	0 ... 300 vpm 0 ... 300 vpm	0 ... 3 000 vpm 0 ... 3 000 vpm		**A B**	
CO NO	0 ... 1 000 vpm 0 ... 1 000 vpm	0 ... 1 0000 vpm 0 ... 1 0000 vpm		**A C**	
For CO/NO (TÜV; Table "TÜV, 2 components in series", page 2/53)					
CO_2 CO	0 ... 100 vpm 0 ... 100 vpm	0 ... 1 000 vpm 0 ... 1 000 vpm		**B A**	
CO_2 CO	0 ... 300 vpm 0 ... 300 vpm	0 ... 3 000 vpm 0 ... 3 000 vpm		**B B**	
CO_2 CO	0 ... 1 000 vpm 0 ... 1 000 vpm	0 ... 10 000 vpm 0 ... 10 000 vpm		**B C**	
CO_2 CO	0 ... 3 000 vpm 0 ... 3 000 vpm	0 ... 30 000 vpm 0 ... 30 000 vpm		**B D**	
CO_2 CO	0 ... 1 % 0 ... 1 %	0 ... 10 % 0 ... 10 %		**B E**	
CO_2 CO	0 ... 3 % 0 ... 3 %	0 ... 30 % 0 ... 30 %		**B F**	
CO_2 CO	0 ... 10 % 0 ... 10 %	0 ... 100 % 0 ... 100 %		**B G**	
CO_2 CH_4	0 ... 10 % 0 ... 10 %	0 ... 100 % 0 ... 100 %		**C G**	
CO_2 NO	0 ... 300 vpm 0 ... 300 vpm	0 ... 3 000 vpm 0 ... 3 000 vpm		**D B**	
Internal gas paths	Sample chamber[1] (lining)	Reference chamber (flow-type)			
Hose made of FKM (Viton)	Aluminum	Non-flow-type		**0**	**0** **0** → **A20, A21, A40, A41**
	Aluminum	Flow-type		**1**	**1**
Pipe made of titanium	Tantalum	Non-flow-type		**4**	**4** → **A20, A21, A40, A41, Y02**
	Tantalum	Flow-type		**5**	**5** → **Y02**
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type		**6**	**6** → **A20, A21, A40, A41**
	Tantalum	Non-flow-type		**8**	**8** → **A20, A21, A40, A41**
With sample gas monitoring					
Hose made of FKM (Viton)	Aluminum	Non-flow-type		**2**	**2** **2** → **A20, A21, A40, A41**
	Aluminum	Flow-type		**3**	**3**
Add-on electronics					
Without					**0**
AUTOCAL function					
• With 8 additional binary inputs/outputs each for channel 1					**1**
• With 8 additional binary inputs/outputs each for channel 1 and channel 2					**2** **2**
• With serial interface for the automotive industry (AK), channel 1					**3** **3** → **E20**
• With serial interface for the automotive industry (AK), channel 1 and channel 2					**4** **4** → **E20**
• With 8 additional binary inputs/outputs for channel 1 and PROFIBUS PA interface					**5**
• With 8 additional binary inputs/outputs each for channel 1 and channel 2 and PROFIBUS PA interface					**6** **6**
• With 8 additional binary inputs/outputs for channel 1 and PROFIBUS DP interface					**7**
• With 8 additional binary inputs/outputs each for channel 1 and channel 2 and PROFIBUS DP interface					**8** **8**

[1] Only for cell length 20 to 180 mm

Selection and ordering data

Order No.

ULTRAMAT 6 gas analyzer D) **7MB2124-** ■■■■■ - ■■■■

Single-channel or dual-channel 19" rack unit for installation in cabinets for measuring 2 or 3 IR components

Cannot be combined

Power supply			
100 ... 120 V AC, 47 ... 63 Hz		0	
200 ... 240 V AC, 47 ... 63 Hz		1	
Channel 2 Measured component	Possible with measuring range identification		
Without channel 2		W	W
CO	11 ... 30	A	
CO highly selective (with optical filter)	12 ... 30	B	
CO (TÜV; see Table "TÜV single component", page 2/53)		X	
CO_2	10 ... 30	C	
CH_4	13 ... 30	D	
C_2H_2	15 ... 30	E	
C_2H_4	15 ... 30	F	
C_2H_6	14 ... 30	G	
C_3H_6	14 ... 30	H	
C_3H_8	13 ... 30	J	
C_4H_6	15 ... 30	K	
C_4H_{10}	14 ... 30	L	
C_6H_{14}	14 ... 30	M	
SO_2 (TÜV; see Table "TÜV single component", page 2/53)	13 ... 30	N	
NO (TÜV; see Table "TÜV single component", page 2/53)	14 ... 20, 22	P	
NH_3 (dry)	14 ... 30	Q	Q
H_2O	17 ... 20, 22	R	R
N_2O	13 ... 30	S	

Smallest measuring range	Largest measuring range	Measuring range identification		
Without channel 2			X	X → A40, A41, B05
0 ... 5 vpm	0 ... 100 vpm	10	A	
0 ... 10 vpm	0 ... 200 vpm	11	B	
0 ... 20 vpm	0 ... 400 vpm	12	C	
0 ... 50 vpm	0 ... 1 000 vpm	13	D	
0 ... 100 vpm	0 ... 1 000 vpm	14	E	
0 ... 300 vpm	0 ... 3 000 vpm	15	F	
0 ... 500 vpm	0 ... 5 000 vpm	16	G	
0 ... 1 000 vpm	0 ... 10 000 vpm	17	H	
0 ... 3 000 vpm	0 ... 10 000 vpm	18	J	
0 ... 3 000 vpm	0 ... 30 000 vpm	19	K	
0 ... 5 000 vpm	0 ... 15 000 vpm	20	L	
0 ... 5 000 vpm	0 ... 50 000 vpm	21	M	
0 ... 1 %	0 ... 3 %	22	N	
0 ... 1 %	0 ... 10 %	23	P	
0 ... 3 %	0 ... 10 %	24	Q	
0 ... 3 %	0 ... 30 %	25	R	
0 ... 5 %	0 ... 15 %	26	S	
0 ... 5 %	0 ... 50 %	27	T	
0 ... 10 %	0 ... 30 %	28	U	
0 ... 10 %	0 ... 100 %	29	V	
0 ... 30 %	0 ... 100 %	30	W	

Operating software and documentation	
German	0
English	1
French	2
Spanish	3
Italian	4

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

19" rack unit

Selection and ordering data

Additional versions	Order code	Cannot be combined
Add "-Z" to Order No. and specify order codes.		
Flow-type reference cell with reduced flow, 6 mm (channel 1)	**A20**	
Flow-type reference cell with reduced flow, ¼" (channel 1)	**A21**	
Flow-type reference cell with reduced flow, 6 mm (channel 2)	**A40**	
Flow-type reference cell with reduced flow, ¼" (channel 2)	**A41**	
Connection pipes (can only be combined with the appropriate gas connection diameter and internal gas path materials)		
• Titanium connection pipe, 6 mm, complete with screwed gland, for sample gas side	**A22**	
• Titanium connection pipe, 6 mm, complete with screwed gland, for reference gas side	**A23**	
• Titanium connection pipe, ¼", complete with screwed gland, for sample gas side	**A24**	
• Titanium connection pipe, ¼", complete with screwed gland, for reference gas side	**A25**	
• Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland, for sample gas side	**A27**	
• Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland, for reference gas side	**A28**	
• Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland, for sample gas side	**A29**	
• Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland, for reference gas side	**A30**	
Telescopic rails (2 units)	**A31**	
Set of Torx screwdrivers	**A32**	
TAG labels (specific inscription based on customer information)	**B03**	
Kalrez gaskets in sample gas path (channel 1)	**B04**	
Kalrez gaskets in sample gas path (channel 2)	**B05**	
FM/CSA certificate – Class I Div 2	**E20**	
Clean for O_2 service (specially cleaned gas path; channels 1 + 2)	**Y02**	
Measuring range indication in plain text, if different from the standard setting	**Y11**	
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**	
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**	
TÜV version acc. to 13th and 17th BImSchV (channel 1)	**Y17**	
TÜV version acc. to 13th and 17th BImSchV (channel 2)	**Y18**	

Retrofitting sets	Order No.
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with serial interface for the automotive industry (AK)	**C79451-A3480-D33**
AUTOCAL function with 8 binary inputs/outputs for channel 1 or channel 2	**C79451-A3480-D511**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA for channel 1 or channel 2	**A5E00057307**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP for channel 1 or channel 2	**A5E00057312**

TÜV single component

Component	CO (TÜV)		SO_2 (TÜV)		NO (TÜV)	
Measuring range identification	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**
C			75 mg/m³	1 500 mg/m³		
D	50 mg/m³	1 000 mg/m³	300 mg/m³	3 000 mg/m³		
E			500 mg/m³	5 000 mg/m³	100 mg/m³	2 000 mg/m³
F	300 mg/m³	3 000 mg/m³	1 000 mg/m³	10 000 mg/m³	300 mg/m³	3 000 mg/m³
G	500 mg/m³	5 000 mg/m³			500 mg/m³	5 000 mg/m³
H	1 000 mg/m³	10 000 mg/m³	3 000 mg/m³	30 000 mg/m³	1 000 mg/m³	10 000 mg/m³
K	3 000 mg/m³	30 000 mg/m³	10 g/m³	100 g/m³	3 000 mg/m³	30 000 mg/m³
P	10 g/m³	100 g/m³	30 g/m³	300 g/m³	10 g/m³	100 g/m³
R	30 g/m³	300 g/m³	100 g/m³	1 000 g/m³	30 g/m³	300 g/m³
V	100 g/m³	1 160 g/m³	300 g/m³	2 630 g/m³	100 g/m³	1 250 g/m³

Example for ordering

ULTRAMAT 6, TÜV
Component: CO
Measuring range: 0 to 50 / 1 000 mg/m³
with hoses, non-flow-type reference compartment
without automatic adjustment (AUTOCAL)
230 V AC; German
7MB2121-0XD00-1AA0-Z +Y17

TÜV, 2 components in series

Component	CO (TÜV)		NO (TÜV)	
Measuring range identification	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**
AA	75 mg/m³	1 000 mg/m³	200 mg/m³	2 000 mg/m³
AB	300 mg/m³	3 000 mg/m³	300 mg/m³	3 000 mg/m³
AC	1 000 mg/m³	10 000 mg/m³	1 000 mg/m³	10 000 mg/m³

Example for ordering

ULTRAMAT 6, TÜV, 2-component unit
Components: CO/NO + SO_2
Measuring range: CO: 0 to 75 / 1 000 mg/m³, NO: 0 to 200 / 2 000 mg/m³, SO_2: 0 to 75 / 1 500 mg/m³
with hoses, non-flow-type reference compartment
without automatic adjustment (AUTOCAL)
230 V AC; German
7MB2124-0AA00-1NC0-Z +Y17+Y18

Note: for 3 components take both tables into consideration.

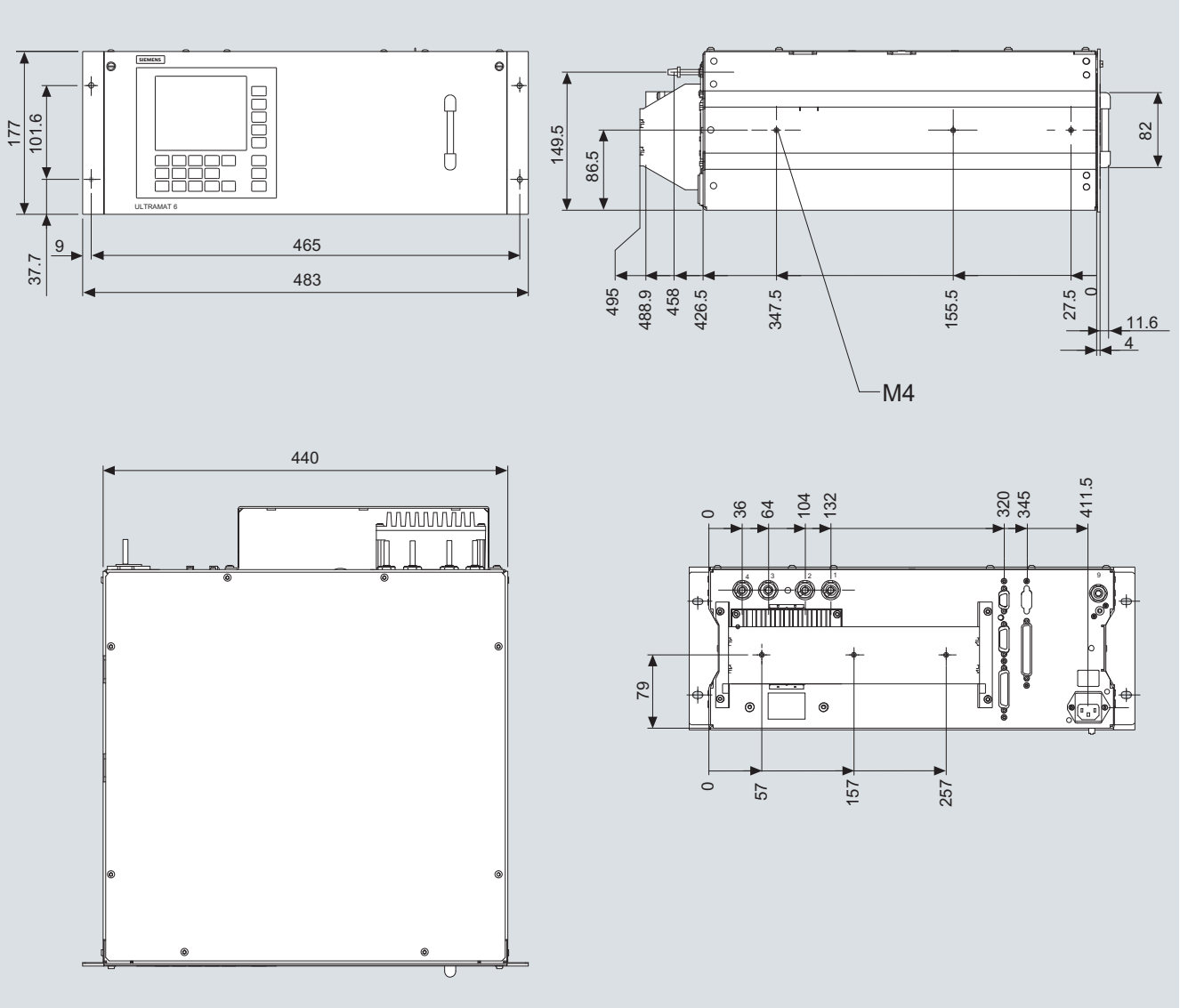
Ordering information measured component N_2O

Certification in accordance with AM0028 and AM0034 (Kyoto Protocol) for measuring N_2O, measuring range 0 ... 300 ppm / 3 000 ppm.

Version: Standard device

19" rack unit

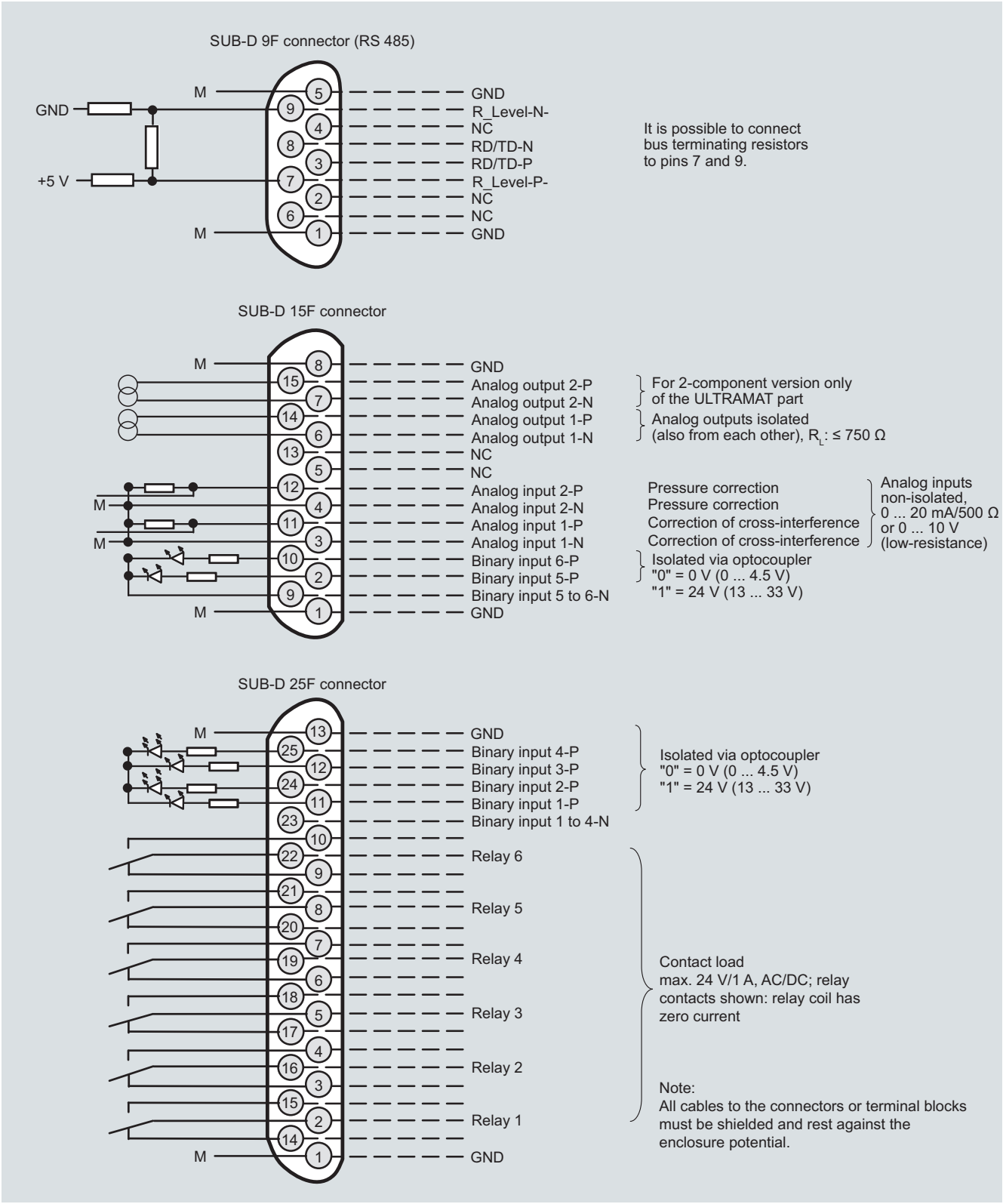
Dimensional drawings



ULTRAMAT 6, 19“ unit, dimensions in mm (example: 1-channel version)

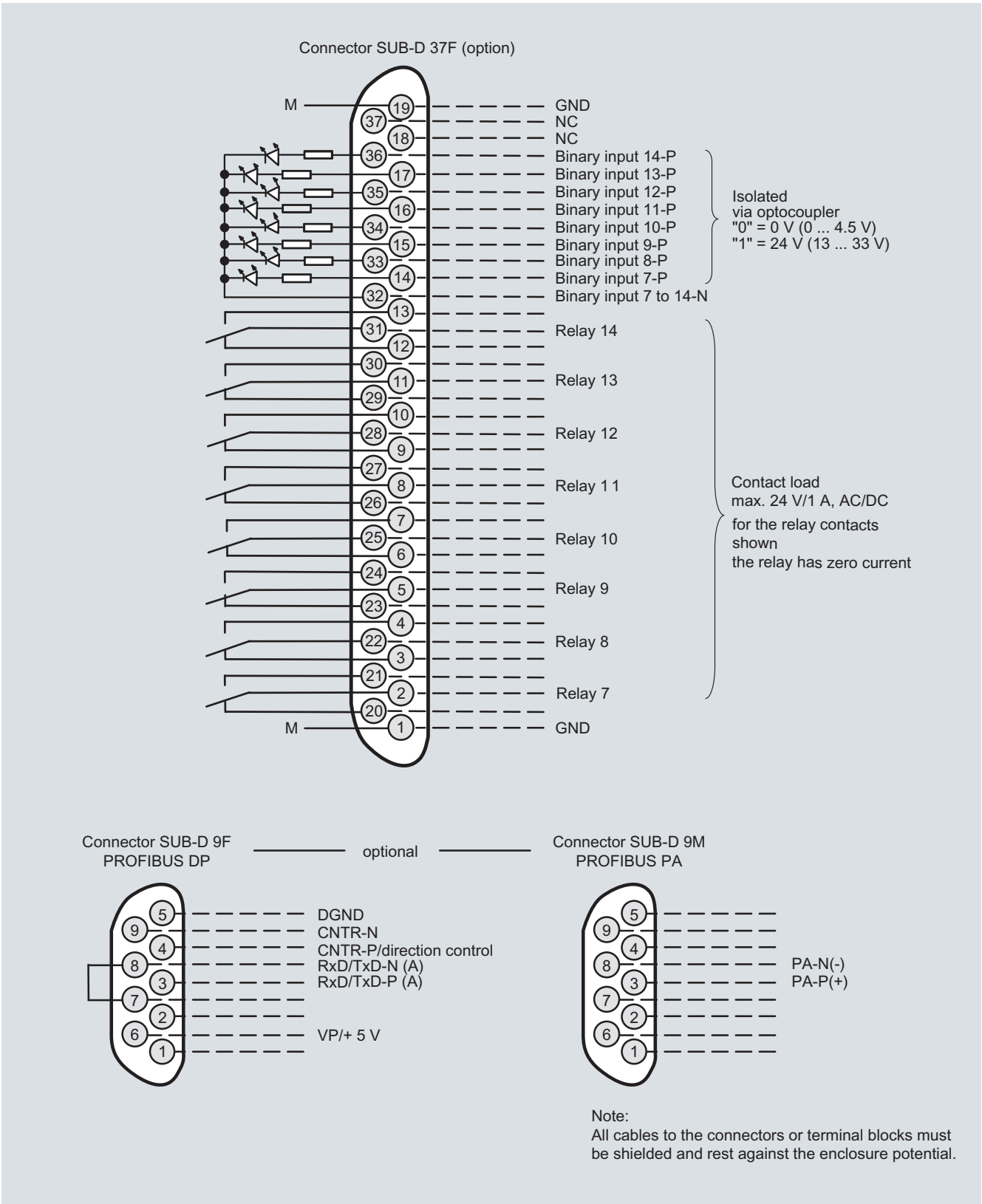
Schematics

Pin assignment (electrical and gas connections)

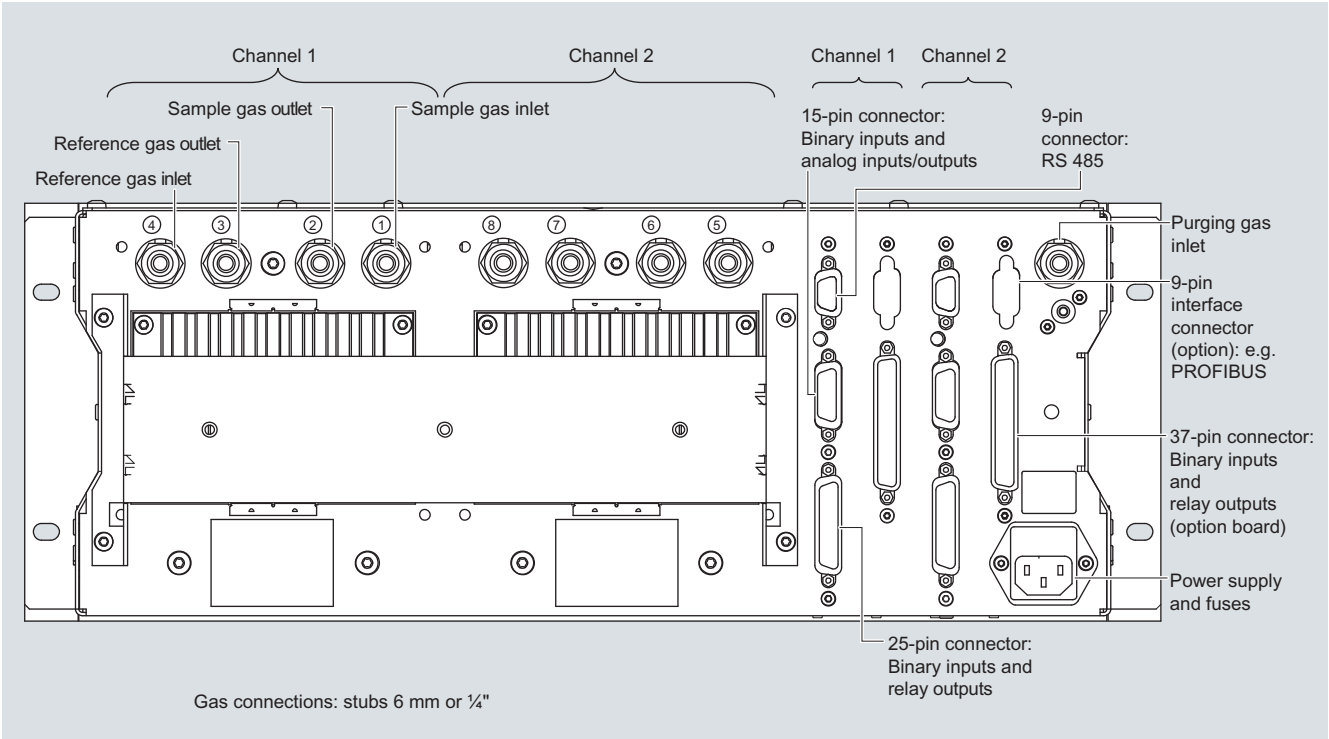


ULTRAMAT 6, 19“ unit, pin assignment

19" rack unit



ULTRAMAT 6, 19“ unit, pin assignment of AUTOCAL board and PROFIBUS connectors



ULTRAMAT 6, 19“ unit, gas and electrical connections (example: 2-channel version)

Technical specifications

General information

Measuring ranges	4, internally and externally switchable; autoranging is also possible
Smallest possible measuring range	Dependent on the application, e.g. CO: 0 … 10 vpm, CO_2: 0 … 5 vpm
Largest possible measuring range	Dependent on the application
Measuring range with suppressed zero point	Any zero point within 0 … 100 vol.% can be implemented; smallest possible span 20 %
Heated version	65 °C
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2

Influence of interfering gases must be considered separately

Design, enclosure

Weight	Approx. 32 kg
Degree of protection	IP65 in accordance with EN 60529, restricted breathing enclosure to EN 50021

Electrical characteristics

Power supply	100 … 120 V AC (nominal range of use 90 … 132 V), 47 … 63 Hz or 200 … 240 V AC (nominal range of use 180 … 264 V), 47 … 63 Hz
Power consumption	Approx. 35 VA; approx. 330 VA with heated version
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	In accordance with EN 61010-1
• Heated units	Overvoltage category II
• Unheated units	Overvoltage category III
Fuse values (unheated unit)	
• 100 ... 120 V	F3: 1 T/250; F4: 1 T/250
• 200 ... 240 V	F3: 0.63 T/250; F4: 0.63 T/250
Fuse values (heated unit)	
• 100 ... 120 V	F1: 1 T/250; F2: 4 T/250 F3: 4 T/250; F4: 4 T/250
• 200 ... 240 V	F1: 0.63 T/250; F2: 2.5 T/250 F3: 2.5 T/250; F4: 2.5 T/250

Gas inlet conditions

Permissible sample gas pressure	
• With hoses (without pressure switch)	600 … 1 500 hPa (absolute)
• With pipes (without pressure switch)	600 … 1 500 hPa (absolute)
- Ex (leakage compensation)	600 … 1 160 hPa (absolute)
- Ex (continuous purging)	600 … 1 500 hPa (absolute)
Purging gas pressure	
• Permanent	< 165 hPa above ambient pressure
• For short periods	250 hPa above ambient pressure
Sample gas flow	18 … 90 l/h (0.3 … 1.5 l/min)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point, for heated version min. 0 … max. 80 °C
Sample gas humidity	< 90 % RH (RH: relative humidity) or dependent on measuring task

Dynamic response

Warm-up period	At room temperature < 30 min (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)	0 … 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approx. 0.5 ... 5 s, depending on version
Time for device-internal signal processing	< 1 s

Pressure correction range

Pressure sensor	
• Internal	700 … 1 200 hPa absolute
• External	700 … 1 500 hPa absolute

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation	< ± 1 % of the smallest possible measuring range according to rating plate
Zero point drift	< ± 1 % of the current measuring range/week
Measured-value drift	< ± 1 % of the current measuring range/week
Repeatability	≤ 1 % of the current measuring range
Detection limit	1 % of the smallest possible measuring range
Linearity error	< 0.5 % of the full-scale value

Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	< 1 % of current measuring range/10 K (with constant receiver cell temperature)
Sample gas pressure	When pressure compensation has been switched on: < 0.15 % of setpoint/1 % atmospheric pressure change
Sample gas flow	Negligible
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %
Environmental conditions	Application-specific measuring influences possible if ambient air contains measured component or cross interference-sensitive gases
Electrical inputs and outputs	
Analog output	0/2/4 … 20 mA, isolated; load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated, non-sparking
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and accompanying gas influence correction (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs, also with PROFIBUS PA or PROFIBUS DP
Climatic conditions	
Permissible ambient temperature	-30 … +70 °C during storage and transportation; 5 … 45 °C during operation
Permissible humidity	< 90 % RH (RH: relative humidity) within average annual value, during storage and transportation (dew point must not be undershot)

Field device

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

ULTRAMAT 6 gas analyzer
For installation in the field, single-channel, 1 component

D) **7MB2111-** ■■■■■ - ■■**A**■ — Cannot be combined

Gas connections			
Ferrule screw connection for pipe, outer diameter 6 mm		**0**	**0 → A29**
Ferrule screw connection for pipe, outer diameter ¼"		**1**	**1 → A28**
Measured component	Possible with measuring range identification		
CO	11 ... 30	**A**	
CO highly selective (with optical filter)	12 ... 30	**B**	
CO (TÜV; see Table "TÜV, single component", page 2/65)		**X**	
CO_2	10 ... 30	**C**	
CH_4	13 ... 30	**D**	
C_2H_2	15 ... 30	**E**	
C_2H_4	15 ... 30	**F**	
C_2H_6	14 ... 30	**G**	
C_3H_6	14 ... 30	**H**	
C_3H_8	13 ... 30	**J**	
C_4H_6	15 ... 30	**K**	
C_4H_{10}	14 ... 30	**L**	
C_6H_{14}	14 ... 30	**M**	
SO_2 (TÜV; see Table "TÜV, single component", page 2/65)	13 ... 30	**N**	
NO (TÜV; see Table "TÜV, single component", page 2/65)	14 ... 20, 22	**P**	
NH_3 (dry)	14 ... 30	**Q**	**Q**
H_2O	17 ... 20; 22 (17 to 24, 26; heated)	**R**	**R**
N_2O	13 ... 30	**S**	

Smallest measuring range	Largest measuring range	Measuring range identification	
0 ... 5 vpm	0 ... 100 vpm	10	**A**
0 ... 10 vpm	0 ... 200 vpm	11	**B**
0 ... 20 vpm	0 ... 400 vpm	12	**C**
0 ... 50 vpm	0 ... 1 000 vpm	13	**D**
0 ... 100 vpm	0 ... 1 000 vpm	14	**E**
0 ... 300 vpm	0 ... 3 000 vpm	15	**F**
0 ... 500 vpm	0 ... 5 000 vpm	16	**G**
0 ... 1 000 vpm	0 ... 10 000 vpm	17	**H**
0 ... 3 000 vpm	0 ... 10 000 vpm	19	**J**
0 ... 3 000 vpm	0 ... 30 000 vpm	19	**K**
0 ... 5 000 vpm	0 ... 15 000 vpm	20	**L**
0 ... 5 000 vpm	0 ... 50 000 vpm	21	**M**
0 ... 1 %	0 ... 3 %	22	**N**
0 ... 1 %	0 ... 10 %	23	**P**
0 ... 3 %	0 ... 10 %	24	**Q**
0 ... 3 %	0 ... 30 %	25	**R**
0 ... 5 %	0 ... 15 %	26	**S**
0 ... 5 %	0 ... 50 %	27	**T**
0 ... 10 %	0 ... 30 %	28	**U**
0 ... 10 %	0 ... 100 %	29	**V**
0 ... 30 %	0 ... 100 %	30	**W**

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

Selection and ordering data — Order No.

ULTRAMAT 6 gas analyzer — D) **7MB2111-** ■■■■■ - ■■ **A** ■

For installation in the field, single-channel, 1 component

Cannot be combined

Internal gas paths	Sample chamber (lining)	Reference chamber (flow-type)								
Hose made of FKM (Viton)	Aluminum	Non-flow-type	0				0	0	0 →	A28, A29
	Aluminum	Flow-type	1				1	1		
Pipe made of titanium	Tantalum[1]	Non-flow-type	2						2 →	A28, A29, Y02
	Tantalum[1]	Flow-type	3						3 →	Y02
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type	6						6 →	A28, A29
	Tantalum[1]	Non-flow-type	8						8 →	A28, A29

Add-on electronics							
Without		0					
AUTOCAL function							
• With 8 additional binary inputs/outputs		1					
• With 8 binary inputs/outputs and PROFIBUS PA interface		6				6	E12
• With 8 binary inputs/outputs and PROFIBUS DP interface		7				7	E12
• With 8 binary inputs/outputs and PROFIBUS PA Ex i		8			8		

Power supply							
Standard unit and acc. to ATEX II 3G version (Zone 2)							
• 100 ... 120 V AC, 48 ... 63 Hz			0		0		
• 200 ... 240 V AC, 48 ... 63 Hz			1		1		
ATEX II 2G versions (Zone 1), incl. certificate							
• 100 ... 120 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: leakage compensation)			2		2	2	
• 200 ... 240 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: leakage compensation)			3		3	3	
• 100 ... 120 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: continuous purging)			6		6	6	
• 200 ... 240 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: continuous purging)			7		7	7	

Heating of internal gas paths and analyzer unit							
Without			A				
With (max. 65 °C)			B				

Language (supplied documentation, software)							
German				0			
English				1			
French				2			
Spanish				3			
Italian				4			

[1] Only for cell length 20 to 180 mm

[2] Only in connection with an approved purging unit

Selection and ordering data

Additional versions	Order code
Add "-Z" to Order No. and specify order codes.	
Flow-type reference cell with reduced flow, 6 mm	**A28**
Flow-type reference cell with reduced flow, ¼"	**A29**
Set of Torx screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Kalrez gaskets in sample gas path	**B04**
Ex versions Possible combinations: see Table "Ex configurations – principle selection criteria", page 6/16	
ATEX II 3G certificate; restricted breathing enclosure, non-flammable gases	**E11**
ATEX II 3G certificate; flammable gases	**E12**
CSA certificate – Class I Div 2	**E20**
ATEX II 3D certificate; potentially explosive dust atmospheres	
• In non-hazardous gas zone	**E40**
• In Ex zone acc. to ATEX II 3G, non-flammable gases	**E41**
• In Ex zone acc. to ATEX II 3G, flammable gases[1)]	**E42**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**
TÜV version acc. to 13th and 17th BImSchV	**Y17**

Additional units for Ex versions		Order No.
Category ATEX II 2G (Zone 1)		
BARTEC EEx p control unit, 230 V, "leakage compensation"		**7MB8000-2BA**
BARTEC EEx p control unit, 115 V, "leakage compensation"		**7MB8000-2BB**
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
Ex isolation amplifier		**7MB8000-3AA**
Ex isolating relay, 230 V		**7MB8000-4AA**
Ex isolating relay, 110 V		**7MB8000-4AB**
Differential pressure switch for corrosive and non-corrosive gases	F)	**7MB8000-5AA**
Stainless steel flame arrestor		**7MB8000-6BA**
Hastelloy flame arrestor		**7MB8000-6BB**
Category ATEX II 3G (Zone 2)		
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
FM/CSA (Class I Div. 2)		
Ex purging unit MiniPurge FM		**7MB8000-1AA**

Retrofitting sets	Order No.
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with 8 binary inputs/outputs	**A5E00064223**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA	**A5E00057315**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057318**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA Ex i (firmware 4.1.10 required)	**A5E00057317**

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

1) Only in connection with an approved purging unit

2

Selection and ordering data

Selection and ordering data			Order No.	Cannot be combined
ULTRAMAT 6 gas analyzer For installation in the field, single-channel, 2 components			D) **7MB2112-** ▪▪▪▪▪ - ▪▪A▪	
Gas connections				
Ferrule screw connection for pipe, outer diameter 6 mm			0	0 → A29
Ferrule screw connection for pipe, outer diameter ¼"			1	1 → A28
Measured component	Smallest measuring range	Largest measuring range		
CO NO	0 ... 100 vpm 0 ... 100 vpm	0 ... 1 000 vpm 0 ... 1 000 vpm	A A	
CO NO	0 ... 300 vpm 0 ... 300 vpm	0 ... 3 000 vpm 0 ... 3 000 vpm	A B	
CO NO	0 ... 1 000 vpm 0 ... 1 000 vpm	0 ... 10 000 vpm 0 ... 10 000 vpm	A C	
For CO/NO (TÜV; see Table "TÜV, 2 components in series", page 2/65)				
CO_2 CO	0 ... 100 vpm 0 ... 100 vpm	0 ... 1 000 vpm 0 ... 1 000 vpm	B A	
CO_2 CO	0 ... 300 vpm 0 ... 300 vpm	0 ... 3 000 vpm 0 ... 3 000 vpm	B B	
CO_2 CO	0 ... 1 000 vpm 0 ... 1 000 vpm	0 ... 10 000 vpm 0 ... 10 000 vpm	B C	
CO_2 CO	0 ... 3 000 vpm 0 ... 3 000 vpm	0 ... 30 000 vpm 0 ... 30 000 vpm	B D	
CO_2 CO	0 ... 1 % 0 ... 1 %	0 ... 10 % 0 ... 10 %	B E	
CO_2 CO	0 ... 3 % 0 ... 3 %	0 ... 30 % 0 ... 30 %	B F	
CO_2 CO	0 ... 10 % 0 ... 10 %	0 ... 100 % 0 ... 100 %	B G	
CO_2 CH_4	0 ... 10 % 0 ... 10 %	0 ... 100 % 0 ... 100 %	C G	
CO_2 NO	0 ... 100 vpm 0 ... 100 vpm	0 ... 1 000 vpm 0 ... 1 000 vpm	D A	
CO_2 NO	0 ... 300 vpm 0 ... 300 vpm	0 ... 3 000 vpm 0 ... 3 000 vpm	D B	
Internal gas paths	Sample chamber (lining)	Reference chamber (flow-type)		
Hose made of FKM (Viton)	Aluminum	Non-flow-type	0	0 0 → A28, A29
	Aluminum	Flow-type	1	1
Pipe made of titanium	Tantalum[1]	Non-flow-type	2	2 → A28, A29, Y02
	Tantalum[1]	Flow-type	3	3 → Y02
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type	6	6 → A28, A29
	Tantalum[1]	Non-flow-type	8	8 → A28, A29
Add-on electronics				
Without			0	
AUTOCAL function				
• With 8 additional binary inputs/outputs			1	
• With 8 binary inputs/outputs and PROFIBUS PA interface			6	6
• With 8 binary inputs/outputs and PROFIBUS DP interface			7	7
• With 8 binary inputs/outputs and PROFIBUS PA Ex i			8	8
Power supply				
Standard unit and acc. to ATEX II 3G version (Zone 2)				
• 100 ... 120 V AC, 48 ... 63 Hz			0	0
• 200 ... 240 V AC, 48 ... 63 Hz			1	1
ATEX II 2G versions (Zone 1), incl. certificate				
• 100 ... 120 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: leakage compensation)			2	2 2
• 200 ... 240 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: leakage compensation)			3	3 3
• 100 ... 120 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: continuous purging)			6	6 6
• 200 ... 240 V AC, 48 ... 63 Hz, according to ATEX II 2G[2] (operating mode: continuous purging)			7	7 7
Heating of internal gas paths and analyzer unit				
Without			A	
With (max. 65 °C)			B	

Field device

ULTRAMAT 6 gas analyzer For installation in the field, single-channel, 2 components	D)	**7MB2112-** ■■■■■ - ■■ **A** ■	Cannot be combined
Language (supplied documentation, software)			
German		**0**	
English		**1**	
French		**2**	
Spanish		**3**	
Italian		**4**	

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

1) Only for cell length 20 to 180 mm.

2) See also next page "Additional units for Ex versions".

Additional versions	**Order code**
Add "-Z" to Order No. and specify order codes.	
Flow-type reference cell with reduced flow, 6 mm	**A28**
Flow-type reference cell with reduced flow, ¼"	**A29**
Set of Torx screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Kalrez gaskets in sample gas path	**B04**
Ex versions Possible combinations: see Table "Ex configurations – principle selection criteria", page 6/16	
ATEX II 3G certificate; restricted breathing enclosure, non-flammable gases	**E11**
ATEX II 3G certificate; flammable gases	**E12**
CSA certificate – Class I Div 2	**E20**
ATEX II 3D certificate; potentially explosive dust atmospheres	
• In non-hazardous gas zone	**E40**
• In Ex zone acc. to ATEX II 3G, non-flammable gases	**E41**
• In Ex zone acc. to ATEX II 3G, flammable gases	**E42**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**
TÜV version acc. to 13th and 17th BImSchV	**Y17**

Additional units for Ex versions		**Order No.**
Category ATEX II 2G (Zone 1)		
BARTEC EEx p control unit, 230 V, "leakage compensation"		**7MB8000-2BA**
BARTEC EEx p control unit, 115 V, "leakage compensation"		**7MB8000-2BB**
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
Ex isolation amplifier		**7MB8000-3AA**
Ex isolating relay, 230 V		**7MB8000-4AA**
Ex isolating relay, 110 V		**7MB8000-4AB**
Differential pressure switch for corrosive and non-corrosive gases	F)	**7MB8000-5AA**
Stainless steel flame arrestor		**7MB8000-6BA**
Hastelloy flame arrestor		**7MB8000-6BB**
Category ATEX II 3G (Zone 2)		
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
FM/CSA (Class I Div. 2)		
Ex purging unit MiniPurge FM		**7MB8000-1AA**

Retrofitting sets	**Order No.**
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with 8 binary inputs/outputs	**A5E00064223**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA	**A5E00057315**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057318**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA Ex i (firmware 4.1.10 required)	**A5E00057317**

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

TÜV, single component
(only with additional suffix Z (Y17, Y18))

Component	CO (TÜV)		SO_2 (TÜV)		NO (TÜV)	
Measuring range identification	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**
C			75 mg/m³	1 500 mg/m³		
D	50 mg/m³	1 000 mg/m³	300 mg/m³	3 000 mg/m³		
E			500 mg/m³	5 000 mg/m³	100 mg/m³	2 000 mg/m³
F	300 mg/m³	3 000 mg/m³	1 000 mg/m³	10 000 mg/m³	300 mg/m³	3 000 mg/m³
G	500 mg/m³	5 000 mg/m³			500 mg/m³	5 000 mg/m³
H	1 000 mg/m³	10 000 mg/m³	3 000 mg/m³	30 000 mg/m³	1 000 mg/m³	10 000 mg/m³
K	3 000 mg/m³	30 000 mg/m³	10 g/m³	100 g/m³	3 000 mg/m³	30 000 mg/m³
P	10 g/m³	100 g/m³	30 g/m³	300 g/m³	10 g/m³	100 g/m³
R	30 g/m³	300 g/m³	100 g/m³	1 000 g/m³	30 g/m³	300 g/m³
V	100 g/m³	1 160 g/m³	300 g/m³	2 630 g/m³	100 g/m³	1 250 g/m³

Example for ordering

ULTRAMAT 6, TÜV (1-component unit)
Component: CO
Measuring range: 0 to 50 / 1 000 mg/m³
with hoses, non-flow-type reference compartment
without automatic adjustment (AUTOCAL)
230 V AC; without heating, German
7MB2111-0XD00-1AA0-Z +Y17

TÜV, 2 components in series

Component	CO (TÜV)		NO (TÜV)	
Measuring range identification	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**
AA	75 mg/m³	1 000 mg/m³	200 mg/m³	2 000 mg/m³
AB	300 mg/m³	3 000 mg/m³	300 mg/m³	3 000 mg/m³
AC	1 000 mg/m³	10 000 mg/m³	1 000 mg/m³	10 000 mg/m³

Example for ordering

ULTRAMAT 6, TÜV (2 components in series)
Components: CO/NO
Measuring range CO: 0 to 75 / 1 000 mg/m³, NO: 0 to 200 / 2 000 mg/m³
with hoses, non-flow-type reference compartment
without automatic adjustment (AUTOCAL)
230 V AC; without heating, German
7MB2112-0AA00-1AA0-Z +Y17

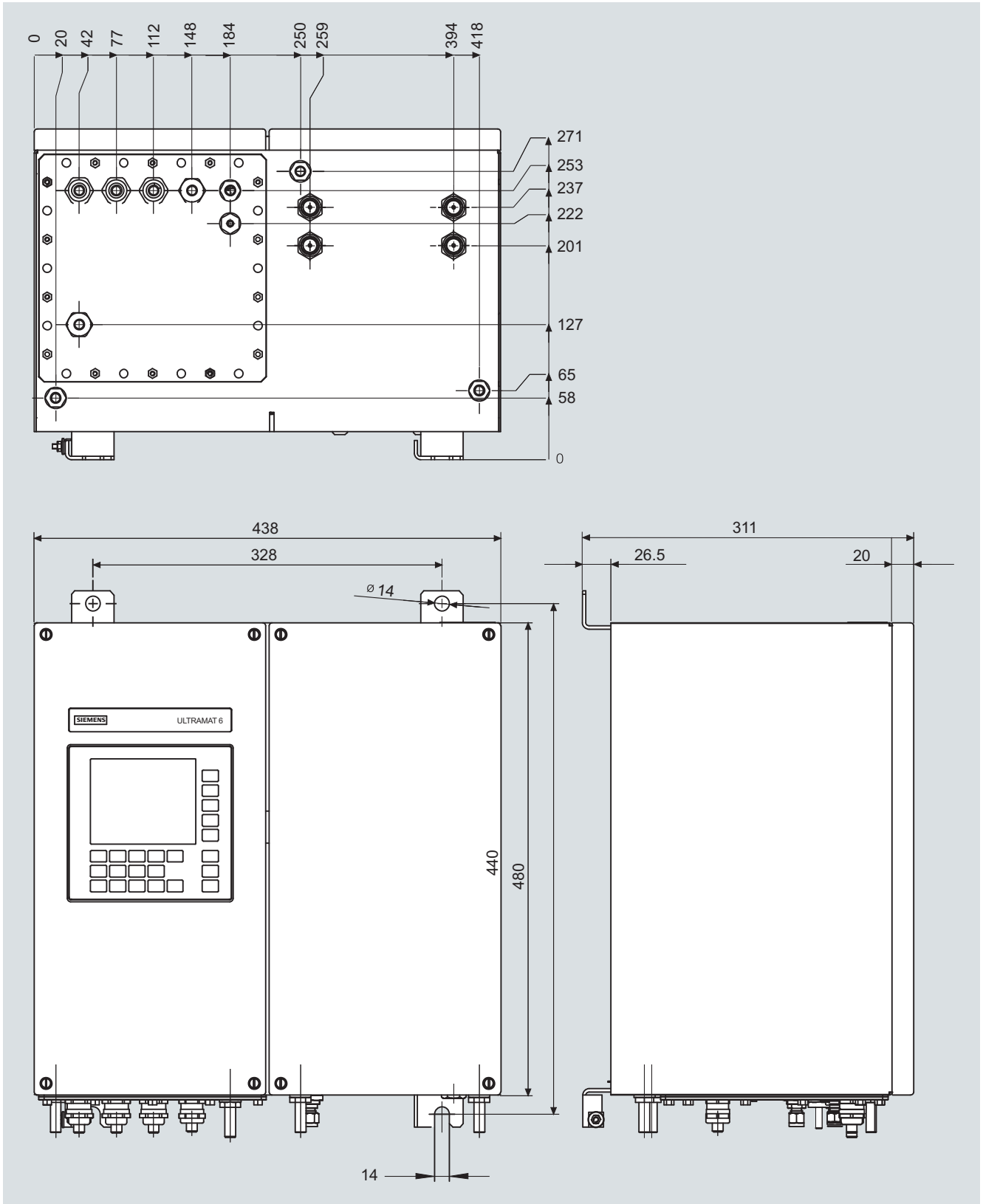
Note: for 3 components take both tables into consideration.

Ordering information measured component N_2O

Certification in accordance with AM0028 and AM0034 (Kyoto Protocol) for measuring N_2O, measuring range 0 to 300 ppm / 3 000 ppm.

Version: Standard device

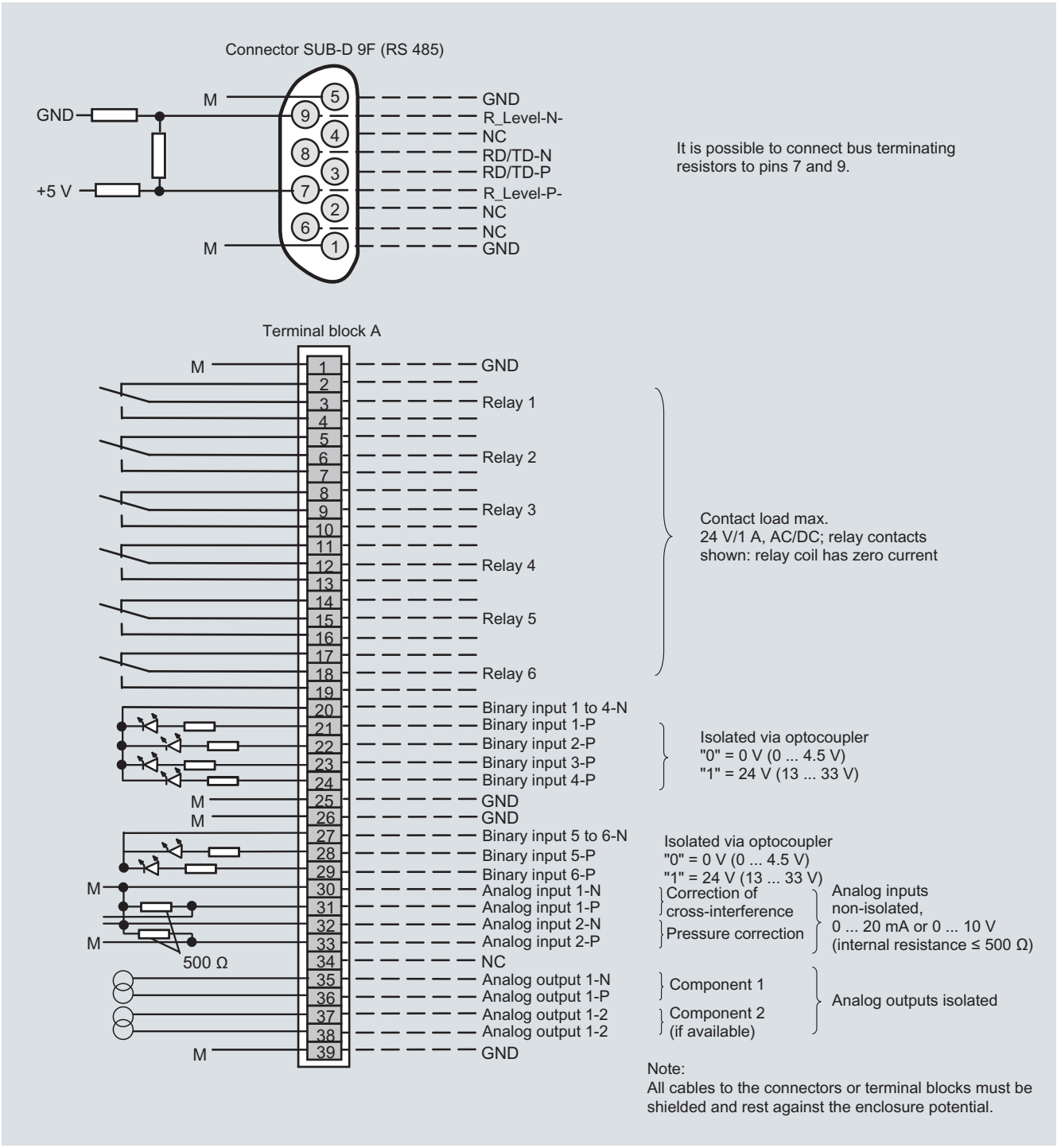
Dimensional drawings



ULTRAMAT 6, field unit, dimensions in mm

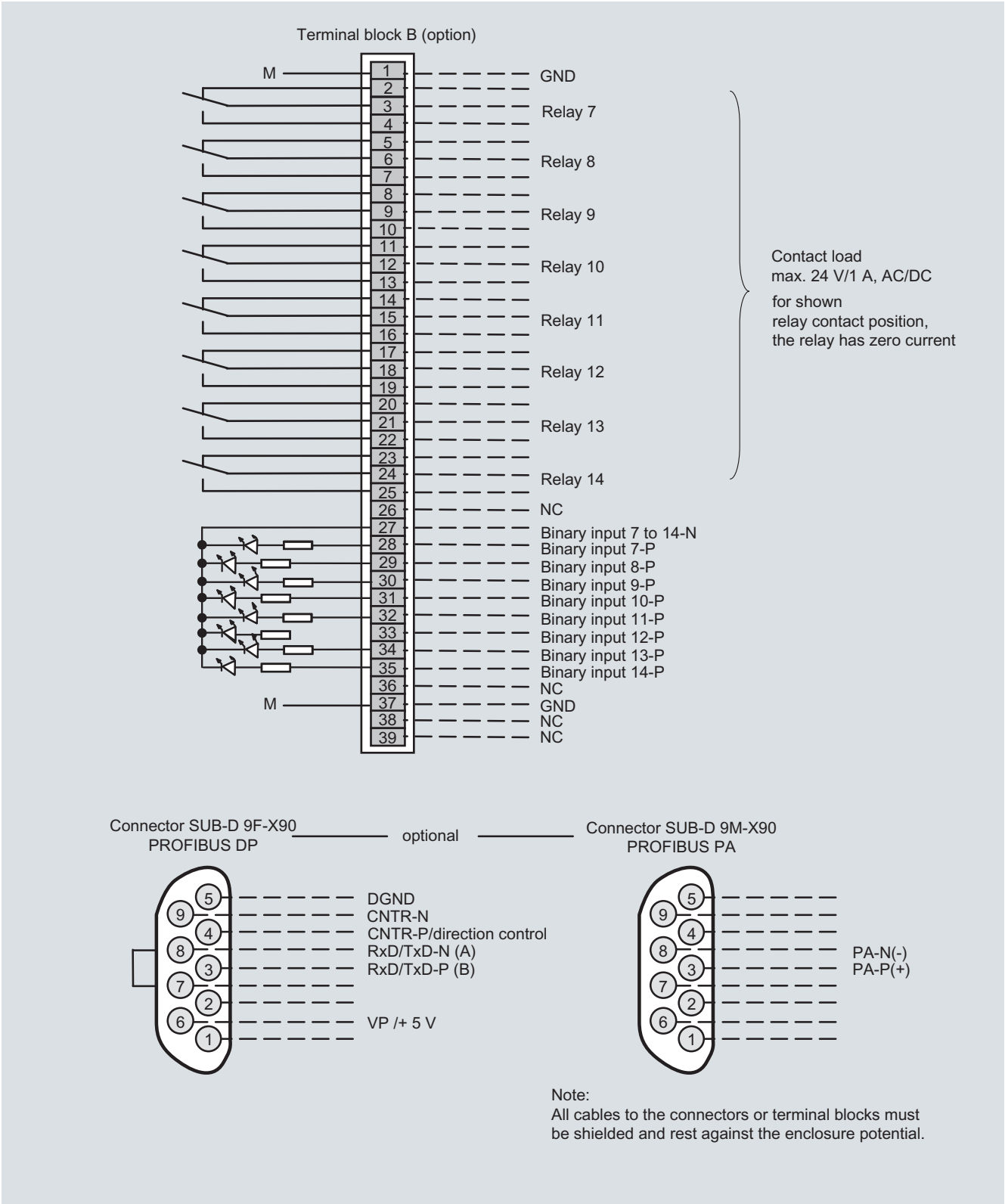
Schematics

Pin assignment (electrical and gas connections)



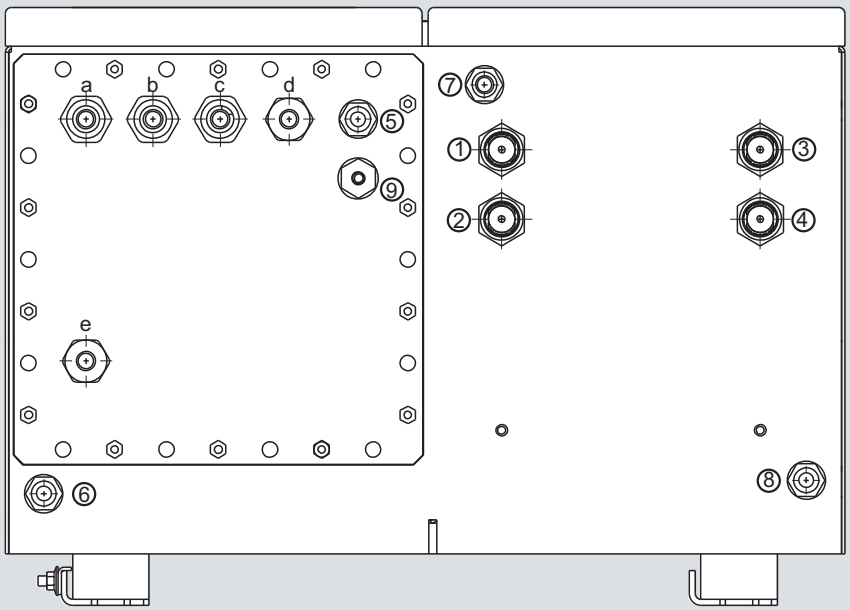
ULTRAMAT 6, field device, pin and terminal assignment

Field device



ULTRAMAT 6, field device, pin and terminal assignment of the AUTOCAL board and PROFIBUS connectors

Field device



Gas connections

①	Sample gas inlet	Clamping gland for pipe Ø 6 mm or ¼"
②	Sample gas outlet	
③	Reference gas inlet (option)	
④	Reference gas outlet (option)	

Electrical connections

a - c	Signal cable (Ø 10 ... 14 mm) (analog + digital): cable gland M20x1.5
d	Interface connection: (Ø 7 ... 12 mm) cable gland M20x1.5
e	Power supply: (Ø 7 ... 12 mm) cable gland M20x1.5

⑤-⑧ Purging gas inlets/outlets, stubs Ø 10 mm or 3/8"
⑨ Connection atmospheric pressure sensor, stubs Ø ¼"

ULTRAMAT 6, field device, gas connections and electrical connections

Documentation

Selection and ordering data

Operating instructions	Order No.
ULTRAMAT 6 / OXYMAT 6	
Gas analyzer for IR-absorbing gases and oxygen	
• German	**C79000-G5200-C143**
• English	**C79000-G5276-C143**
• French	**C79000-G5277-C143**
• Spanish	**C79000-G5278-C143**
• Italian	**C79000-G5272-C143**

Suggestions for spare parts

Selection and ordering data

Description	7MB-2121	7MB-2123	7MB-2124	7MB-2111	7MB-2112	7MB-2111/2 Ex	2 years (quantity)	5 years (quantity)		Order No.
Analyzer unit										
O-ring for cover (window)	x	x	x	x	x	x	2	4	D)	**C79121-Z100-A24**
Cover (cell length 20 ... 180 mm)	x	x	x	x	x	x	2	2		**C79451-A3462-B151**
Cover (cell length 0.2 ... 6 mm)	x	x	x	x	x	x	2	2		**C79451-A3462-B152**
O-rings, set	x	x	x	x	x	x		1	D)	**C79451-A3462-D501**
Sample gas path										
O-ring (hose clip)				x	x	x	2	4	D)	**C71121-Z100-A159**
Pressure switch	x	x	x				1	2		**C79302-Z1210-A2**
Flow indicator	x	x	x				1	2		**C79402-Z560-T1**
Hose clip	x	x	x	x	x	x		1		**C79451-A3478-C9**
Heating cartridge (heated unit)				x	x	x		1		**W75083-A1004-F120**
Electronics										
Temperature fuse (heated unit)				x	x			1		**W75054-T1001-A150**
Fuse (device fuse)						x	1	2		**A5E00061505**
Temperature controller - electronics, 230 V AC				x	x	x		1		**A5E00118527**
Temperature controller - electronics, 115 V AC				x	x	x		1		**A5E00118530**
Fan, 24 V DC (heated unit)				x	x	x		1		**A5E00302916**
Front plate with keyboard	x	x	x				1	1		**C79165-A3042-B504**
Temperature sensor				x	x	x		1		**C79165-A3044-B176**
Adapter plate, LCD/keyboard	x	x	x	x	x		1	1		**C79451-A3474-B605**
Motherboard, with firmware: see spare parts list	x	x	x	x	x	x		1		
LC display	x	x	x	x	x		1	1		**W75025-B5001-B1**
Connector filter	x	x	x	x	x			1	F)	**W75041-E5602-K2**
Fuse, T 0.63 A/250 V	x		x	x	x	x	2	3		**W79054-L1010-T630**
Fuse, T 1 A/250 V	x	x	x	x	x	x	2	3		**W79054-L1011-T100**
Fuse, T 1.6 A/250 V		x	x				2	3		**W79054-L1011-T160**
Fuse, T 2.5 A/250 V				x	x	x	2	3	D)	**W79054-L1011-T250**

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

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

If the ULTRAMAT 6 was supplied with a specially cleaned gas path for high oxygen context ("Clean for O_2 service"), please ensure that you specify this when ordering spare parts. This is the only way to guarantee that the gas path will continue to comply with the special requirements for this version.

Overview

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

The ULTRAMAT 6 channel operates according to the NDIR two-beam alternating light principle and measures one or two gases highly selectively whose absorption bands lie in the infrared wavelength range from 2 to 9 µm, such as CO, CO_2, NO, SO_2, NH_3, H_2O as well as CH_4 and other hydrocarbons.

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

Benefits

- Corrosion-resistant materials in gas path (option)
  - Measurement possible in highly corrosive sample gases
- Sample chambers can be cleaned as required on site
  - Cost savings due to reuse after contamination
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and servicing information (option)

ULTRAMAT channel

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

OXYMAT channel

- Paramagnetic alternating pressure principle
  - Small measuring ranges (0 to 0.5 % or 99.5 to 100 % O_2)
  - Absolute linearity
- Detector element has no contact with the sample gas
  - Can be used to measure corrosive gases
  - Long service life
- Physically suppressed zero through suitable selection of reference gas (air or O_2), e.g. 98 to 100 % O_2 for purity monitoring/air separation

Application

Fields of application

- Measurement for boiler control in incineration plants
- Emission measurements in incineration plants
- Measurement in the automotive industry (test benches)
- Process gas concentrations in chemical plants
- Trace measurements in pure gas processes
- Environmental protection
- TLV (Threshold Limit Value) monitoring at places of work
- Quality monitoring

Special versions

- Special applications
  Besides the standard combinations, special applications concerning material in the gas path, material in the sample cells (e.g. Titan, Hastelloy C22) and sample components are also available on request.
- TÜV version/QAL
  TÜV-approved versions of the ULTRAMAT/OXYMAT 6 are available for measurement of CO, NO, SO_2 and O_2 according to 13th and 17th BImSchV and TA Luft.
  Smallest TÜV-approved and permitted measuring ranges:
  - 1-component analyzer
    CO: 0 to 50 mg/m^3
    NO: 0 to 100 mg/m^3
    SO_2: 0 to 75 mg/m^3
  - 2-component analyzer (series connection)
    CO: 0 to 75 mg/m^3
    NO: 0 to 200 mg/m^3

All larger measuring ranges are also approved.

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

- Flow-type reference compartment
  - The flow through the reference compartment should be adapted to the sample gas flow
  - The gas supply of the reduced flow-type reference compartment should have an upstream pressure of 3 000 to 5 000 hPa (abs.). Then a restrictor will automatically adjust the flow to approximately 8 hPa

Design

19" rack unit

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescopic rails
- Front plate can be swung down for servicing purposes (laptop connection)
- Internal gas paths: hose made of FKM (Viton) or pipe made of titanium or stainless steel
- Gas connections for sample gas inlet and outlet: pipe diameter 6 mm or 1/4"
- Flow indicator for sample gas on front plate (option)
- Sample chamber (OXYMAT channel) – with or without flow-type compensation branch – made of stainless steel (mat. no. 1.4571) or of tantalum for highly corrosive sample gases (e.g. HCl, Cl_2, SO_2, SO_3, etc.)
- Monitoring (option) of sample gas and/or reference gas (both channels)

General information

Display and control panel

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

Inputs and outputs (per channel)

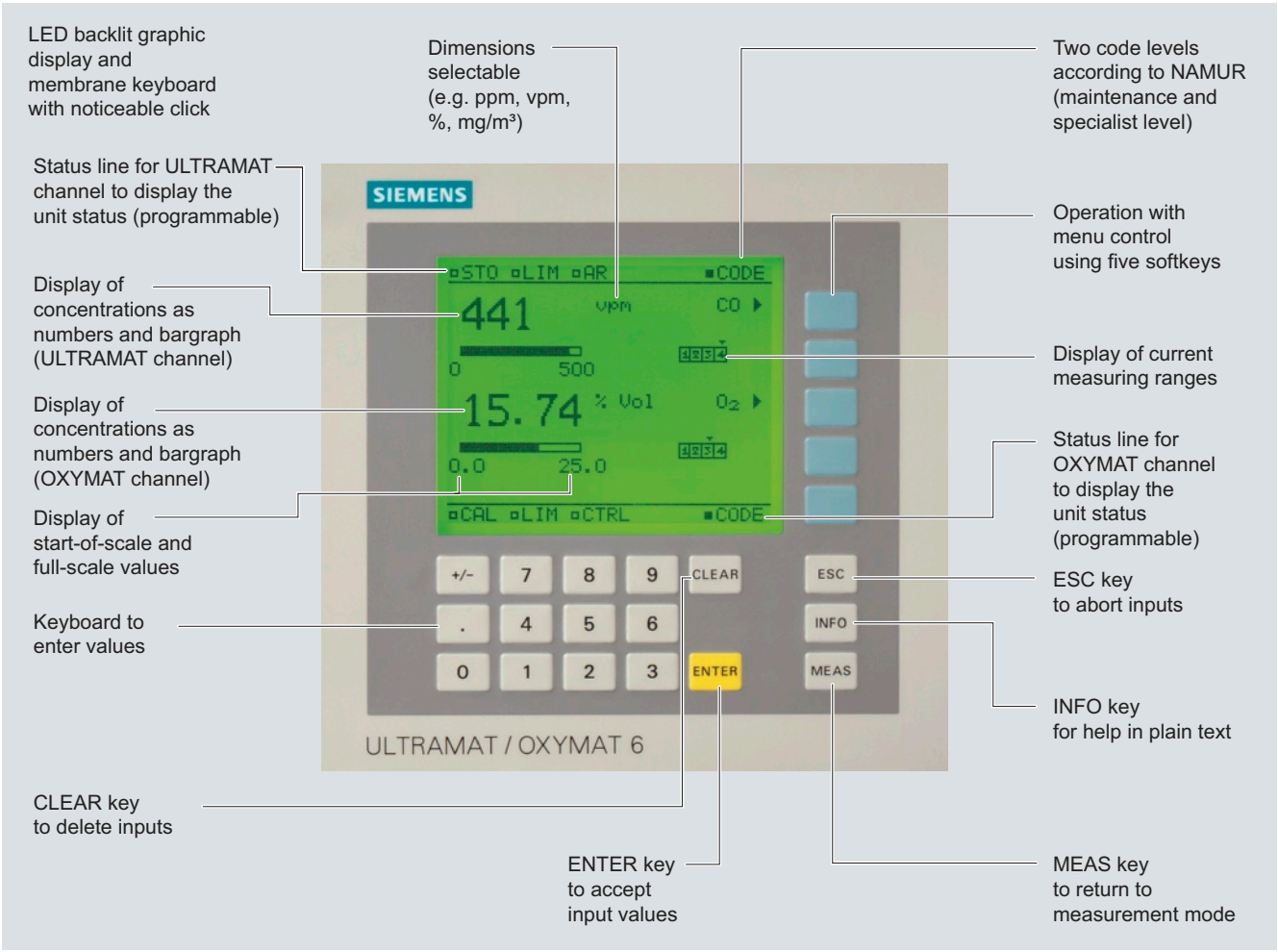
- One analog output for each measured component
- Two analog inputs freely configurable (e.g. correction of cross-interference or external pressure sensor)
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable e.g. for fault, maintenance request, limit alarm, external solenoid valves
- Expansion by eight additional binary inputs and eight additional relay outputs e.g. for autocalibration with up to four calibration gases

Communication

RS 485 present in the basic unit (connection at the rear; for the rack unit also behind the front plate).

Options

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



ULTRAMAT/OXYMAT 6, membrane keyboard and graphic display

Designs – Parts touched by sample gas, standard

Gas path ULTRAMAT channel		19" rack unit
With hoses	Bushing	Stainless steel, mat. no. 1.4571
	Hose	FKM (e.g. Viton)
	Sample chamber:	
	• Body	Aluminum
	• Lining	Aluminum
	• Fitting	Stainless steel, mat. no. 1.4571, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
	• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
With pipes	Bushing	Titanium
	Pipe	Titanium, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
	Sample chamber:	
	• Body	Aluminum
	• Lining	Tantalum (only for cell length 20 mm to 180 mm)
	• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
With pipes	Bushing	Stainless steel, mat. no. 1.4571
	Pipe	Stainless steel, mat. no. 1.4571, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
	Sample chamber:	
	• Body	Aluminum
	• Lining	Aluminum or tantalum (Ta: only for cell length 20 mm to 180 mm)
	• Window	CaF_2, adhesive: E353, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
Flow indicator	Measurement pipe	Duran glass
	Variable area	Duran glass
	Suspension boundary	PTFE (Teflon)
	Angle pieces	FKM (e.g. Viton)
Pressure switch	Membrane	FKM (e.g. Viton)
	Enclosure	PA 6.3T

Options

Gas path ULTRAMAT channel		19" rack unit
Flow indicator	Measurement pipe	Duran glass
	Variable area	Duran glass
	Suspension boundary	PTFE (Teflon)
	Angle pieces	FKM (e.g. Viton)
Pressure switch	Membrane	FKM (e.g. Viton)
	Enclosure	PA 6.3T

Versions – Parts wetted by sample gas, special applications (examples)

Gas path ULTRAMAT channel		19" rack unit
With pipes	Bushing	e.g. Hastelloy C22
	Pipe	e.g. Hastelloy C22, O-ring: FKM (e.g. Viton) or FFKM (Kalrez)
	Sample chamber:	
	• Body	e.g. Hastelloy C22
	• Window	CaF_2, without adhesive O-ring: FKM (e.g. Viton) or FFKM (Kalrez)

General information

Designs – Parts touched by sample gas, standard

Gas path OXYMAT channel		19" rack unit
With hoses	Bushing	Stainless steel, mat. no. 1.4571
	Hose	FKM (e.g. Viton)
	Sample chamber	Stainless steel, mat. no. 1.4571 or tantalum
	Fittings for sample chamber	Stainless steel, mat. no. 1.4571
	Restrictor	PTFE (e.g. Teflon)
	O-rings	FKM (e.g. Viton)
With pipes	Bushing	Titanium
	Pipe	Titanium
	Sample chamber	Stainless steel, mat. no. 1.4571 or Tantalum
	Restrictor	Titanium
	O-rings	FKM (Viton) or FFKM (Kalrez)
With pipes	Bushing	Stainless steel, mat. no. 1.4571
	Pipe	Stainless steel, mat. no. 1.4571
	Sample chamber	Stainless steel, mat. no. 1.4571 or Tantalum
	Restrictor	Stainless steel, mat. no. 1.4571
	O-rings	FKM (Viton) or FFKM (Kalrez)
With pipes	Bushing	Hastelloy C 22
	Pipe	Hastelloy C 22
	Sample chamber	Stainless steel, mat. no. 1.4571 or Tantalum
	Restrictor	Hastelloy C 22
	O-rings	FKM (e.g. Viton) or FFKM (e.g. Kalrez)

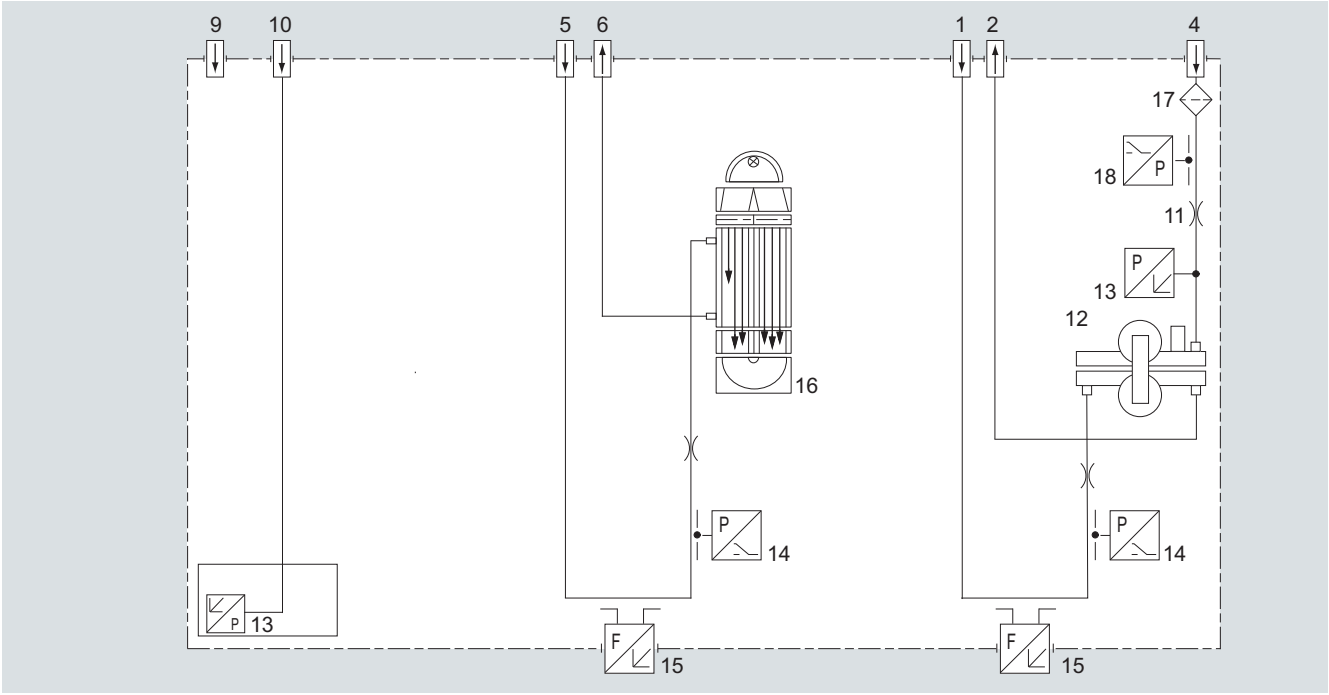
Options

Gas path ULTRAMAT channel and OXYMAT channel		19" rack unit
Flow indicator	Measurement pipe	Duran glass
	Variable area	Duran glass
	Suspension boundary	PTFE (Teflon)
	Angle pieces	FKM (e.g. Viton)
Pressure switch	Membrane	FKM (e.g. Viton)
	Enclosure	PA 6.3T

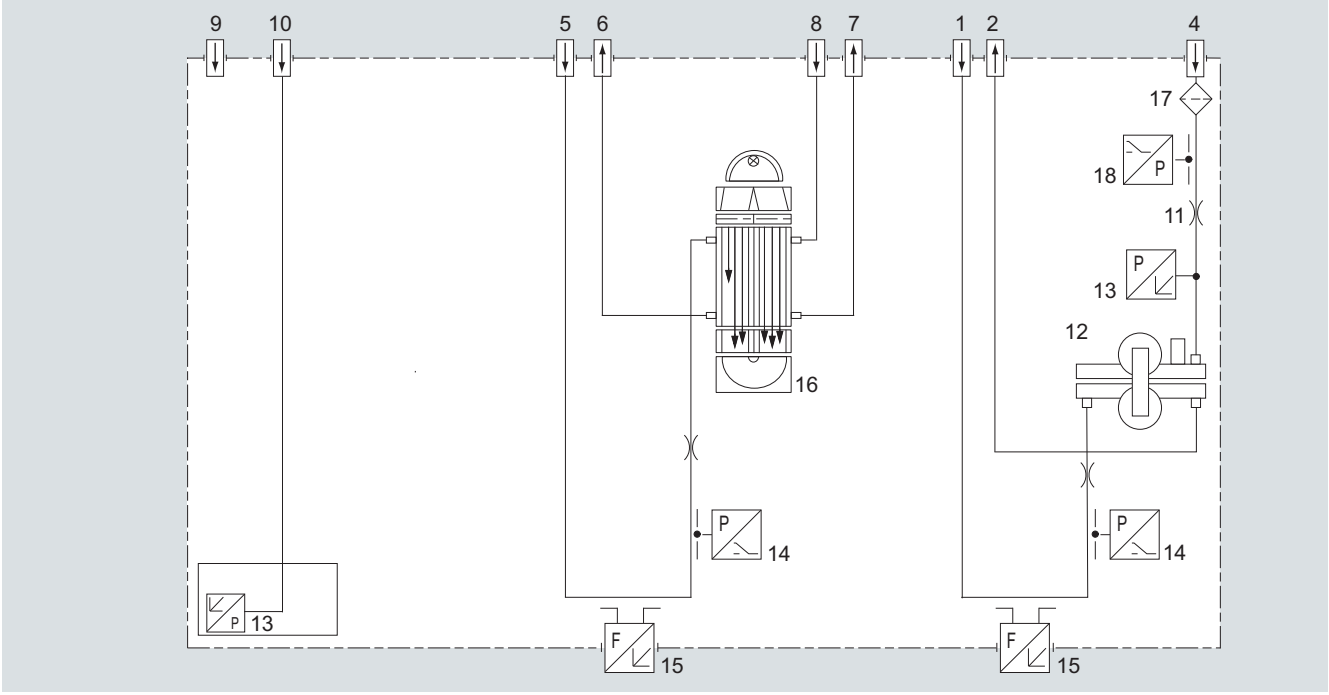
Gas path

Legend for the gas path figures

1	Sample gas inlet (OXYMAT channel)	10	Connection of pressure sensor (ULTRAMAT channel)
2	Sample gas outlet (OXYMAT channel)	11	Restrictor (in reference gas inlet)
3	Not used	12	O_2 physical system
4	Reference gas inlet	13	Pressure sensor
5	Sample gas inlet (ULTRAMAT channel)	14	Pressure switch in sample gas path (option)
6	Sample gas outlet (ULTRAMAT channel)	15	Flow indicator in sample gas path (option)
7	Reference gas outlet (ULTRAMAT channel, option)	16	IR physical system
8	Reference gas inlet (ULTRAMAT channel, option)	17	Filter
9	Purging gas	18	Pressure switch (reference gas) (option)



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



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

General information

Function

Principle of operation, ULTRAMAT channel

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

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

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

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

The reference beam passes through a reference cell (8) filled with N_2 (a non-infrared-active gas) and reaches the right-hand side of the detector (11) practically unattenuated. The sample beam passes through the sample chamber (7) through which the sample gas flows and reaches the left-hand side of the detector (10) attenuated to a lesser or greater extent depending on the concentration of the sample gas. The detector is filled with a defined concentration of the gas component to be measured.

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

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

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

The microflow sensor consists of two nickel-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.

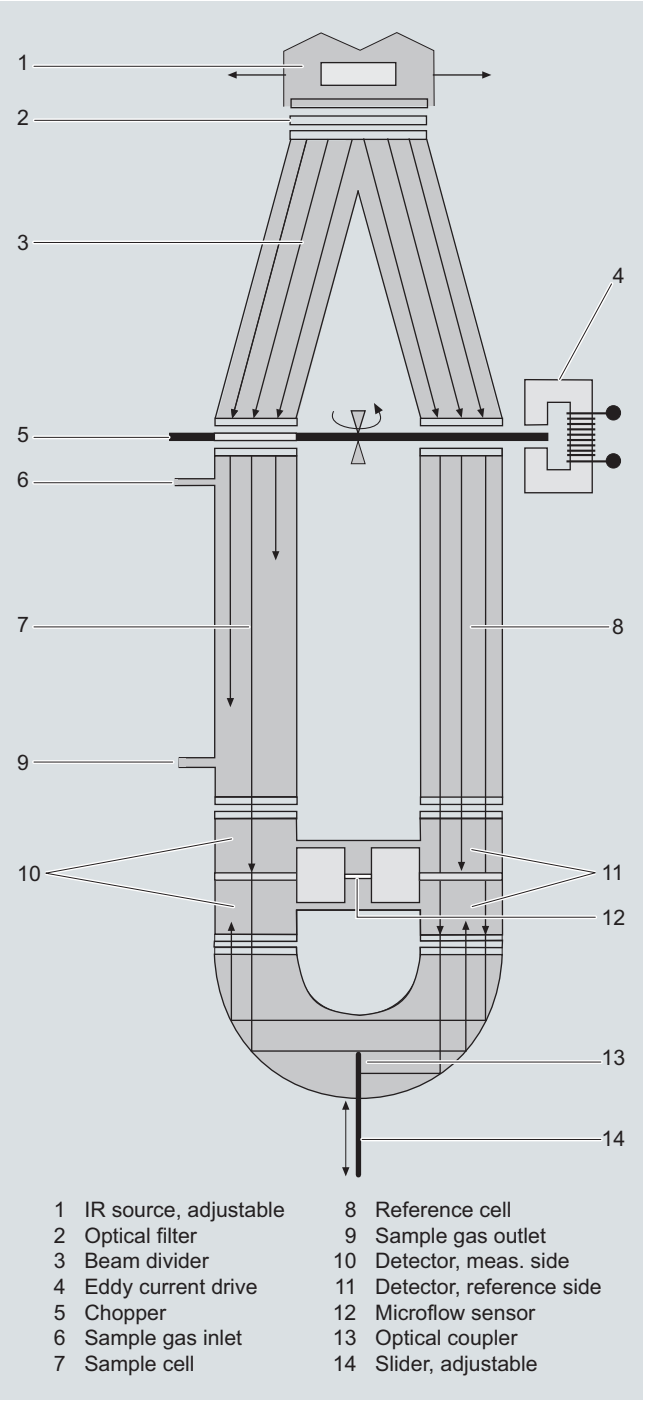
Note

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.

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

Flow-type reference sides with reduced flow and an O_2 content > 70 % may only be used together with Y02.



ULTRAMAT channel, principle of operation

Channels with electronically suppressed zero point only differ from the standard version in the measuring range parameterization.

Physically suppressed zeros can be provided as a special application.

Principle of operation, OXYMAT channel

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

Oxygen molecules in an inhomogeneous magnetic field are drawn in the direction of increased field strength due to their paramagnetism. When two gases with different oxygen contents meet in a magnetic field, a pressure difference is produced between them.

One gas (1) is a reference gas (N_2, O_2 or air), the other is the sample gas (5). The reference gas is introduced into the sample chamber (6) through two channels (3). One of these reference gas streams meets the sample gas within the area of a magnetic field (7). Because the two channels are connected, the pressure, which is proportional to the oxygen content, causes a cross flow. This flow is converted into an electric signal by a microflow sensor (4).

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 results in a change in the resistance of the Ni grids. This leads to an offset in the bridge which is dependent on the oxygen concentration of the sample gas.

Because the microflow sensor is located in the reference gas stream, the measurement is not influenced by the thermal conductivity, the specific heat or the internal friction of the sample gas. This also provides a high degree of corrosion resistance because the microflow sensor is not exposed to the direct influence of the sample gas.

By using a magnetic field with alternating strength (8), the effect of the background flow in the microflow sensor is not detected, and the measurement is thus independent of the instrument's operating position.

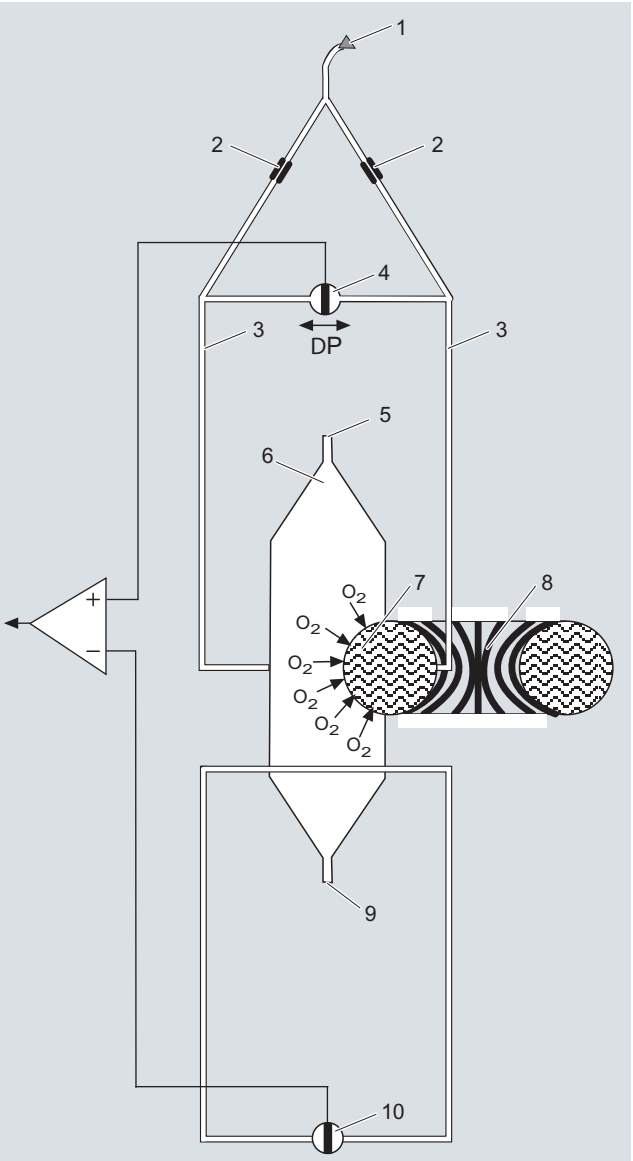
The sample chamber is directly in the sample path and has a small volume, and the microflow sensor is a low-lag sensor. This results in a very short response time.

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

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

Note

The sample gases must be fed into the analyzers free of dust. Condensation should be prevented from occurring in the sample chambers. Therefore, gas modified for the measuring tasks is necessary in most application cases.



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

OXYMAT channel, principle of operation

General information

Essential characteristics

- Dimension of measured value freely selectable (e.g. vpm, mg/m^3)
- Four freely-parameterizable measuring ranges per component
- Measuring ranges with suppressed zero point possible
- Measuring range identification
- Galvanically isolated signal output 0/2/4 to 20 mA per component
- Automatic or manual measuring range switchover selectable; remote switching is also possible
- Storage of measured values possible during adjustments
- Time constants selectable within wide limits (static/dynamic noise suppression); i.e. the response time of the analyzer or component can be matched to the respective measuring task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 6 measuring points (programmable)
- Measuring point identification
- Monitoring of sample gas flow (option)
- Two control levels with separate authorization codes to prevent unintentional and unauthorized inputs
- Automatic, parameterizable measuring range calibration
- Simple handling using a numerical membrane keyboard and operator prompting
- Operation based on NAMUR recommendation
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording

ULTRAMAT channel

- Differential measuring ranges with flow-type reference cell
- Internal pressure sensor for correction of variations in atmospheric pressure in the range 700 to 1 200 hPa absolute
- External pressure sensor - only with piping as the gas path - can be connected for correction of variations in the process gas pressure in the range 700 to 1 500 hPa absolute (option)
- Sample chambers for use in presence of highly corrosive sample gases (e.g. tantalum layer or Hastelloy C22)

OXYMAT channel

- Monitoring of sample gas and/or reference gas (option)
- Different smallest measuring ranges (0.5 %, 2.0 % or 5.0 % O_2)
- Analyzer unit with flow-type compensation circuit (option): a flow is passed through the compensation branch to reduce the vibration dependency in the case of highly different densities of the sample and reference gases
- Internal pressure sensor for correction of pressure variations in sample gas (range 500 to 2 000 hPa absolute)
- External pressure sensor - only with piping as the gas path - can be connected for correction of variations in the sample gas pressure up to 3 000 hPa absolute (option)
- Monitoring of reference gas with reference gas connection 3 000 to 5 000 hPa (option), absolute
- Sample chamber for use in presence of highly corrosive sample gases

Reference gases

Measuring range	Recommended reference gas	Reference gas connection pressure	Remarks
0 to ... vol.% O_2	N_2	2 000 … 4 000 hPa above sample gas pressure (max. 5 000 hPa absolute)	The reference gas flow is set automatically to 5 … 10 ml/min (up to 20 ml/min with flow-type compensation branch)
... to 100 vol.% O_2 (suppressed zero point with full-scale value 100 vol.% O_2)	O_2		
Around 21 vol.% O_2 (suppressed zero point with 21 vol.% O_2 within the measuring span)	Air	100 hPa with respect to sample gas pressure which may vary by max. 50 hPa around the atmospheric pressure	

Table 1: Reference gases for OXYMAT channel

Correction of zero error / cross-sensitivities (OXYMAT channel)

Accompanying gas (concentration 100 vol.%)	Deviation from zero point in vol.% O_2 absolute	Accompanying gas (concentration 100 vol.%)	Deviation from zero point in vol.% O_2 absolute
Organic gases		**Inert gases**	
Ethane C_2H_6	-0.49	Helium He	+0.33
Ethene (ethylene) C_2H_4	-0.22	Neon Ne	+0.17
Ethine (acetylene) C_2H_2	-0.29	Argon Ar	-0.25
1.2 butadiene C_4H_6	-0.65	Krypton Kr	-0.55
1.3 butadiene C_4H_6	-0.49	Xenon Xe	-1.05
n-butane C_4H_{10}	-1.26		
iso-butane C_4H_{10}	-1.30	**Inorganic gases**	
1-butene C_4H_8	-0.96	Ammonia NH_3	-0.20
iso-butene C_4H_8	-1.06	Hydrogen bromide HBr	-0.76
Dichlorodifluoromethane (R12) CCl_2F_2	-1.32	Chlorine Cl_2	-0.94
Acetic acid CH_3COOH	-0.64	Hydrogen chloride HCl	-0.35
n-heptane C_7H_{16}	-2.40	Dinitrogen monoxide N_2O	-0.23
n-hexane C_6H_{14}	-2.02	Hydrogen fluoride HF	+0.10
Cyclo-hexane C_6H_{12}	-1.84	Hydrogen iodide HI	-1.19
Methane CH_4	-0.18	Carbon dioxide CO_2	-0.30
Methanol CH_3OH	-0.31	Carbon monoxide CO	+0.07
n-octane C_8H_{18}	-2.78	Nitrogen oxide NO	+42.94
n-pentane C_5H_{12}	-1.68	Nitrogen N_2	0.00
iso-pentane C_5H_{12}	-1.49	Nitrogen dioxide NO_2	+20.00
Propane C_3H_8	-0.87	Sulfur dioxide SO_2	-0.20
Propylene C_3H_6	-0.64	Sulfur hexafluoride SF_6	-1.05
Trichlorofluoromethane (R11) CCl_3F	-1.63	Hydrogen sulfide H_2S	-0.44
Vinyl chloride C_2H_3Cl	-0.77	Water H_2O	-0.03
Vinyl fluoride C_2H_3F	-0.55	Hydrogen H_2	+0.26
1.1 vinylidene chloride $C_2H_2Cl_2$	-1.22		

Table 2: Zero point error due to diamagnetism or paramagnetism of some accompanying gases with reference to nitrogen at 60 °C und 1 000 hPa absolute (according to IEC 1207/3)

Conversion to other temperatures:

The deviations from the zero point listed in Table 2 must be multiplied by a correction factor (k):

- with diamagnetic gases: $k = 333\ K / (\vartheta\ [°C] + 273\ K)$
- with paramagnetic gases: $k = [333\ K / (\vartheta\ [°C] + 273\ K)]^2$

(all diamagnetic gases have a negative deviation from zero point)

19" rack unit

Technical specifications

ULTRAMAT/OXYMAT 6, 19" rack unit	
General information	
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2
Design, enclosure	
Weight	Approx. 21 kg
Degree of protection	IP20 according to EN 60529
Electrical characteristics	
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	According to EN 61010-1, overvoltage category III
Power supply	100 ... 120 V AC (nominal range of use 90 ... 132 V), 48 ... 63 Hz or 200 ... 240 V AC (nominal range of use 180 ... 264 V), 48 ... 63 Hz
Power consumption	Approx. 70 VA
Fuse values	120 ... 120 V: F1/F2 = T 1.6 A 200 ... 240 V: F1/F2 = T 1 A
Electrical inputs and outputs (per channel)	
Analog output	0/2/4 ... 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated, non-sparking
Analog inputs	2, dimensioned for 0/2/4 … 20 mA for external pressure sensor and correction of influence of accompanying gas (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function each with 8 additional binary inputs and relay outputs, also with PROFIBUS PA or PROFIBUS DP
Climatic conditions	
Permissible ambient temperature	-30 ... +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity	< 90 % relative humidity, during storage and transportation (dew point must not be undershot)

Technical data, ULTRAMAT channel	
Measuring ranges	4, internally and externally switchable; autoranging is also possible
Smallest possible measuring range	Dependent on the application, e.g. CO: 0 ... 10 vpm CO_2: 0 ... 5 vpm
Largest possible measuring range	Dependent on the application
Measuring ranges with suppressed zero point	Any zero point within 0 ... 100 vol.% can be implemented; smallest possible span 20 %
Characteristic	Linearized
Influence of interfering gases must be considered separately	
Gas inlet conditions	
Permissible sample gas pressure	
• Without pressure switch	700 ... 1 500 hPa (absolute)
• With integrated pressure switch	700 ... 1 300 hPa (absolute)
Sample gas flow	18 ... 90 l/h (0.3 ... 1.5 l/min)
Sample gas temperature	Min. 0 to max. 50 °C, but above the dew point
Sample gas humidity	< 90 % (relative humidity), or dependent on measuring task, non-condensing
Dynamic response	
Warm-up period	At room temperature < 30 min (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)	0 ... 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approx. 0.5 ... 5 s, depending on version
Time for device-internal signal processing	< 1 s
Pressure correction range	
Pressure sensor	
• Internal	700 ... 1 200 hPa absolute
• External	700 ... 1 500 hPa absolute
Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Output signal fluctuation	< ± 1 % of the smallest possible measuring range according to rating plate
Zero point drift	<± 1 % of the current measuring range/week
Measured-value drift	<± 1 % of the current measuring range/week
Repeatability	≤ 1 % of the current measuring range
Detection limit	1 % of the smallest possible measuring range
Linearity error	< 0.5 % of the full-scale value

Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	< 1 % of current measuring range/10 K (with constant receiver cell temperature)
Sample gas pressure	• When pressure compensation has been switched on: < 0.15 % of the span/1 % change in atmospheric pressure • When pressure compensation has been switched off: < 1.5 % of the span/1 % change in atmospheric pressure
Sample gas flow	Negligible
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %
Environmental conditions	Application-specific measuring influences possible if ambient air contains measured component or cross interference-sensitive gases

Technical data, OXYMAT channel	
Measuring ranges	4, internally and externally switchable; automatic measuring range switchover also possible
Smallest possible span (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	0.5 vol.%, 2 vol.% or 5 vol.% O_2
Largest possible measuring range	100 vol.% O_2
Measuring ranges with suppressed zero point	Any zero point within 0 ... 100 vol.% can be implemented, provided that a suitable reference gas is used
Gas inlet conditions	
Permissible sample gas pressure	
• With pipes	500 ... 3 000 hPa absolute
• With hoses	
- Without pressure switch	500 ... 1 500 hPa absolute
- With pressure switch	500 ... 1 300 hPa absolute
Sample gas flow	18 ... 60 l/h (0.3 ... 1 l/min)
Sample gas temperature	0 ... 50 °C
Sample gas humidity	< 90 % RH (relative humidity)
Reference gas pressure (high-pressure version)	2 000 ... 4 000 hPa above sample gas pressure, but max. 5 000 hPa
Reference gas pressure (low-pressure version)	Min. 100 hPa above sample gas pressure
Dynamic response	
Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Delayed display (T_{90} time)	Min. 1.5 ... 3.5 s, depending on version
Damping (electrical time constant)	0 ... 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approx. 0.5 ... 2.5 s, depending on version
Time for device-internal signal processing	< 1 s

Pressure correction range	
Pressure sensor	
• Internal	500 ... 2 000 hPa absolute
• External	500 ... 3 000 hPa absolute

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Output signal fluctuation	< 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (corresponds to ± 0.25 % at 2σ)
Zero point drift	< 0.5 %/month of the smallest possible measuring span according to rating plate
Measured-value drift	≤ 0.5 %/month of the current measuring range
Repeatability	≤ 1 %/month of the current measuring range
Detection limit	1 % of the current measuring range
Linearity error	1 % of the current measuring range

Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	• < 0.5 %/10 K referred to smallest possible span according to rating plate • With measuring span 0.5 %: 1 %/10 K
Sample gas pressure (with air (100 hPa) as reference gas, correction of the atmospheric pressure fluctuations is only possible if the sample gas can vent to ambient air)	• When pressure compensation has been switched off: < 2 % of the current measuring range/1 % atmospheric pressure change • When pressure compensation has been switched on: < 0.2 % of the current measuring range/1 % atmospheric pressure change
Accompanying gases	Deviation from zero point corresponding to paramagnetic or diamagnetic deviation of accompanying gas
Sample gas flow	< 1 % of the smallest possible span according to rating plate with a change in flow of 0.1 l/min within the permissible flow range
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %

19" rack unit

Selection and ordering data		Order No.	Cannot be combined
ULTRAMAT/OXYMAT 6 gas analyzer 19" rack unit for installation in cabinets Combined measurement of IR-absorbing gas and O_2	D)	**7MB2023-** ■■■■■- ■■■■	
Gas connections for sample gas and reference gas			
Pipe with 6 mm outer diameter		**0**	**0 → A21**
Pipe with ¼" outer diameter		**1**	**1 → A20**
Smallest possible span O_2			
0.5 % reference gas pressure 3 000 hPa		**A**	
0.5 % reference gas pressure 100 hPa (external pump)		**B**	**B B → A26, Y02**
2 % reference gas pressure 3 000 hPa		**C**	
2 % reference gas pressure 100 hPa (external pump)		**D**	**D D → A26, Y02**
5 % reference gas pressure 3 000 hPa		**E**	
5 % reference gas pressure 100 hPa (external pump)		**F**	**F F → A26, Y02**
Sample chamber (OXYMAT channel)			
Non-flow-type compensation branch			
• Made of stainless steel, mat. no. 1.4571		**A**	
• Made of tantalum		**B**	
Flow-type compensation branch			
• Made of stainless steel, mat. no. 1.4571		**C**	**C**
• Made of tantalum		**D**	**D**

Internal gas paths (both channels)	Sample chamber[1] (lining) (ULTRAMAT channel)	Reference chamber (flow-type) (ULTRAMAT channel)		
Hose made of FKM (Viton)	Aluminum	Non-flow-type	**0**	**0 0 → A20, A21**
	Aluminum	Flow-type	**1**	**1**
Pipe made of titanium	Tantalum	Non-flow-type	**4**	**4 → A20, A21, Y02**
	Tantalum	Flow-type	**5**	**5 → Y02**
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type	**6**	**6 → A20, A21**
	Tantalum	Non-flow-type	**8**	**8 → A20, A21**
With sample gas monitoring (both channels)				
Hose made of FKM (Viton)	Aluminum	Non-flow-type	**2**	**2 2 → A20, A21**
	Aluminum	Flow-type	**3**	**3**

Add-on electronics		
Without	**0**	
AUTOCAL function		
• With 8 additional binary inputs and outputs for OXYMAT channel	**1**	
• With 8 additional binary inputs and outputs for ULTRAMAT channel	**2**	
• With 8 additional binary inputs and 8 additional binary outputs for ULTRAMAT channel and OXYMAT channel	**3**	
• With serial interface for the automotive industry (AK)	**5**	**5 → Y02**
• With 8 additional binary inputs/outputs and PROFIBUS PA interface for ULTRAMAT channel and OXYMAT channel	**6**	
• With 8 additional binary inputs/outputs and PROFIBUS DP interface for ULTRAMAT channel and OXYMAT channel	**7**	
Power supply		
100 ... 120 V AC, 48 ... 63 Hz	**0**	
200 ... 240 V AC, 48 ... 63 Hz	**1**	

Footnotes, see next page

Selection and ordering data			Order No.		
ULTRAMAT/OXYMAT 6 gas analyzer 19" rack unit for installation in cabinets Combined measurement of IR-absorbing gas and O_2			D) **7MB2023-** ■■■■■ **-** ■■■■		Cannot be combined
ULTRAMAT channel Measured component		Possible with measuring range identification			
CO		11[2], 12 ... 30		**A**	
CO highly selective (with optical filter)		12[2], 13 ... 30		**B**	
CO (TÜV; see Table "TÜV, single component (IR channel)", page 2/88)				**X**	
CO_2		10[2], 11 ... 30		**C**	
CH_4		13[2], 14 ... 30		**D**	
C_2H_2		15[2], 16 ... 30		**E**	
C_2H_4		15[2], 16 ... 30		**F**	
C_2H_6		14[2], 15 ... 30		**G**	
C_3H_6		14[2], 15 ... 30		**H**	
C_3H_8		13[2], 14 ... 30		**J**	
C_4H_6		15[2], 16 ... 30		**K**	
C_4H_{10}		14[2], 15 ... 30		**L**	
C_6H_{14}		14[2], 15 ... 30		**M**	
SO_2 (TÜV; see Table "TÜV, single component (IR channel)", page 2/88)		13[2], 14 ... 30		**N**	
NO (TÜV; see Table "TÜV, single component (IR channel)", page 2/88)		14[2], 15 ... 20, 22		**P**	
NH_3 (dry)		14[2], 15 ... 30		**Q**	**Q**
H_2O		17[2], 18 ... 20, 22		**R**	**R**
N_2O		13[2], 14 ... 30		**S**	
Smallest measuring range	Largest measuring range	Measuring range identification			
0 ... 5 vpm	0 ... 100 vpm	10		**A**	
0 ... 10 vpm	0 ... 200 vpm	11		**B**	
0 ... 20 vpm	0 ... 400 vpm	12		**C**	
0 ... 50 vpm	0 ... 1 000 vpm	13		**D**	
0 ... 100 vpm	0 ... 1 000 vpm	14		**E**	
0 ... 300 vpm	0 ... 3 000 vpm	15		**F**	
0 ... 500 vpm	0 ... 5 000 vpm	16		**G**	
0 ... 1 000 vpm	0 ... 10 000 vpm	17		**H**	
0 ... 3 000 vpm	0 ... 10 000 vpm	18		**J**	
0 ... 3 000 vpm	0 ... 30 000 vpm	19		**K**	
0 ... 5 000 vpm	0 ... 15 000 vpm	20		**L**	
0 ... 5 000 vpm	0 ... 50 000 vpm	21		**M**	
0 ... 1 %	0 ... 3 %	22		**N**	
0 ... 1 %	0 ... 10 %	23		**P**	
0 ... 3 %	0 ... 10 %	24		**Q**	
0 ... 3 %	0 ... 30 %	25		**R**	
0 ... 5 %	0 ... 15 %	26		**S**	
0 ... 5 %	0 ... 50 %	27		**T**	
0 ... 10 %	0 ... 30 %	28		**U**	
0 ... 10 %	0 ... 100 %	29		**V**	
0 ... 30 %	0 ... 100 %	30		**W**	
Operating software and documentation					
German					**0**
English					**1**
French					**2**
Spanish					**3**
Italian					**4**

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

1) Only for cell length 20 to 180 mm

2) Can be ordered as special application (no. 3100 with order code Y12)

19" rack unit

Selection and ordering data

Additional versions	Order code	Cannot be combined
Add "-Z" to Order No. and specify order codes.		
Flow-type reference cell with reduced flow, 6 mm (ULTRAMAT channel)[1]	**A20**	
Flow-type reference cell with reduced flow, ¼" (ULTRAMAT channel)[1]	**A21**	
Reference gas monitoring (pressure switch ... 3 000 hPa), for OXYMAT channel only	**A26**	
Connection pipes (can only be combined with the appropriate gas connection diameter and internal gas path materials)		
• Titanium connection pipe, 6 mm, complete with screwed gland, for sample gas side	**A22**	
• Titanium connection pipe, ¼", complete with screwed gland, for sample gas side	**A24**	
• Stainless steel connection pipe (mat. no. 1.4571), 6 mm, complete with screwed gland, for sample gas side	**A27**	
• Stainless steel connection pipe (mat. no. 1.4571), ¼", complete with screwed gland, for sample gas side	**A29**	
Telescopic rails (2 units)	**A31**	
Set of Torx screwdrivers	**A32**	
Kalrez gaskets in sample gas path (O_2 side)	**B01**	
TAG labels (specific inscription based on customer information)	**B03**	
Kalrez gaskets in sample gas path (IR side)	**B04**	
FM/CSA certificate – Class I Div 2	**E20**	
Clean for O_2 service (specially cleaned gas path) (ULTRAMAT channel and OXYMAT channel)	**Y02**	
Measuring range indication in plain text[2], if different from the standard setting	**Y11**	
Special setting (only in conjunction with an application no., e.g. extended measuring range, only ULTRAMAT channel)	**Y12**	
Extended special setting (only in conjunction with an application no., e.g. determination of interference influences, only ULTRAMAT channel)	**Y13**	
TÜV version acc. to 13th and 17th BImSchV (only ULTRAMAT channel)	**Y17**	**E20**

Retrofitting sets	Order No.
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with serial interfaces for the automotive industry (AK)	**C79451-A3480-D33**
AUTOCAL function with 8 binary inputs/outputs for ULTRAMAT channel or OXYMAT channel	**C79451-A3480-D511**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA for ULTRAMAT channel or OXYMAT channel	**A5E00057307**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP for ULTRAMAT channel or OXYMAT channel	**A5E00057312**

[1] Cannot be combined with non-flow-type reference cell.

[2] Standard setting: Smallest measuring range, 25 % of largest measuring range, 50 % of largest measuring range, Largest measuring range } in % or ppm (vpm)

Selection and ordering data			Order No.	Cannot be combined
ULTRAMAT/OXYMAT 6 gas analyzer 19" rack unit for installation in cabinets Combined measurement of IR-absorbing gas and O_2			**7MB2024-** ▢▢▢▢▢ - ▢▢▢▢	
Gas connections for sample gas and reference gas				
Pipe with 6 mm outer diameter			**0**	**0 → A21**
Pipe with ¼" outer diameter			**1**	**1 → A20**
Smallest possible span O_2				
0.5 % reference gas pressure 3 000 hPa			**A**	
0.5 % reference gas pressure 100 hPa (external pump)			**B**	**B B → A26, Y02**
2 % reference gas pressure 3 000 hPa			**C**	
2 % reference gas pressure 100 hPa (external pump)			**D**	**D D → A26, Y02**
5 % reference gas pressure 3 000 hPa			**E**	
5 % reference gas pressure 100 hPa (external pump)			**F**	**F F → A26, Y02**
Sample chamber (OXYMAT channel)				
Non-flow-type compensation branch				
• Made of stainless steel, mat. no. 1.4571			**A**	
• Made of tantalum			**B**	
Flow-type compensation branch				
- Made of stainless steel, mat. no. 1.4571			**C**	**C**
- Made of tantalum			**D**	**D**
Internal gas paths (both channels)	Sample chamber[1] (lining) (ULTRAMAT channel)	Reference chamber (flow-type) (ULTRAMAT channel)		
Hose made of FKM (Viton)	Aluminum	Non-flow-type	**0**	**0 → A20, A21**
	Aluminum	Flow-type	**1**	
Pipe made of titanium	Tantalum	Non-flow-type	**4**	**4 → A20, A21, Y02**
	Tantalum	Flow-type	**5**	**5 → Y02**
Stainless steel pipe (mat. no. 1.4571)	Aluminum	Non-flow-type	**6**	**6 → A20, A21**
	Tantalum	Non-flow-type	**8**	**8 → A20, A21**
With sample gas monitoring (both channels)				
Hose made of FKM (Viton)	Aluminum	Non-flow-type	**2**	**2 → A20, A21**
	Aluminum	Flow-type	**3**	
Add-on electronics				
Without			**0**	
AUTOCAL function				
• With 8 additional binary inputs and outputs for ULTRAMAT channel and OXYMAT channel			**1**	
• With serial interface for the automotive industry (AK)			**5**	**5 → Y02**
• With 8 additional binary inputs/outputs and PROFIBUS PA interface for ULTRAMAT channel and OXYMAT channel			**6**	
• With 8 additional binary inputs/outputs and PROFIBUS DP interface for ULTRAMAT channel and OXYMAT channel			**7**	
Power supply				
100 ... 120 V AC, 48 ... 63 Hz			**0**	
200 ... 240 V AC, 48 ... 63 Hz			**1**	

Footnote, see next page

19" rack unit

Selection and ordering data				Order No.	
ULTRAMAT/OXYMAT 6 gas analyzer 19" rack unit for installation in cabinets Combined measurement of IR-absorbing gas and O_2				**7MB2024-** ■■■■■ - ■■■■	Cannot be combined
ULTRAMAT channel Measured component		Smallest measuring range	Largest measuring range		
CO/NO	CO	0 ... 100 vpm	0 ... 1 000 vpm	**A H**	
	NO	0 ... 300 vpm	0 ... 1 000 vpm		
CO/NO	CO	0 ... 300 vpm	0 ... 3 000 vpm	**A J**	
	NO	0 ... 500 vpm	0 ... 3 000 vpm		
CO/NO	CO	0 ... 1 000 vpm	0 ... 10 000 vpm	**A C**	
	NO	0 ... 1 000 vpm	0 ... 10 000 vpm		
For CO/NO (TÜV; see Table "TÜV, two components in series", page 2/88)					
CO_2/CO	CO_2	0 ... 100 vpm	0 ... 1 000 vpm	**B A**	
	CO	0 ... 100 vpm	0 ... 1 000 vpm		
CO_2/CO	CO_2	0 ... 300 vpm	0 ... 3 000 vpm	**B B**	
	CO	0 ... 300 vpm	0 ... 3 000 vpm		
CO_2/CO	CO_2	0 ... 1 000 vpm	0 ... 10 000 vpm	**B C**	
	CO	0 ... 1 000 vpm	0 ... 10 000 vpm		
CO_2/CO	CO_2	0 ... 3 000 vpm	0 ... 30 000 vpm	**B D**	
	CO	0 ... 3 000 vpm	0 ... 30 000 vpm		
CO_2/CO	CO_2	0 ... 1 %	0 ... 10 %	**B E**	
	CO	0 ... 1 %	0 ... 10 %		
CO_2/CO	CO_2	0 ... 3 %	0 ... 30 %	**B F**	
	CO	0 ... 3 %	0 ... 30 %		
CO_2/CO	CO_2	0 ... 10 %	0 ... 100 %	**B G**	
	CO	0 ... 10 %	0 ... 100 %		
CO_2/CH_4	CO_2	0 ... 10 %	0 ... 100 %	**C G**	
	CH_4	0 ... 10 %	0 ... 100 %		
CO_2/NO	CO_2	0 ... 300 vpm	0 ... 3 000 vpm	**D J**	
	NO	0 ... 500 vpm	0 ... 3 000 vpm		
Operating software and documentation					
German					**0**
English					**1**
French					**2**
Spanish					**3**
Italian					**4**

1) Only for cell length 20 to 180 mm

Selection and ordering data

Additional versions	**Order code**	Cannot be combined
Add "-Z" to Order No. and specify order codes.		
Flow-type reference cell with reduced flow, 6 mm (ULTRAMAT channel)[1]	**A20**	
Flow-type reference cell with reduced flow, ¼" (ULTRAMAT channel)[1]	**A21**	
Reference gas monitoring (pressure switch ... 3 000 hPa), for OXYMAT channel only	**A26**	
Connection pipes (can only be combined with the appropriate gas connection diameter and internal gas path materials)		
• Titanium connection pipe, 6 mm, complete with screwed gland, for sample gas side	**A22**	
• Titanium connection pipe, ¼", complete with screwed gland, for sample gas side	**A24**	
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Telescopic rails (2 units)	**A31**	
Set of Torx screwdrivers	**A32**	
Kalrez gaskets in sample gas path (O_2 side)	**B01**	
TAG labels (specific inscription based on customer information)	**B03**	
Kalrez gaskets in sample gas path (IR side)	**B04**	
FM/CSA certificate – Class I Div 2	**E20**	
Clean for O_2 service (specially cleaned gas path) (ULTRAMAT channel and OXYMAT channel)	**Y02**	
Measuring range indication in plain text[2], if different from the standard setting	**Y11**	
Special setting (only in conjunction with an application no., e.g. extended measuring range, only ULTRAMAT channel)	**Y12**	
Extended special setting (only in conjunction with an application no., e.g. determination of interference influences, only ULTRAMAT channel)	**Y13**	
TÜV version acc. to 13th and 17th BImSchV (only ULTRAMAT channel)	**Y17**	→ **E20**

Retrofitting sets	**Order No.**
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with serial interfaces for the automotive industry (AK)	**C79451-A3480-D33**
AUTOCAL function with 8 binary inputs/outputs for ULTRAMAT channel or OXYMAT channel	**C79451-A3480-D511**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA for ULTRAMAT channel or OXYMAT channel	**A5E00057307**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP for ULTRAMAT channel or OXYMAT channel	**A5E00057312**

[1] Cannot be combined with non-flow-type reference cell.

[2] Standard setting: Smallest measuring range, 25 % of largest measuring range, 50 % of largest measuring range, Largest measuring range } in % or ppm (vpm)

19" rack unit

TÜV, single component (IR channel)

Component	CO (TÜV)		SO_2 (TÜV)		NO (TÜV)	
Measuring range identification	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**
C			75 mg/m³	1 500 mg/m³		
D	50 mg/m³	1 000 mg/m³	300 mg/m³	3 000 mg/m³		
E			500 mg/m³	5 000 mg/m³	100 mg/m³	2 000 mg/m³
F	300 mg/m³	3 000 mg/m³	1 000 mg/m³	10 000 mg/m³	300 mg/m³	3 000 mg/m³
G	500 mg/m³	5 000 mg/m³			500 mg/m³	5 000 mg/m³
H	1 000 mg/m³	10 000 mg/m³	3 000 mg/m³	30 000 mg/m³	1 000 mg/m³	10 000 mg/m³
K	3 000 mg/m³	30 000 mg/m³	10 g/m³	100 g/m³	3 000 mg/m³	30 000 mg/m³
P	10 g/m³	100 g/m³	30 g/m³	300 g/m³	10 g/m³	100 g/m³
R	30 g/m³	300 g/m³	100 g/m³	1 000 g/m³	30 g/m³	300 g/m³
V	100 g/m³	1 160 g/m³	300 g/m³	2 630 g/m³	100 g/m³	1 250 g/m³

Example for ordering

ULTRAMAT/OXYMAT 6, TÜV
IR channel
Component: CO
Measuring range: 0 to 50 / 1 000 mg/m³
with hoses, non-flow-type reference compartment
without automatic adjustment (AUTOCAL)
230 V AC; German
7MB2023-0EA00-1XD0-Z +Y17

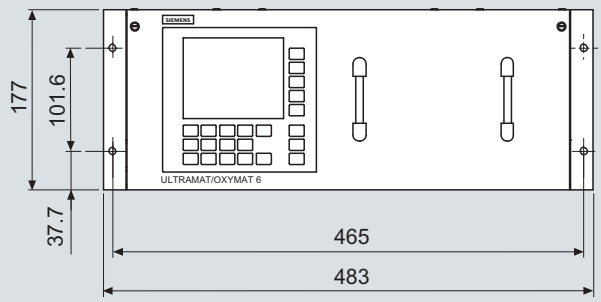
TÜV, two components in series

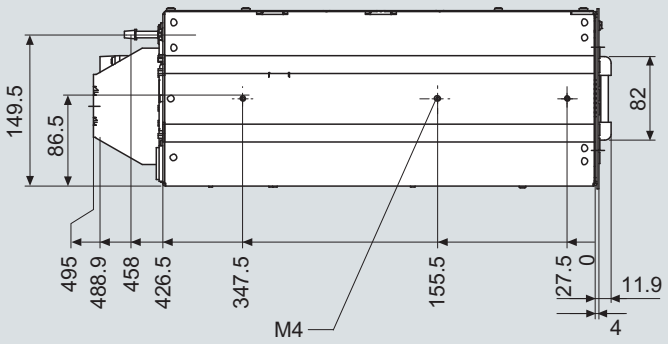
Component	CO (TÜV)		NO (TÜV)	
Measuring range identification	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**	**Smallest measuring range from 0 to ...**	**Largest measuring range from 0 to ...**
AH	75 mg/m³	1 000 mg/m³	200 mg/m³	2 000 mg/m³
AJ	300 mg/m³	3 000 mg/m³	500 mg/m³	3 000 mg/m³
AC	1 000 mg/m³	10 000 mg/m³	1 000 mg/m³	10 000 mg/m³

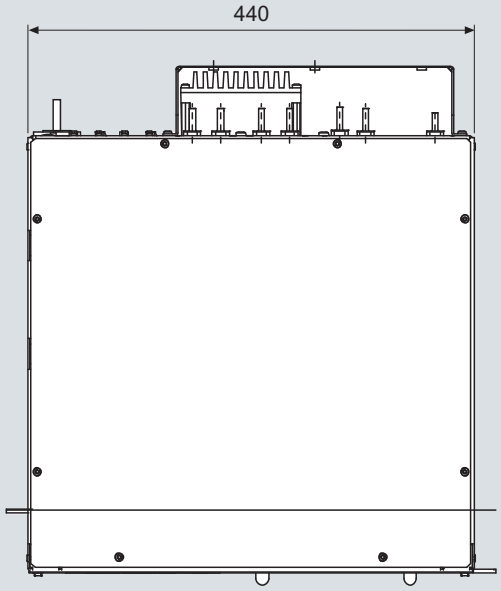
Example for ordering

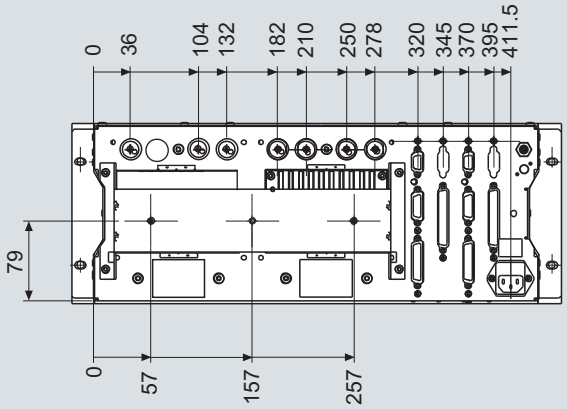
ULTRAMAT/OXYMAT 6, TÜV
IR channel
Components: CO/NO
Measuring range CO: 0 to 75 / 1 000 mg/m³, NO: 0 to 200 / 2 000 mg/m³
with hoses, non-flow-type reference cell
without automatic adjustment (AUTOCAL)
230 V AC; German
7MB2024-0EA00-1AH0-Z +Y17

Dimensional drawings







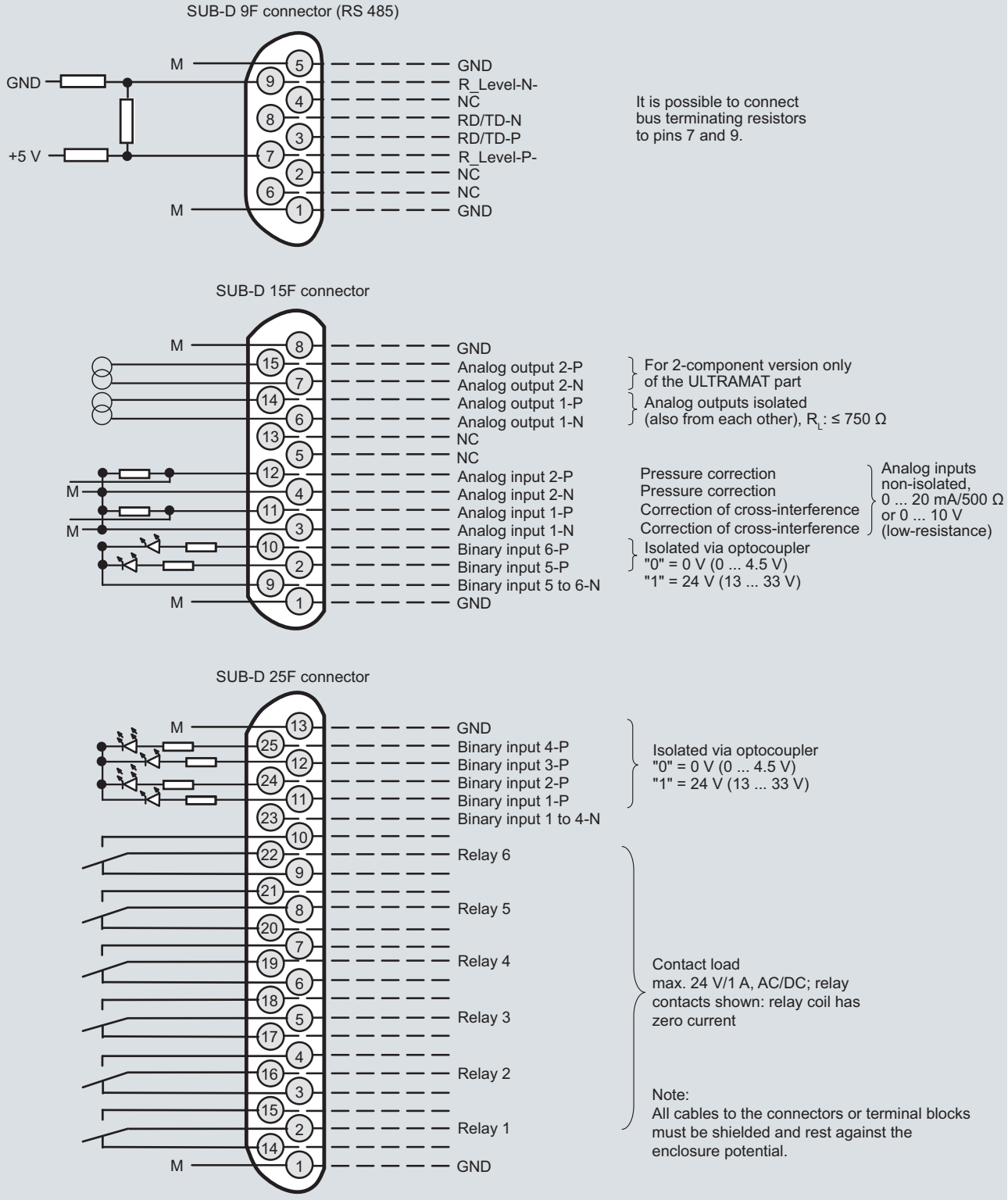


ULTRAMAT/OXYMAT 6, 19“ unit, dimensions in mm

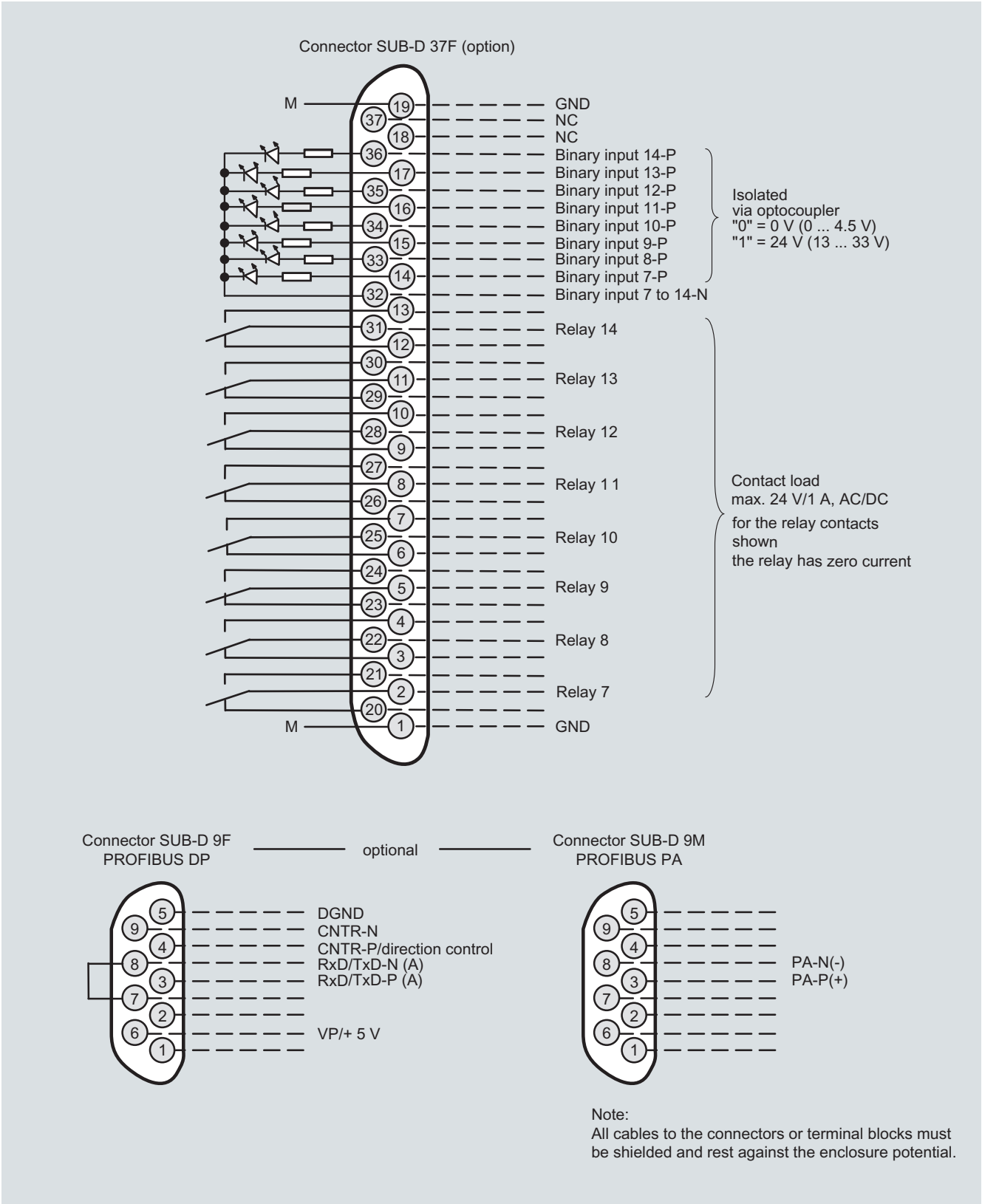
19" rack unit

Schematics

Pin assignment (electrical and gas connections)

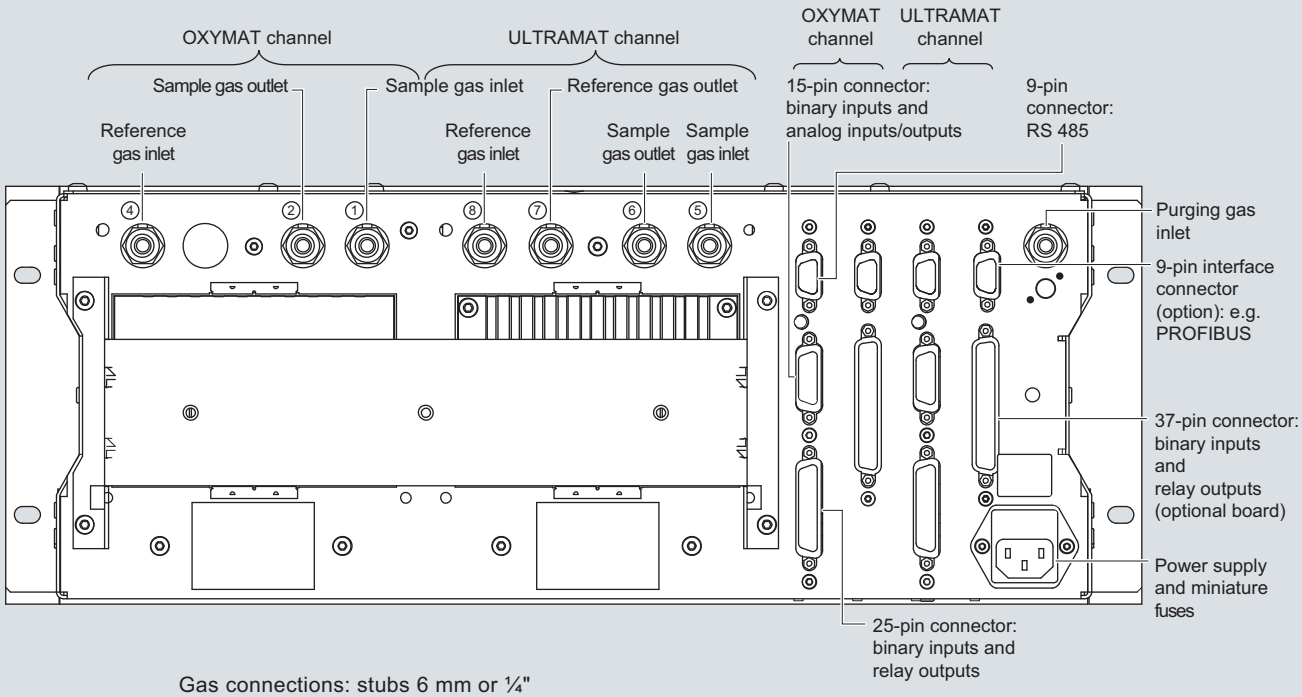


ULTRAMAT/OXYMAT 6, 19“ unit, pin assignment



ULTRAMAT/OXYMAT 6, 19“ unit, pin assignment of AUTOCAL board and PROFIBUS connectors

19" rack unit



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

Documentation

Selection and ordering data

Operating instructions	Order No.
ULTRAMAT 6 / OXYMAT 6	
Gas analyzer for IR-absorbing gases and oxygen	
• German	**C79000-G5200-C143**
• English	**C79000-G5276-C143**
• French	**C79000-G5277-C143**
• Spanish	**C79000-G5278-C143**
• Italian	**C79000-G5272-C143**

Selection and ordering data

Description	7MB2023	7MB2024	2 years (quantity)	5 years (quantity)		Order No.
Analyzer unit						
Analyzer unit, ULTRAMAT channel						
• O-ring for cover (window, rear)	x	x	2	2	D)	**C79121-Z100-A24**
• Cover (cell length 20 ... 180 mm)	x	x	2	2		**C79451-A3462-B151**
• Cover (cell length 0.2 ... 6 mm)	x	x	2	2		**C79451-A3462-B152**
• O-rings, set (ULTRAMAT)	x	x	—	1	D)	**C79451-A3462-D501**
Analyzer unit, OXYMAT channel						
• O-ring	x	x	1	2	D)	**C74121-Z100-A6**
• O-ring (measuring head)	x	x	2	4	D)	**C79121-Z100-A32**
• O-ring	x	x	2	4	D)	**C71121-Z100-A159**
• Sample chamber, stainless steel, mat. no. 1.4571; non-flow-type compensation branch	x	x	—	1	D)	**C79451-A3277-B535**
• Sample chamber, tantalum, non-flow-type compensation branch	x	x	—	1		**C79451-A3277-B536**
• Sample chamber, stainless steel, mat. no. 1.4571; flow-type compensation branch	x	x	—	1		**C79451-A3277-B537**
• Sample chamber, tantalum, flow-type compensation branch	x	x	—	1		**C79451-A3277-B538**
• Measuring head, non-flow-type compensation branch	x	x	1	1		**C79451-A3460-B525**
• Measuring head, flow-type compensation branch	x	x	1	1		**C79451-A3460-B526**
Sample gas path						
Pressure switch	x	x	1	2		**C79302-Z1210-A2**
Restrictor, stainless steel, mat. no. 1.4571; hose gas path	x	x	2	2		**C79451-A3480-C10**
Flow indicator	x	x	1	2		**C79402-Z560-T1**
Sample gas path, ULTRAMAT channel						
• Hose clip	x	x	—	1		**C79451-A3478-C9**
Sample gas path, OXYMAT channel						
• Restrictor, titanium, pipe gas path	x	x	2	2		**C79451-A3480-C37**
• Reference gas path, 3000 hPa	x	x	1	1		**C79451-A3480-D518**
• Capillary, 100 hPa, connection set	x	x	1	1		**C79451-A3480-D519**
• Restrictor, stainless steel, mat. no. 1.4571; pipe gas path	x	x	1	1		**C79451-A3520-C5**
Electronics						
Front plate with keyboard	x	x	1	1	D)	**C79165-A3042-B506**
Adapter plate, LCD/keyboard	x	x	1	1		**C79451-A3474-B605**
LC display	x	x	1	1		**W75025-B5001-B1**
Connector filter	x	x	—	1	F)	**W75041-E5602-K2**
Fuse, T 0.63A/250 V	x	x	2	3		**W79054-L1010-T630**
Fuse, T 1 A/250 V	x	x	2	3		**W79054-L1011-T100**
Fuse, T 2.5 A/250 V	x	x	2	3	D)	**W79054-L1011-T250**
Electronics, ULTRAMAT channel						
• Motherboard, with firmware: see spare parts list	x	x	—	1		
Electronics, OXYMAT channel						
• Motherboard, with firmware: see spare parts list	x	x	—	1		

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

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

If the device was supplied with a specially cleaned gas path for high oxygen context ("Clean for O_2 service"), please ensure that you specify this when ordering spare parts. This is the only way to guarantee that the gas path will continue to comply with the special requirements for this version.

General information

Overview

The function of the OXYMAT 6 gas analyzers is based on the paramagnetic alternating pressure method and are used to measure oxygen in gases.

Benefits

- Paramagnetic alternating pressure principle
  - Small measuring ranges (0 to 0.5 % or 99.5 to 100 % O_2)
  - Absolute linearity
- Detector element has no contact with the sample gas
  - Can be used under harsh conditions
  - Long service life
- Physically suppressed zero through suitable selection of reference gas (air or O_2), e.g. 98 to 100 % O_2 for purity monitoring/air separation
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and service information (option)
- Electronics and physics: gas-tight isolation, purging is possible, IP65, long service life even in harsh environments (field device only)
- Heated versions (option), use also in presence of gases condensing at low temperature (field device only)
- EEx(p) for zones 1 and 2 according to ATEX 2G and ATEX 3G (field device only)

Application

Fields of application

- For boiler control in incineration plants
- In safety-related areas
- In the automotive industry (testbed systems)
- Warning equipment
- In chemical plants
- For ultra-pure gas quality monitoring
- Environmental protection
- Quality monitoring
- Inert gas monitoring with certified gas warning equipment (DMT certificate)
- Versions for analyzing flammable and non-flammable gases or vapors for use in hazardous areas

Special versions

Special applications

Besides the standard combinations, special applications concerning material in the gas path, material in the sample cells are also available on request

TÜV version QAL

As a reference variable for emission measurements according to TA-Luft, 13th and 17th BImSchV

Design

19" rack unit

- With 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescopic rails
- Front plate can be swung down for servicing purposes (laptop connection)
- Internal gas paths: hose made of FKM (Viton) or pipe made of titanium or stainless steel (mat. no. 1.4571)
- Gas connections for sample gas inlet and outlet and for reference gas: fittings, pipe diameter of 6 mm or ¼"
- Flow indicator for sample gas on front plate (option)
- Pressure switch in sample gas path for flow monitoring (option)

Field device

- Two-door enclosure with gas-tight separation of analyzer and electronics sections
- Each half of the enclosure can be purged separately
- Analyzer unit and piping can be heated up to 130 °C (option)
- Gas path and stubs made of stainless steel (mat. no. 1.4571) or titanium, Hastelloy C22
- Purging gas connections: pipe diameter 10 mm or 3/8"
- Gas connections for sample gas inlet and outlet and for reference gas: clamping ring connection for a pipe diameter of 6 mm or ¼"

Display and control panel

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

Input and outputs

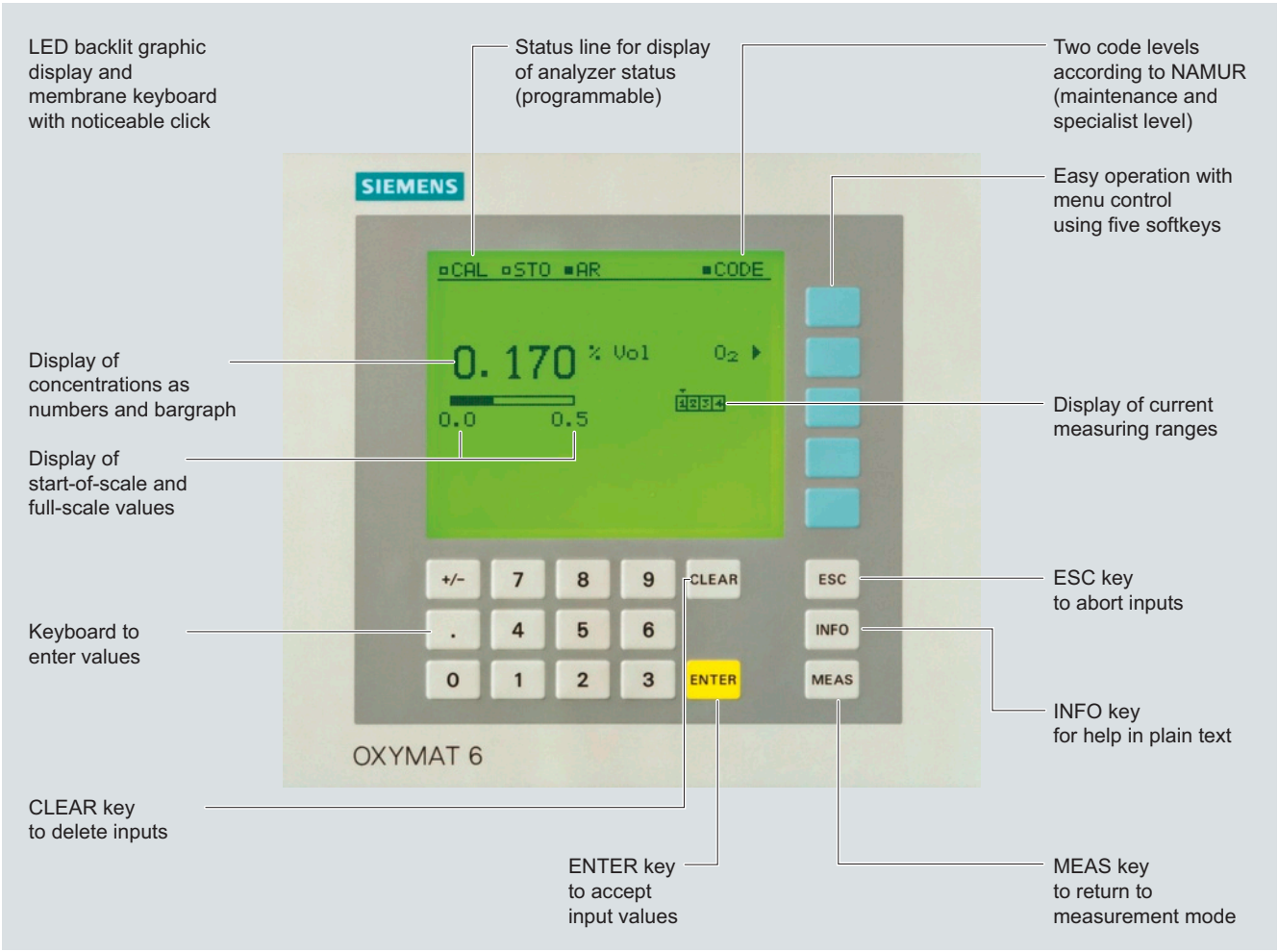
- One analog output per measured component (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Two analog inputs configurable (e.g. correction of cross-interference, external pressure sensor)
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (failure, maintenance request, maintenance switch, threshold alarm, external magnetic valves)
- Expansion: by eight additional binary inputs and eight additional relay outputs each, e.g. for autocalibration with up to four calibration gases

Communication

RS 485 present in the basic unit (connection at the rear; for the rack unit also behind the front plate).

Options

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



OXYMAT 6, membrane keyboard and graphic display

General information

Designs – Parts touched by sample gas, standard

Gas path		19" rack unit	Field device	Field device Ex
With hoses	Bushing	Stainless steel, mat. no. 1.4571	-	-
	Hose	FKM (e.g. Viton)		
	Sample chamber	Stainless steel, mat. no. 1.4571 or Tantalum		
	Fittings for sample chamber	Stainless steel, mat. no. 1.4571		
	Restrictor	PTFE (e.g. Teflon)		
	O-rings	FKM (e.g. Viton)		
With pipes	Bushing	Titanium		
	Pipe	Titanium		
	Sample chamber	Stainless steel, mat. no. 1.4571 or Tantalum		
	Restrictor	Titanium		
	O-rings	FKM (Viton) or FFKM (Kalrez)		
With pipes	Bushing	Stainless steel, mat. no. 1.4571		
	Pipe	Stainless steel, mat. no. 1.4571		
	Sample chamber	Stainless steel, mat. no. 1.4571 or tantalum		
	Restrictor	Stainless steel, mat. no. 1.4571		
	O-rings	FKM (Viton) or FFKM (Kalrez)		
With pipes	Bushing		Hastelloy C 22	
	Pipe		Hastelloy C 22	
	Sample chamber		Stainless steel, mat. no. 1.4571 or tantalum	
	Restrictor		Hastelloy C 22	
	O-rings		FKM (e.g. Viton) or FFKM (e.g. Kalrez)	

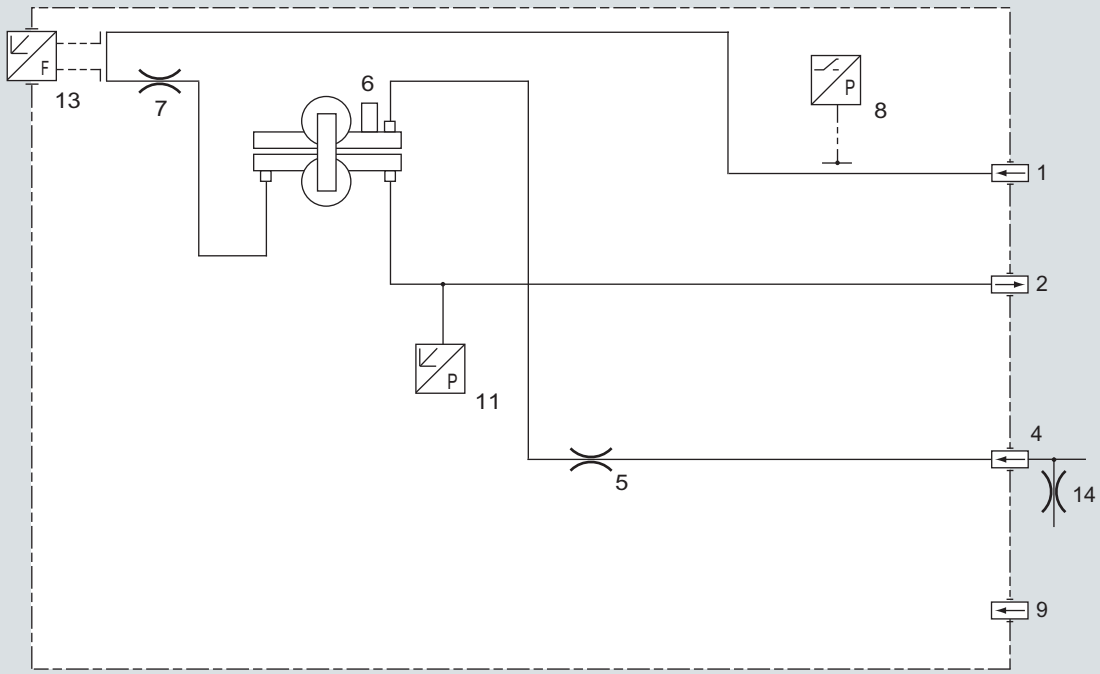
Options

Flow indicator	Measurement pipe	Duran glass	-	-
	Variable area	Duran glass, black		
	Suspension boundary	PTFE (Teflon)		
	Angle pieces	FKM (Viton)		
Pressure switch	Membrane	FKM (Viton)	-	-
	Enclosure	PA 6.3 T		

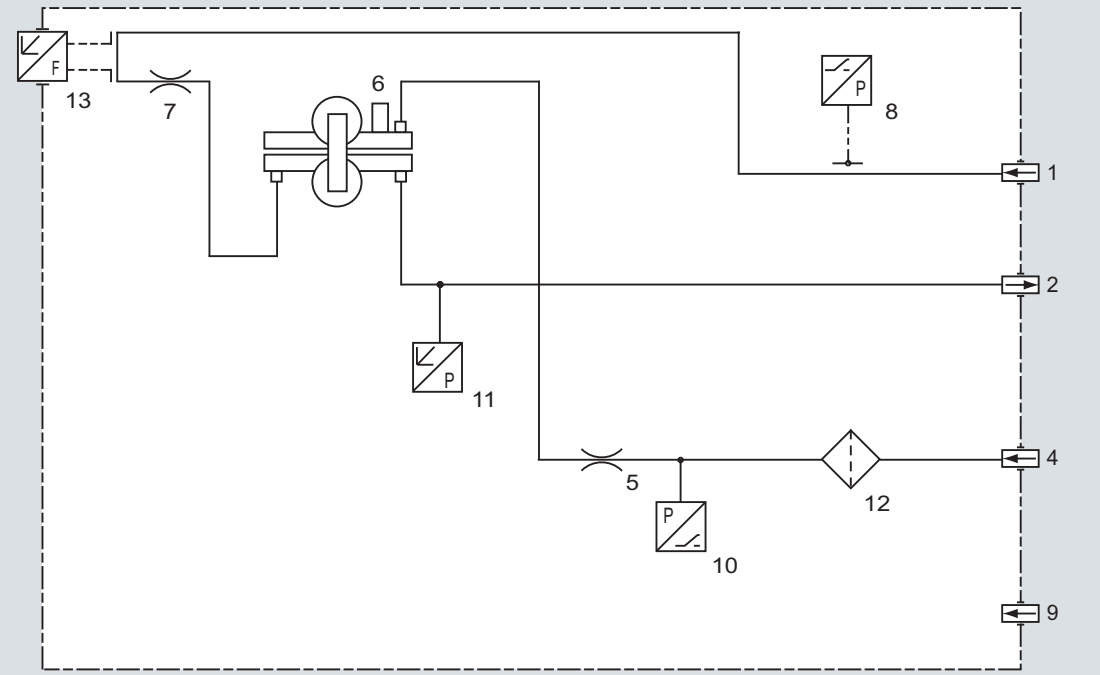
Gas path (19" rack unit)

Legend for the gas path figures

1	Sample gas inlet	8	Pressure switch in sample gas path (option)
2	Sample gas outlet	9	Purging gas
3	Not used	10	Pressure switch in reference gas path (option)
4	Reference gas inlet	11	Pressure sensor
5	Restrictor in reference gas inlet	12	Filter
6	O_2 physical system	13	Flow indicator in sample gas path (option)
7	Restrictor in sample gas path	14	Outlet restrictor



Gas path, reference gas connection 1 100 hPa, absolute



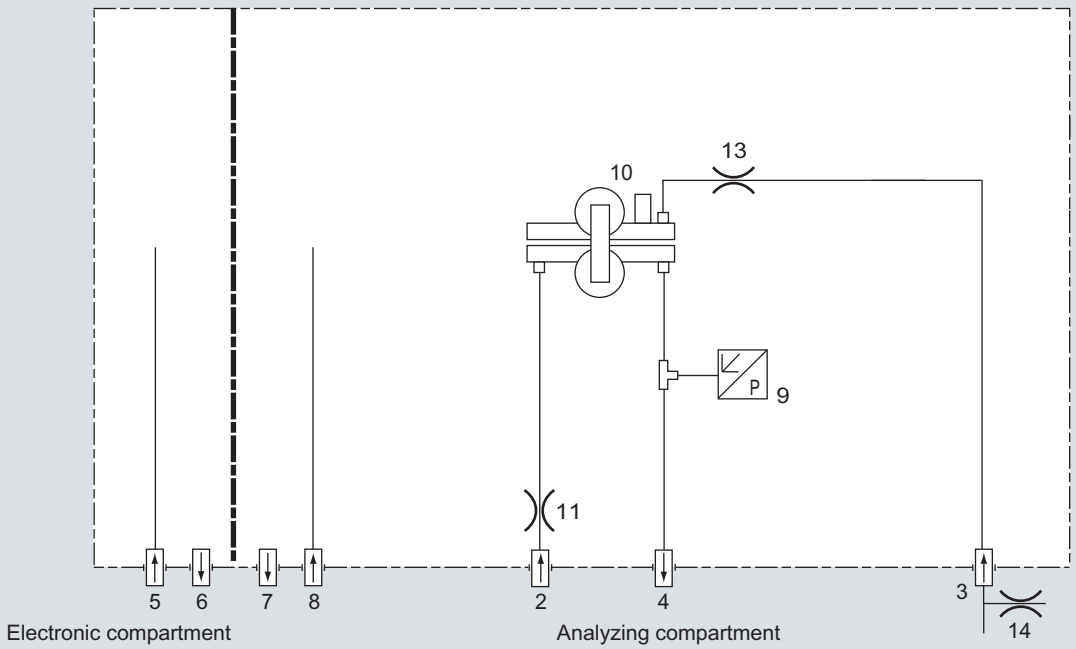
Gas path, reference gas connection 3 000 to 5 000 hPa, absolute

General information

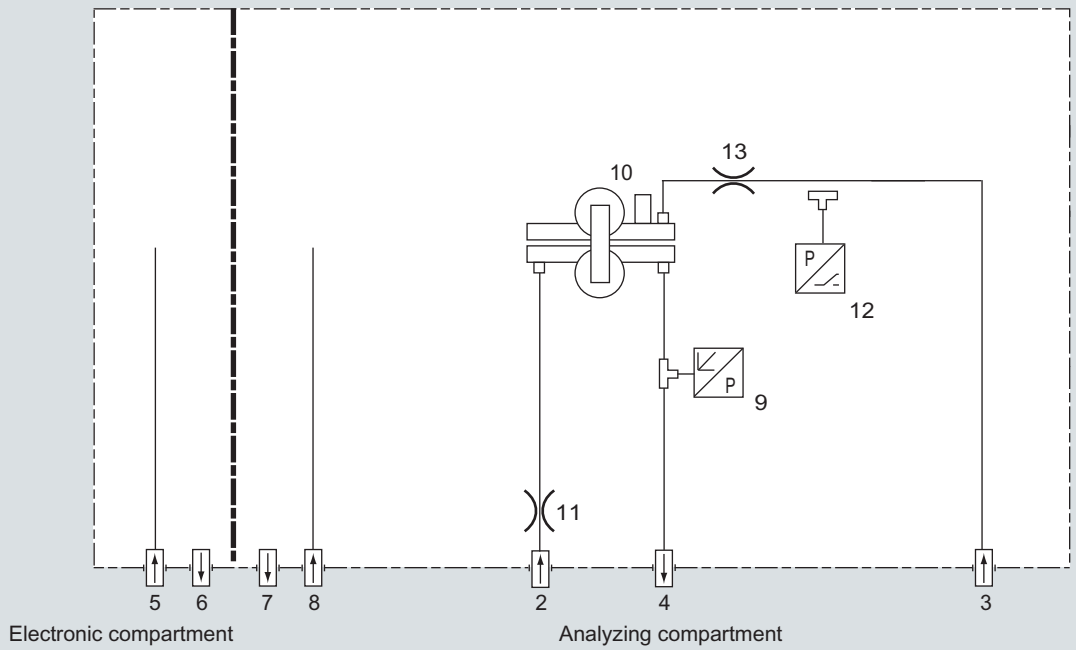
Gas path (field device)

Legend for the gas path figures

1	Not used	8	Purging gas inlet (analyzer side)
2	Sample gas inlet	9	Pressure sensor
3	Reference gas inlet	10	O_2 physical system
4	Sample gas outlet	11	Restrictor in sample gas path
5	Purging gas inlet (electronics side)	12	Flow indicator in reference gas path (option)
6	Purging gas outlet (electronics side)	13	Restrictor
7	Purging gas outlet (analyzer side)	14	Outlet restrictor



Gas path, reference gas connection 1 100 hPa, absolute



Gas path, reference gas connection 3 000 to 5 000 hPa, absolute

Function

Principle of operation

In contrast to almost all other gases, oxygen is paramagnetic. This property is utilized as the measuring principle by the OXYMAT 6 gas analyzers.

Oxygen molecules in an inhomogeneous magnetic field are drawn in the direction of increased field strength due to their paramagnetism. When two gases with different oxygen contents meet in a magnetic field, a pressure difference is produced between them.

In the case of OXYMAT 6, one gas (1) is a reference gas (N_2, O_2 or air), the other is the sample gas (5). The reference gas is introduced into the sample chamber (6) through two channels (3). One of these reference gas streams meets the sample gas within the area of a magnetic field (7). Because the two channels are connected, the pressure, which is proportional to the oxygen content, causes a cross flow. This flow is converted into an electric signal by a microflow sensor (4).

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 results in a change in the resistance of the Ni grids. This leads to an offset in the bridge which is dependent on the oxygen concentration of the sample gas.

Because the microflow sensor is located in the reference gas stream, the measurement is not influenced by the thermal conductivity, the specific heat or the internal friction of the sample gas. This also provides a high degree of corrosion resistance because the microflow sensor is not exposed to the direct influence of the sample gas.

By using a magnetic field with alternating strength (8), the effect of the background flow in the microflow sensor is not detected, and the measurement is thus independent of the instrument's operating position.

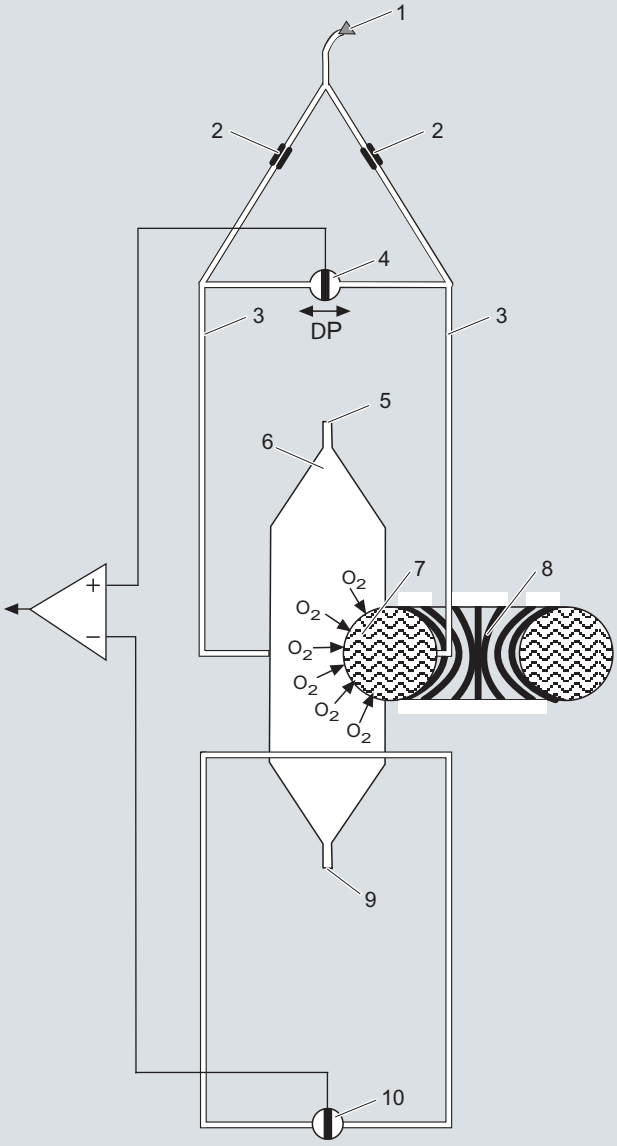
The sample chamber is directly in the sample path and has a small volume, and the microflow sensor is a low-lag sensor. This results in a very short response time for the OXYMAT 6.

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

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

Note

The sample gases 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.



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

OXYMAT 6, principle of operation

General information

Advantages of the function-based application of reference gas

- The zero point can be defined specific to the application. It is then also possible to set "physically" suppressed zero points. For example, it is possible when using pure oxygen as the zero gas to set a measuring range of 99.5 to 100 % O_2 with a resolution of 50 ppm.
- The sensor (microflow sensor) is located outside the sample gas. Through use of an appropriate material in the gas path this also allows measurements in highly corrosive gases.
- Pressure variations in the sample gas can be compensated better since the reference gas is subjected to the same fluctuations.
- No influences on the thermal conductivity of the sample gas since the sensor is positioned on the reference gas side.
- The same gas is used for the serial gas calibration and as the reference gas. As a result of the low consumption of reference gas (3 to 10 ml/min), one calibration cylinder can be used for both gases.
- No measuring effect is generated in the absence of oxygen. The measured signal need not therefore be set electronically to zero, and is thus extremely stable with regard to temperature and electronic influences.

Essential characteristics

- Four freely parameterizable measuring ranges, also with suppressed zero point, all measuring ranges linear
- Measuring ranges with physically suppressed zero point possible
- Measuring range identification
- Galvanically isolated measured-value output 0/2/4 to 20 mA (also inverted)
- Autoranging possible; remote switching is also possible
- Storage of measured values possible during adjustments
- Wide range of selectable time constants (static/dynamic noise suppression); i.e. the response time of the analyzer can be matched to the respective measuring task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 6 measuring points (programmable)
- Measuring point identification
- Internal pressure sensor for correction of pressure variations in sample gas range 500 to 2 000 hPa (abs.)
- External pressure sensor - only with piping as the gas path - can be connected for correction of variations in the sample gas pressure up to 3 000 hPa absolute (option)
- Monitoring of sample gas flow (option for version with hoses)
- Monitoring of sample gas and/or reference gas (option)
- Monitoring of reference gas with reference gas connection 3 000 to 5 000 hPa (abs.) (option)
- Automatic, parameterizable measuring range calibration
- Operation based on the NAMUR recommendation
- Two control levels with their own authorization codes for the prevention of accidental and unauthorized operator interventions
- Simple handling using a numerical membrane keyboard and operator prompting
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording
  - Clean for O_2 service
  - Kalrez gaskets
- Analyzer unit with flow-type compensation branch: a flow is passed through the compensation branch (option) to reduce the vibration dependency in the case of highly different densities of the sample and reference gases
- Sample chamber for use in presence of highly corrosive sample gases

Reference gases

Measuring range	Recommended reference gas	Reference gas connection pressure	Remarks
0 to ... vol.% O_2	N_2	2 000 … 4 000 hPa above sample gas pressure (max. 5 000 hPa absolute)	The reference gas flow is set automatically to 5 … 10 ml/min (up to 20 ml/min with flow-type compensation branch)
... to 100 vol.% O_2 (suppressed zero point with full-scale value 100 vol.% O_2)	O_2		
Around 21 vol.% O_2 (suppressed zero point with 21 vol.% O_2 within the measuring span)	Air	100 hPa with respect to sample gas pressure which may vary by max. 50 hPa around the atmospheric pressure	

Reference gases for OXYMAT 6

Correction of zero point error / cross-sensitivities

Accompanying gas (concentration 100 vol.%)	Deviation from zero point in vol.% O_2 absolute
Organic gases	
Ethane C_2H_6	-0.49
Ethene (ethylene) C_2H_4	-0.22
Ethine (acetylene) C_2H_2	-0.29
1.2 butadiene C_4H_6	-0.65
1.3 butadiene C_4H_6	-0.49
n-butane C_4H_{10}	-1.26
iso-butane C_4H_{10}	-1.30
1-butene C_4H_8	-0.96
iso-butene C_4H_8	-1.06
Dichlorodifluoromethane (R12) CCl_2F_2	-1.32
Acetic acid CH_3COOH	-0.64
n-heptane C_7H_{16}	-2.40
n-hexane C_6H_{14}	-2.02
Cyclo-hexane C_6H_{12}	-1.84
Methane CH_4	-0.18
Methanol CH_3OH	-0.31
n-octane C_8H_{18}	-2.78
n-pentane C_5H_{12}	-1.68
iso-pentane C_5H_{12}	-1.49
Propane C_3H_8	-0.87
Propylene C_3H_6	-0.64
Trichlorofluoromethane (R11) CCl_3F	-1.63
Vinyl chloride C_2H_3Cl	-0.77
Vinyl fluoride C_2H_3F	-0.55
1.1 vinylidene chloride $C_2H_2Cl_2$	-1.22

Accompanying gas (concentration 100 vol.%)	Deviation from zero point in vol.% O_2 absolute
Inert gases	
Helium He	+0.33
Neon Ne	+0.17
Argon Ar	-0.25
Krypton Kr	-0.55
Xenon Xe	-1.05
Inorganic gases	
Ammonia NH_3	-0.20
Hydrogen bromide HBr	-0.76
Chlorine Cl_2	-0.94
Hydrogen chloride HCl	-0.35
Dinitrogen monoxide N_2O	-0.23
Hydrogen fluoride HF	+0.10
Hydrogen iodide HI	-1.19
Carbon dioxide CO_2	-0.30
Carbon monoxide CO	+0.07
Nitrogen oxide NO	+42.94
Nitrogen N_2	0.00
Nitrogen dioxide NO_2	+20.00
Sulfur dioxide SO_2	-0.20
Sulfur hexafluoride SF_6	-1.05
Hydrogen sulfide H_2S	-0.44
Water H_2O	-0.03
Hydrogen H_2	+0.26

Table 2: Zero point error due to diamagnetism or paramagnetism of some accompanying gases with reference to nitrogen at 60 °C und 1 000 hPa absolute (according to IEC 1207/3)

Conversion to other temperatures:

The deviations from the zero point listed in Table 2 must be multiplied by a correction factor (k):

- with diamagnetic gases: $k = 333\ K / (\vartheta\ [°C] + 273\ K)$
- with paramagnetic gases: $k = [333\ K / (\vartheta\ [°C] + 273\ K)]^2$

(all diamagnetic gases have a negative deviation from zero point)

19" rack unit

Technical specifications

General information	
Measuring ranges	4, internally and externally switchable; autoranging is also possible
Smallest possible span (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	0.5 vol.%, 2 vol.% or 5 vol.% O_2
Largest possible measuring span	100 vol.% O_2 (for a pressure above 2 000 hPa: 25 vol.% O_2)
Measuring ranges with suppressed zero point	Any zero point can be implemented within 0 … 100 vol.%, provided that a suitable reference gas is used (see Table 1 in "Function")
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2
Design, enclosure	
Degree of protection	IP20 according to EN 60529
Weight	Approx. 13 kg
Electrical characteristics	
Power supply	100 … 120 V AC (nominal range of use 90 … 132 V), 48 … 63 Hz or 200 … 240 V AC (nominal range of use 180 … 264 V), 48 … 63 Hz
Power consumption	Approx. 35 VA
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98), EN 61326, EN 50270 (with gas warning unit)
Electrical safety	According to EN 61010-1, overvoltage category III
Fuse values	100 ... 120 V: 1.0 T/250 200 ... 240 V: 0.63 T/250
Gas inlet conditions	
Permissible sample gas pressure	
• With pipes	500 … 3 000 hPa absolute
• With hoses	
- Without pressure switch	500 … 1 500 hPa absolute
- With pressure switch	500 … 1 300 hPa absolute
Sample gas flow	18 … 60 l/h (0.3 … 1 l/min)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Sample gas humidity	< 90 % RH (RH: relative humidity)
Reference gas pressure (high-pressure version)	2 000 ... 4 000 hPa above sample gas pressure, but max. 5 000 hPa
Reference gas pressure (low-pressure version)	Min. 100 hPa above sample gas pressure

Dynamic response	
Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Delayed display (T_{90}-time)	Min. 1.5 … 3.5 s, depending on version
Damping (electrical time constant)	0 … 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approximately 0.5 ... 2.5 s, depending on version
Time for device-internal signal processing	< 1 s
Pressure correction range	
Pressure sensor	
• Internal	500 … 2 000 hPa absolute
• External	500 … 3 000 hPa absolute
Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Output signal fluctuation	< ± 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (corresponds to ±0.25 % at 2 σ)
Zero point drift	< ± 0.5 %/month of the smallest possible span according to rating plate
Measured-value drift	< ±0.5 %/month of the current measuring range
Repeatability	< 1 % of the current measuring range
Detection limit	1 % of the current measuring range
Linearity error	< 0.1 % of the current measuring range
Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	< 0.5 %/10 K relating to the smallest possible measuring range according to rating plate, with measuring span 0.5 %: 1 %/10 K
Sample gas pressure (with air (100 hPa) as reference gas, correction of the atmospheric pressure fluctuations is only possible if the sample gas can vent to ambient air)	• When pressure compensation is switched off: < 2 % of the current measuring range/1 % pressure change • When pressure compensation is switched on: < 0.2 % of the current measuring range/1 % pressure change
Carrier gases	Deviation from zero point corresponding to paramagnetic or diamagnetic deviation of carrier gas
Sample gas flow at zero point	< 1 % of the current measuring range according to rating plate with a change in flow of 0.1 l/min within the permissible flow range
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %

Electrical inputs and outputs	
Analog output	0/2/4 … 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and residual gas influence correction (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs each, also with PROFIBUS PA or PROFIBUS DP
Climatic conditions	
Permissible ambient temperature	-30 … +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity	< 90 % RH (RH: relative humidity) within average annual value, during storage and transportation (dew point must not be undershot)

OXYMAT 6

19" rack unit

Selection and ordering data		Order No.	Cannot be combined
OXYMAT 6 gas analyzer 19" rack unit for installation in cabinets	D)	**7MB2021-** ■■■■ **0 -** ■■■■	
Gas connections			
Pipe with 6 mm outer diameter		**0**	
Pipe with ¼" outer diameter		**1**	
Smallest possible span O_2			
0.5 % reference gas pressure 3 000 hPa		**A**	**A** → **E30**
0.5 % reference gas pressure 100 hPa (external pump)		**B**	**B** **B** → **E30, Y02**
2 % reference gas pressure 3 000 hPa		**C**	
2 % reference gas pressure 100 hPa (external pump)		**D**	**D** **D** → **E30, Y02**
5% reference gas pressure 3 000 hPa		**E**	
5% reference gas pressure 100 hPa (external pump)		**F**	**F** **F** → **E30, Y02**
Sample chamber			
Non-flow-type compensation branch			
• Made of stainless steel, mat. no. 1.4571		**A**	
• Made of tantalum		**B**	
Flow-type compensation branch			
• Made of stainless steel, mat. no. 1.4571		**C**	**C**
• Made of tantalum		**D**	**D**
Internal gas paths			
Hose made of FKM (Viton)		**0**	
Pipe made of titanium		**1**	**1** **1** → **Y02**
Pipe made of stainless steel, mat. no. 1.4571		**2**	**2**
Power supply			
100 ... 120 V AC, 48 ... 63 Hz		**0**	
200 ... 240 V AC, 48 ... 63 Hz		**1**	
Monitoring (reference gas, sample gas)			
Without		**A**	**A** → **E30**
Reference gas only		**B**	**B**
Reference gas and sample gas (with flow indicator and pressure switch for sample gas)		**C**	**C** **C** **C** → **E30**
Sample gas only		**D**	**D** **D** → **E30**
Add-on electronics			
Without		**A**	
AUTOCAL function			
• With 8 additional binary inputs/outputs		**B**	
• With serial interface for the automotive industry (AK)		**D**	**D** → **E20**
• With 8 additional binary inputs/outputs and PROFIBUS PA interface		**E**	
• With 8 additional binary inputs/outputs and PROFIBUS DP interface		**F**	
Language			
German		**0**	
English		**1**	
French		**2**	
Spanish		**3**	
Italian		**4**	

Additional versions	Order code	Cannot be combined
Add "-Z" to Order No. and specify order codes.		
Telescopic rails (2 units)	**A31**	
Kalrez gaskets in sample gas path	**B01**	
TAG labels (specific inscription based on customer information)	**B03**	
FM/CSA certificate – Class I Div 2	**E20**	→ **E30**
ATEX II G certificate; safety-related measurements in non-hazardous gas zone	**E30**	→ **E20**
Clean for O_2 service (specially cleaned gas path)	**Y02**	
Measuring range indication in plain text, if different from the standard setting	**Y11**	

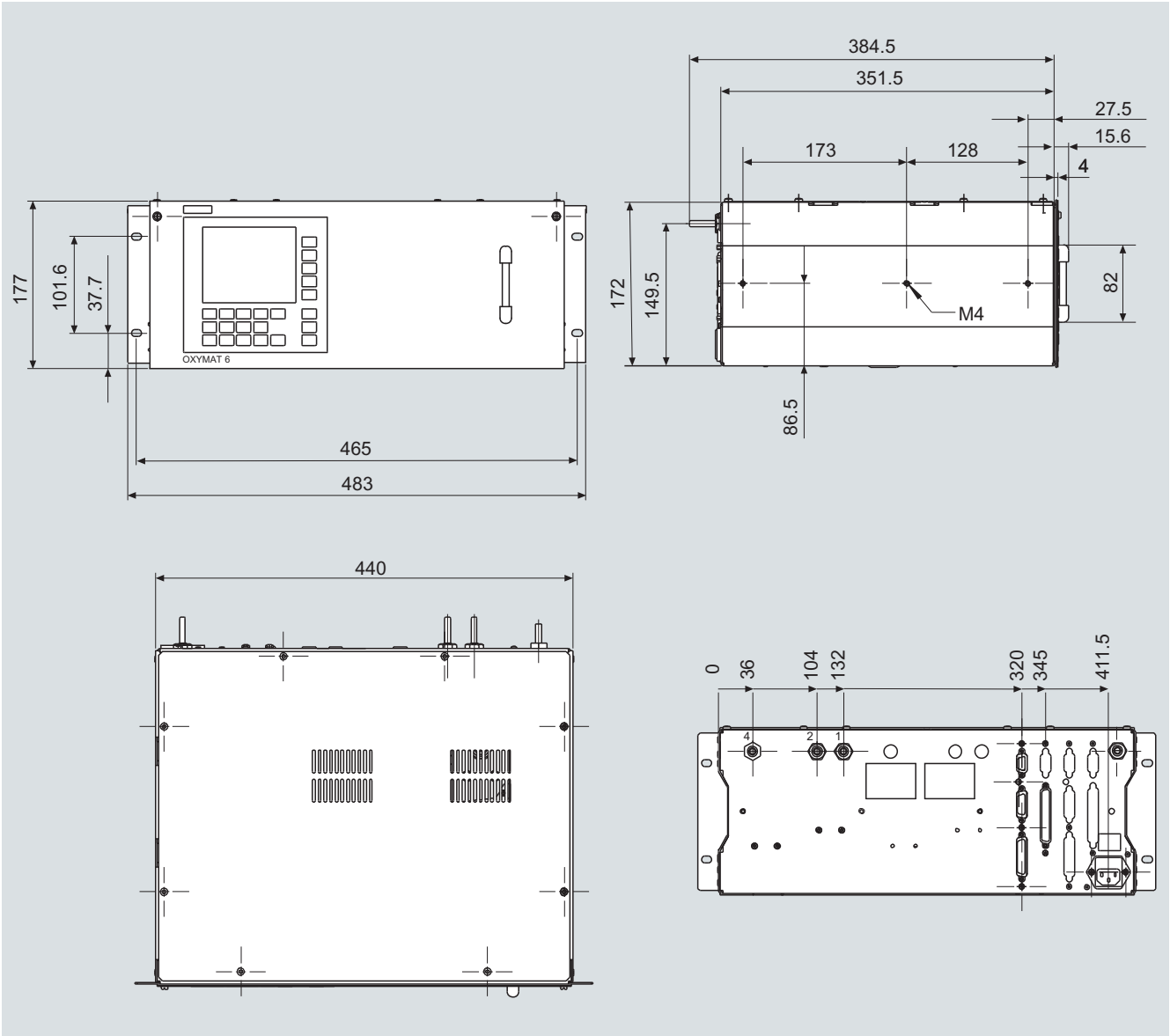
D) Subject to export regulations AL: 9I999, ECCN: N

Selection and ordering data

Retrofitting sets		Order No.
RS 485/Ethernet converter		**A5E00852383**
RS 485/RS 232 converter		**C79451-Z1589-U1**
RS 485/USB converter	D)	**A5E00852382**
AUTOCAL function with serial interface for the automotive industry (AK)		**C79451-A3480-D512**
AUTOCAL function with 8 binary inputs/outputs		**C79451-A3480-D511**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA		**A5E00057307**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP		**A5E00057312**

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

Dimensional drawings

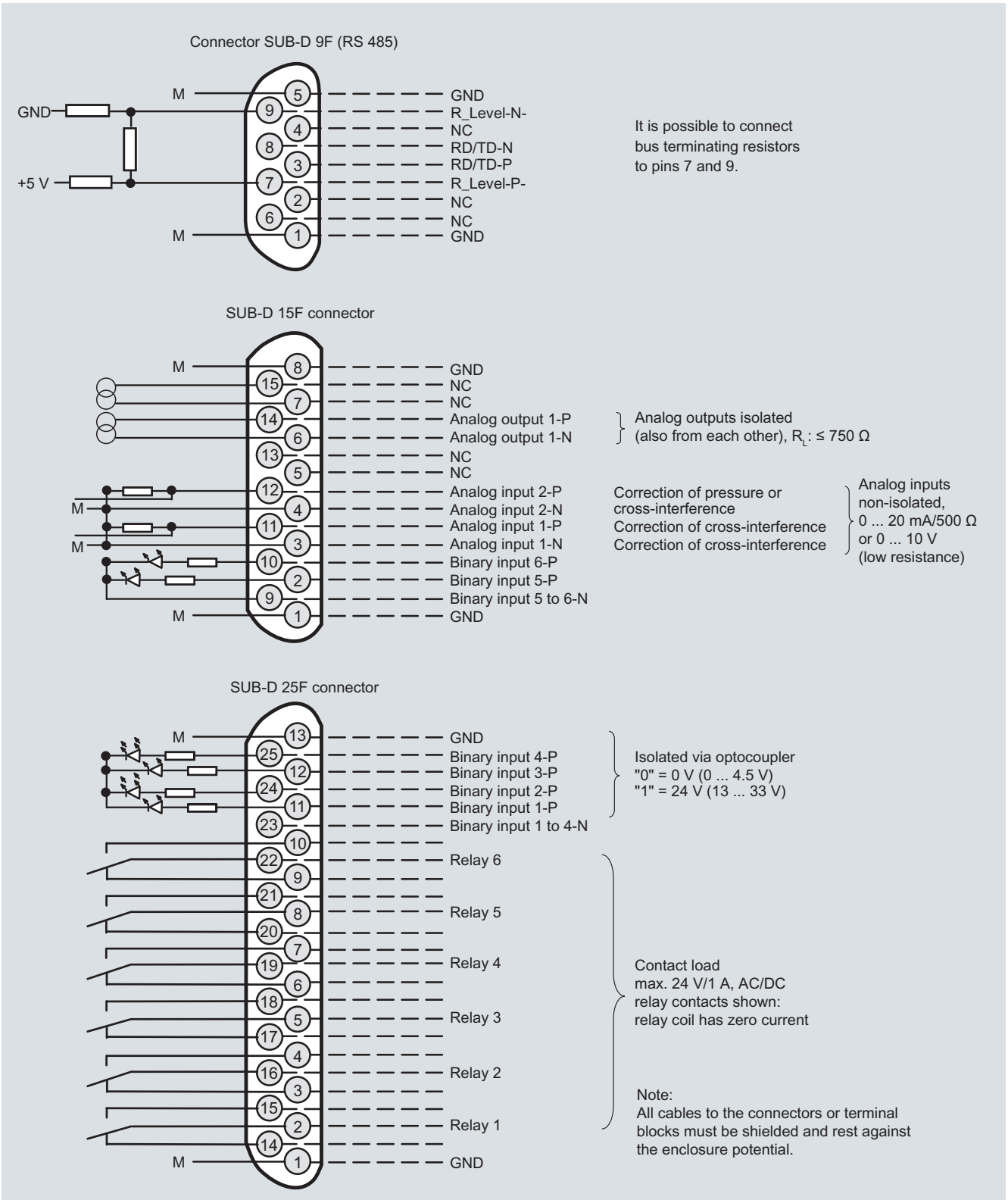


OXYMAT 6, 19“ unit, dimensions in mm

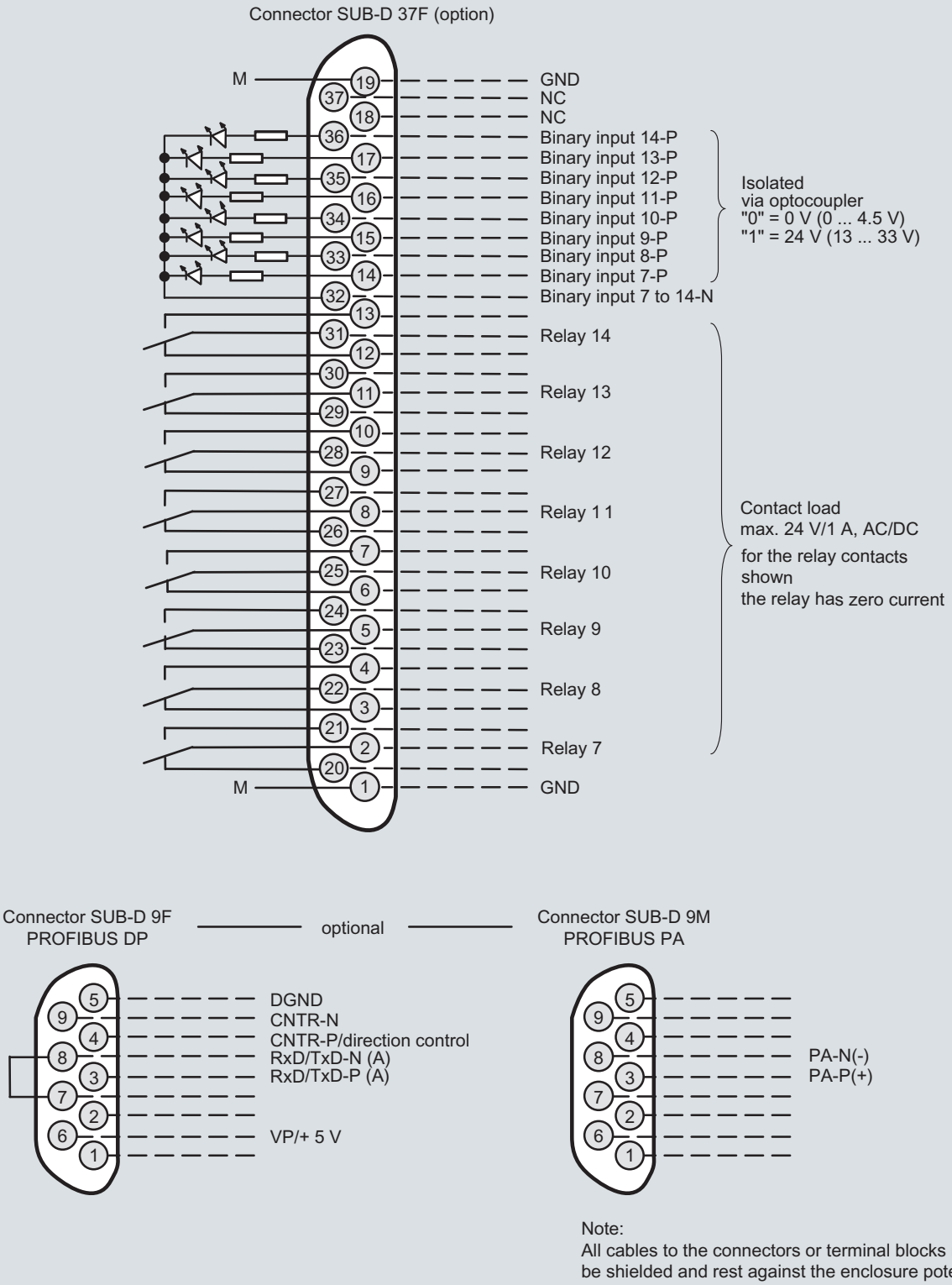
19" rack unit

Schematics

Pin assignment (electrical and gas connections)

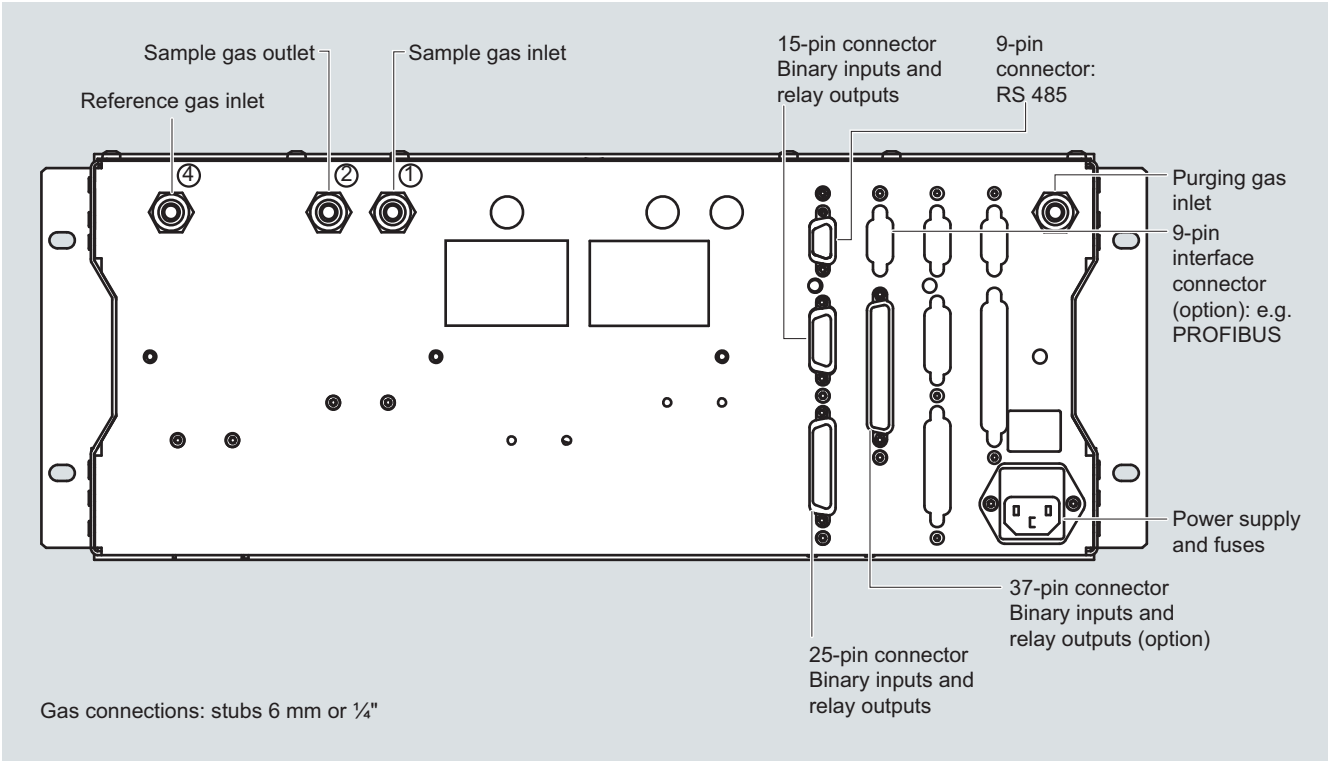


OXYMAT 6, 19“ unit, pin assignment



OXYMAT 6, 19“ unit, pin assignment of AUTOCAL board and PROFIBUS connectors

19" rack unit



OXYMAT 6, 19" unit, gas and electrical connections

Technical specifications

General information

Measuring ranges	4, internally and externally switchable; autoranging is also possible
Smallest possible span (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature), smallest possible span with heated version: 0.5 % (< 65 °C); 0.5 … 1 % (65 … 90 °C); 1 … 2 % (90 … 130 °C))	0.5 vol.%, 2 vol.% or 5 vol.% O_2
Largest possible measuring span	100 vol.% O_2 (for a pressure above 2 000 hPa: 25 vol.% O_2)
Measuring ranges with suppressed zero point	Any zero point can be implemented within 0 … 100 vol.%, provided that a suitable reference gas is used (see Table "Reference gases for OXYMAT 6", page 2/101)
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2

Design, enclosure

Degree of protection	IP65 in accordance with EN 60529, restricted breathing enclosure to EN 50021
Weight	Approx. 28 kg

Electrical characteristics

Power supply	100 … 120 V AC (nominal range of use 90 … 132 V), 48 … 63 Hz or 200 … 240 V AC (nominal range of use 180 … 264 V), 48 … 63 Hz
Power consumption	Approx. 35 VA, approx. 330 VA with heated version
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98), EN 61326, EN 50270 (with gas warning unit)
Electrical safety	In accordance with EN 61010-1
• Heated units	Overvoltage category II
• Unheated units	Overvoltage category III
Fuse values (unheated unit)	
• 100 ... 120 V	F3: 1 T/250; F4: 1 T/250
• 200 ... 240 V	F3: 0.63 T/250; F4: 0.63 T/250
Fuse values (heated unit)	
• 100 ... 120 V	F1: 1 T/250; F2: 4 T/250 F3: 4 T/250; F4: 4 T/250
• 200 ... 240 V	F1: 0.63 T/250; F2: 2.5 T/250 F3: 2.5 T/250; F4: 2.5 T/250

Gas inlet conditions

Permissible sample gas pressure	
• With pipes	500 … 3 000 hPa absolute
• With pipes, Ex version	
- Leakage compensation	500 … 1 160 hPa absolute
- Continuous purging	500 … 3 000 hPa absolute
Reference gas pressure (high-pressure version)	2 000 ... 4 000 hPa above sample gas pressure, but max. 5 000 hPa
Reference gas pressure (low-pressure version)	Min. 100 hPa above sample gas pressure
Purging gas pressure	
• Permanent	< 165 hPa above ambient pressure
• For short periods	Max. 250 hPa above ambient pressure
Sample gas flow	18 … 60 l/h (0.3 … 1 l/min)
Sample gas temperature	• Min. 0 ... max. 50 °C, but above the dew point (unheated) • 15 °C above temperature analyzer unit (heated)
Sample gas humidity	< 90 % relative humidity

Dynamic response

Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Delayed display (t_{90}-time)	< 1.5 s
Damping (electrical time constant)	0 … 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approx. 0.5 s
Time for device-internal signal processing	< 1 s

Pressure correction range

Pressure sensor	
• Internal	500 … 2 000 hPa absolute
• External	500 … 3 000 hPa absolute

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation	< ± 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (corresponds to ± 0.25 % at 2 σ)
Zero point drift	< ± 0.5 %/month of the smallest possible span according to rating plate
Measured-value drift	< ±0.5 %/month of the current measuring range
Repeatability	< 1 % of the current measuring range
Detection limit	1 % of the current measuring range
Linearity error	< 0.1 % of the current measuring range

Field device

Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Ambient temperature	< 0.5 %/10 K relating to the smallest possible measuring range according to rating plate, with measuring span 0.5 %: 1 %/10 K
Sample gas pressure (with air (100 hPa) as reference gas, correction of the atmospheric pressure fluctuations is only possible if the sample gas can vent to ambient air)	• When pressure compensation is switched off: < 2 % of the current measuring range/1 % pressure change • When pressure compensation is switched on: < 0.2 % of the current measuring range/1 % pressure change
Carrier gases	Deviation from zero point corresponding to paramagnetic or diamagnetic deviation of carrier gas
Sample gas flow at zero point	< 1 % of the current measuring range according to rating plate with a change in flow of 0.1 l/min within the permissible flow range; heated version up to double error
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %

Electrical inputs and outputs

Analog output	0/2/4 … 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and residual gas influence correction (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs each, also with PROFIBUS PA or PROFIBUS DP

Climatic conditions

Permissible ambient temperature	-30 … +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity	< 90 % RH (relative humidity) as annual average (maximum accuracy achieved after 2 hours), during storage and transportation (dew point must not be undershot)

Selection and ordering data	Order No.	Cannot be combined
OXYMAT 6 gas analyzer for field installation	D) **7MB2011-** **0** -	
Gas connections for sample gas and reference gas		
Ferrule screw connection made of stainless steel (mat. no. 1.4571)		
• Pipe with 6 mm outer diameter	**0**	0 → D02
• Pipe with ¼" outer diameter	**1**	1 → D01
Ferrule screw connection made of titanium		
• Pipe with 6 mm outer diameter	**2**	2 → D01, D02, Y02
• Pipe with ¼" outer diameter	**3**	3 → D01, D02, Y02
Piping and gas connections made of Hastelloy C22: 7MB2011-0/1.... + order code D01 or D02		
Smallest possible span O_2		
0.5 % reference gas pressure 3 000 hPa	**A**	A → E30 ... E33
0.5 % reference gas pressure 100 hPa (external pump)	**B**	B B B → Y02, E30 ... E33
2 % reference gas pressure 3 000 hPa	**C**	
2 % reference gas pressure 100 hPa (external pump)	**D**	D D D → Y02, E30 ... E33
5 % reference gas pressure 3 000 hPa	**E**	
5 % reference gas pressure 100 hPa (external pump)	**F**	F F F → Y02, E30 ... E33
Sample chamber		
Non-flow-type compensation branch		
• Made of stainless steel, mat. no. 1.4571	**A**	
• Made of tantalum	**B**	
Flow-type compensation branch		
• Made of stainless steel, mat. no. 1.4571	**C**	C
• Made of tantalum	**D**	D
Heating of internal gas paths and analyzer unit		
Without	**0**	
With (65 ... 130 °C)	**1**	1
Power supply		
Standard unit and acc. to ATEX II 3G version (Zone 2)		
• 100 ... 120 V AC, 48 ... 63 Hz	**0**	0
• 200 ... 240 V AC, 48 ... 63 Hz	**1**	1
ATEX II 2G versions (Zone 1), incl. certificate		
• 100 ... 120 V AC, 48 ... 63 Hz, according to ATEX II 2G[1)] (operating mode: leakage compensation)	**2**	2 2 2 → E11, E12
• 200 ... 240 V AC, 48 ... 63 Hz, according to ATEX II 2G[1)] (operating mode: leakage compensation)	**3**	3 3 3 → E11, E12
• 100 ... 120 V AC, 48 ... 63 Hz, according to ATEX II 2G[1)] (operating mode: continuous purging)	**6**	6 6 6 → E11, E12
• 200 ... 240 V AC, 48 ... 63 Hz, according to ATEX II 2G[1)] (operating mode: continuous purging)	**7**	7 7 7 → E11, E12
Reference gas monitoring		
Without	**A**	A
With	**B**	B
Add-on electronics		
Without	**A**	
AUTOCAL function		
• With 8 additional binary inputs and 8 additional relay outputs	**B**	
• With 8 additional binary inputs/outputs and PROFIBUS PA interface	**E**	E → E12
• With 8 additional binary inputs/outputs and PROFIBUS DP interface	**F**	F → E12
• With 8 additional binary inputs/outputs and PROFIBUS PA Ex-i	**G**	G
Language		
German	**0**	
English	**1**	
French	**2**	
Spanish	**3**	
Italian	**4**	

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

[1)] See also next page, "Additional units for Ex versions".

Selection and ordering data

Additional versions	Order code	Cannot be combined
Add "-Z" to Order No. and specify order codes.		
Set of Torx screwdrivers	**A32**	
Kalrez gaskets in sample gas path	**B01**	
TAG labels (specific inscription based on customer information)	**B03**	
Gas connections and piping made of Hastelloy C22		
• Outer diameter 6 mm	**D01**	→ **E20**
• Outer diameter ¼"	**D02**	→ **E20**
Ex versions		
For possible combinations, see Table "Ex configurations – principle selection criteria", page 6/16		
ATEX II 3G certificate; restricted breathing enclosure, non-flammable gases	**E11**	
ATEX II 3G certificate; flammable gases	**E12**	
CSA certificate – Class I Div 2	**E20**	
ATEX II G certificate; safety-related measurements		
• In non-hazardous gas zone	**E30**	
• In Ex zone acc. to ATEX II 2G, leakage compensation	**E31**	
• In Ex zone acc. to ATEX II 2G, continuous purging	**E32**	
• In Ex zone acc. to ATEX II 3G, flammable and non-flammable gases	**E33**	
- Extended element with heated units; 110/120 V	**E38**	
- Extended element with heated units; 220/240 V	**E39**	
ATEX II 3D certificate; potentially explosive dust atmospheres		
• In non-hazardous gas zone	**E40**	
• In Ex zone acc. to ATEX II 3G, non-flammable gases	**E41**	
• In Ex zone acc. to ATEX II 3G, flammable gases[1)]	**E42**	
Clean for O_2 service (specially cleaned gas path)	**Y02**	
Measuring range indication in plain text, if different from the standard setting	**Y11**	

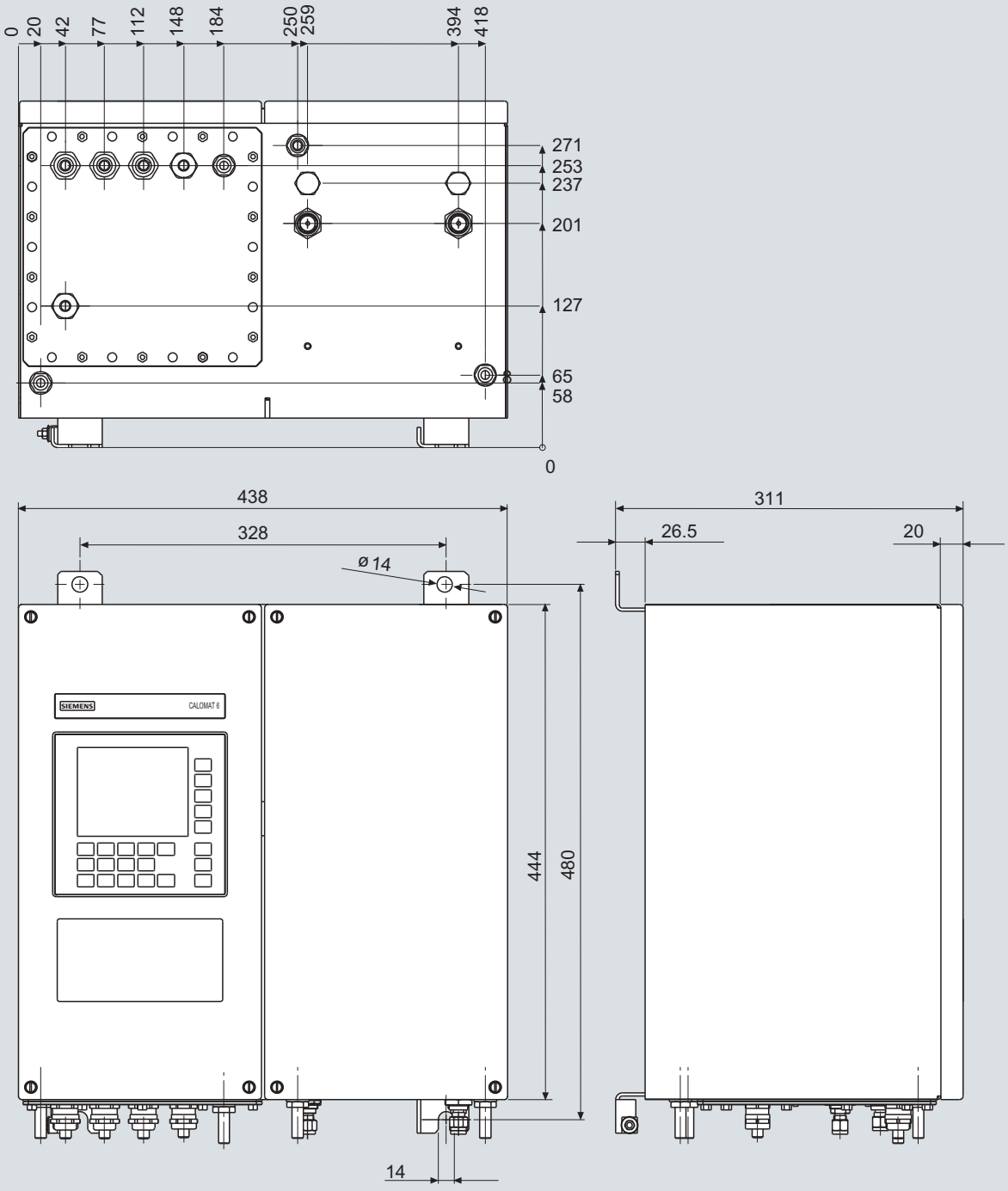
Additional units for Ex versions		Order No.
Category ATEX II 2G (Zone 1)		
BARTEC EEx p control unit, 230 V, "leakage compensation"		**7MB8000-2BA**
BARTEC EEx p control unit, 115 V, "leakage compensation"		**7MB8000-2BB**
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
Ex isolation amplifier		**7MB8000-3AA**
Ex isolating relay, 230 V		**7MB8000-4AA**
Ex isolating relay, 110 V		**7MB8000-4AB**
Differential pressure switch for corrosive and non-corrosive gases	F)	**7MB8000-5AA**
Stainless steel flame arrestor		**7MB8000-6BA**
Hastelloy flame arrestor		**7MB8000-6BB**
Category ATEX II 3G (Zone 2)		
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
FM/CSA (Class I Div. 2)		
Ex purging unit MiniPurge FM		**7MB8000-1AA**

Retrofitting sets	
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with 8 binary inputs/outputs	**A5E00064223**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA	**A5E00057315**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057318**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA Ex i (firmware 4.1.10 required)	**A5E00057317**

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

1) Only in connection with an approved purging unit

Dimensional drawings

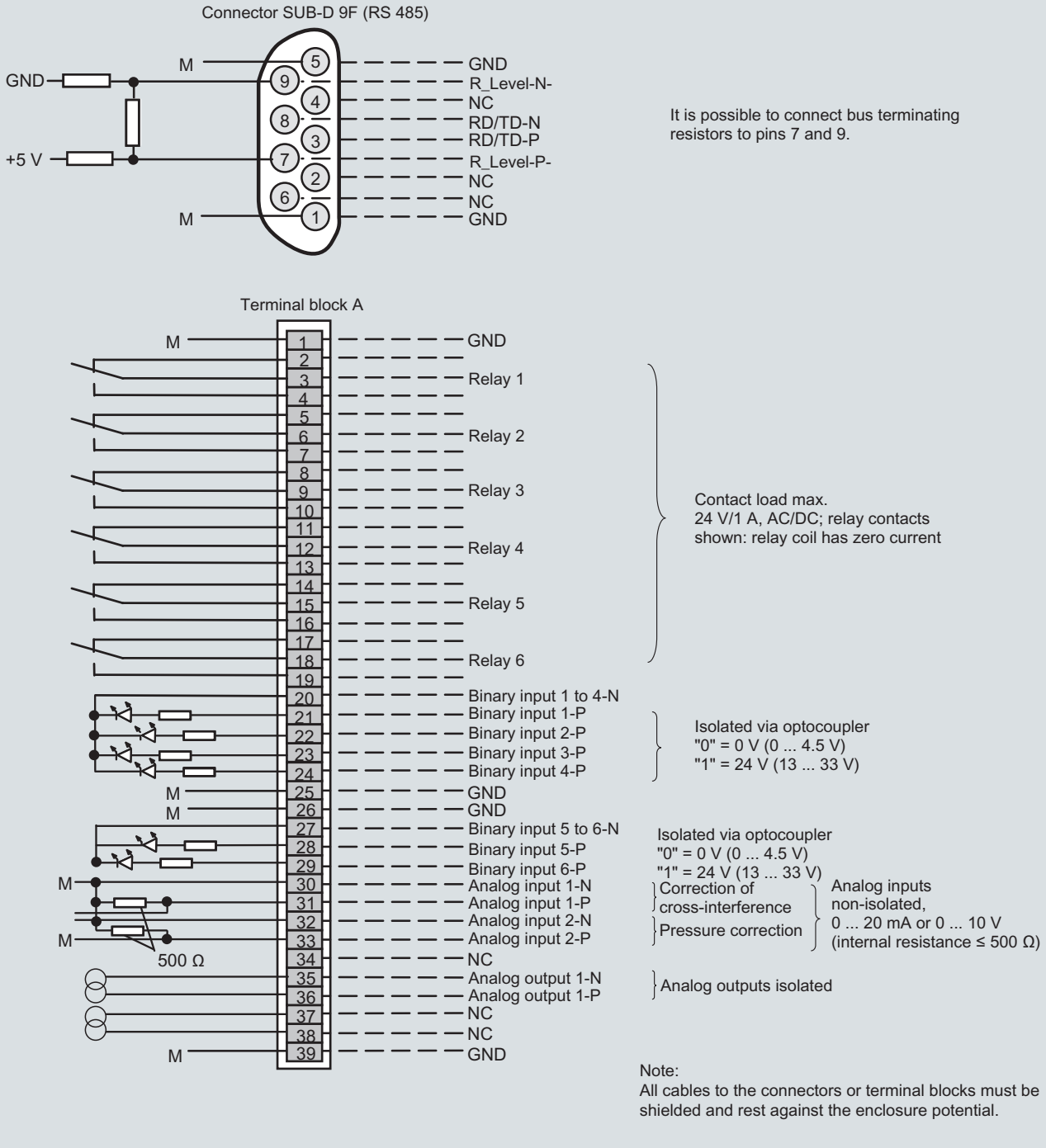


OXYMAT 6, field unit, dimensions in mm

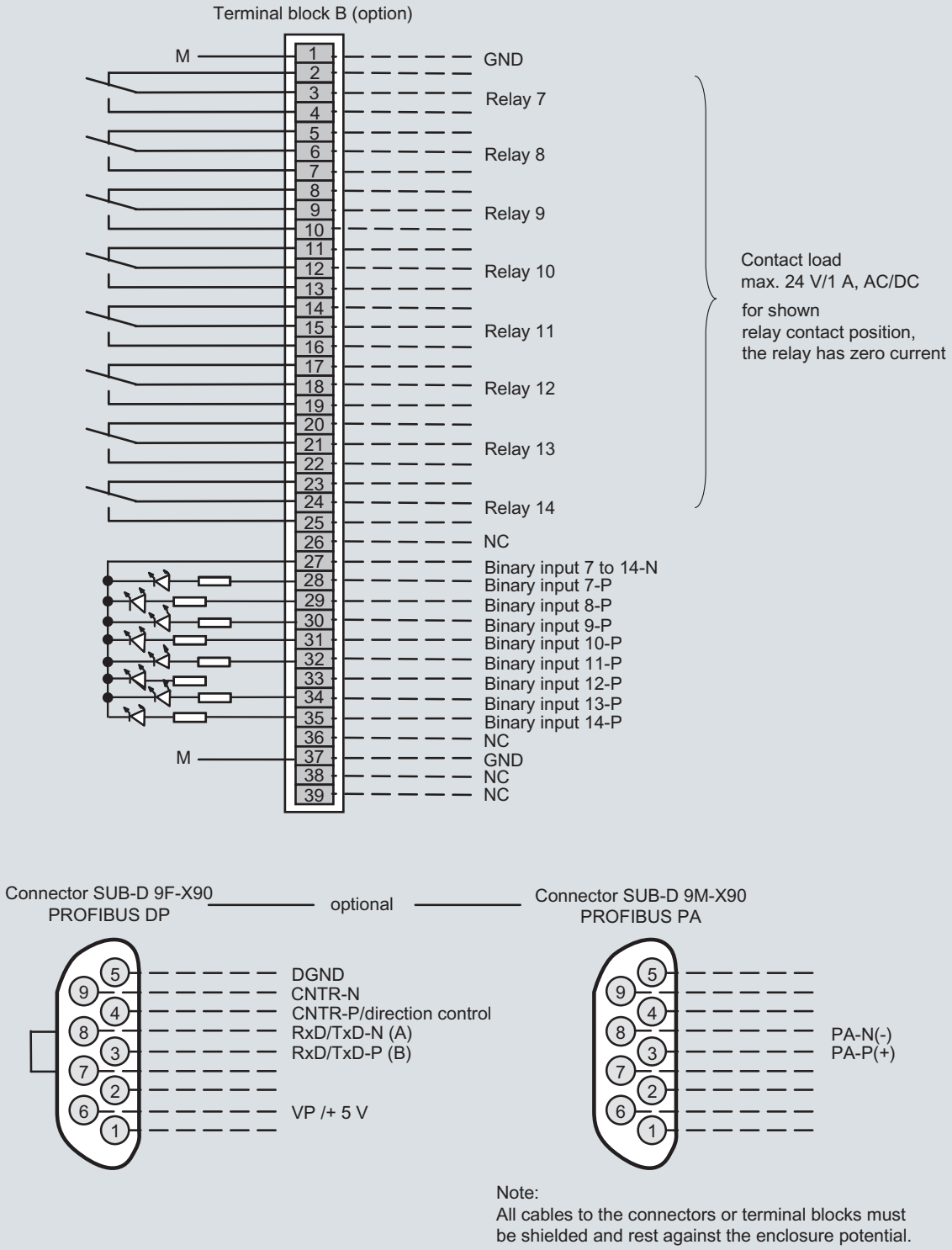
2

Schematics

Pin assignment (electrical and gas connections)

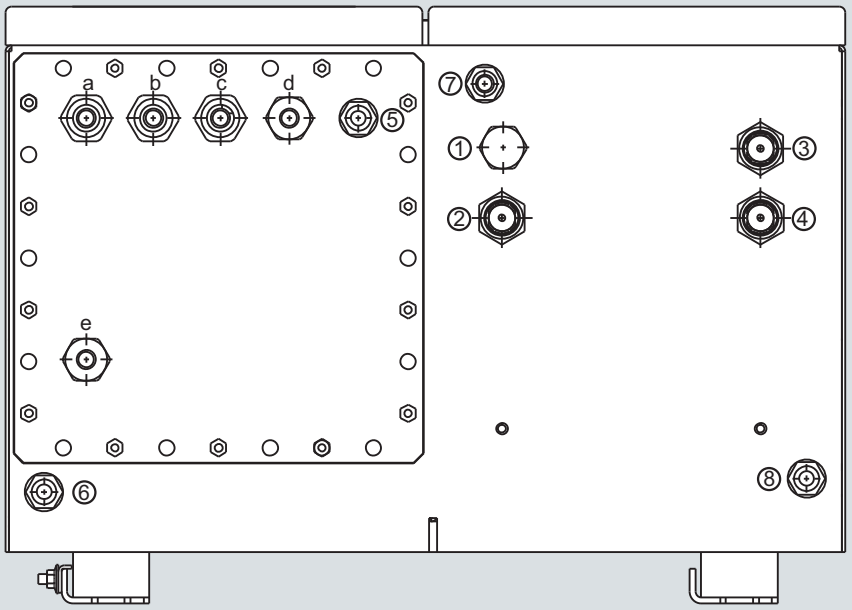


OXYMAT 6, field unit, connector and terminal assignment



OXYMAT 6, field unit, connector and terminal assignment of the AUTOCAL board and PROFIBUS connectors

Field device



Gas connections

①	not used	Clamping gland for pipe Ø 6 mm or ¼"
②	Sample gas inlet	
③	Reference gas inlet	
④	Sample gas outlet	
⑤-⑧	Purging gas inlets/outlets stubs Ø 10 mm or 3/8 "	

Electrical connections

a - c	Signal cable (Ø 10 ... 14 mm) (analog + digital): cable gland M20x1.5
d	Interface connection: (Ø 7 ... 12 mm) cable gland M20x1.5
e	Power supply: (Ø 7 ... 12 mm) cable gland M20x1.5

OXYMAT 6, field unit, gas and electrical connections

Documentation

Selection and ordering data

Operating instructions	Order No.
ULTRAMAT 6 / OXYMAT 6	
Gas analyzer for IR-absorbing gases and oxygen	
• German	**C79000-G5200-C143**
• English	**C79000-G5276-C143**
• French	**C79000-G5277-C143**
• Spanish	**C79000-G5278-C143**
• Italian	**C79000-G5272-C143**

Selection and ordering data

Description	7MB2021	7MB2011	7MB2011 Ex	2 years (quantity)	5 years (quantity)		Order No.
Analyzer unit							
O ring (sample cell)	x	x	x	2	4	D)	**C71121-Z100-A159**
O ring (fitting)	x	x	x	1	2	D)	**C74121-Z100-A6**
O-ring (measuring head)	x	x	x	2	4	D)	**C79121-Z100-A32**
Spacer		x	x	-	1		**C79451-A3277-B22**
Sample chamber, stainless steel, mat. no. 1.4571; non-flow-type compensation branch	x	x	x	-	1	D)	**C79451-A3277-B535**
Sample chamber, tantalum, non-flow-type compensation branch	x	x	x	-	1		**C79451-A3277-B536**
Sample chamber, stainless steel, mat. no. 1.4571; flow-type compensation branch	x	x	x	-	1		**C79451-A3277-B537**
Sample chamber, tantalum, flow-type compensation branch	x	x	x	-	1		**C79451-A3277-B538**
Measuring head, non-flow-type compensation branch	x	x	x	1	1		**C79451-A3460-B525**
Measuring head, flow-type compensation branch	x	x	x	1	1		**C79451-A3460-B526**
Magnetic field connection plate	x	x	x	-	1	C)	**C79451-A3474-B606**
Temperature sensor		x	x	-	1		**C79451-A3480-B25**
Heating cartridge		x	x	-	1		**W75083-A1004-F120**
Sample gas path							
Pressure switch (sample gas)	x			1	2		**C79302-Z1210-A2**
Flowmeter	x			1	2		**C79402-Z560-T1**
Restrictor, stainless steel, mat. no. 1.4571; hose gas path	x			2	2		**C79451-A3480-C10**
Restrictor, titanium, pipe gas path	x	x	x	2	2		**C79451-A3480-C37**
Reference gas path, 3000 hPa	x	x	x	1	1		**C79451-A3480-D518**
Capillary, 100 hPa, connection set	x	x	x	1	1		**C79451-A3480-D519**
Restrictor, stainless steel, mat. no. 1.4571; pipe gas path	x	x	x	1	1		**C79451-A3520-C5**
Electronics							
Temperature controller - electronics, 230 V AC		x	x	-	1		**A5E00118527**
Temperature controller - electronics, 115 V AC		x	x	-	1		**A5E00118530**
Fuse (device fuse) T 0.125 A/250 V			x	1	2		**A5E00061505**
Front plate with keyboard	x			1	1		**C79165-A3042-B505**
Motherboard, with firmware: see spare parts list	x	x	x	-	1		
Adapter plate, LCD/keyboard	x	x		1	1		**C79451-A3474-B605**
LC display	x	x		1	1		**W75025-B5001-B1**
Connector filter	x	x	x	-	1	F)	**W75041-E5602-K2**
Temperature fuse (heated version only)		x		-	1		**W75054-T1001-A150**
Fuse, T 0.63 A/250 V	x	x	x	2	3		**W79054-L1010-T630**
Fuse, T 1 A/250 V	x	x	x	2	3		**W79054-L1011-T100**
Fuse, T 2.5 A/250 V		x	x	2	3	D)	**W79054-L1011-T250**

C) Subject to export regulations AL: N, ECCN: EAR99

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

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

If the OXYMAT 6 was supplied with a specially cleaned gas path for high oxygen context ("Clean for O_2 service"), please ensure that you specify this when ordering spare parts. This is the only way to guarantee that the gas path will continue to comply with the special requirements for this version.

OXYMAT 61

General information

Overview

The measuring principle of the OXYMAT 61 gas analyzers is based on the paramagnetic alternating pressure method and is used to measure oxygen in gases in standard applications.

Benefits

- Integrated pump for reference gas (option, e.g. ambient air)
- High linearity
- Compact design
- Physically suppressed zero possible

Application

Application areas

- Environmental protection
- Boiler control in firing systems
- Quality monitoring (e.g. in ultra-pure gases)
- Process exhaust monitoring
- Process optimization

Further applications

- Chemical plants
- Gas manufacturers
- Research and development

Design

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescope rails
- Front plate can be swung down for servicing purposes (laptop connection)
- Gas connections for sample gas inlet and outlet; pipe diameter 6 mm or ¼"
- Gas and electrical connections at the rear

Display and control panel

- Large LCD field for simultaneous display of:
  - Measured value
  - Status bar
  - Measuring ranges
- Contrast of LCD panel adjustable using menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Menu-driven operation for parameterization, test functions, adjustment
- User help in plain text
- Graphic display of concentration trend; programmable time intervals
- Bilingual operating software German/English, English/Spanish, French/English, Spanish/English, Italian/English

Input and outputs

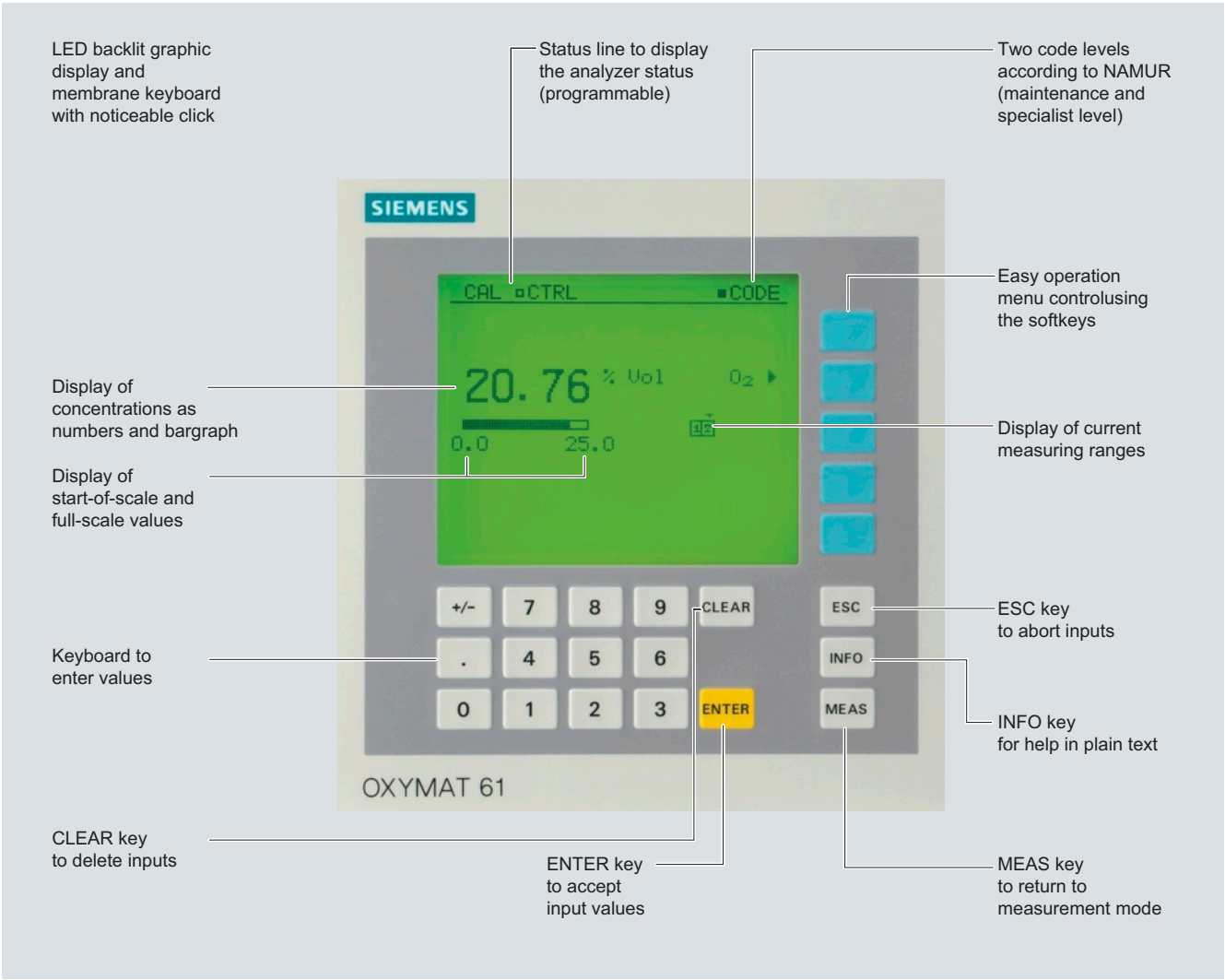
- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (failure, maintenance request, maintenance switch,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

Communication

RS 485 present in basic unit (connection from the rear).

Options

- RS 485/RS 232 converter
- RS 485/Ethernet converter
- RS 485/USB converter
- Connection to networks via PROFIBUS DP/PA interface
- SIPROM GA software as service and maintenance tool



OXYMAT 61, membrane keyboard and graphic display

Designs – Parts touched by sample gas, standard

Gas path		19" rack unit
With hoses	Bushing	Stainless steel, mat. no. 1.4571
	Hose	FKM (Viton)
	Sample chamber	Stainless steel, mat. no. 1.4571
	Fittings for sample chamber	Stainless steel, mat. no. 1.4571
	Restrictor	PTFE (Teflon)
	O-rings	FKM (Viton)
	Hose coupling	Polyamide 6

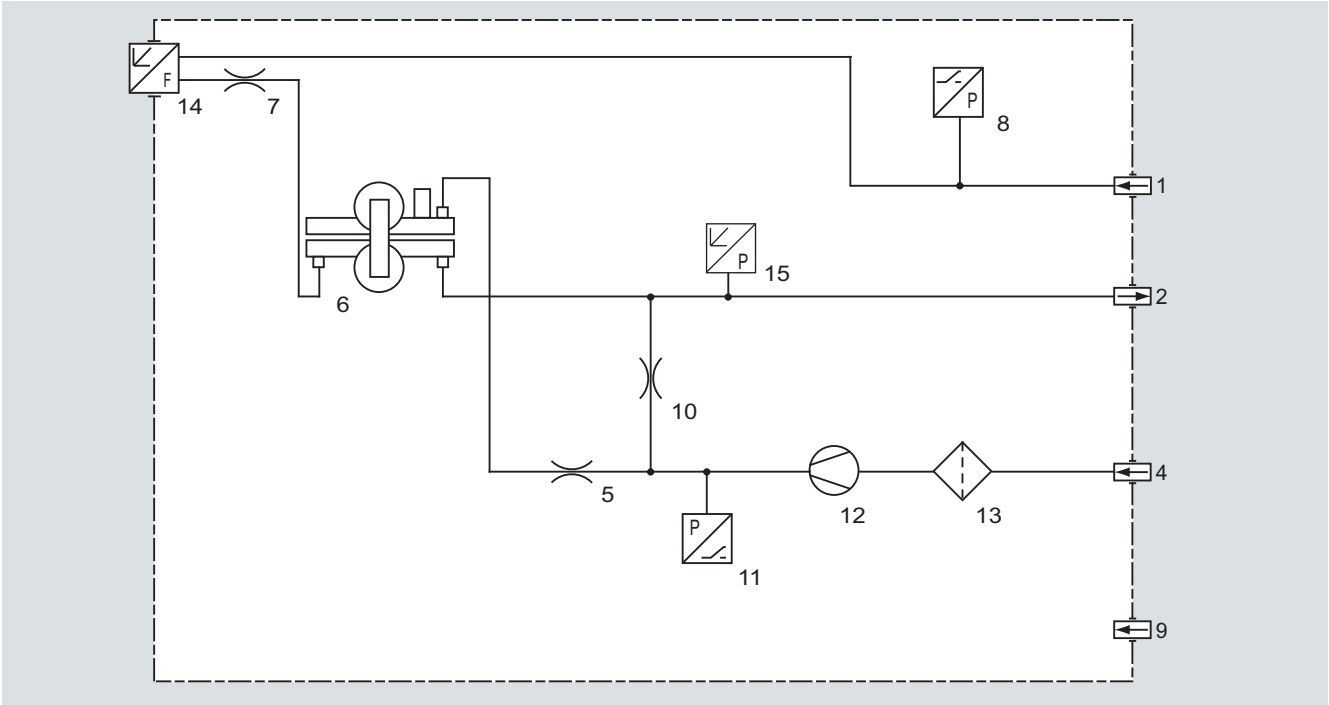
Options		
Flow indicator	Measurement pipe	Duran glass
	Variable area	Duran glass, black
	Suspension boundary	PTFE (Teflon)
	Angle pieces	FKM (Viton)
Pressure switch	Membrane	FKM (Viton)
	Enclosure	PA 6.3 T

General information

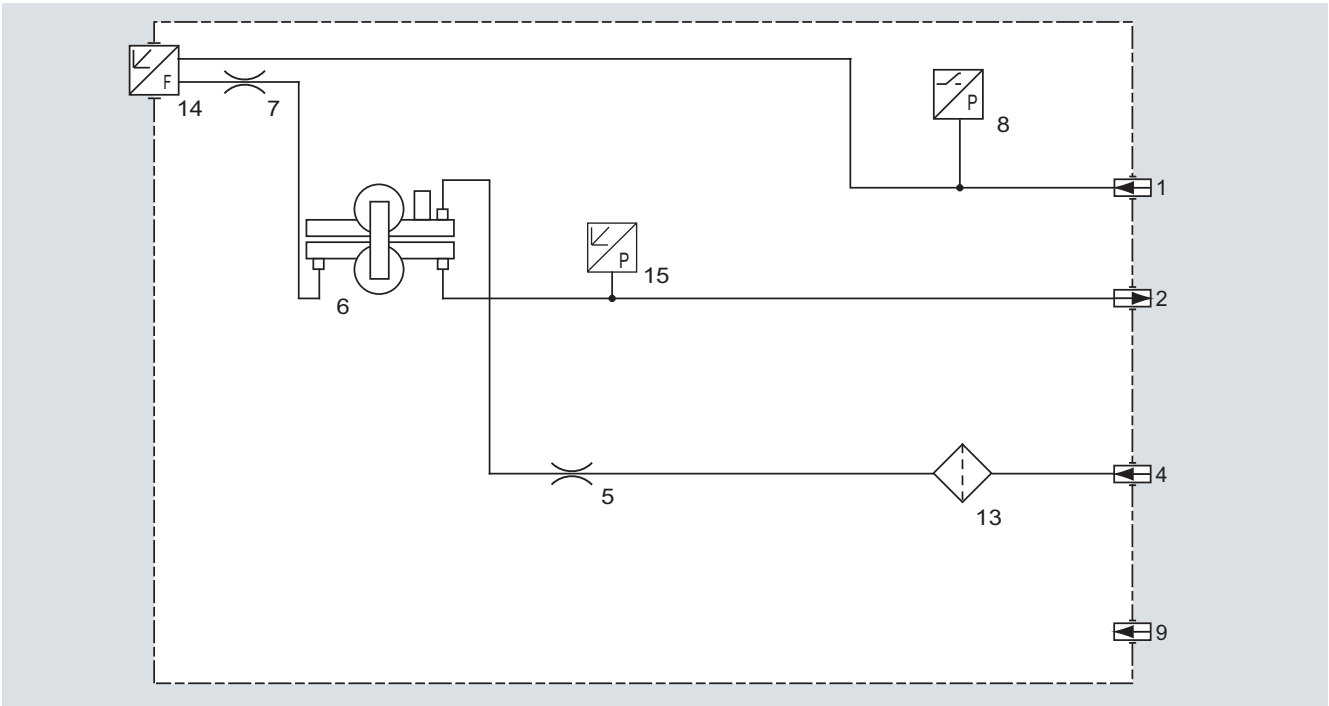
Gas path

Legend for the gas path figures

1	Sample gas inlet	9	Purging gas
2	Sample gas outlet	10	Restrictor in reference gas path (outlet)
3	Not used	11	Pressure switch for reference gas monitoring
4	Reference gas inlet	12	Pump
5	Restrictor in reference gas path	13	Filter
6	O_2 physical system	14	Flow indicator in sample gas path (option)
7	Restrictor in sample gas path	15	Pressure sensor
8	Pressure switch in sample gas path (option)		



Gas path OXYMAT 61 with integrated reference gas pump (connection for 1 100 hPa, absolute)



Gas path OXYMAT 61 with reference gas connection 3 000 to 5 000 hPa, absolute

Function

In contrast to almost all other gases, oxygen is paramagnetic. This property is utilized as the measuring principle by the OXYMAT 61 gas analyzers.

Oxygen molecules in an inhomogeneous magnetic field are drawn in the direction of increased field strength due to their paramagnetism. When two gases with different oxygen contents meet in a magnetic field, a pressure difference is produced between them.

In the case of OXYMAT 61, one gas (1) is a reference gas (N_2, O_2 or air), the other is the sample gas (5). The reference gas is introduced into the sample chamber (6) through two channels (3). One of these reference gas streams meets the sample gas within the area of a magnetic field (7). Because the two channels are connected, the pressure, which is proportional to the oxygen content, causes a cross flow. This flow is converted into an electric signal by a microflow sensor (4).

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 results in a change in the resistance of the Ni grids. This leads to an offset in the bridge which is dependent on the oxygen concentration of the sample gas.

Because the microflow sensor is located in the reference gas stream, the measurement is not influenced by the thermal conductivity, the specific heat or the internal friction of the sample gas. This also provides a high degree of corrosion resistance because the microflow sensor is not exposed to the direct influence of the sample gas.

By using a magnetic field with alternating strength (8), the effect of the background flow in the microflow sensor is not detected, and the measurement is thus independent of the instrument's operating position.

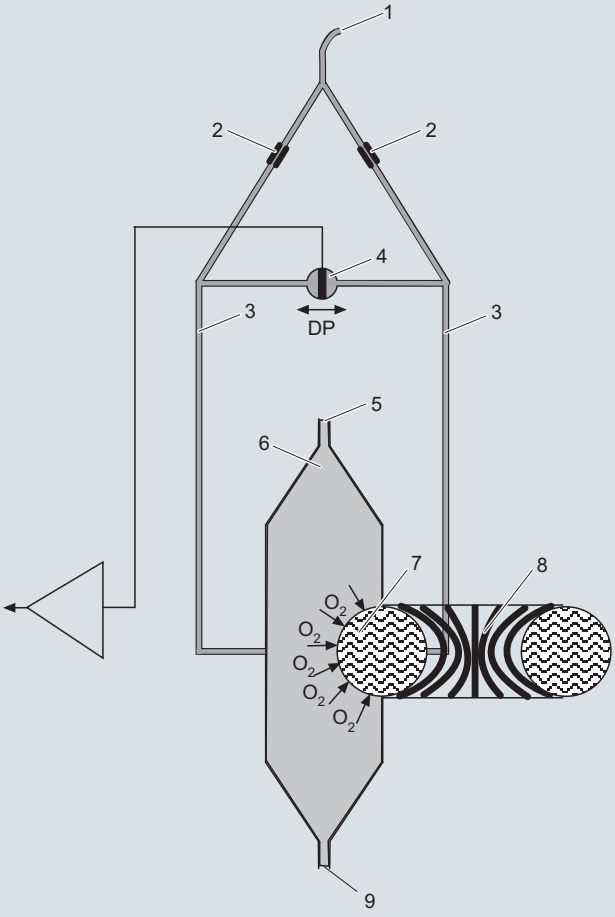
The sample chamber is directly in the sample path and has a small volume, and the microflow sensor is a low-lag sensor. This results in a very short response time for the OXYMAT 61.

Note

The sample gases must be fed into the analyzers free of dust. Condensation should be prevented from occurring in the sample chambers. Therefore, gas modified for the measuring tasks is necessary in most application cases.

Essential characteristics

- Four freely parameterizable measuring ranges, also with suppressed zero point, all measuring ranges linear
- Galvanically isolated measured-value output 0/2/4 to 20 mA (also inverted)
- Autoranging possible; remote switching is also possible
- Storage of measured values possible during adjustments
- Wide range of selectable time constants (static/dynamic noise suppression); i.e. the response time of the device can be adapted to the respective measuring task
- Easy handling thanks to menu-driven operation
- Low long-term drift
- Two control levels with their own authorization codes for the prevention of accidental and unauthorized operator interventions
- Automatic, parameterizable measuring range calibration
- Operation based on the NAMUR recommendation
- Monitoring of sample gas (option)
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording



1 Reference gas inlet
2 Restrictors
3 Reference gas channels
4 Microflow sensor for measurement
5 Sample gas inlet
6 Sample cell
7 Paramagnetic effect
8 Electromagnet with alternating field strength
9 Sample gas and reference gas outlet

OXYMAT 61, principle of operation

- Simple handling using a numerical membrane keyboard and operator prompting
- Short response time
- Reference gas supply either externally (N_2, O_2 or air, approx. 3 000 hPa) or via built-in reference gas pump (ambient air, approx. 1 100 hPa abs.)
- Monitoring of reference gas with reference gas connection; only on version with built-in reference gas pump
- Different smallest measuring ranges, depending on version 2.0 % or 5.0 % O_2
- Internal pressure sensor for correction of fluctuations in the sample gas pressure

General information

Correction of zero error / cross-sensitivities

Accompanying gas (concentration 100 vol.%)	Deviation from zero point in vol.% O_2 absolute
Organic gases	
Ethane C_2H_6	-0.49
Ethene (ethylene) C_2H_4	-0.22
Ethine (acetylene) C_2H_2	-0.29
1.2 butadiene C_4H_6	-0.65
1.3 butadiene C_4H_6	-0.49
n-butane C_4H_{10}	-1.26
iso-butane C_4H_{10}	-1.30
1-butene C_4H_8	-0.96
iso-butene C_4H_8	-1.06
Dichlorodifluoromethane (R12) CCl_2F_2	-1.32
Acetic acid CH_3COOH	-0.64
n-heptane C_7H_{16}	-2.40
n-hexane C_6H_{14}	-2.02
Cyclo-hexane C_6H_{12}	-1.84
Methane CH_4	-0.18
Methanol CH_3OH	-0.31
n-octane C_8H_{18}	-2.78
n-pentane C_5H_{12}	-1.68
iso-pentane C_5H_{12}	-1.49
Propane C_3H_8	-0.87
Propylene C_3H_6	-0.64
Trichlorofluoromethane (R11) CCl_3F	-1.63
Vinyl chloride C_2H_3Cl	-0.77
Vinyl fluoride C_2H_3F	-0.55
1.1 vinylidene chloride $C_2H_2Cl_2$	-1.22

Accompanying gas (concentration 100 vol.%)	Deviation from zero point in vol.% O_2 absolute
Inert gases	
Helium He	+0.33
Neon Ne	+0.17
Argon Ar	-0.25
Krypton Kr	-0.55
Xenon Xe	-1.05
Inorganic gases	
Ammonia NH_3	-0.20
Hydrogen bromide HBr	-0.76
Chlorine Cl_2	-0.94
Hydrogen chloride HCl	-0.35
Dinitrogen monoxide N_2O	-0.23
Hydrogen fluoride HF	+0.10
Hydrogen iodide HI	-1.19
Carbon dioxide CO_2	-0.30
Carbon monoxide CO	+0.07
Nitrogen oxide NO	+42.94
Nitrogen N_2	0.00
Nitrogen dioxide NO_2	+20.00
Sulfur dioxide SO_2	-0.20
Sulfur hexafluoride SF_6	-1.05
Hydrogen sulfide H_2S	-0.44
Water H_2O	-0.03
Hydrogen H_2	+0.26

Table 1: Zero error due to diamagnetism or paramagnetism of some accompanying gases with nitrogen as the reference gas at 60 °C and 1 000 hPa absolute (according to IEC 1207/3)

Conversion to other temperatures:

The deviations from the zero point listed in Table 1 must be multiplied by a correction factor (k):

- with diamagnetic gases: $k = 333\ K / (\vartheta\ [°C] + 273\ K)$
- with paramagnetic gases: $k = [333\ K / (\vartheta\ [°C] + 273\ K)]^2$

(all diamagnetic gases have a negative deviation from zero point)

Reference gases

Measuring range	Recommended reference gas	Reference gas connection pressure	Remarks
0 to … vol.% O_2	N_2	2 000 … 4 000 hPa above sample gas pressure (max. 5 000 hPa absolute)	The reference gas flow is set automatically to 5 … 10 ml/min
... to 100 vol.% O_2 (suppressed zero point with full-scale value 100 vol.% O_2)	O_2		
Around 21 vol.% O_2 (suppressed zero point with 21 vol.% O_2 within the measuring span)	Air	Atmospheric pressure with internal reference gas pump	

Technical specifications

General information	
Measuring ranges	4, internally and externally switchable; autoranging is also possible
Smallest possible span (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	2 vol.% or 5 vol.% O_2
Largest possible measuring span	100 vol.% O_2
Measuring ranges with suppressed zero point	Any zero point within 0 ... 100 vol.% can be implemented, provided that a suitable reference gas is used
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2
Design, enclosure	
Degree of protection	IP20 according to EN 60529
Weight	Approx. 13 kg
Electrical characteristics	
Power supply	100 … 120 V AC (nominal range of use 90 … 132 V), 47 … 63 Hz or 200 … 240 V AC (nominal range of use 180 … 264 V), 47 … 63 Hz
Power consumption	Approx. 37 VA
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	According to EN 61010-1, overvoltage category III
Fuse values	100 ... 120 V: 1.0 T/250 200 ... 240 V: 0.63 T/250
Gas inlet conditions	
Permissible sample gas pressure	
• External reference gas supply	800 … 1 200 hPa absolute
• With integrated pump	Atmospheric pressure ± 50 hPa
Sample gas flow	18 … 60 l/h (0.3 … 1 l/min)
Sample gas temperature	Min. 0 to max. 50 °C, but above the dew point
Sample gas humidity	< 90 % relative humidity
Reference gas pressure (high-pressure version)	2 000 ... 4 000 hPa above sample gas pressure, but max. 5 000 hPa absolute (version without reference gas pump)
Reference gas pressure (low-pressure version) with external pump	Min. 100 hPa above sample gas pressure
Dynamic response	
Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Delayed display (T_{90})	3.5 s
Damping (electrical time constant)	0 … 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approximately 0.5 ... 2.5 s, depending on version
Time for device-internal signal processing	< 1 s
Pressure correction range	
Pressure sensor internal	500 … 2 000 hPa, absolute (see gas inlet conditions for permissible sample gas pressure)

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Output signal fluctuation	< ± 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (corresponds to ± 0.25 % at 2 σ)
Zero point drift	< ± 0.5 %/month of the smallest possible span according to rating plate
Measured-value drift	< ±0.5 %/month of the current measuring range
Repeatability	< 1 % of the current measuring range
Detection limit	1 % of the current measuring range
Linearity error	< 1 % of the current measuring range
Influencing variable (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	< 2 %/10 K with span 5 %
Sample gas pressure (with air (100 hPa) as internal reference gas supply, correction of the atmospheric pressure fluctuations is only possible if the sample gas can vent to ambient air.)	• When pressure compensation has been switched off: < 2 % of the current measuring range/1 % pressure change • When pressure compensation has been switched on: < 0.2 % of the current measuring range/1 % pressure change
Accompanying gases	Deviation from zero point corresponding to paramagnetic or diamagnetic deviation of accompanying gas (see table)
Sample gas flow at zero point	< 1 % of the current measuring range according to rating plate with a change in flow of 0.1 l/min within the permissible flow range
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %
Electrical inputs and outputs	
Analog output	0/2/4 … 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, potential-free
Analog inputs	2, dimensioned for 0/2/4 … 20 mA for external pressure sensor and accompanying gas influence correction (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs, also with PROFIBUS PA or PROFIBUS DP
Climatic conditions	
Permissible ambient temperature	-30 … +70 °C during storage and transportation 5 … 45 °C during operation
Permissible humidity	< 90 % relative humidity as annual average, during storage and transportation (must not fall below dew point)

OXYMAT 61

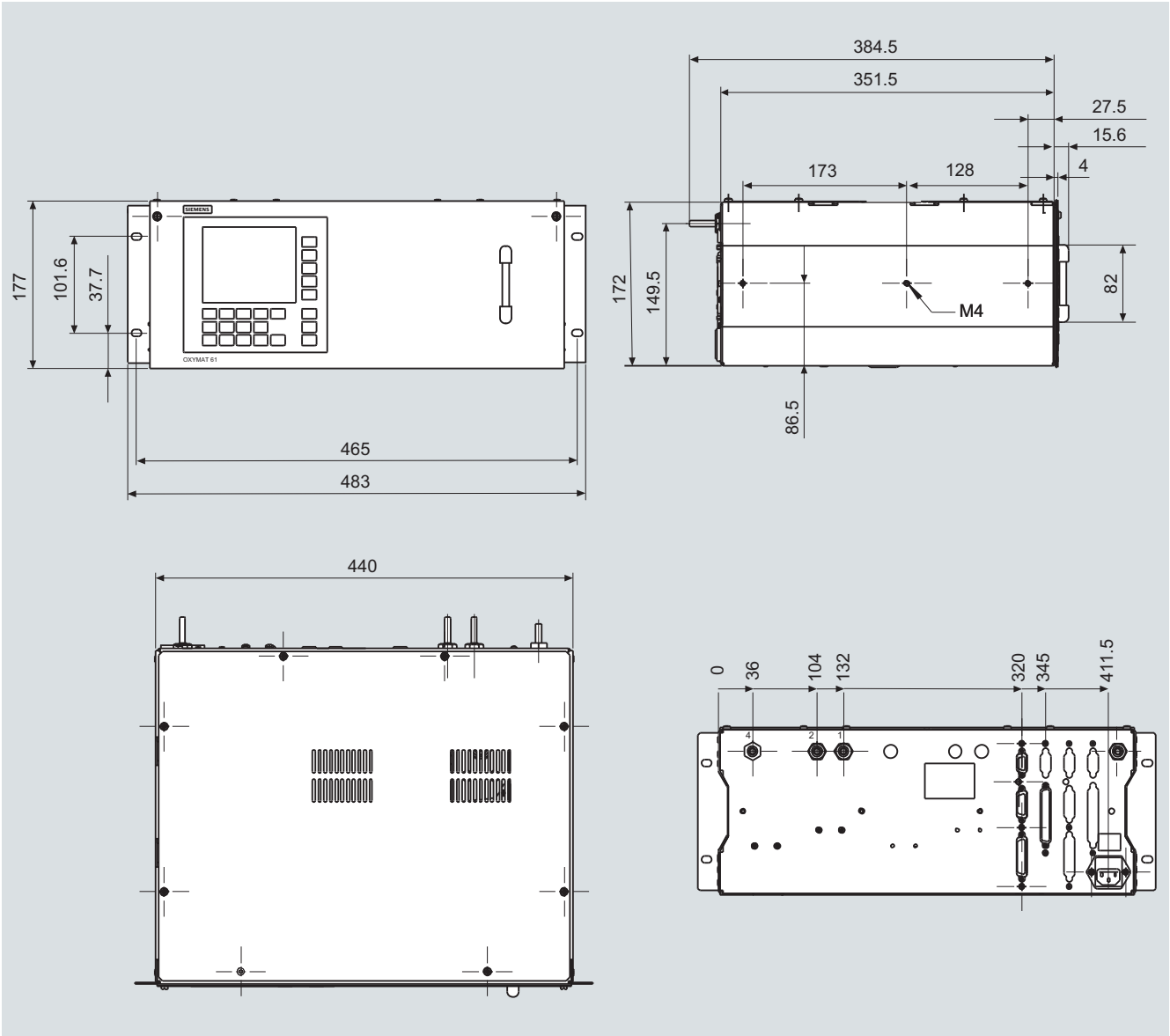
19" rack unit

Selection and ordering data		Order No.								Cannot be combined
OXYMAT 61 gas analyzer 19" rack unit for installation in cabinets	D)	**7MB2001-**	■	■	**A**	**0**	**0**	**-**	■ ■ ■ ■	
Gas connections for sample gas and reference gas										
Pipe with 6 mm outer diameter			**0**							
Pipe with ¼" outer diameter			**1**							
Smallest possible span O_2										
2 % reference gas pressure 3 000 hPa				**C**						
2 % reference gas supply with internal pump				**D**						**D → Y02**
5 % reference gas pressure 3 000 hPa				**E**						
5 % reference gas supply with internal pump				**F**						**F → Y02**
Power supply										
100 ... 120 V AC, 47 ... 63 Hz						**0**				
200 ... 240 V AC, 47 ... 63 Hz						**1**				
Sample gas monitoring										
Without							**A**			
With (incl. flow indicator and pressure switch)							**D**			
Add-on electronics										
Without								**A**		
AUTOCAL function										
• With 8 additional binary inputs/outputs								**B**		
• With serial interface for the automotive industry (AK)								**D**		
• With 8 additional binary inputs/outputs and PROFIBUS PA interface								**E**		
• With 8 additional binary inputs/outputs and PROFIBUS DP interface								**F**		
Language										
German									**0**	
English									**1**	
French									**2**	
Spanish									**3**	
Italian									**4**	
Additional versions		**Order code**								
Add "-Z" to Order No. and specify Order code										
Telescopic rails (2 units)		**A31**								
Set of Torx screwdrivers		**A32**								
TAG labels (specific inscription based on customer information)		**B03**								
Damping element for sample gas		**B04**								**→ Y02**
Clean for O_2 service (specially cleaned gas path)		**Y02**								
Measuring range indication in plain text, if different from the standard setting[1)]		**Y11**								
Retrofitting sets		**Order No.**								
RS 485/Ethernet converter		**A5E00852383**								
RS 485/RS 232 converter		**C79451-Z1589-U1**								
RS 485/USB converter		**A5E00852382**								
AUTOCAL function each with 8 binary inputs/outputs		**C79451-A3480-D511**								
AUTOCAL function 8 binary inputs/outputs each and PROFIBUS PA		**A5E00057307**								
AUTOCAL function 8 binary inputs/outputs each and PROFIBUS DP		**A5E00057312**								

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

1) Standard setting:
Measuring range 1: 0 to smallest span
Measuring range 2: 0 to 10 %
Measuring range 3: 0 to 25 %
Measuring range 4: 0 to 100 %

Dimensional drawings

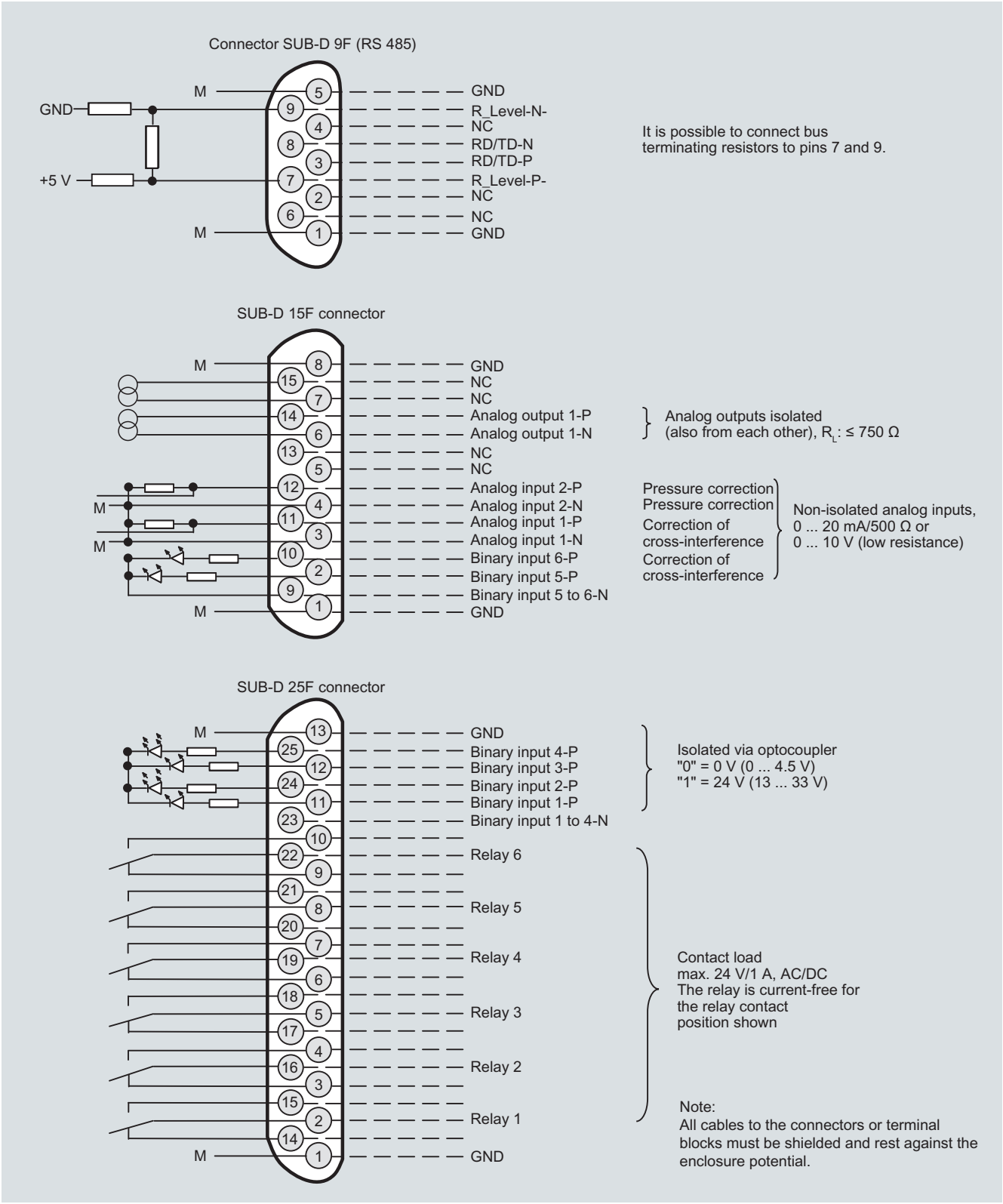


OXYMAT 61, 19“ unit, dimensions in mm

2

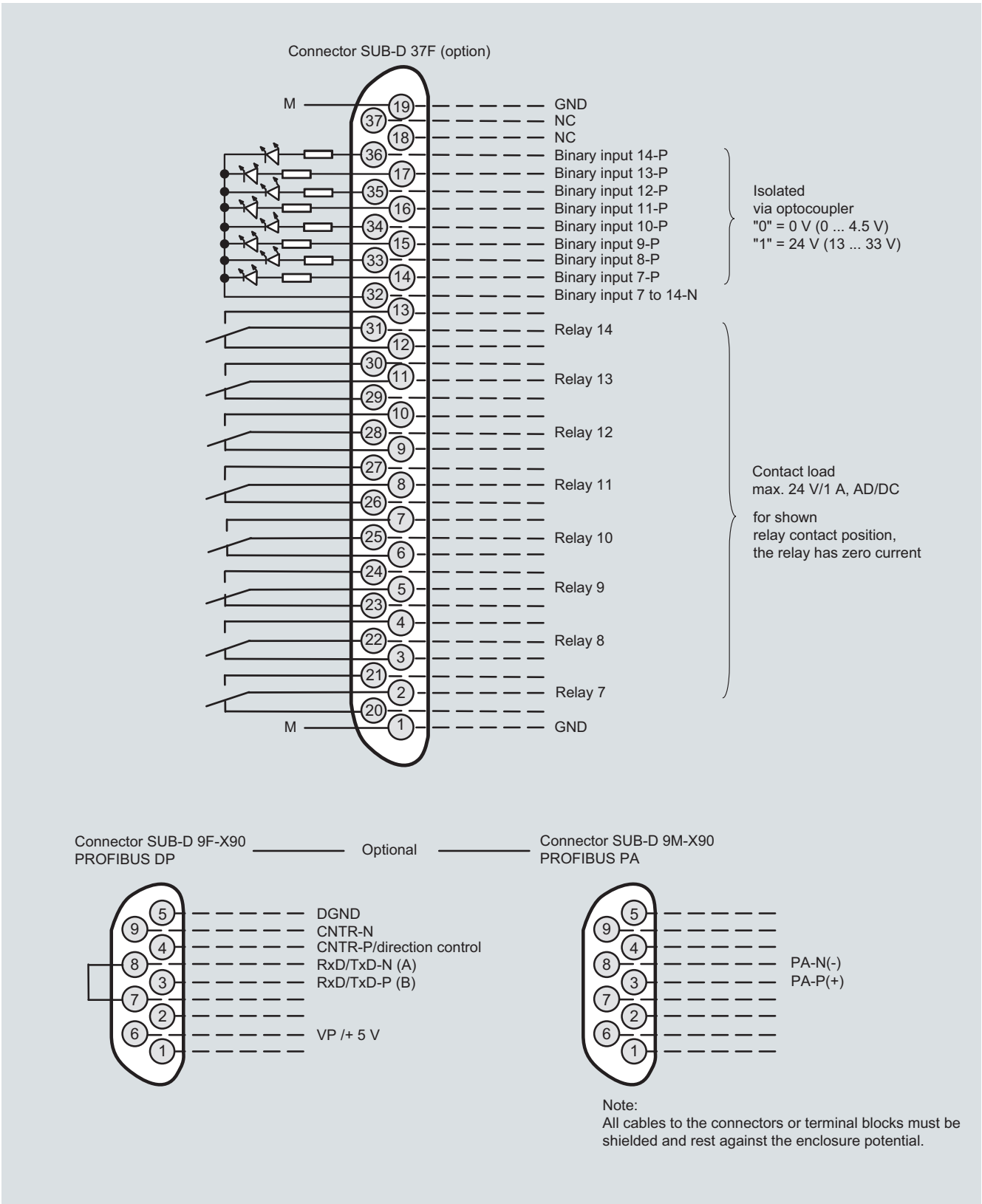
Schematics

Pin assignment (electrical connections)



OXYMAT 61, 19“ unit, pin assignment

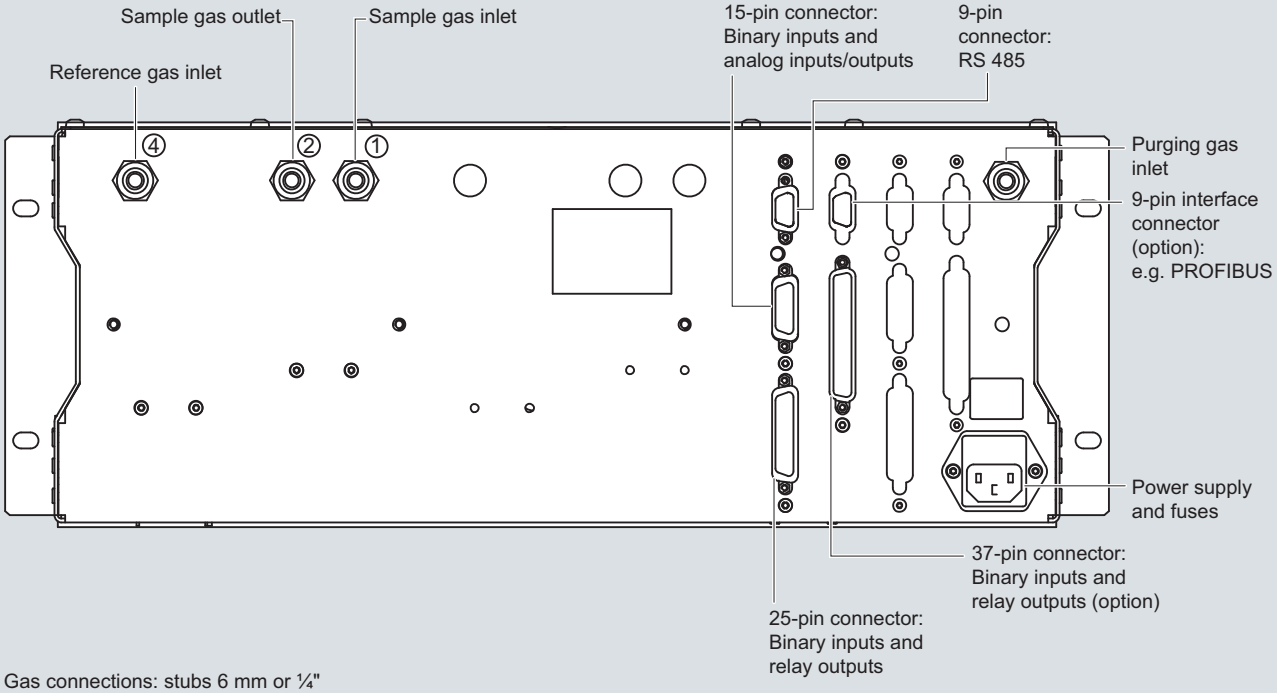
Pin assignment (electrical connections)



OXYMAT 61, 19“ unit, pin assignment of the AUTOCAL board and PROFIBUS connectors

19" rack unit

Gas and electrical connections



OXYMAT 61, 19“ unit, gas and electrical connections

Documentation

Selection and ordering data

Operating instructions	Order No.
OXYMAT 61	
Gas analyzer for measurement of oxygen	
• German	**A5E00123066**
• English	**A5E00123067**
• French	**A5E00123068**
• Spanish	**A5E00123069**
• Italian	**A5E00123070**

Selection and ordering data

Description	Quantity for 2 years	Quantity for 5 years		Order No.
Analyzer unit				
Reference gas supply (pump, restrictor, pressure switch, hose)	1	1		**A5E00114838**
O-ring	1	2	D)	**C74121-Z100-A6**
Pressure switch (sample gas)	1	2		**C79302-Z1210-A2**
Flowmeter	1	2		**C79402-Z560-T1**
Sample chamber				
• Stainless steel, mat. no. 1.4571; non-flow-type compensation branch	-	1	D)	**C79451-A3277-B535**
• O-ring (measuring head)	2	4	D)	**C79121-Z100-A32**
• O ring (fitting)	2	4	D)	**C71121-Z100-A159**
Measuring head (non-flow-type compensation branch)	1	1		**C79451-A3460-B525**
Restrictor for sample gas path, hose	2	2		**C79451-A3480-C10**
Reference gas path, 3 000 hPa (set of parts)	1	1		**C79451-A3480-D518**
Electronics				
Front plate with keyboard	1	1		**A5E00259978**
Motherboard, with firmware: see spare parts list	-	1		
Adapter plate, LCD/keyboard	1	1		**C79451-A3474-B605**
Magnetic field connection plate	-	1	C)	**C79451-A3474-B606**
LC display	1	1		**W75025-B5001-B1**
Connector filter	-	1	F)	**W75041-E5602-K2**
Fuse				
• 0.63 A/250 V (230 V version)	2	3		**W79054-L1010-T630**
• 1.0 A/250 V (110 V version)	2	3		**W79054-L1011-T100**

C) Subject to export regulations AL: N, ECCN: EAR99

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

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

If the OXYMAT 61 was supplied with a specially cleaned gas path for high oxygen context ("Clean for O_2 service"), please ensure that you specify this when ordering spare parts. This is the only way to guarantee that the gas path will continue to comply with the special requirements for this version.

OXYMAT 64

General information

Overview

The OXYMAT 64 gas analyzer is used for the trace measurement of oxygen.

Benefits

- High linearity
- Compact design
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and service information (option)

Application

- *Production of technical gases*
  Measurements in N_2 and CO_2
- *Welding*
  Measurements in protective gases during welding of highly alloyed steels, titanium, etc.
- *Systems for air separation*
  Measurements in N_2 and in inert gases (e.g. Ne, Ar)
  Measurements in CO_2
- *Food production*
  Measurement in CO_2 (e.g. breweries)
- *Electronics industry*
  Low-pressure version with pump
- *Flow soldering systems*

Design

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescope rails
- Front plate for service purposes can be pivoted down (laptop connection)
- Connections for sample gas
  - Input: Clamping ring connection for a pipe diameter of 6 mm or ¼"
  - Output: Pipe connection with diameter 6 mm or ¼"
- High-pressure and low-pressure versions
- Catalytically active and inactive cell

Display and control panel

- Large LCD field for simultaneous display of
  - Measured value
  - Status bar
  - Measurement ranges
- Contrast of the LCD field adjustable via the menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Five-digit measured-value display (decimal point counts as one digit)
- Menu-driven operation for parameterization, configuration, test functions, adjustment
- Operator support in plain text
- Graphical display of the concentration progression; time intervals parameterizable
- Bilingual operating software German/English, English/Spanish, French/English, Spanish/English, Italian/English
- Switchover from ppm measuring range to % measuring range

Input and outputs

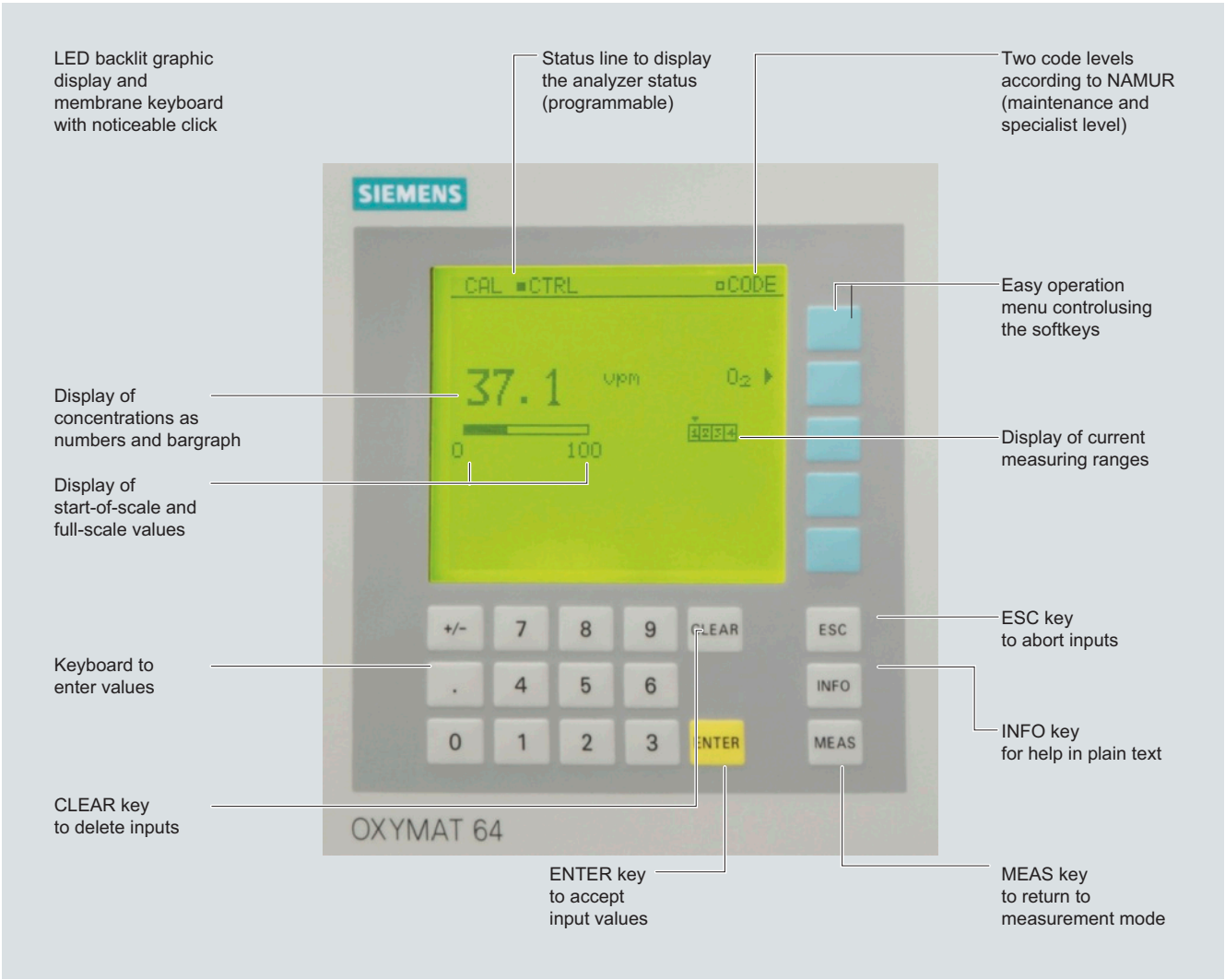
- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (failure, maintenance request, maintenance switch,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

Communication

RS 485 present in basic unit (connection from the rear).

Options

- RS 485/RS 232 converter
- RS 485/Ethernet converter
- RS 485/USB converter
- Connection to networks via PROFIBUS DP/PA interface
- SIPROM GA software as the service and maintenance tool



OXYMAT 64, membrane keyboard and graphic display

Designs – Parts touched by sample gas, standard

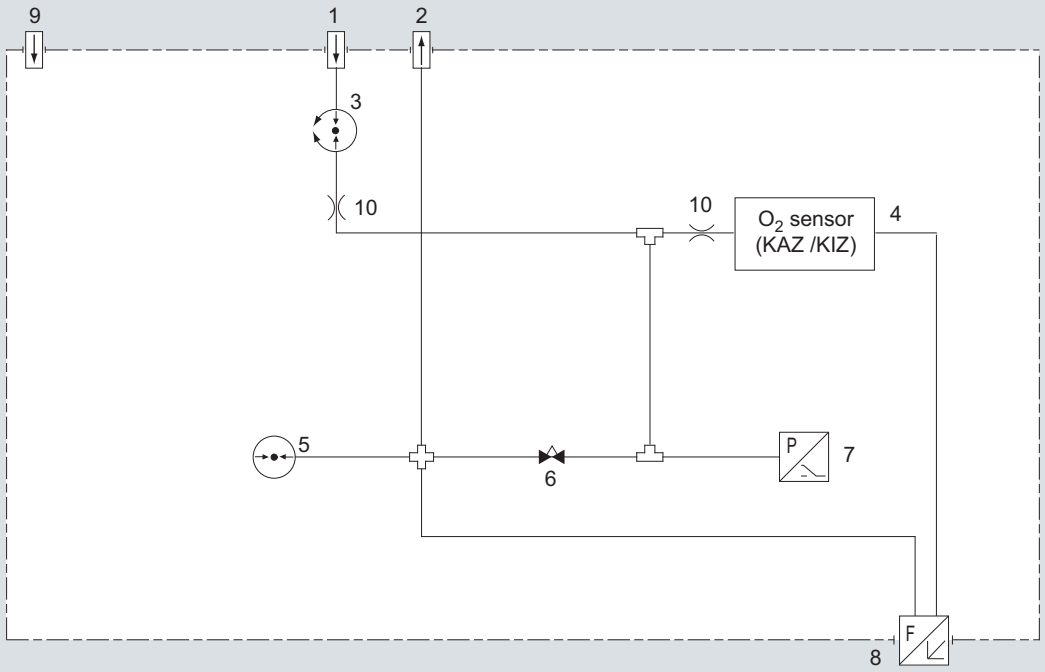
Gas path		19" rack unit
Sample gas path	Bushing	Stainless steel, mat. no. 1.4571
	Pipe inlet	Stainless steel
	O_2 sensor	ZrO_2 ceramic
	Bypass line	FPM (Viton)
	Connection pieces	PTFE (Teflon)
Pressure sensor	Enclosure	Polycarbonate
	Diaphragm	SiO_4
	Sensor adapter	Aluminum
	Bypass restrictor	Stainless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

General information

Gas path (high-pressure version)

Legend for the gas path figure

1	Sample gas inlet; inlet pressure - without internal pressure regulator: 2 000 hPa (abs.), regulated - with internal pressure regulator: 2 000 ... 6 000 hPa (abs.)	5	Pressure sensor
		6	Bypass restrictor
		7	Pressure switch
2	Sample gas outlet; sample gas flows off free of dynamic pressure	8	Flow measuring tube
3	Pressure regulator (order version)	9	Purging gas connection
4	O_2 sensor	10	Restrictor



Gas path OXYMAT 64, high-pressure version

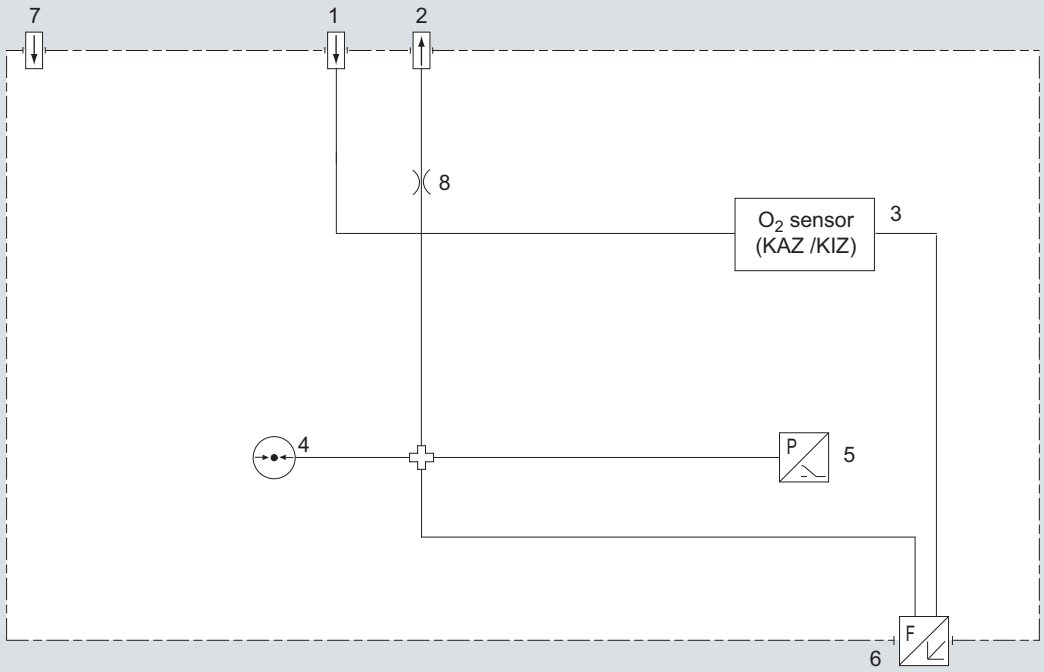
The sample gas pressure (2 000 to 6 000 hPa) is regulated by the pressure regulator (3) at approx. 2 000 hPa or is provided by the operator with 2 000 hPa. This pressure is applied at the restrictor (10). The restrictor (10) reduces the pressure such that a sample gas flow of 15 to 30 l/h is created. This flow is subdivided via the sample gas restrictor (11) and the adjustable bypass restrictor (6) such that there is a sample gas flow of 7.5 l/h through the sensor.

If the sample gas can flow off into the atmosphere unhampered, the sample gas pressure corresponds to the atmospheric pressure. If the sample gas flows off via an exhaust gas line, it works like a flow resistance. If the resulting dynamic pressure exceeds 100 hPa (rel.), a maintenance request is output.

Gas path (low pressure)

Legend for the gas path figure

1	Sample gas inlet; flow 125 ml/min (7.5 l/h)	5	Pressure switch
2	Sample gas outlet; sample gas flows off free of dynamic pressure	6	Flow measuring tube
3	O_2 sensor	7	Purging gas connection
4	Pressure sensor	8	Restrictor



Gas path OXYMAT 64, low-pressure version

With the low-pressure version, the sample gas flow must be set externally to 125 ml/min. With a built-in pressure switch, the sample gas pressure is approx. 30 hPa above the current atmospheric pressure since the sample gas flows off via a restrictor. If the resulting dynamic pressure exceeds 100 hPa (rel.), a maintenance request is output. In order to reduce the 90 % time, we recommend installation of a bypass upstream of the gas inlet which then provides a faster exchange of gas. This is particularly important with long sample gas lines between the gas sampling point and the analyzer. Please make absolutely sure that the flow in the OXYMAT 64 does not exceed 125 ml/min.

General information

Function

The measuring cell consists of a cylindrical (pipe-shaped) ZrO_2 membrane. The sample gas (low O_2 content) flows at a constant rate through the inside of the membrane, which is regulated at 650 °C. The exterior of the sensor is exposed to the ambient air (approx. 21 % O_2).

Both sides of the ZrO_2 membrane are coated with thin platinum films that act as electrodes. This forms a solid, electrochemical cell. The amount of oxygen atoms ionized depends on the oxygen concentration at the electrodes.

The differences in concentration at each side means that a differential partial pressure prevails. Since ZrO_2 conducts ions at 650 °C, ionic migration takes place in the direction of the lower partial pressure.

An oxygen gradient arises across the width of the ZrO_2 membrane, which, according to equation (1), results in an electrical potential difference between the platinum electrodes.

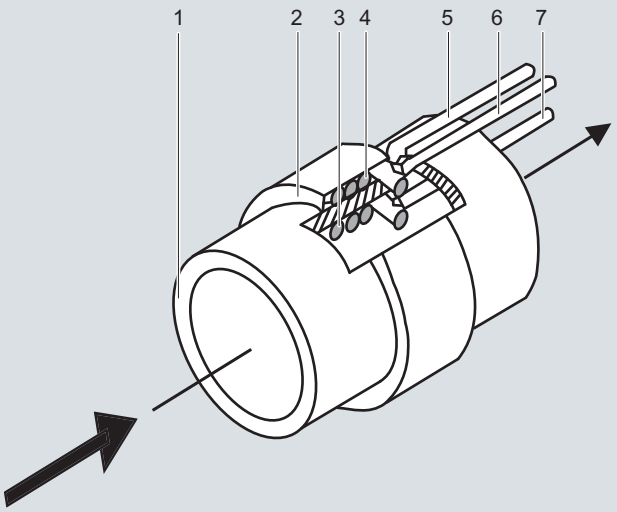
Defects in the crystal lattice, caused by contamination of the ZrO_2 material with Y_2O_3 and/or CaO (introduced originally to prevent cracks forming in ceramic material) make it easier for O_2 ions to diffuse in the ZrO_2 grid.

Catalytically active ZrO_2 sensor (CAZ)

The electrode material is made of platinum (Pt). This type of sensor has a higher cross-sensitivity when flammable accompanying gas components are present.

Catalytically inactive ZrO_2 sensor (CIZ)

The catalytically inactive sensor has the same general design as the CAZ. The contacts and electrode surface inside the pipe are made of a specially developed material which largely prevents catalytic oxidation except of H_2, CO and CH_4.



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

OXYMAT 64, principle of operation

Measuring effect

$U = U_A + RT/4F (\ln [O_2,air] - \ln [O_2])$ (equation 1)

U	measuring effect
U_A	asymmetric voltage (voltage, at $[O_2] = [O_2,air]$
T	ceramic temperature
$[O_2,air]$	O_2 concentration in the air
$[O_2]$	O_2 concentration in sample gas

Note

The sample gas must be fed into the analyzer free of dust. Condensation should be avoided. Therefore, gas modified for the measuring tasks is necessary in most application cases.

Calibration of the calibration point is carried out as with the other analyzers of Series 6 after a maximum of 14 days by connecting the calibration gas O_2 in residual N_2 at concentrations of approx. 60 to 90 % of the master measuring range.

Contrary to the other analyzers of Series 6, the zero point calibration cannot be carried out using pure nitrogen, but with a "small" concentration of oxygen in nitrogen appropriate to the selected measuring range (e.g.: measuring range 0 … 10 vpm; calibration gas approx. 2 ppm O_2 in residual N_2).

Essential characteristics

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

Influence of interfering gas

Catalytically active sensor (CAZ)

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

Catalytically inactive sensor (CIZ)

There is only a slight cross-interference in the case of accompanying gases with a concentration in the range of the O_2 concentration. H_2, CO and CH_4 still have a noticeable effect in the case of flammable accompanying gas components.

Measured component / interfering gas	Diagonal gas offset
78 vpm O_2/140 vpm CO	-6.1 vpm
10 vpm O_2/10 vpm CO	-0.6 vpm
74 vpm O_2 / 25 vpm CH_4	-0.3 vpm
25 vpm O_2 / 357 vpm CH_4	-1.1 vpm
25 vpm O_2 / 70 vpm H_2	-3 vpm
5 vpm O_2 / 9.6 vpm H_2	-0.55 vpm
170 vpm O_2 / 930 vpm C_2H_4	-118 vpm

Examples of typical diagonal gas offsets on a catalytically inactive sensor

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

19" rack unit

Technical specifications

General	
Measurement ranges	4, internally and externally switchable; automatic measuring range switchover also possible
Smallest possible span (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow, and 25 °C ambient temperature)	0 ... 10 vpm O_2
Largest possible measuring span	0 ... 100 %
Operating position	Front wall vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2 and RoHS
Design, enclosure	
Degree of protection	IP20 according to EN 60529
Weight	Approx. 11 kg
Electrical characteristics	
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98) and EN 61326
Electrical safety	In accordance with EN 61010-1, overvoltage category II
Power supply	100 ... 120 V AC (nominal range of use 90 ... 132 V), 48 ... 63 Hz or 200 ... 240 V AC (nominal range of use 180 ... 264 V), 48 ... 63 Hz
Power consumption	Approx. 37 VA
Fuse values	100 ... 120 V: 1.0T/250 200 ... 240 V: 0.63T/250
Gas inlet conditions	
Sample gas flow	
• through the sensor	7.5 l/h
• Overall consumption	15 ... 30 l/h
Permissible sample gas pressure	
• without internal pressure regulator	2 000 hPa (abs.)
• with internal pressure regulator	2 000 ... 6 000 hPa (abs.)
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Sample gas humidity	< 1 % relative humidity
Dynamic response	
Warm-up period	At room temperature < 30 min (the technical specification will be met after 2 hours)
Damping (electrical time constant)	0 ... 100 s, parameterizable
Dead time (high-pressure version) (purging time of the gas path in the unit at 125 ml/min)	10 ... 30 s
Dead time (low-pressure version without pump)	< 5 s
Dead time (low-pressure version with pump)	< 10 s
Time for device-internal signal processing	< 1 s
Pressure correction range	
Pressure sensor internal	800 ... 1 100 hPa (abs.)

Measuring response (referred to sample gas pressure 1 013 hPa absolute, sample gas flow 7.5 l/min, and ambient temperature 25 °C)	
Output signal fluctuation	< ± 1 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s
Zero point drift	< ± 1 % of the current span/month
Measured-value drift	< ± 1 % of the current span/month
Repeatability	< 3 % of the current measuring span
Detection limit	1 % of current measuring range, < 0.1 vpm in measuring range 0 ... 10 vpm
Linearity error	< 2 % of the current measuring span
Influencing variables (relating to sample gas pressure 1 013 hPa absolute, 7.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	< 2 %/10 K referred to current measuring span
Sample gas pressure only possible if the sample gas can flow out into the ambient air	• When pressure compensation has been switched off: < 1 % of current span/1 % pressure change • When pressure compensation has been switched on: < 0.2 % of current span/1 % pressure change
Residual gases, deviation from zero point	
• Catalytically active sensor (CAZ)	Only gases with non-combustible residual gas components can be introduced
• Catalytically inactive sensor (CIZ)	Residual gas concentration of 10 vpm H_2; CO and CH_4 have a lower cross-interference; higher HCs are negligible
Sample gas flow	< 2 % of the smallest possible span with a change in flow of 10 ml/min
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %
Electrical inputs and outputs	
Analog output	0/2/4 ... 20 mA, 4 … 20 mA (NAMUR), isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 … 20 mA for external pressure sensor and correction of influence of residual gas (correction of cross-interference)
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measurement range switchover
Serial interface	RS 485
Options	AUTOCAL function each with 8 additional binary inputs and relay outputs, also with PROFIBUS PA or PROFIBUS DP
Climatic conditions	
Permissible ambient temperature	-40 ... +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity	< 90 % relative humidity as annual average, during storage and transportation (must not fall below dew point)

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

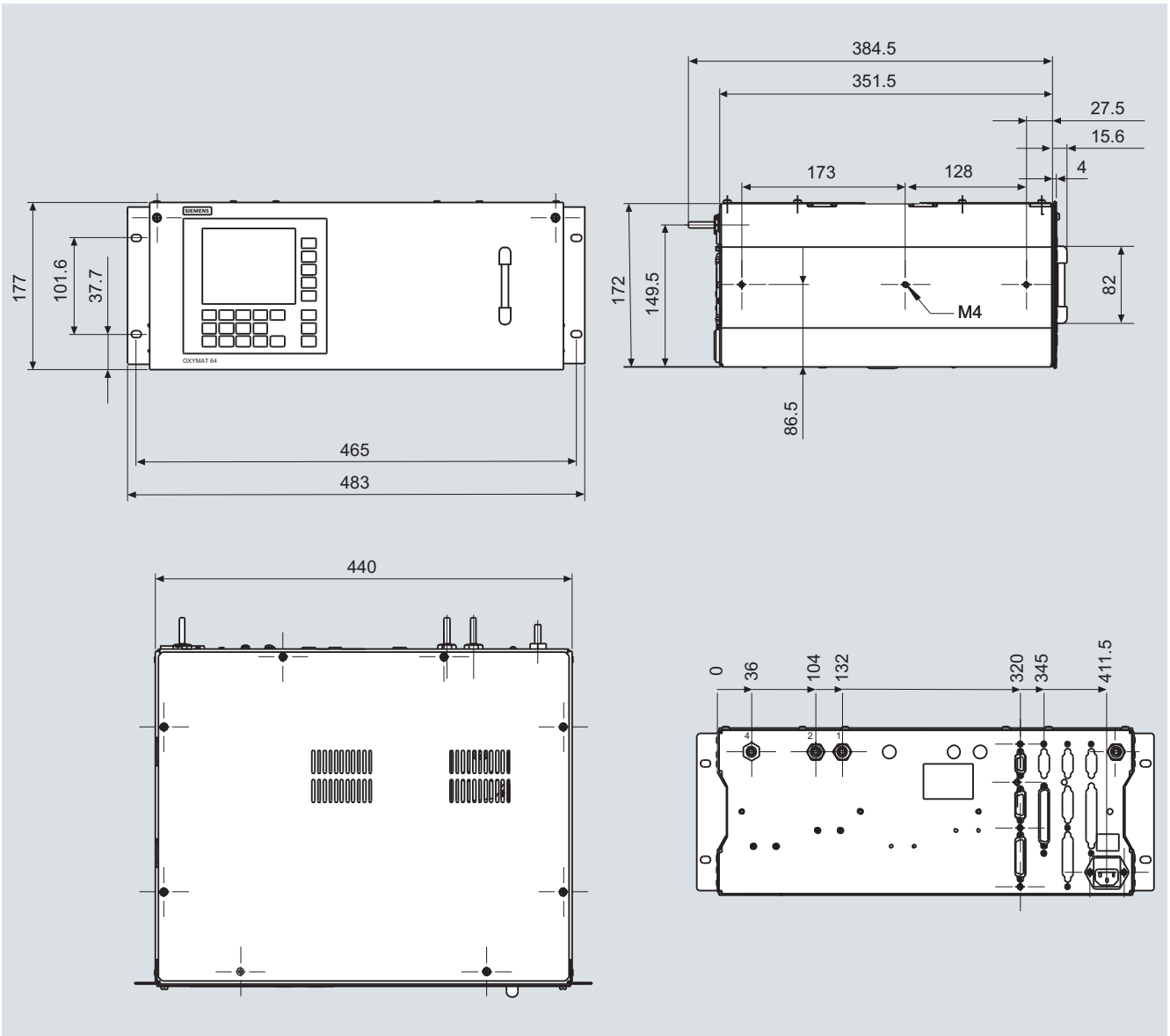
Additional versions	Order code
Add "-Z" to Order No. and specify Order code	
Telescopic rails (2 units)	**A31**
TAG labels (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**

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

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

19" rack unit

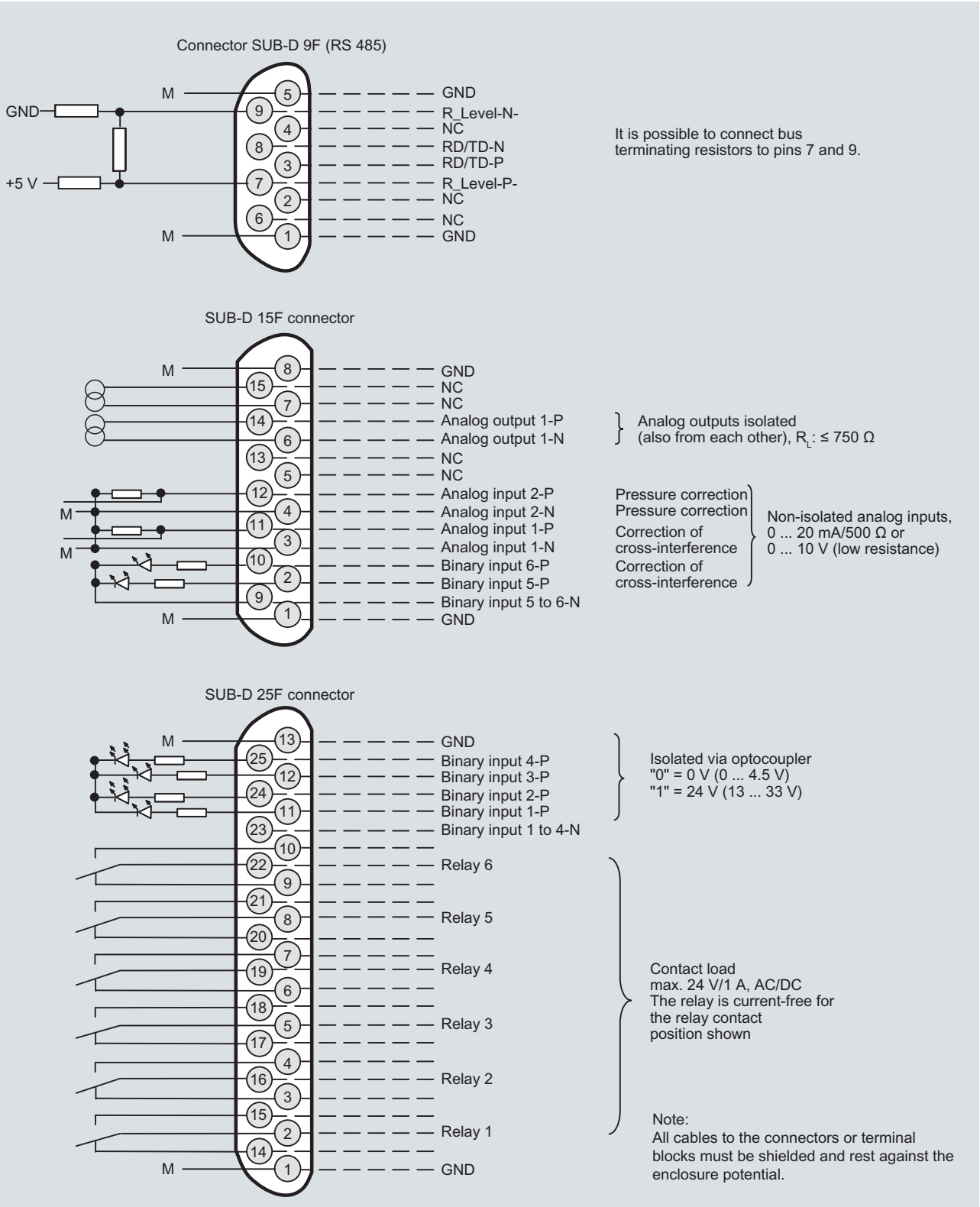
Dimensional drawings



OXYMAT 64, 19" rack unit, size in mm

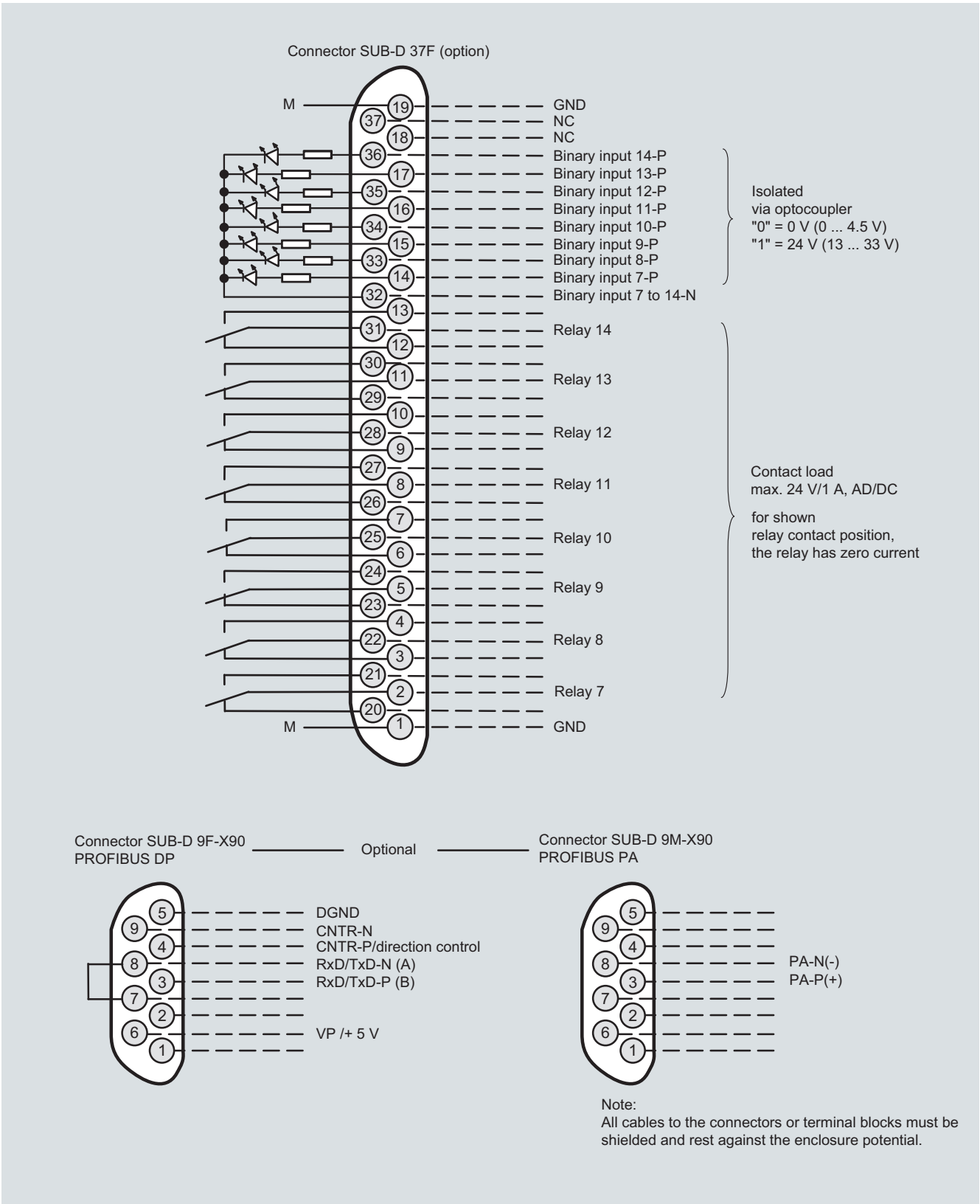
Schematics

Pin assignment (electrical connections)



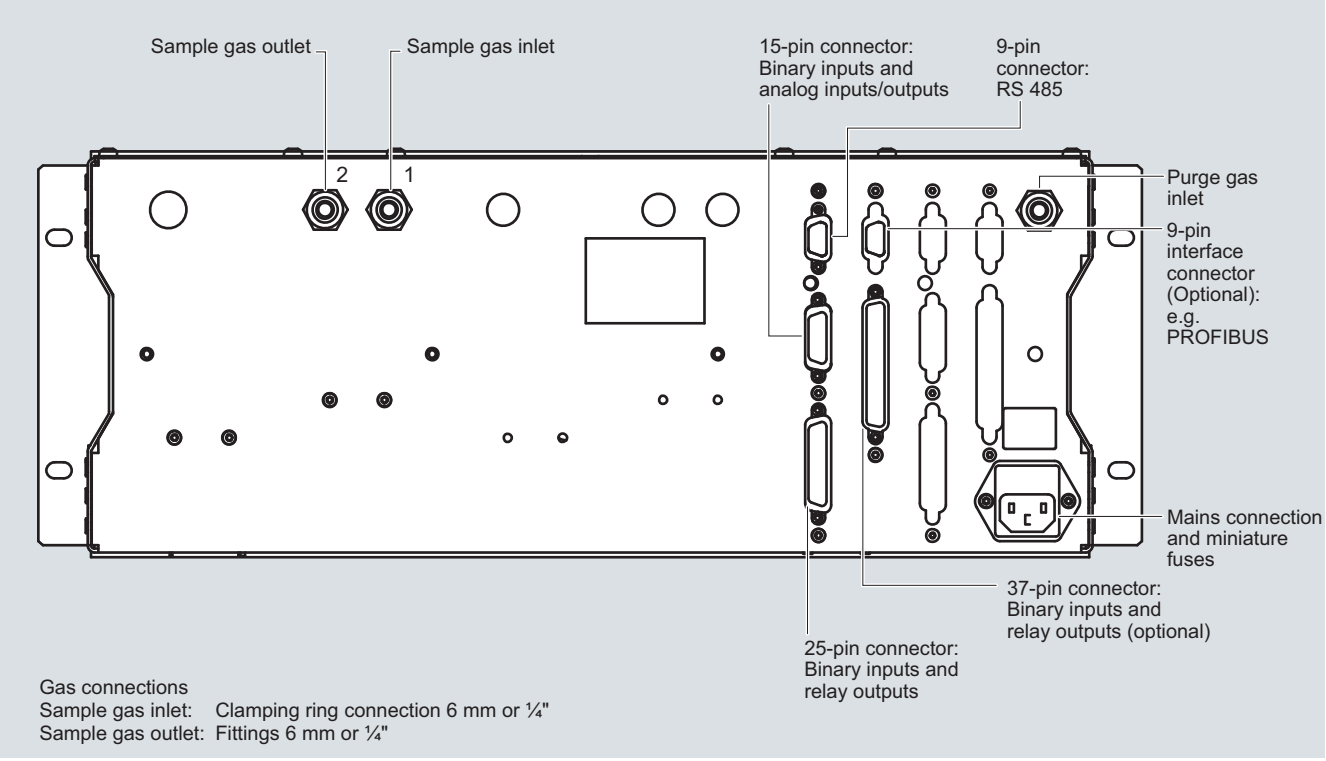
OXYMAT 64, 19" rack unit, pin assignment

19" rack unit



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

Gas connections and pin assignment



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

Documentation

Selection and ordering data

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

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

Suggestions for spare parts

Selection and ordering data

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

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

Overview

The CALOMAT 6 gas analyzer is primarily used for quantitative determination of H_2 or He in binary or quasi-binary non-corrosive gas mixtures.

Concentrations of other gases can also be measured if their thermal conductivities differ significantly from the residual gases like Ar, CO_2, CH_4, NH_3.

Benefits

- Small T_{90} time due to micromechanical-produced Si sensor
- Universally applicable hardware basis, high measuring range dynamics (e.g. 0 to 1 %, 0 to 100 %, 95 to 100 % H_2)
- Integrated correction of cross-interference, no external calculation required
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and service information (option)
- Electronics and analyzer part: gas-tight separation, purgeable, IP65, long service life even in harsh environments
- EEx(p) for Zones 1 and 2 (in accordance with 94/9/EC (ATEX 2G and ATEX 3G), and Class I Div 2 (CSA) Ex(n)

Application

Fields of application

- Pure gas monitoring (0 to 1 % H_2 in Ar)
- Protective gas monitoring (0 to 2 % He in N_2)
- Hydroargon gas monitoring (0 to 25 % H_2 in Ar)
- Forming gas monitoring (0 to 25 % H_2 in N_2)
- Gas production:
  - 0 to 2 % He in N_2
  - 0 to 10 % Ar in O_2
- Chemical applications:
  - 0 to 2 % H_2 in NH_3
  - 50 to 70 % H_2 in N_2
- Wood gasification (0 to 30 % H_2 in $CO/CO_2/CH_4$)
- Blast furnace gas (0 to 5 % H_2 in $CO/CO_2/CH_4/N_2$)
- Bessemer converter gas (0 to 20 % H_2 in CO/CO_2)
- Monitoring equipment for hydrogen-cooled turbo-alternators:
  - 0 to 100 % CO_2/Ar in air
  - 0 to 100 % H_2 in CO_2/Ar
  - 80 to 100 % H_2 in air
- Versions for the analysis of flammable and non-flammable gases or vapors for use in hazardous areas (Zone 1 and Zone 2)

Special versions

Special applications

In addition to the standard combinations, special applications are also available upon request (e.g. higher sample gas pressure up to 2 000 hPa absolute).

Design

19" rack unit

- With 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescopic rails
- Front plate for service purposes can be pivoted down (laptop connection)
- Internal gas paths: stainless steel pipe (mat. no. 1.4571)
- Gas connections for sample gas inlet and outlet and for purging gas: fittings, pipe diameter of 6 mm or ¼"

Field device

- Two-door enclosure (IP65) with gas-tight separation of analyzer and electronics sections
- Individually purgeable enclosure halves
- Stainless steel gas path and stubs (mat. no. 1.4571)
- Purging gas connections: pipe diameter 10 mm or 3/8"
- Gas connections for sample gas inlet and outlet: clamping ring connection for a pipe diameter of 6 mm or ¼"

Display and control panel

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

Input and outputs

- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Two analog inputs configurable (e.g. correction of cross-interference or external pressure sensor)
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (e.g. failure, maintenance request, limit alarm, external solenoid valves)
- Each can be expanded by eight additional binary inputs and relay outputs (e.g. for autocalibration with max. four test gases)

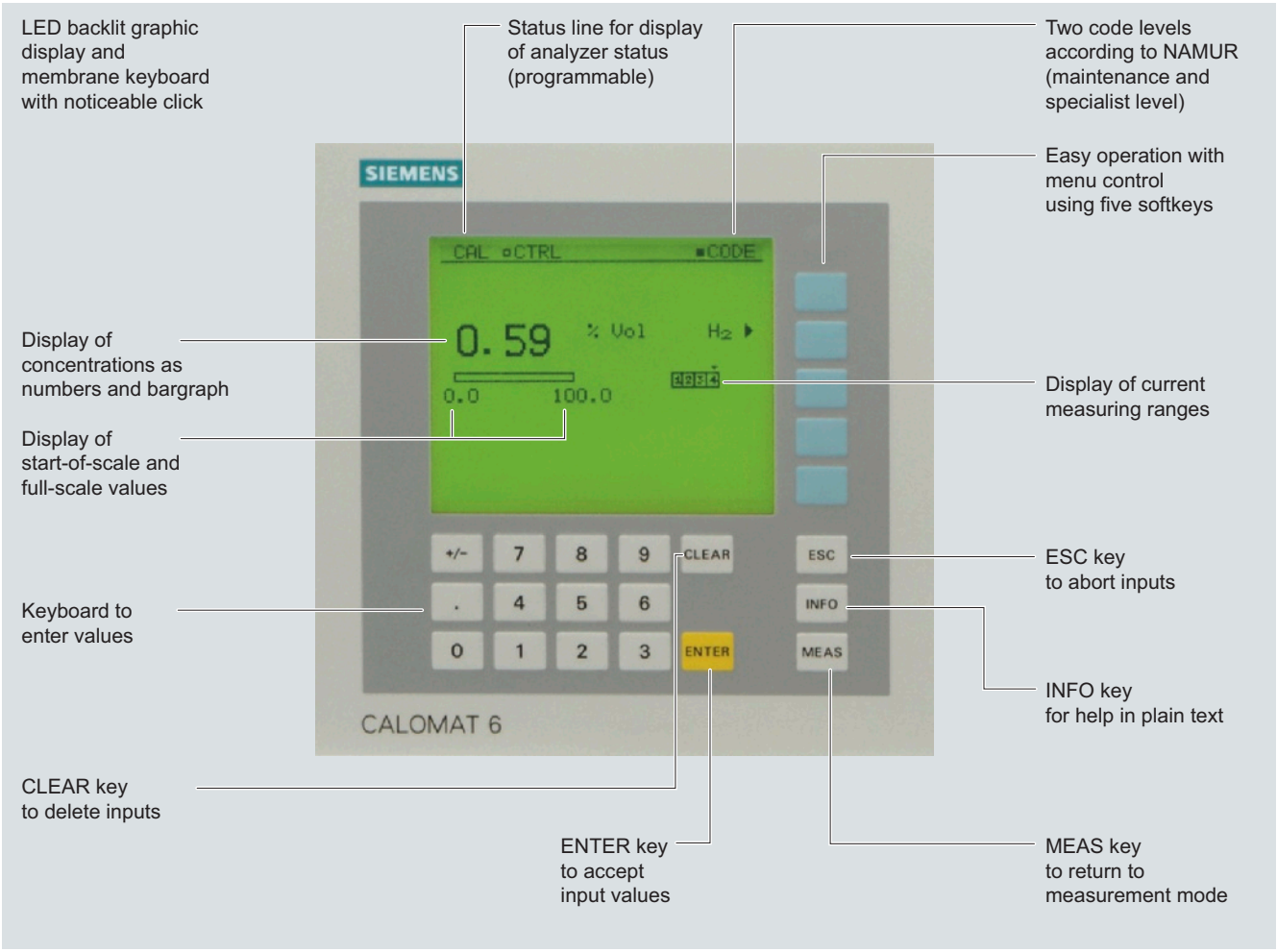
Communication

RS 485 present in basic unit (connection from the rear; for the rack unit also behind the front plate).

Options

- RS 485/RS 232 converter
- RS 485/Ethernet converter
- RS 485/USB converter
- Connection to networks via PROFIBUS DP/PA interface
- SIPROM GA software as the service and maintenance tool

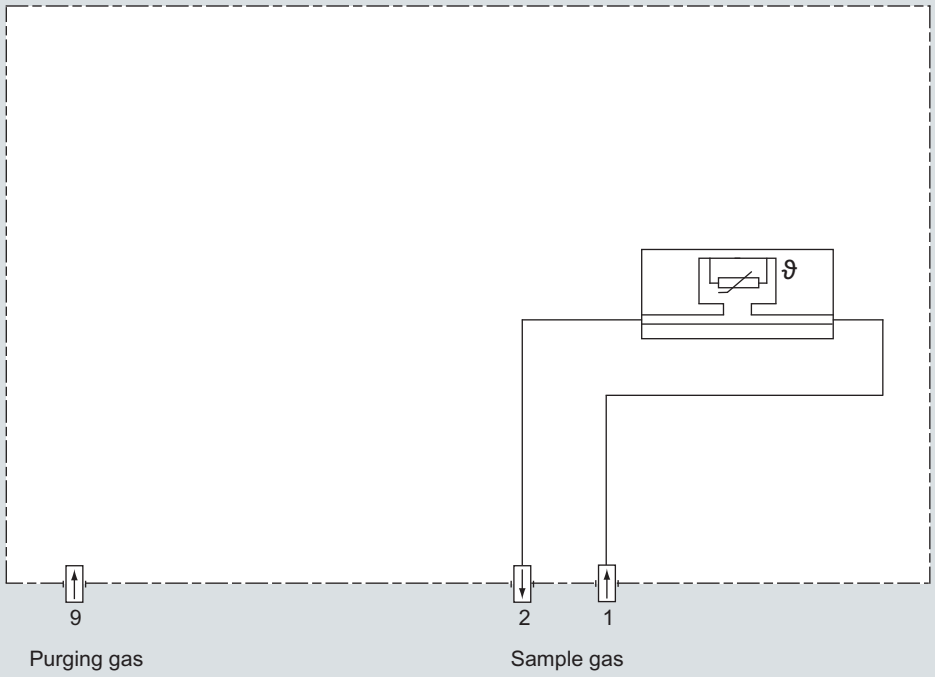
General information



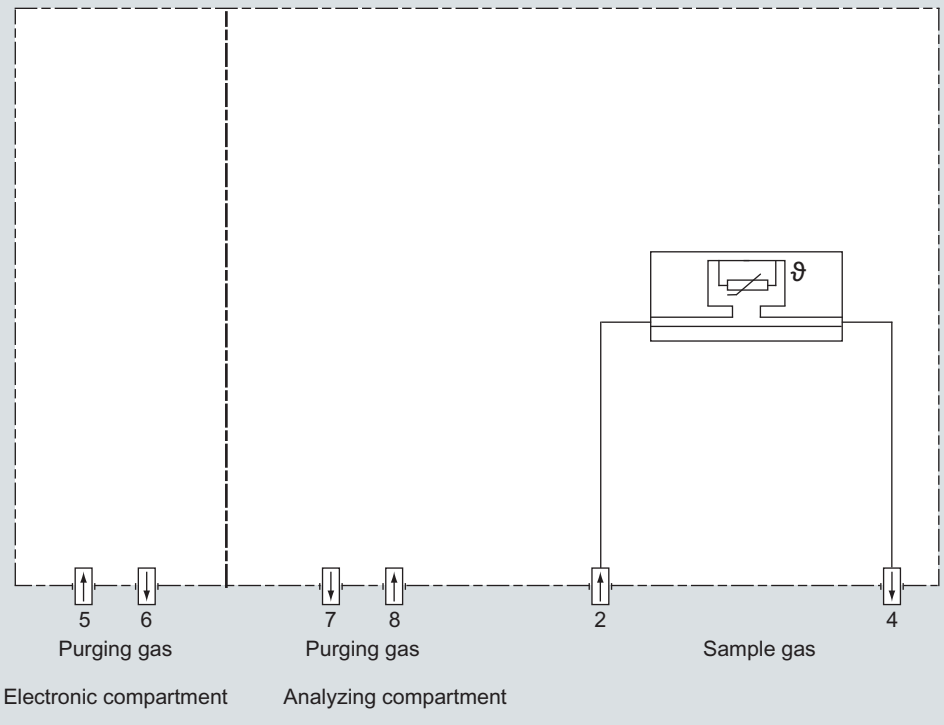
CALOMAT 6, membrane keyboard and graphic display

Designs – parts wetted by sample gas

Gas path		19" rack unit	Field device	Field device Ex
With pipes	Bushing	Stainless steel, mat. no. 1.4571		
	Pipe	Stainless steel, mat. no. 1.4571		
	Sample cell body	Stainless steel, mat. no. 1.4571		
	O-rings	FFKM-Chemraz		
	Sensor	Si, SiO_xN_y, AU, epoxy resin, glass		
	Tightness	Leakage < 1 µl/s		



CALOMAT 6, 19" rack unit, gas path



CALOMAT 6, field device, gas path

General information

Function

Principle of operation

The measuring principle is based on the different thermal conductivity of gases.

The CALOMAT 6 works with a micromechanically produced Si chip whose measuring membrane is equipped with thin-film resistors.

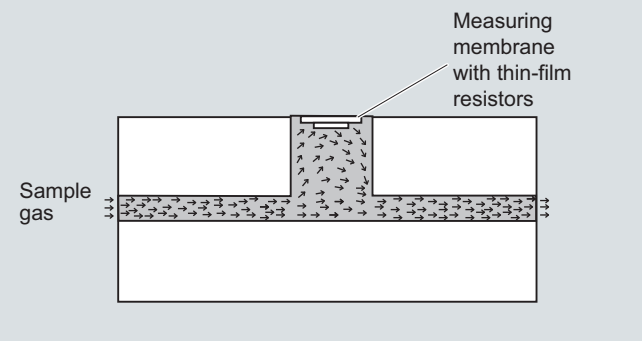
The resistors are kept at a constant temperature. This requires an current intensity depending on the thermal conductivity of the sample gas. This "raw value" is processed further electronically to calculate the gas concentration.

The sensor is located in a thermostatically-controlled stainless steel enclosure in order to prevent the influence of changes in ambient temperature.

To prevent the influence of changes in flow, the sensor is positioned in a bore located to the side of the main flow.

Note

The sample gases must be fed into the analyzers free of dust. Condensation (dew point sample gas < ambient temperature) is to be avoided in the measurement chambers. Therefore, the use of gas modified for the measuring tasks is necessary in most application cases.



CALOMAT, principle of operation

Essential characteristics

- Four freely parameterizable measuring ranges, also with suppressed zero point, all measuring ranges linear
- Smallest measuring spans up to 1 % H_2 (with disabled zero point: 95 to 100 % H_2) possible
- Measuring range identification
- Galvanically isolated measured-value output 0/2/4 to 20 mA (also inverted)
- Autoranging or manual measurement range switchover possible; remote switching is also possible
- Storage of measured values possible during adjustments
- Wide range of selectable time constants (static/dynamic noise suppression); i.e. the response time of the analyzer can be matched to the respective measuring task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 6 measuring points (programmable)
- Measuring range identification
- Measuring point identification
- External pressure sensor can be connected – for the correction of sample gas fluctuations
- Automatic range calibration can be parameterized
- Operation based on the NAMUR recommendation
- Two control levels with their own authorization codes for the prevention of accidental and unauthorized operator interventions
- Simple handling using a numerical membrane keyboard and operator prompting
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording
  - Clean for O_2 service

Measuring spans

The smallest and largest possible spans depend on both the measured component (type of gas) and the respective application.

The smallest possible spans listed below refer to N_2 as the residual gas. With other gases which have a larger/smaller thermal conductivity than N_2, the smallest possible span is also larger/smaller.

Component	Smallest possible span
H_2	0 ... 1 % (95 ... 100 %)
He	0 ... 2 %
Ar	0 ... 10 %
CO_2	0 ... 20 %
CH_4	0 ... 15 %
H_2 in blast furnace gas	0 ... 10 %
H_2 in converter gas	0 ... 20 %
H_2 with wood gasification	0 ... 30 %

Influence of interfering gases

Knowledge of the sample gas composition is necessary to determine the influence of residual gases with several interfering components.

The following table lists the zero offsets expressed in % H_2 resulting from 10 % residual gas (interfering gas) in each case.

Component	Zero offset
Ar	-1.28 %
CH_4	+1.59 %
C_2H_6 (non-linear response)	+0.04 %
C_3H_8	-0.80 %
CO	-0.11 %
CO_2	-1.07 %
He	+6.51 %
H_2O (non-linear response)	+1.58 %
NH_3 (non-linear response)	+1.3 %
O_2	-0.18 %
SF_6	-2.47 %
SO_2	-1.34 %
Air (dry)	+0.50 %

For residual gas concentrations differing from 10 %, the corresponding multiple of the associated value in the table provides an acceptable approximation. This is valid for for residual gas concentrations up to 25 % (dependent on type of gas).

The thermal conductivity of most gas mixtures has a non-linear response. Even ambiguous results, such as e.g. with NH_3/N_2 mixtures, can occur within a specific concentration range.

In addition to a zero offset, it should also be noted that the gradient of the characteristic is influenced by the residual gas. However, this effect is negligible for most gases.

In case of correction of the influence of interfering gases with additional analyzers (ULTRAMAT 6/ULTRAMAT 23), the resulting measuring error can – depending on the application – amount up to 5 % of the smallest measuring range of the respective application.

Example of correction of cross-interference

Specification for the interface cable

Surge impedance	100 ... 300 Ω, with a measuring frequency of > 100 kHz
Cable capacitance	Typ. < 60 pF/m
Core cross-section	> 0.22 mm^2, corresponds to AWG 23
Cable type	Twisted pair, 1 x 2 conductors of cable section
Signal attenuation	Max. 9 dB over the whole length
Shielding	Copper braided shield or braided shield and foil shield
Connection	Pin 3 and pin 8

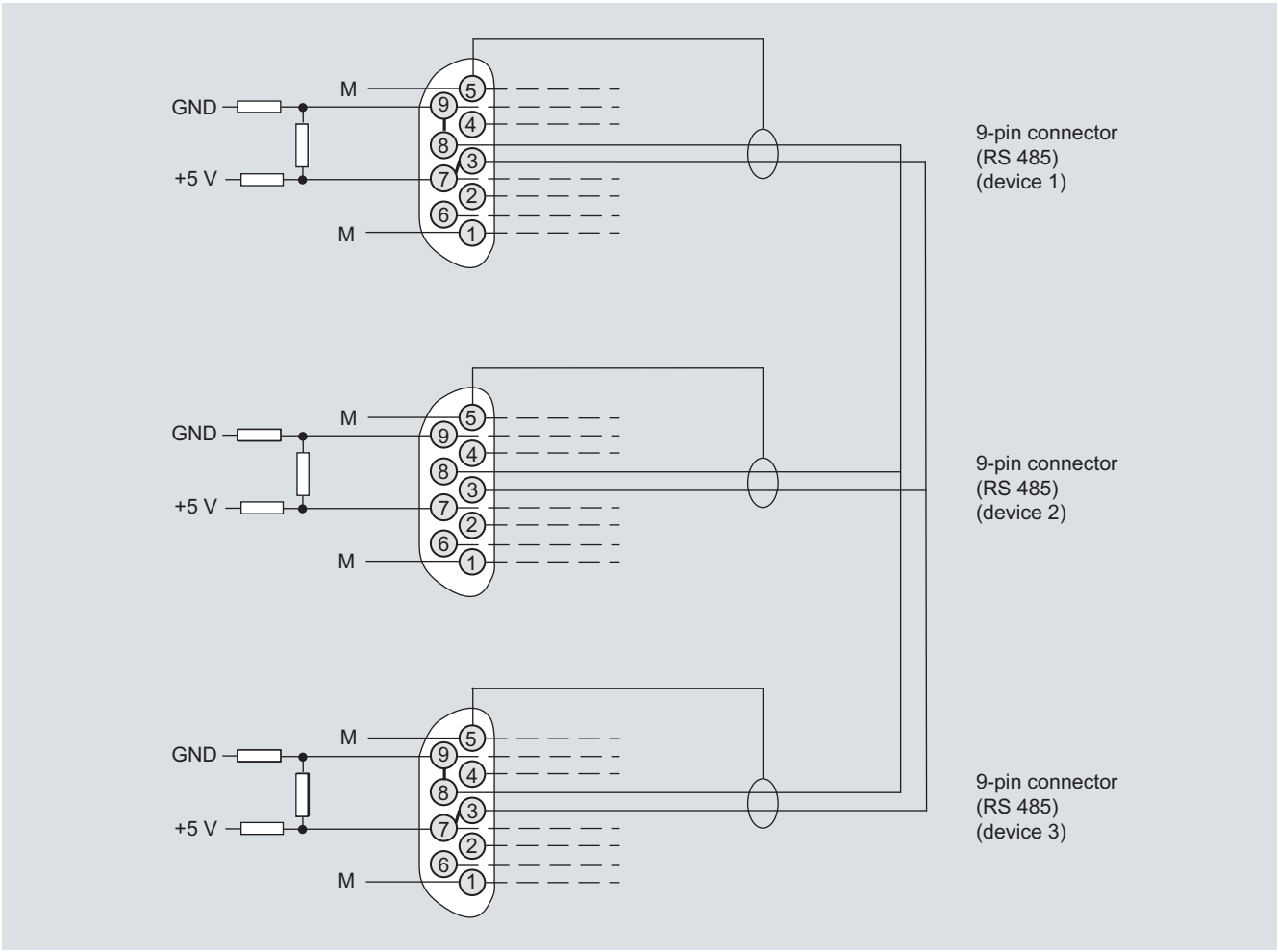
Bus terminating resistors

Pins 3-7 and 8-9 of the first and last connectors of a bus cable must be bridged (see image).

Note

It is advisable to install a repeater on the device side in the case of a cable length of more than 500 m or with high interferences.

Up to four components can be corrected via the ELAN bus, correction of cross-interference can be carried out for one or two components via the analog input.



Bus cable with plug connections, example

19" rack unit

Technical specifications

General (based on EN 61207/IEC 1207. All data refers to the binary mixture H_2 in N_2)

Measuring ranges	4, internally and externally switchable; automatic measurement range switchover also possible
Largest possible measuring span	100 vol.% H_2 (for smallest measuring span, see "Function")
Measuring ranges with suppressed zero point	Any zero point within 0 ... 100 vol.% can be implemented, smallest possible measuring span: 5 % H_2
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 61326/A1 and EN 61010/1

Design, enclosure

Degree of protection	IP20 according to EN 60529
Weight	Approx. 10 kg

Electrical characteristics

EMC (**E**lectro**m**agnetic **C**ompatibility) All signal lines must be shielded. Measured value deviations of up to 4 % of the smallest measuring range may occur in ranges with strong electromagnetic interference.	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	In accordance with EN 61010-1; overvoltage category II
Power supply (see rating plate)	100 V -10 % ... 120 V +10 % AC, 47 ... 63 Hz or 200 V -10 % ... 240 V +10 % AC, 47 ... 63 Hz
Power consumption	Approx. 20 VA
Fuse values	100 ... 120 V: 1.0T/250 200 ... 240 V: 0.63 T/250

Gas inlet conditions

Sample gas pressure	800 ... 1 100 hPa (absolute)
Sample gas flow	30 ... 90 l/h (0.5 ... 1.5 l/min)
Sample gas temperature	Min. 0 to max. 50 °C, but above the dew point
Temperature of the measuring cell	Approx. 60 °C
Sample gas humidity	< 90 % relative humidity

Dynamic response

Warm-up period	< 30 min (the technical specification will be met after 2 hours)
Delayed display (T_{90})	< 5 s
Damping (electrical time constant)	0 ... 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	Approx. 0.5 s

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation	< ± 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (σ = 0.25 %)
Zero point drift	< ± 1 %/week of the smallest possible measuring span according to rating plate
Measured-value drift	< ± 0.5 %/week of the smallest possible span according to rating plate
Repeatability	< 1 % of the current measuring range
Detection limit	1 % of the current measuring range
Linearity error	< ± 1 % of the current measuring range

Influencing variable (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Ambient temperature	< 1 %/10 K referred to smallest possible measuring span according to rating plate
Carrier gases	Deviation from zero point (for influence of interfering gas see paragraph titled "Interference influences")
Sample gas flow	< 0.2 % of the smallest possible span according to rating plate with a change in flow of 0.1 l/min within the permissible flow range
Sample gas pressure	< 1 % of the current measuring range with a pressure change of 100 hPa
Power supply	< 0.1 % of the current measuring range with rated voltage ± 10 %

Electrical inputs and outputs

Analog output	0/2/4 ... 20 mA, isolated; load max. 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 … 20 mA for external pressure sensor and correction of cross-interference
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measurement range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs each, also with PROFIBUS PA or PROFIBUS DP

Climatic conditions

Permissible ambient temperature	-30 … +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity (dew point must not be undershot)	< 90 % relative humidity as annual average, during storage and transportation

Selection and ordering data		Order No.	
CALOMAT 6 gas analyzer 19" rack unit for installation in cabinets		**7MB2521-** ■■■ **0** ■ **-** ■ **A** ■■	Cannot be combined
Connections for sample gas			
Pipe with 6 mm outer diameter		**0**	
Pipe with 1/4" outer diameter		**1**	
Measured component	Smallest/largest measuring range		
H_2 in N_2	0 ... 1/100 %	**A A**	
H_2 in N_2 (blast furnace gas measurement)[1]	0 ... 5/100 %	**A W**	
H_2 in N_2 (converter measurement)[1]	0 ... 5/100 %	**A X**	
H_2 in N_2 (wood gasification)[1]	0 ... 5/100 %	**A Y**	
H_2 in Ar	0 ... 1/100 %	**A B**	
H_2 in NH_3	0 ... 1/100 %	**A C**	
He in N_2	0 ... 2/100 %	**B A**	
He in Ar	0 ... 2/100 %	**B B**	
He in H_2	0 ... 10/80 %	**B C**	
Ar in N_2	0 ... 10/100 %	**C A**	
Ar in O_2	0 ... 10/100 %	**C B**	
CO_2 in N_2	0 ... 20/100 %	**D A**	
CH_4 in Ar	0 ... 15/100 %	**E A**	
NH_3 in N_2	0 ... 10/30 %	**F A**	
H_2 monitoring (turbo generators)		**G A**	**GA**
• CO_2 in air	0 ... 100 %		
• H_2 in CO_2	0 ... 100 %		
• H_2 in air	80 ... 100 %		
Add-on electronics			
Without		**0**	
AUTOCAL function			
• With 8 additional binary inputs and outputs		**1**	
• With 8 additional binary inputs/outputs and PROFIBUS PA interface		**6**	**6**
• With 8 additional binary inputs/outputs and PROFIBUS DP interface		**7**	**7**
Power supply			
100 ... 120 V AC, 47 ... 63 Hz		**0**	
200 ... 240 V AC, 47 ... 63 Hz		**1**	
Explosion protection			
Without		**A**	
Certificate: ATEX II 3G, flammable and non-flammable gases		**B**	
CSA certificate - Class I Div 2		**D**	
Language (supplied documentation, software)			
German		**0**	
English		**1**	
French		**2**	
Spanish		**3**	
Italian		**4**	

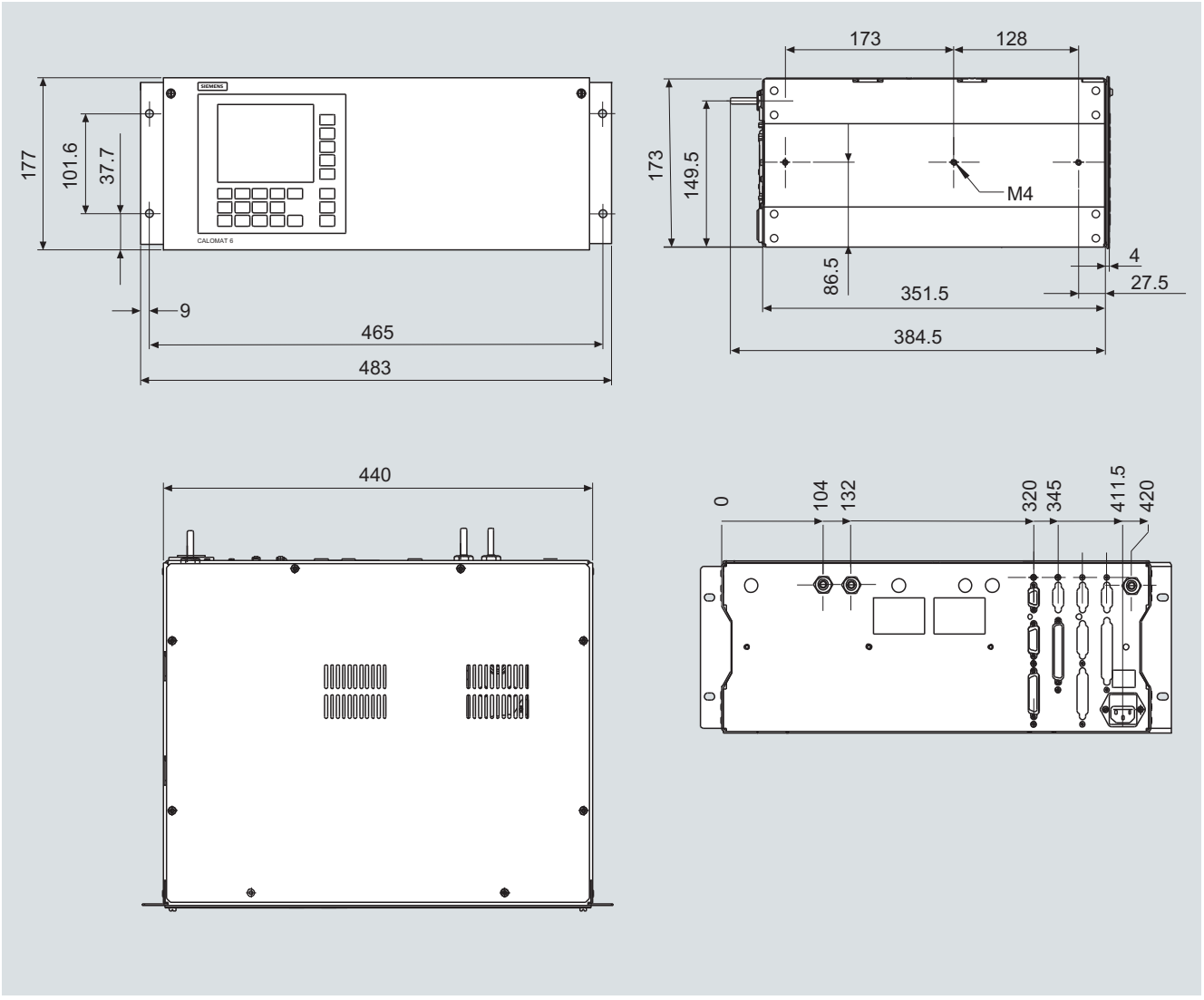
[1] Ready to enter external correction of cross-interferences for CO, CO_2 and CH_4 (CH_4 only for blast furnace gas and wood gasification).

19" rack unit

Selection and ordering data

Additional versions	Order code
Add "-Z" to Order No. and specify order codes.	
Telescopic rails (2 units)	**A31**
Set of Torx screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Retrofitting sets	**Order No.**
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with 8 binary inputs/outputs	**C79451-A3480-D511**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA	**A5E00057307**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057312**

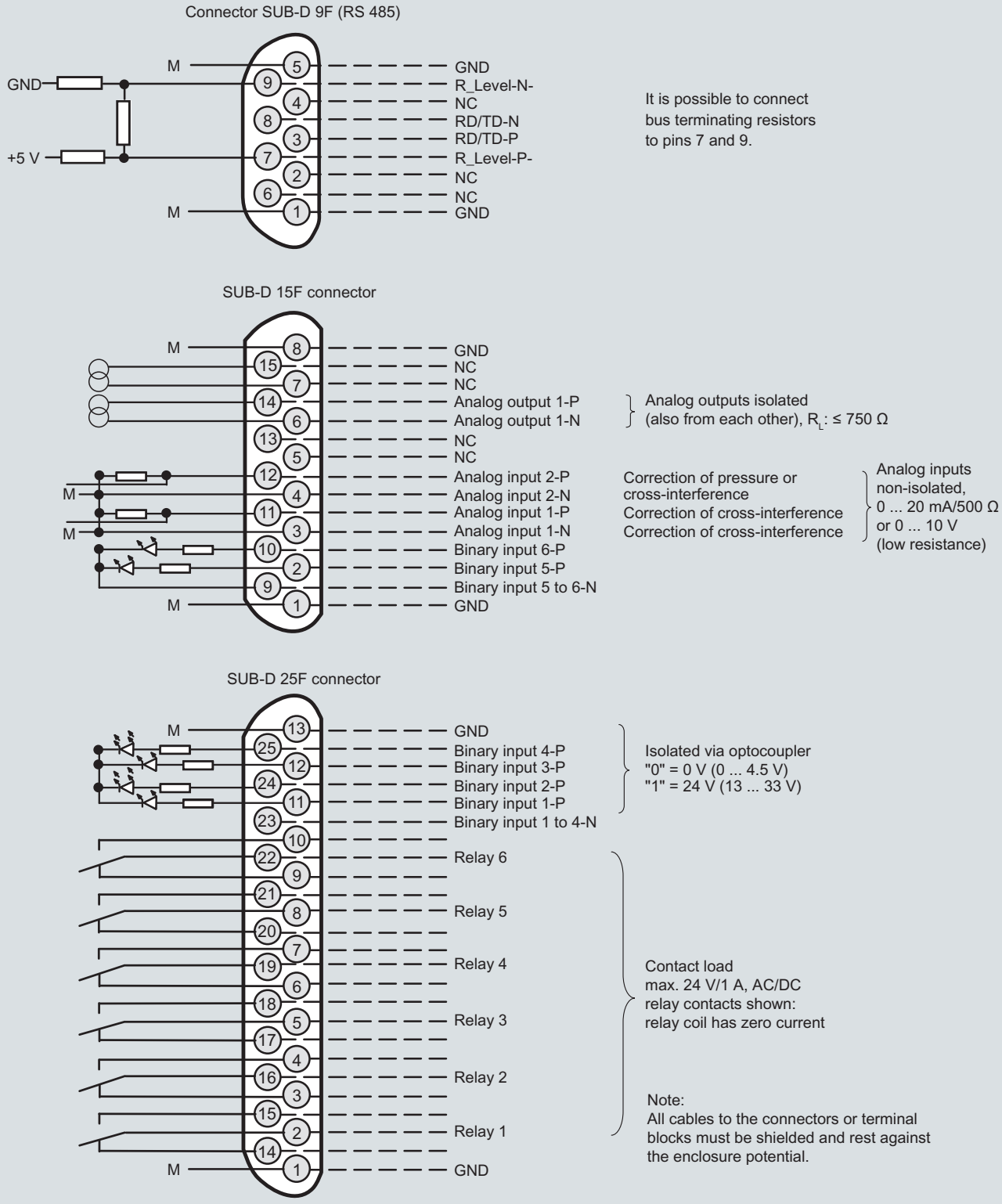
Dimensional drawings



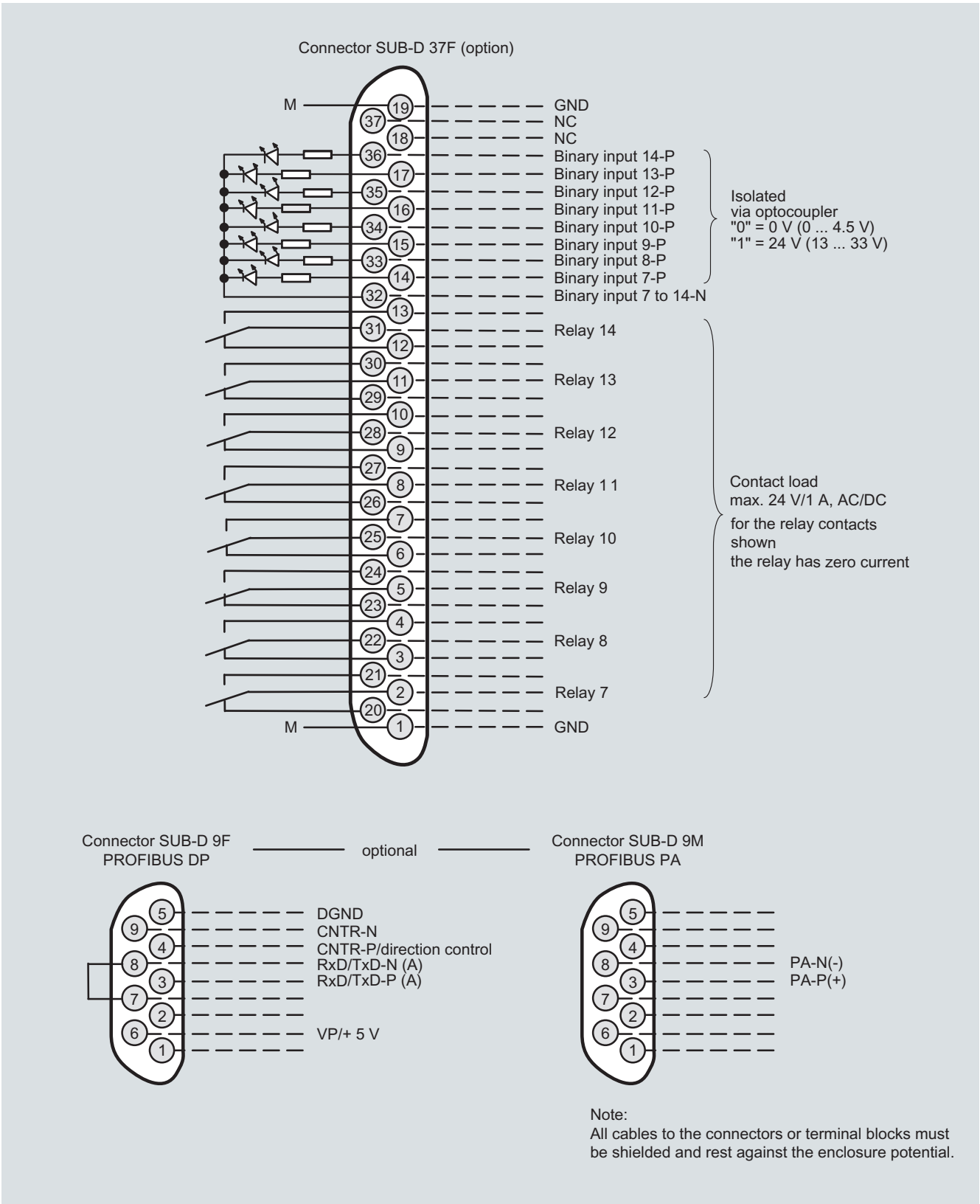
CALOMAT 6, 19“ unit, dimensions in mm

Schematics

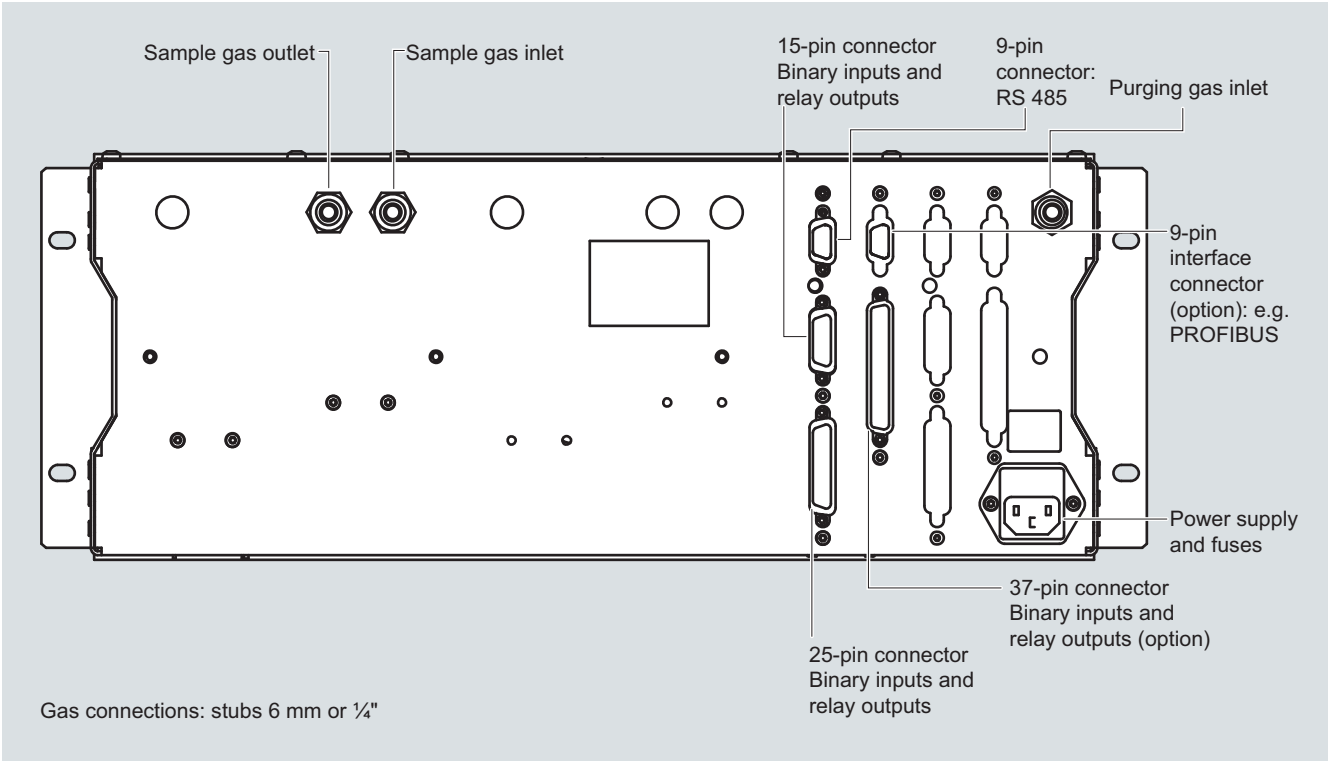
Pin assignment (electrical and gas connections)



CALOMAT 6, 19" unit, pin assignment



CALOMAT 6, 19“ unit, pin assignment of AUTOCAL board and PROFIBUS connectors



CALOMAT 6, 19" unit, gas and electrical connections

Technical specifications

General (based on DIN EN 61207 / IEC 1207. All data refers to the binary mixture H_2 in N_2)

Measuring ranges	4, internally and externally switchable; automatic measuring range changeover also possible
Largest possible measuring span	100 vol.% H_2 (for smallest measuring span, see "Function")
Measuring ranges with suppressed zero point	Any zero point within 0 ... 100 vol.% can be implemented; smallest possible measuring span: 5 % H_2
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 61326/A1 and EN 61010/1

Design, enclosure

Degree of protection	IP65 according to EN 60529
Weight	Approx. 25 kg

Electrical characteristics

EMC (**E**lectro**m**agnetic **C**ompatibility) (All signal lines must be shielded. Measured value deviations of up to 4 % of the smallest measuring range may occur in ranges with strong electromagnetic interference.)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	In accordance with EN 61010-1; overvoltage category II
Power supply (see rating plate)	100 V -10 % ... 120 V +10 % AC, 47 ... 63 Hz or 200 V -10 % ... 240 V +10 % AC, 47 ... 63 Hz
Power consumption (unit)	Approx. 20 VA
Fuse values	100 ... 120 V: 1.0T/250 200 ... 240 V: 0.63 T/250

Gas inlet conditions

Sample gas pressure	800 ... 1 100 hPa (absolute)
Sample gas flow	30 ... 90 l/h (0.5 ... 1.5 l/min)
Sample gas temperature	Min. 0 to max. 50 °C, but above the dew point
Temperature of the measuring cell	Approx. 60 °C
Sample gas humidity	< 90 % relative humidity
Purging gas pressure	
• Permanent	165 hPa above ambient pressure
• For short periods	Max. 250 hPa above ambient pressure

Dynamic response (relating to sample gas pressure 1 000 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Warm-up period	< 30 min (the technical specification will be met after 2 hours)
Delayed display (T_{90})	< 5 s
Electrical damping	0 ... 100 s, parameterizable
Dead time (at 1 l/min)	Approx. 0.5 s

Measuring response (relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Output signal fluctuation (maximum accuracy achieved after 2 hours)	< ± 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (σ = 0.25 %)
Zero point drift	< ± 1 %/week of the smallest possible measuring span according to rating plate
Measured-value drift	< ± 0.5 %/week of the smallest possible measuring span according to rating plate
Repeatability	< 1 % of the current measuring range
Detection limit	1 % of the current measuring range
Linearity error	< ± 1 % of the current measuring range

Influencing variables (relating to sample gas pressure 1013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)

Ambient temperature	< 1 %/10 K referred to smallest possible measuring span according to rating plate
Carrier gases	Deviation from zero point (for influence of interfering gas see paragraph titled "Interference influences")
Sample gas flow	< 0.2 % of the smallest possible span according to rating plate with a change in flow of 0.1 l/min within the permissible flow range
Sample gas pressure	< 1 % of the current measuring range with a pressure change of 100 hPa

Electrical inputs and outputs

Analog output	0/2/4 ... 20 mA, isolated; load max. 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and correction of cross-interference
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs each, also with PROFIBUS PA or PROFIBUS DP

Climatic conditions

Permissible ambient temperature	-30 ... +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity (dew point must not be undershot)	< 90 % relative humidity as annual average, during storage and transportation

Selection and ordering data		Order No.	
CALOMAT 6 gas analyzer for field installation		D) **7MB2511-** ■■■ **0** ■ **-** ■ **A** ■■	Cannot be combined
Connections for sample gas			
Ferrule screw connection for pipe, outer diameter 6 mm		**0**	
Ferrule screw connection for pipe, outer diameter 1/4"		**1**	
Measured component	Smallest/largest measuring range		
H_2 in N_2	0 ... 1/100 %	**AA**	**AA**
H_2 in N_2 (blast furnace gas measurement)[1]	0 ... 5/100 %	**AW**	**AW**
H_2 in N_2 (converter measurement)[1]	0 ... 5/100 %	**AX**	**AX**
H_2 in N_2 (wood gasification)[1]	0 ... 5/100 %	**AY**	**AY**
H_2 in Ar	0 ... 1/100 %	**AB**	**AB**
H_2 in NH_3	0 ... 1/100 %	**AC**	**AC**
He in N_2	0 ... 2/100 %	**BA**	
He in Ar	0 ... 2/100 %	**BB**	
He in H_2	0 ... 10/80 %	**BC**	**BC**
Ar in N_2	0 ... 10/100 %	**CA**	
Ar in O_2	0 ... 10/100 %	**CB**	
CO_2 in N_2	0 ... 20/100 %	**DA**	
CH_4 in Ar	0 ... 15/100 %	**EA**	**EA**
NH_3 in N_2	0 ... 10/30 %	**FA**	**FA**
H_2 monitoring (turbo generators)		**GA**	**GA** **GA**
• CO_2 in air	0 ... 100 %		
• H_2 in CO_2	0 ... 100 %		
• H_2 in air	80 ... 100 %		
Add-on electronics			
Without		**0**	
AUTOCAL function			
• With 8 additional binary inputs and outputs		**1**	
• With 8 additional binary inputs/outputs and PROFIBUS PA interface		**6**	**6** **6**
• With 8 additional binary inputs/outputs and PROFIBUS DP interface		**7**	**7** **7**
• With 8 additional binary inputs/outputs and PROFIBUS PA Ex-i interface		**8**	**8** **8**
Power supply			
100 ... 120 V AC, 47 ... 63 Hz		**0**	
200 ... 240 V AC, 47 ... 63 Hz		**1**	
Explosion protection, incl. certificate			
Without		**A**	
Acc. to ATEX II 3G, non-flammable gases		**B**	**B**
Acc. to ATEX II 3G; flammable gases[2]		**C**	
CSA certificate - Class I Div 2		**D**	**D**
According to ATEX II 2G, leakage compensation[2]		**E**	**E**
According to ATEX II 2G, continuous purging[2]		**F**	**F**
ATEX II 3D certificate; potentially explosive dust atmospheres			
• In non-hazardous gas zone		**G**	
• In Ex zone acc. to ATEX II 3G, non-flammable gases		**H**	
• In Ex zone acc. to ATEX II 3G, flammable gases[2]		**J**	
Language (supplied documentation, software)			
German		**0**	
English		**1**	
French		**2**	
Spanish		**3**	
Italian		**4**	

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

1) Ready to enter external correction of cross-interferences for CO, CO_2 and CH_4 (CH_4 only for blast furnace gas and wood gasification).

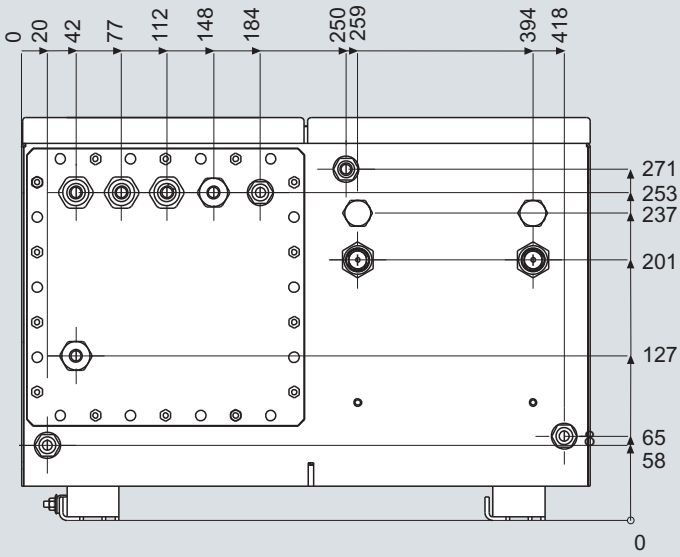
2) Only in connection with an approved purging unit.

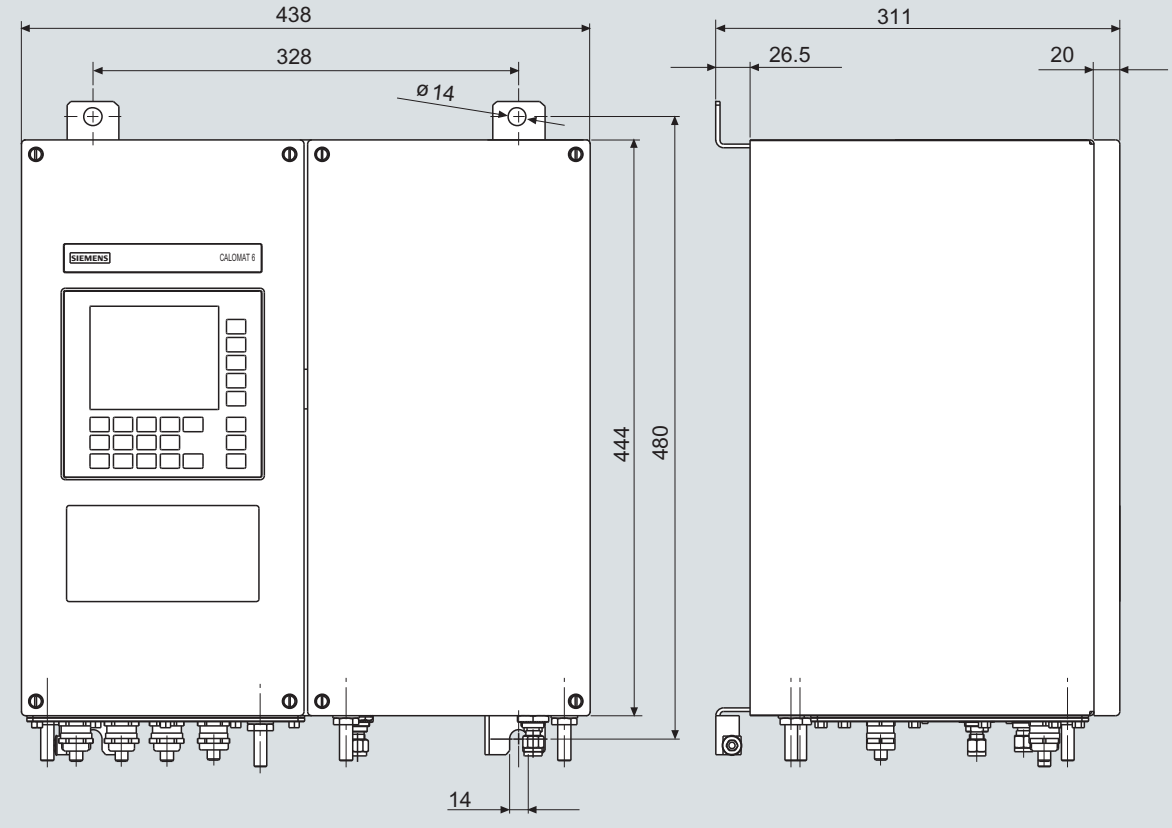
Selection and ordering data

Additional versions		Order code
Add "-Z" to Order No. and specify order codes.		
Set of Torx screwdrivers		**A32**
TAG labels (specific inscription based on customer information)		**B03**
Clean for O_2 service (specially cleaned gas path)		**Y02**
Measuring range indication in plain text, if different from the standard setting		**Y11**
Additional units for Ex versions		**Order No.**
ATEX Category II 2G (zone 1)		
BARTEC EEx p control unit, 230 V, "leakage compensation"		**7MB8000-2BA**
BARTEC EEx p control unit, 115 V, "leakage compensation"		**7MB8000-2BB**
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
Ex isolation amplifier		**7MB8000-3AA**
Ex isolating relay, 230 V		**7MB8000-4AA**
Ex isolating relay, 110 V		**7MB8000-4AB**
Differential pressure switch for corrosive and non-corrosive gases	F)	**7MB8000-5AA**
Stainless steel flame arrestor		**7MB8000-6BA**
Hastelloy flame arrestor		**7MB8000-6BB**
ATEX Category II 3G (zone 2)		
BARTEC EEx p control unit, 230 V, "continuous purging"		**7MB8000-2CA**
BARTEC EEx p control unit, 115 V, "continuous purging"		**7MB8000-2CB**
FM/CSA (Class I Div. 2)		
Ex purging unit Minipurge FM		**7MB8000-1AA**
Retrofitting sets		
RS 485/Ethernet converter		**A5E00852383**
RS 485/RS 232 converter		**C79451-Z1589-U1**
RS 485/USB converter		**A5E00852382**
AUTOCAL function with 8 binary inputs/outputs		**A5E00064223**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA		**A5E00057315**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP		**A5E00057318**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA Ex i (firmware 4.1.10 required)		**A5E00057317**

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

Dimensional drawings



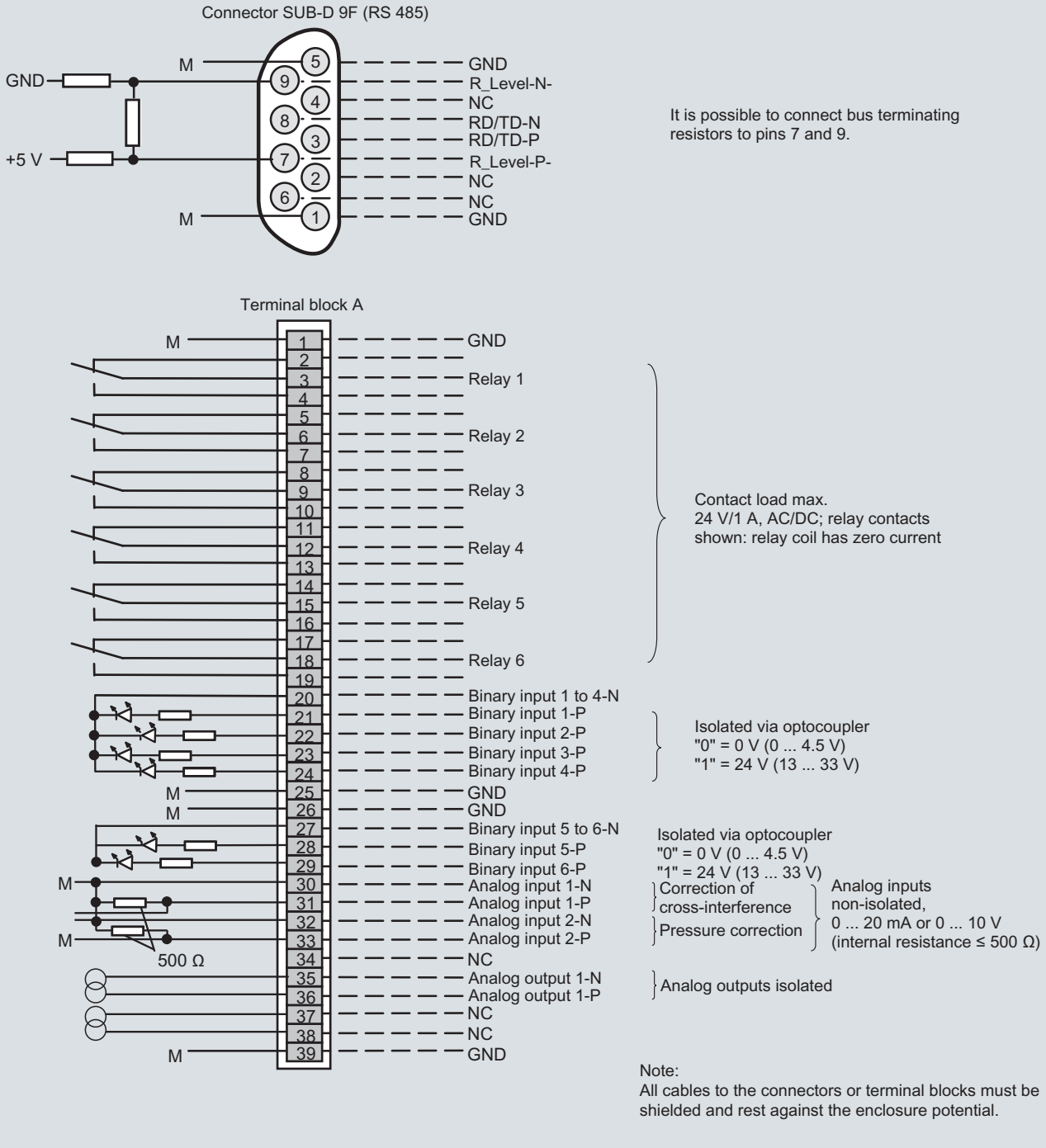


CALOMAT 6, field unit, dimensions in mm

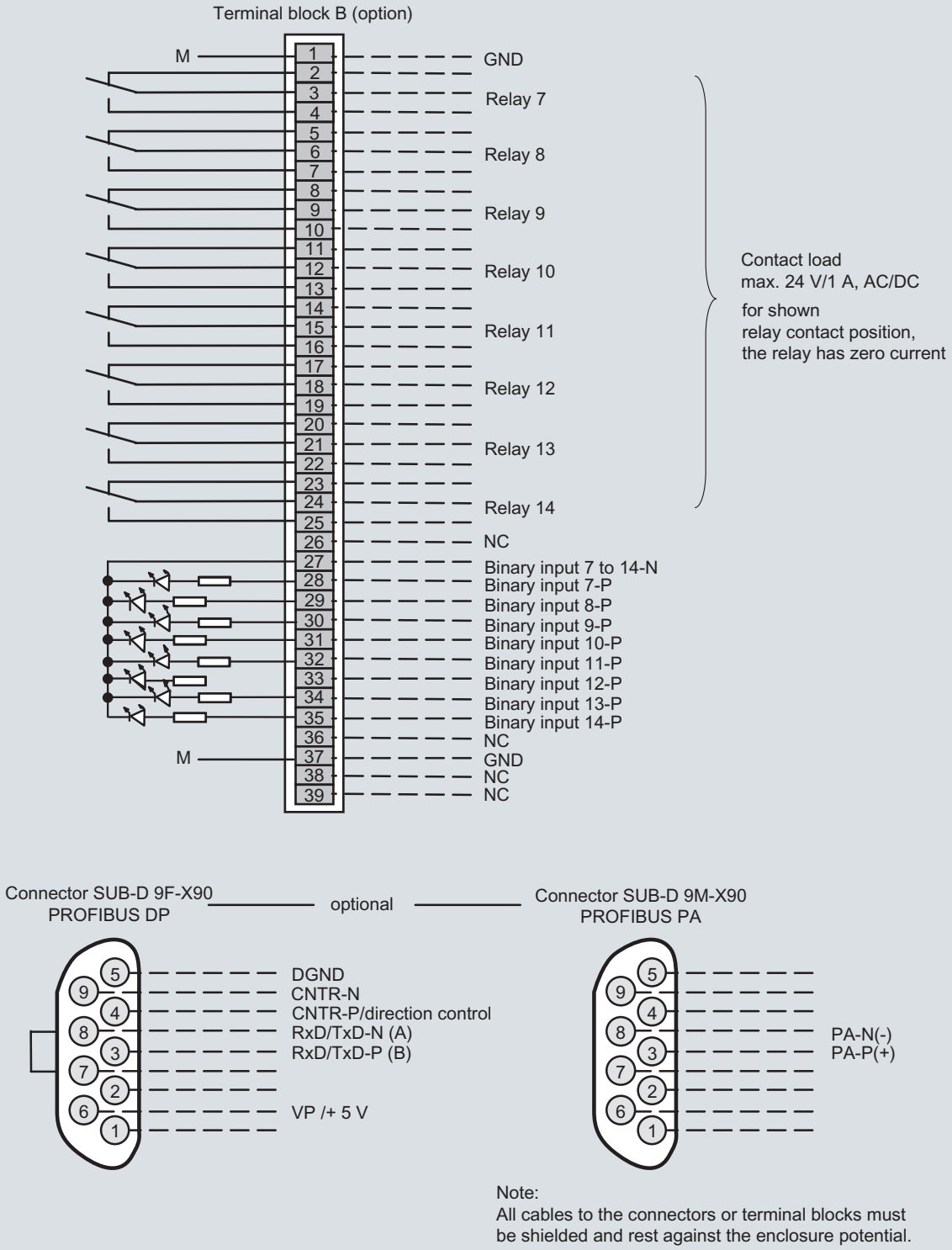
2

Schematics

Pin assignment (electrical and gas connections)

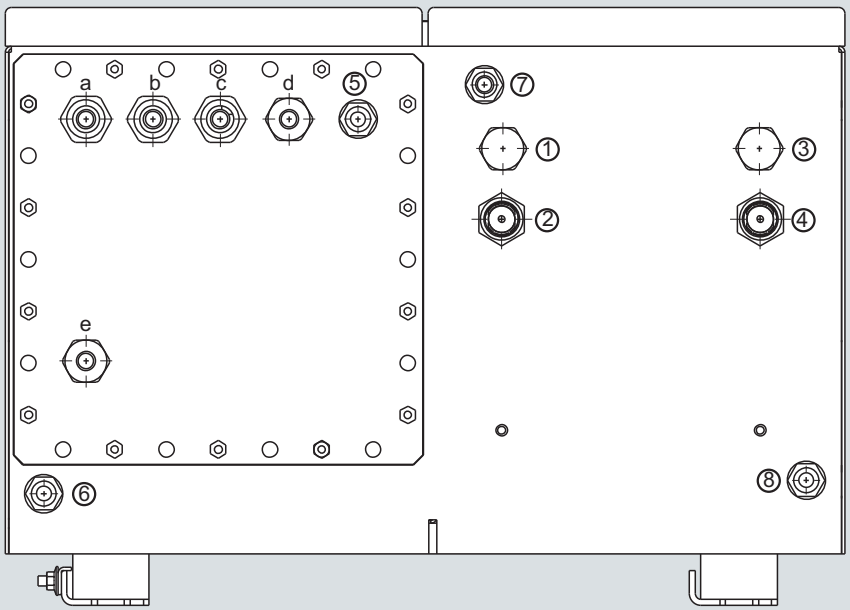


CALOMAT 6, field unit, connector and terminal assignment



CALOMAT 6, field unit, connector and terminal assignment of the AUTOCAL board and PROFIBUS connectors

Field device



Gas connections

①	not used	Clamping gland for pipe Ø 6 mm or ¼"
②	Sample gas inlet	
③	not used	
④	Sample gas outlet	
⑤-⑧	Purging gas inlets/outlets stubs Ø 10 mm or 3/8 "	

Electrical connections

a - c	Signal cable (Ø 10 ... 14 mm) (analog + digital): cable gland M20x1.5
d	Interface connection: (Ø 7 ... 12 mm) cable gland M20x1.5
e	Power supply: (Ø 7 ... 12 mm) cable gland M20x1.5

CALOMAT 6, field unit, gas and electrical connections

Documentation

Selection and ordering data

Operating instructions	Order No.
CALOMAT 6	
Thermal conductivity gas analyzer	
• German	**A5E00116454**
• English	**A5E00116455**
• French	**A5E00116456**
• Italian	**A5E00116457**
• Spanish	**A5E00116458**
Gas analyzers of Series 6 and ULTRAMAT 23	
PROFIBUS DP/ PA interface	
• German and English	**A5E00054148**

Suggestions for spare parts

Selection and ordering data

	7MA2521	7MB2511	7MB2511 Ex	2 years (quantity)	5 years (quantity)		Order No.
Analyzer unit							
Measuring cell	x	x	x	1	1		**A5E00095332**
O ring (set of 4)	x	x	x	1	2	D)	**A5E00124182**
Electronics							
Fuse (device fuse)			x	1	2		**A5E00061505**
Front plate without LC display	x			1	1		**C79165-A3042-B508**
Motherboard, with firmware: see spare parts list	x	x	x	-	1		
Adapter plate, LCD/keyboard	x	x		1	1		**C79451-A3474-B605**
LC display (non-Ex version)	x			1	1		**W75025-B5001-B1**
Line transformer, 115 V	x	x	x	-	1		**W75040-B21-D80**
Line transformer, 230 V	x	x	x	-	1		**W75040-B31-D80**
Connector filter	x	x	x	-	1	F)	**W75041-E5602-K2**
Fuse, T 0.63/250 V	x	x		2	3		**W79054-L1010-T630**
Fuse, 1 A, 110/120 V	x	x	x	2	3		**W79054-L1011-T100**

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

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

If the CALOMAT 6 is supplied with a specially cleaned gas path for high oxygen context ("Cleaned for O_2 service"), please ensure that you specify this when ordering spare parts. This is the only way to guarantee that the gas path will continue to comply with the special requirements for this version.

CALOMAT 62

General information

Overview

The CALOMAT 62 gas analyzer is primarily used for quantitative determination of one gas component (e.g. H_2, N_2, Cl_2, HCl, NH_3) in binary or quasi-binary gas mixtures.

The CALOMAT 62 is specially designed for use in corrosive gas mixtures.

Benefits

- Universally applicable hardware basis
- Integrated correction of cross-interference, no external calculation required
- Open interface architecture (RS 485, RS 232, PROFIBUS)
- SIPROM GA network for maintenance and servicing information (option)
- Electronics and analyzer unit: gas-tight isolation, purging is possible, IP65, long service life even in harsh environments (field device)

Application

Fields of application

- Chlorine-alkali electrolysis
- Metallurgy (steel production and processing)
- H_2 measurement in LNG (Liquefied Natural Gas) process
- Ammonia synthesis
- Fertilizer production
- Petrochemicals

Special versions

Special applications

In addition to the standard combinations, special applications are also available upon request (e.g. higher sample gas pressure up to 2 000 hPa absolute).

Design

19" rack unit

- With 4HE for installation
  - in hinged frame
  - in cabinets with or without telescope rails
  - With closed or flow-type reference chambers
- Front plate for service purposes can be pivoted down (laptop connection)
- IP20 degree of protection, with purging gas connection
- Internal gas routes: Pipe made of stainless steel (mat. no. 1.4571)
- Gas connections for sample gas inlet and outlet and for reference gas: Internal thread 1/8" – 27 NPT
- Purging gas connections: Pipe diameter 6 mm or 1/4"
- With closed or flow-type reference chambers

Field device

- Two-door enclosure (IP65) for wall mounting with gas-tight separation of analyzer and electronic parts, purgeable
- Individually purgeable enclosure halves
- Gas path with screw pipe connection made of stainless steel (mat. no. 1.4571), or Hastelloy C22
- Purging gas connections: Pipe diameter 10 mm or 3/8"
- Gas connections for sample gas inlet and outlet and for reference gas: Internal thread 1/8" – 27 NPT
- With closed or flow-type reference chambers

Display and control panel

- Large LCD field for simultaneous display of:
  - Measured value (digital and analog displays)
  - Status bar
  - Measuring ranges
- Contrast of the LCD field adjustable via the menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Menu-driven operator control for parameterization, test functions, adjustment
- Operator support in plain text
- Graphical display of the concentration progression; time intervals parameterizable
- Bilingual operating software German/English, English/Spanish, French/English, Spanish/English, Italian/English

Input and outputs

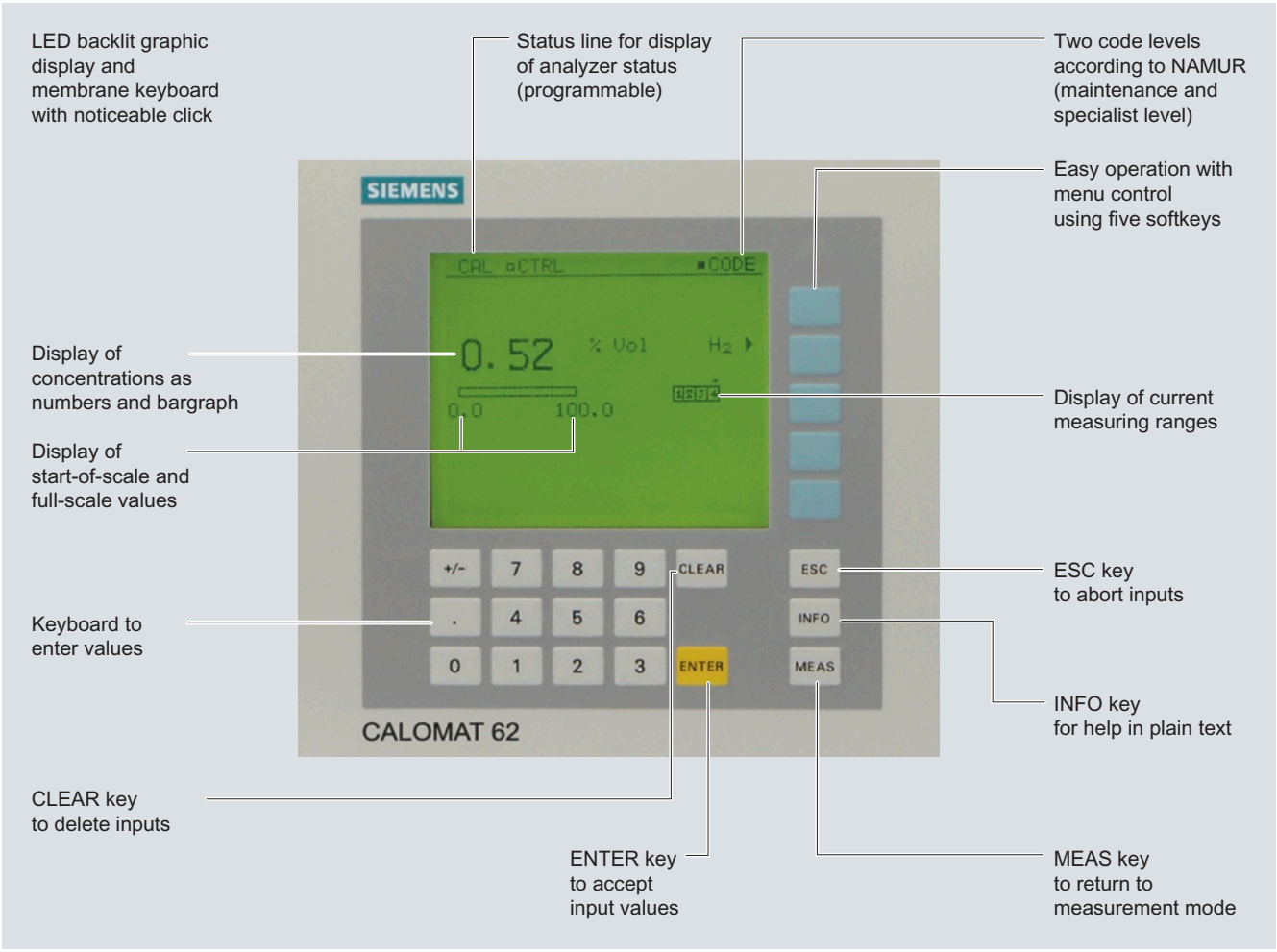
- One analog output per medium (from 0, 2, 4 to 20 mA; NAMUR parameterizable)
- Two analog inputs configurable (e.g. correction of cross-interference or external pressure sensor)
- Six binary inputs freely configurable (e.g. measurement range changeover, processing of external signals from the sample preparation)
- Six relay outputs, freely configurable (e.g. failure, maintenance request, threshold alarm, external magnetic valves)
- Each can be expanded by eight additional binary inputs and relay outputs (e.g. for autocalibration with max. four test gases)

Communication

RS 485 present in basic unit (connection from the rear; for the rack unit also behind the front plate).

Options

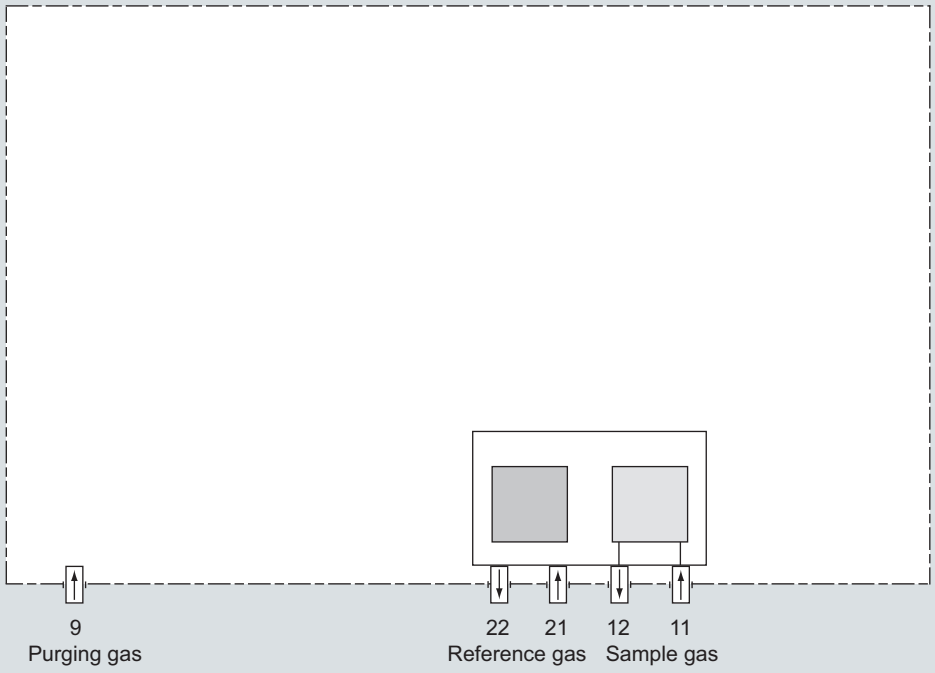
- RS 485/RS 232 converter
- RS 485/Ethernet converter
- RS 485/USB converter
- Connection to networks via PROFIBUS DP/PA interface
- SIPROM GA software as the service and maintenance tool



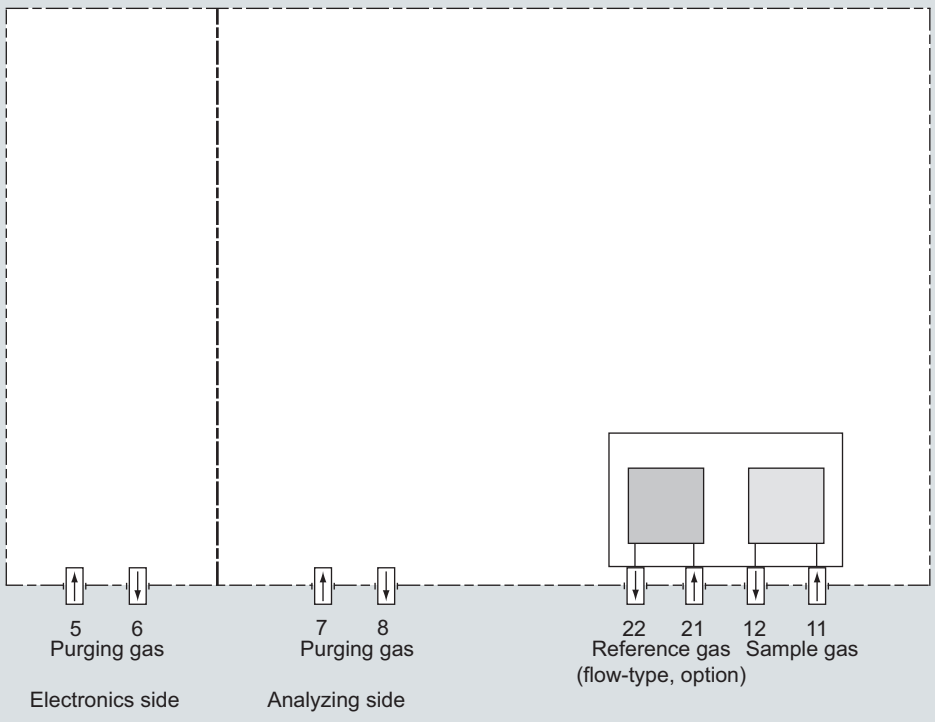
CALOMAT 62, membrane keyboard and graphic display

Designs – parts wetted by sample gas

Gas connection	19" rack unit	Field device
Input block with gas connection	Stainless steel, mat. no. 1.4571	Stainless steel, mat. no. 1.4571
Seal	FPM (e.g. Viton) or FFPM	FPM (e.g. Viton) or FFPM
Sensor	Glass	Glass
Input block with gas connection		Hastelloy C22
Seal		FFPM (e.g. Kalrez)
Sensor		Glass



CALOMAT 62, 19" rack unit, gas path



CALOMAT 62, field device, gas path

Function

Principle of operation

The measuring principle is based on the different thermal conductivity of gases.

The temperature of a heated resistor surrounded by gas is determined by the thermal conductivity of the gas. Four such resistors are connected as a bridge.

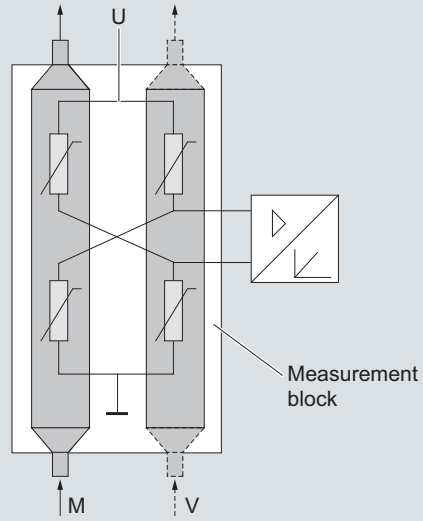
Sample gas flows around two of them, reference gas surrounds the other two. A constant DC voltage heats the resistors above the temperature of the measurement block.

The different thermal conductivities of the sample and reference gases result in different temperatures of the resistors. A change in the composition of the sample gas thus also causes a change in the resistance values.

The electrical equilibrium of the measuring bridge is disrupted, and a voltage is generated in the bridge diagonal. This is a measure of the concentration of the measured component.

Note

The sample gases must be fed into the analyzers free of oil, grease, and dust. The formation of condensation in the sample chambers (dew point of sample gas < ambient temperature) must be avoided. Therefore, gas prepared for the respective task must be provided in most applications.



M Measurement chamber
V Reference gas chamber (optional: flow-type)

CALOMAT 62, principle of operation, example of a non-flow-type reference chamber

Important features

- Four freely-programmable measuring ranges, also with suppressed zero, all ranges linear
- Smallest spans down to 1 % H_2 (with suppressed zero: 99 to 100 % H_2) possible
- Measuring range identification
- Electrically isolated measured-value output 0/2/4 to 20 mA (also inverted)
- Automatic or manual measuring range switchover selectable; remote switching is also possible
- Measured value can be saved during adjustment
- Time constants are selectable within wide ranges (static/dynamic noise suppression); i.e. the response time of the analyzer can be adapted to the respective task
- Short response time
- Low long-term drift
- Measuring point switchover for up to 6 measuring points (parameterizable)
- Measuring point identification
- External pressure sensor can be connected – for correction of variations in sample gas pressure
- Possibility for correcting the influence of residual gases (correction of cross-interference)
- Automatic measuring range calibration can be programmed
- Operation based on the NAMUR recommendation
- Two operator input levels with their own authorization codes to prevent unintentional and unauthorized interventions
- Simple handling using a numerical membrane keyboard and operator prompting
- Customer-specific device versions, such as:
  - Customer acceptance
  - TAG labels
  - Drift recording
  - Clean for O_2 service

Spans

The smallest and largest possible spans depend on both the measured component (gas type) and the respective application (see ordering data).

Cross-interferences

Information on the sample gas composition is required in order to determine the cross-interference of residual gases with several interfering components.

The zero offsets in % H_2 which result from 1 % residual gas (interfering gas) are listed in the following table; the specified values are approximate values.

It should be noted that the influence of interfering gas is not linear to its concentration. Information on the sample gas composition is required in order to determine the cross-interference of residual gases with several interfering components.

Ar	Approx. - 0.15 %
O_2	Approx. + 0.02 %
CO_2	Approx. - 0.13 %
CH_4	Approx. + 0.17 %
SO_2	Approx. - 0.31 %
Air (dry)	Approx. + 0.25 %

Effect of 1 % gas component with nitrogen as the residual gas, expressed in % H_2

Moreover, it must be noted that - in addition to a zero offset - the gradient of the characteristic can also be affected by the residual gas. However, this effect is negligible in the case of variations in the interfering gas concentration below 10 %.

Taking these facts into consideration and due to the fact that the cross-interference analyzers cause further measuring inaccuracies, a larger error in measurement occurs than with binary gas mixtures despite correction of cross-interference.

General information

Specification for the interface cable

Surge impedance	100 ... 300 Ω, with a measuring frequency of > 100 kHz
Cable capacitance	Typ. < 60 pF/m
Core cross-section	> 0.22 mm^2, corresponds to AWG 23
Cable type	Twisted pair, 1 x 2 conductors of cable section
Signal attenuation	Max. 9 dB over the whole length
Shielding	Copper braided shield or braided shield and foil shield
Connection	Pin 3 and pin 8

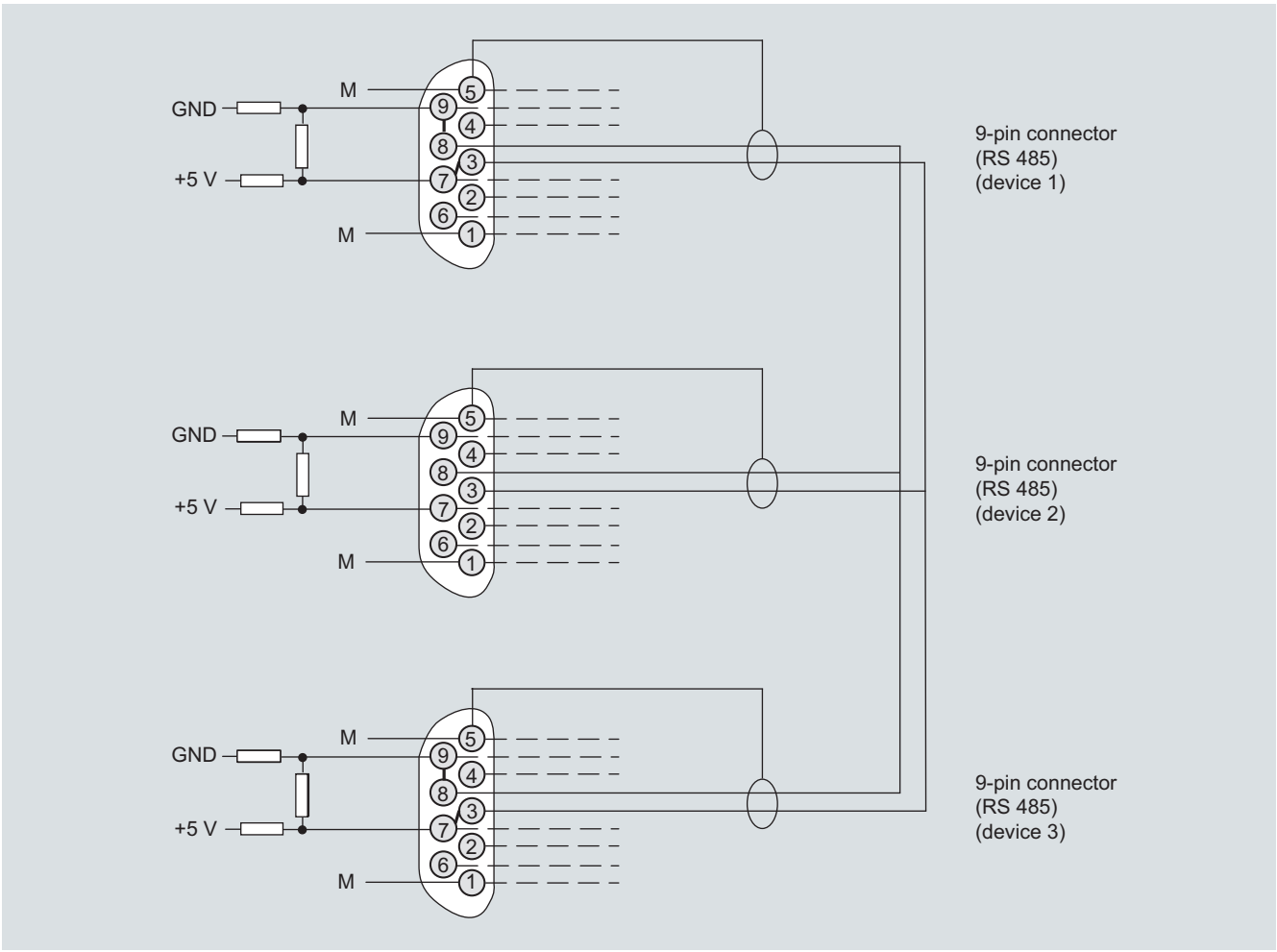
Bus terminating resistors

Pins 3-7 and 8-9 of the first and last connectors of a bus cable must be bridged (see figure).

Note

It is advisable to install a repeater on the device side in the case of a cable length of more than 500 m or with high interferences.

Up to four components can be corrected via the ELAN bus, correction of cross-interference can be carried out for one or two components via the analog input.



Bus cable with plug connections, example

Technical specifications

General (based on DIN EN 61207/IEC 1207. All data refers to the binary gas mixture H_2 in N_2)

Measuring ranges	4, internally and externally switchable; automatic measuring range switchover also possible
Span	Application-dependent (see ordering data)
Measuring ranges with suppressed zero point	Application-dependent (see ordering data)
Operating position	Front wall, vertical
Conformity	CE marking in accordance with EN 50081-1/EN 50081-2 and RoHS

Design, enclosure

Degree of protection	IP20 according to EN 60529
Weight	Approx. 13 kg

Electrical characteristics

EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98) and EN 61326
Electrical safety	In accordance with EN 61010-1; overvoltage category II
Power supply (see nameplate)	100 V AC -10 % ... 120 V AC +10 %, 47 ... 63 Hz or 200 V AC -10 % ... 240 V AC +10 %, 47 ... 63 Hz
Power consumption	Approx. 30 VA
Fuse values	100 ... 120 V: 1.0T/250 200 ... 240 V: 0.63T/250

Gas inlet conditions

Sample gas pressure	800 ... 1 100 hPa (absolute)
Sample gas flow	30 ... 90 l/h
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Temperature of the measuring cell	70 °C

Dynamic response (the dynamic and measuring response refers to the measurement of H_2 in N_2)

Warm-up period	< 30 min at room temperature (the technical specification will be met after 2 hours)
Delayed display (T_{90})	Approx. 35 s (including dead time)
Damping (electrical time constant)	0 ... 100 s, parameterizable
Dead time (the diffusion to the probes is the determining variable)	Approx. 34 s
Dead time (special application)	< 10 s

Measuring response(the dynamic and measuring response refers to the measurement of H_2 in N_2) (referred to sample gas pressure 1 000 hPa absolute, sample gas flow 0.5 l/min, and ambient temperature 25 °C)

Output signal fluctuation (3σ value)	< ± 1 % of the smallest possible span according to rating plate, with electronic damping constant of 1 s
Zero point drift	< ± 1 % of the current span/week
Measured-value drift	< ± 1 % of the smallest possible span (according to rating plate)/week
Repeatability	< ± 1 % of the current span
Detection limit	1 % of the smallest possible span according to rating plate
Linearity error	< ± 1 % of the current span

Influencing variables (referred to sample gas pressure 1 000 hPa absolute, sample gas flow 0.5 l/min, and ambient temperature 25 °C)

Ambient temperature	< 2 %/10 K referred to smallest possible span according to label
Accompanying gases	Deviation from zero point (for influence of interfering gas, see section "Cross-interference")
Sample gas flow	0.2 % of the current measuring span with a change in flow of 0.1 l/min within the permissible flow range
Sample gas pressure	< 1 % of the current span with a change in pressure of 100 hPa
Power supply	< 0.1 % of the current span with rated voltage ± 10 %

Electrical inputs and outputs

Analog output	0/2/4 ... 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 ... 20 mA for external pressure sensor and correction of cross-interference
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and 8 additional relay outputs, also with PROFIBUS PA (on request) or PROFIBUS DP (on request)

Climatic conditions

Permissible ambient temperature	-40 ... +70 °C during storage and transportation, 5 ... 45 °C during operation
Permissible humidity (dew point must not be fallen below)	< 90 % relative humidity as annual average, during storage and transportation

CALOMAT 62

19" rack unit

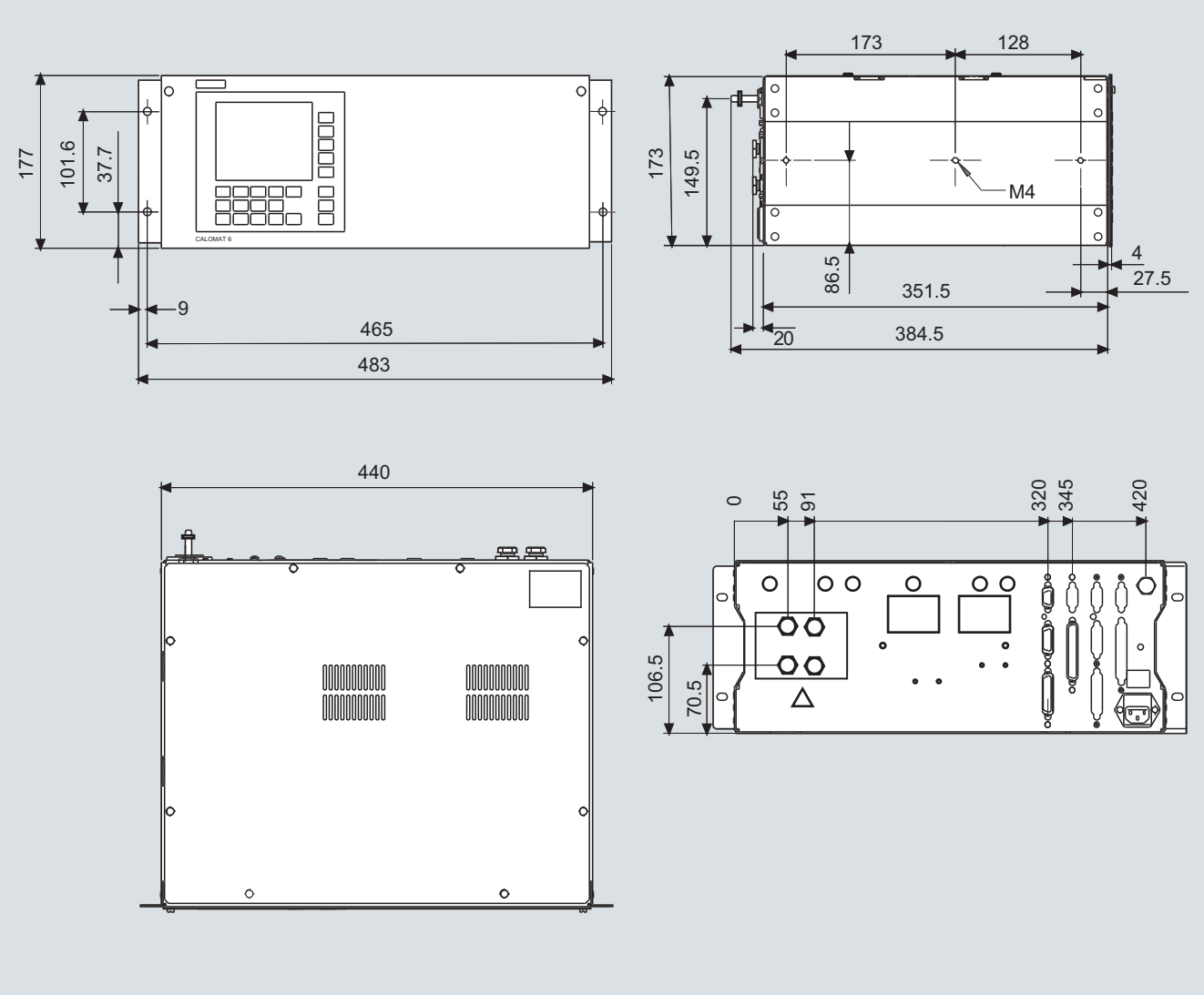
Selection and ordering data			Order No.
CALOMAT 62 gas analyzer 19" rack unit for installation in cabinets			D) **7MB2541-** ■■■■■ - ■ **A** ■■
Material of sample gas path			
Stainless steel, mat. no. 1.4571; non-flow-type reference chamber, 1/8''-27 NPT		Purging gas stub 6 mm	**0**
Stainless steel, mat. no. 1.4571; non-flow-type reference chamber, 1/8''-27 NPT		Purging gas stub 1/4"	**4**
Application		Possible with measuring range identification	
H_2 in N_2		0; 5	**A N**
SO_2 in air		1; 6	**E L**
CO_2 in H_2		0; 5	**K A**
CO_2 in N_2		1; 6	**K N**
Smallest measuring range	Largest measuring range	Reference gas or filling gas	
0 ... 1 %	0 ... 100 %	Accompanying gas component	**0**
0 ... 5 %	0 ... 100 %		**1**
0 ... 5 %	0 ... 60 %		**2**
0 ... 10 %	0 ... 100 %		**3**
0 ... 20 %	0 ... 40 %		**4**
100 ... 99 %	100 ... 0 %	Sample gas component	**5**
100 ... 95 %	100 ... 0 %		**6**
100 ... 90 %	100 ... 0 %		**7**
100 ... 80 %	100 ... 60 %		**8**
Add-on electronics			
Without			**0**
AUTOCAL function			
• With 8 additional binary inputs and outputs			**1**
• With 8 additional 8 binary inputs/outputs and PROFIBUS PA interface			**6**
• With 8 additional binary inputs/outputs and PROFIBUS DP interface			**7**
Power supply			
100 ... 120 V AC, 47 ... 63 Hz			**0**
200 ... 240 V AC, 47 ... 63 Hz			**1**
Explosion protection			
Without			**A**
Language (supplied documentation, software)			
German			**0**
English			**1**
French			**2**
Spanish			**3**
Italian			**4**

Additional versions	Order code
Add "-Z" to Order No. and specify order codes.	
TAG labels (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**

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

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

Dimensional drawings

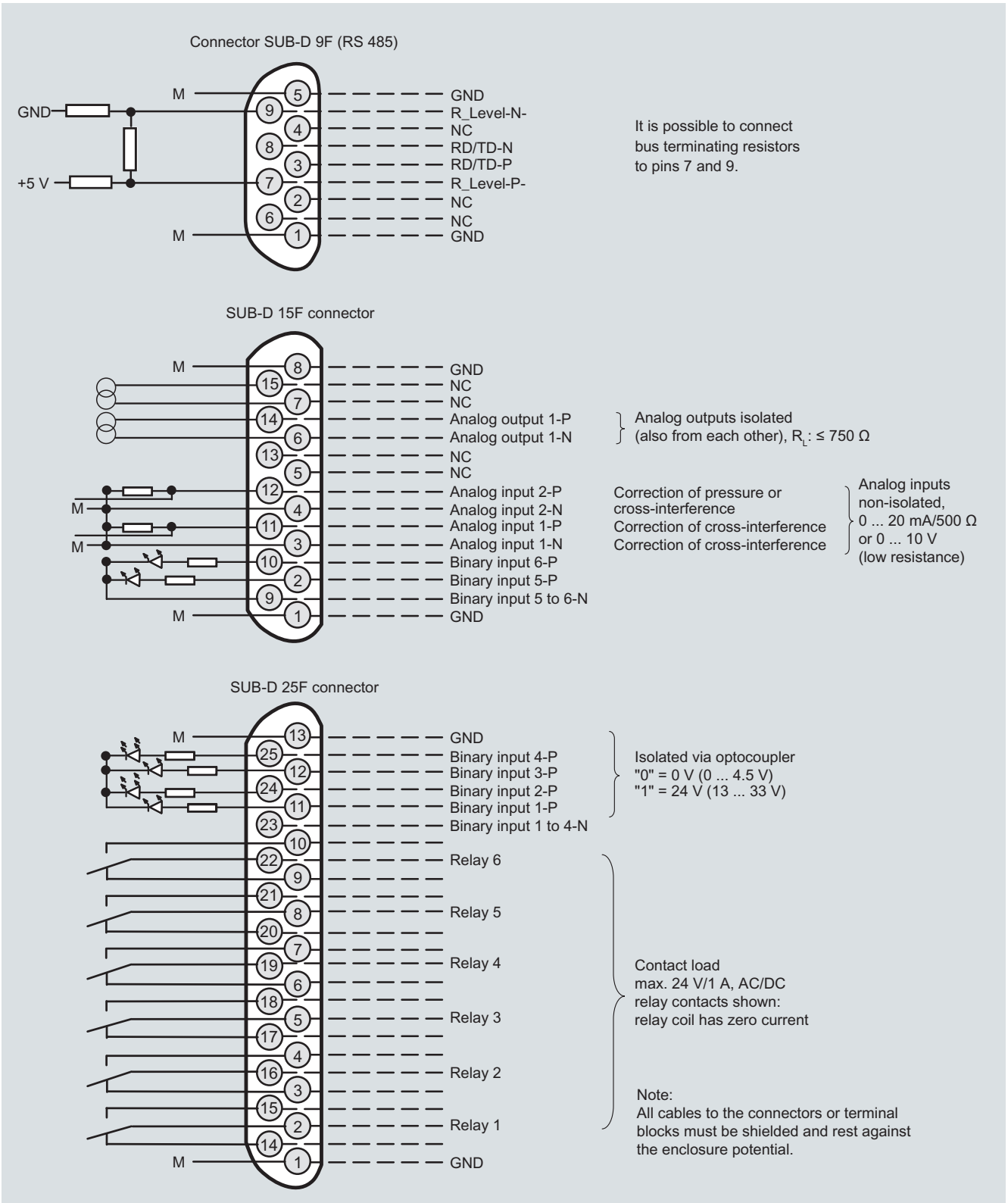


CALOMAT 62, 19" rack unit, dimensions in mm

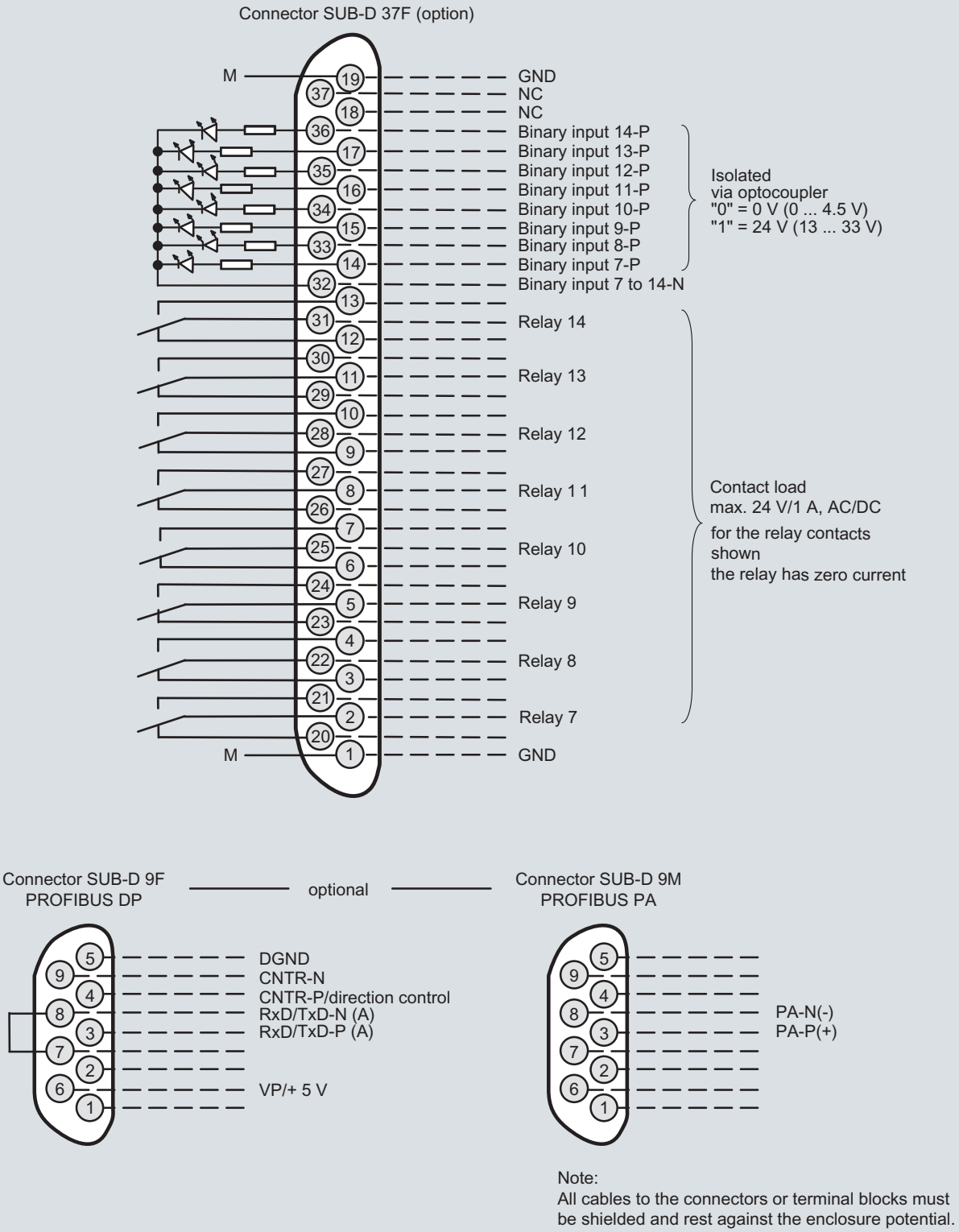
2

Schematics

Pin assignment (electrical and gas connections)

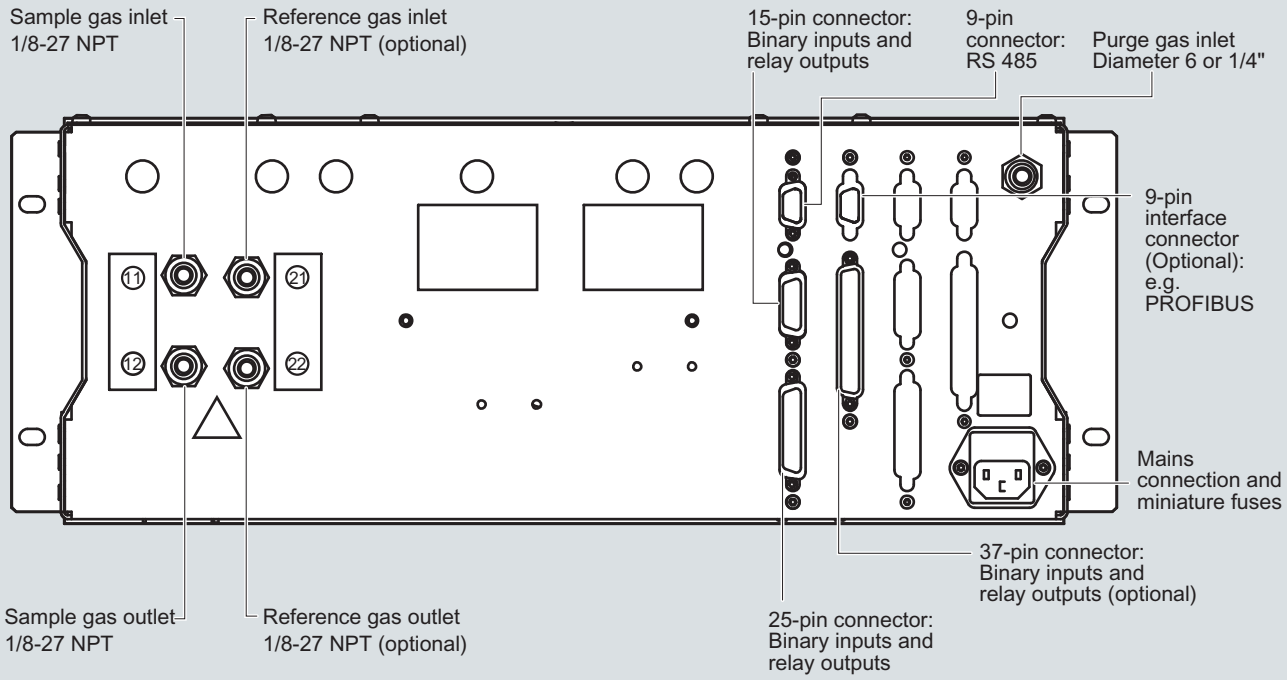


CALOMAT 62, 19" rack unit, pin assignment



CALOMAT 62, 19" rack unit, pin assignment of the AUTOCAL board and PROFIBUS connectors

19" rack unit



CALOMAT 62, 19" rack unit, gas connections and electrical connections

Technical specifications

General (based on DIN EN 61207/IEC 1207. All data refers to the binary gas mixture H_2 in N_2)

Measuring ranges	4, internally and externally switchable; automatic measuring range switchover also possible
Span	Application-dependent (see ordering data)
Measuring ranges with suppressed zero point	Application-dependent (see ordering data)
Operating position	Front wall, vertical
Conformity	CE marking in accordance with EN 50081-1/EN 50081-2 and RoHS

Design, enclosure

Degree of protection	IP65 according to EN 60529
Weight	Approx. 25 kg

Electrical characteristics

EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98) and EN 61326
Electrical safety	In accordance with EN 61010-1; overvoltage category II
Power supply (see nameplate)	100 AC -10 % ... 120 V AC +10 %, 47 ... 63 Hz or 200 AC -10 % ... 240 V AC +10 %, 47 ... 63 Hz
Power consumption	• Approx. 25 VA (gas connection block unheated) • Approx. 330 VA (gas connection block heated)
Fuse values (gas connection unheated)	100 ... 120 V F3 1T/250 F4 1T/250 200 ... 240 V F3 0.63T/250 F4 0.63T/250
Fuse values (gas connection heated)	100 ... 120 V F1 1T/250 F2 4T/250 F3 4T/250 F4 4T/250 200 ... 240 V F1 0.63T/250 F2 2.5T/250 F3 2.5T/250 F4 2.5T/250

Gas inlet conditions

Sample gas pressure	800 ... 1 100 hPa (absolute)
Sample gas flow	30 ... 90 l/h
Sample gas temperature	Min. 0 ... max. 50 °C, but above the dew point
Temperature • of the measuring cell (sensor) • of the measureming cell block (base)	 70 °C 80 °C (heated)
Sample gas humidity	< 90 % relative humidity
Purging gas pressure • Permanent • For short periods	 165 hPa above ambient pressure Max. 250 hPa above ambient pressure

Dynamic response (the dynamic and measuring response refers to the measurement of H_2 in N_2) (referred to sample gas pressure 1 000 hPa absolute, sample gas flow 0.5 l/min, and ambient temperature 25 °C)

Warm-up period	< 30 min at room temperature (the technical specification will be met after 2 hours)
Delayed display (T_{90})	Approx. 35 s (including dead time)
Electrical damping	0 ... 100 s, parameterizable
Dead time (the diffusion to the probes is the determining variable)	Approx. 34 s

Measuring response (the dynamic and measuring response refers to the measurement of H_2 in N_2) (referred to sample gas pressure 1 000 hPa absolute, sample gas flow 0.5 l/min, and ambient temperature 25 °C)

Output signal fluctuation (3σ value)	< ± 1 % of the smallest possible span according to rating plate with electronic damping constant of 1 s
Zero point drift	< ± 1 % of the current span/week
Measured-value drift	< ± 1 % of the smallest possible span (according to rating plate)/week
Repeatability	< ± 1 % of the current span
Detection limit	1 % of the smallest possible span according to rating plate
Linearity error	< ± 1 % of the current span

Influencing variables (referred to sample gas pressure 1 000 hPa absolute, sample gas flow 0.5 l/min, and ambient temperature 25 °C)

Ambient temperature	< 2 %/10 K referred to smallest possible span according to rating plate
Accompanying gases	Deviation from zero point (for influence of interfering gas, see section "Cross-interference")
Sample gas flow	0.2 % of the current measuring span with a change in flow of 0.1 l/min within the permissible flow range
Sample gas pressure	< 1 % of the span with a change in pressure of 100 hPa
Power supply	< 0.1 % of the output signal span with rated voltage ± 10 %

Electrical inputs and outputs

Analog output	0/2/4 ... 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, isolated
Analog inputs	2, dimensioned for 0/2/4 … 20 mA for external pressure sensor and correction of cross-interference
Binary inputs	6, designed for 24 V, isolated, freely parameterizable, e.g. for measuringrange switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and 8 additional relay outputs, also with PROFIBUS PA (on request) or PROFIBUS DP (on request)

Climatic conditions

Permissible ambient temperature	-40 ... +70 °C during storage and transportation, 5 … 45 °C during operation
Permissible humidity (dew point must not be fallen below)	< 90 % relative humidity as annual average, during storage and transportation

CALOMAT 62

Field device

Selection and ordering data		Order No.	Cannot be combined
CALOMAT 62 gas analyzer for field installation		D) **7MB2531-** ■■■■■ - ■■■■	
Material of sample gas path			
Stainless steel, mat. no. 1.4571; non-flow-type reference chamber, 1/8"-27 NPT	Purging gas stub 10 mm	**0**	**0**
Hastelloy C22; non-flow-type reference chamber, 1/8"-27 NPT		**2**	
Hastelloy C22; flow-type reference chamber, 1/8"-27 NPT		**3**	**3**
Stainless steel, mat. no. 1.4571; non-flow-type reference chamber, 1/8"-27 NPT	Purging gas stub $^3/_8$"	**4**	**4**
Hastelloy C22; non-flow-type reference chamber, 1/8"-27 NPT		**6**	
Hastelloy C22; flow-type reference chamber, 1/8"-27 NPT		**7**	**7**
Application	Possible with measuring range identification		
H_2 in N_2	0; 5	**A N**	**AN**
H_2 in Cl_2	0; 5	**A B**	**AB**
H_2 in HCl	0; 5	**A C**	**AC**
Cl_2 in air	1; 6	**B L**	**BL**
Cl_2 in HCl	3; 7	**B C**	**BC**
HCl in air	1; 6	**C L**	**CL**
NH_3 in N_2	4; 8	**D N**	**DN**
SO_2 in air	1; 6	**E L**	**EL**
CO_2 in H_2	0; 5	**K A**	**KA**
CO_2 in N_2	1; 6	**K N**	**KN**
Smallest measuring range / Largest measuring range	Reference gas or filling gas		
0 ... 1 % / 0 ... 100 %	Accompanying gas component	**0**	
0 ... 5 % / 0 ... 100 %		**1**	
0 ... 5 % / 0 ... 60 %		**2**	
0 ... 10 % / 0 ... 100 %		**3**	
0 ... 20 % / 0 ... 40 %		**4**	
100 ... 99 % / 100 ... 0 %	Sample gas component	**5**	
100 ... 95 % / 100 ... 0 %		**6**	
100 ... 90 % / 100 ... 0 %		**7**	
100 ... 80 % / 100 ... 60 %		**8**	
Add-on electronics			
Without		**0**	
AUTOCAL function			
• With 8 additional binary inputs/outputs		**1**	
• With 8 additional binary inputs/outputs and PROFIBUS PA interface		**6**	
• With 8 additional binary inputs/outputs and PROFIBUS DP interface		**7**	
Power supply			
100 ... 120 V AC, 47 ... 63 Hz		**0**	
200 ... 240 V AC, 47 ... 63 Hz		**1**	
Heating of internal gas paths and analyzer unit			
Without		**A**	
With (max. 80 °C)		**B**	
Explosion protection			
Without		**A**	
According to ATEX II 2G, leakage compensation[1)]		**E**	
According to ATEX II 2G, continuous purging[1)]		**F**	
Language (supplied documentation, software)			
German		**0**	
English		**1**	
French		**2**	
Spanish		**3**	
Italian		**4**	

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

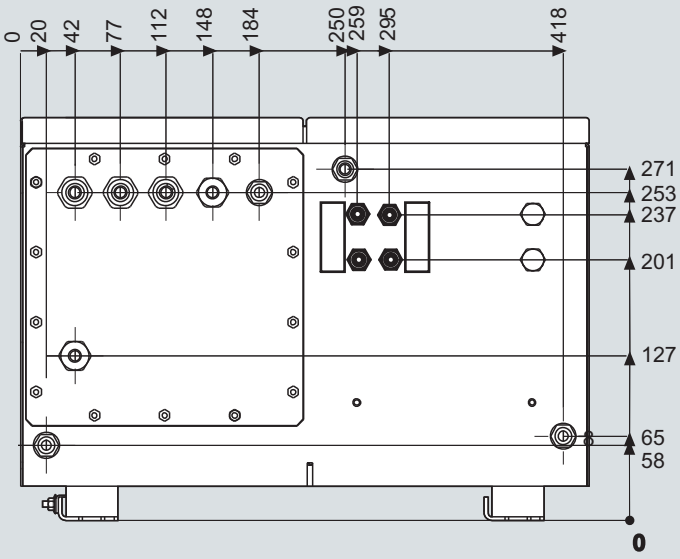
1) Only in connection with an approved purging unit.

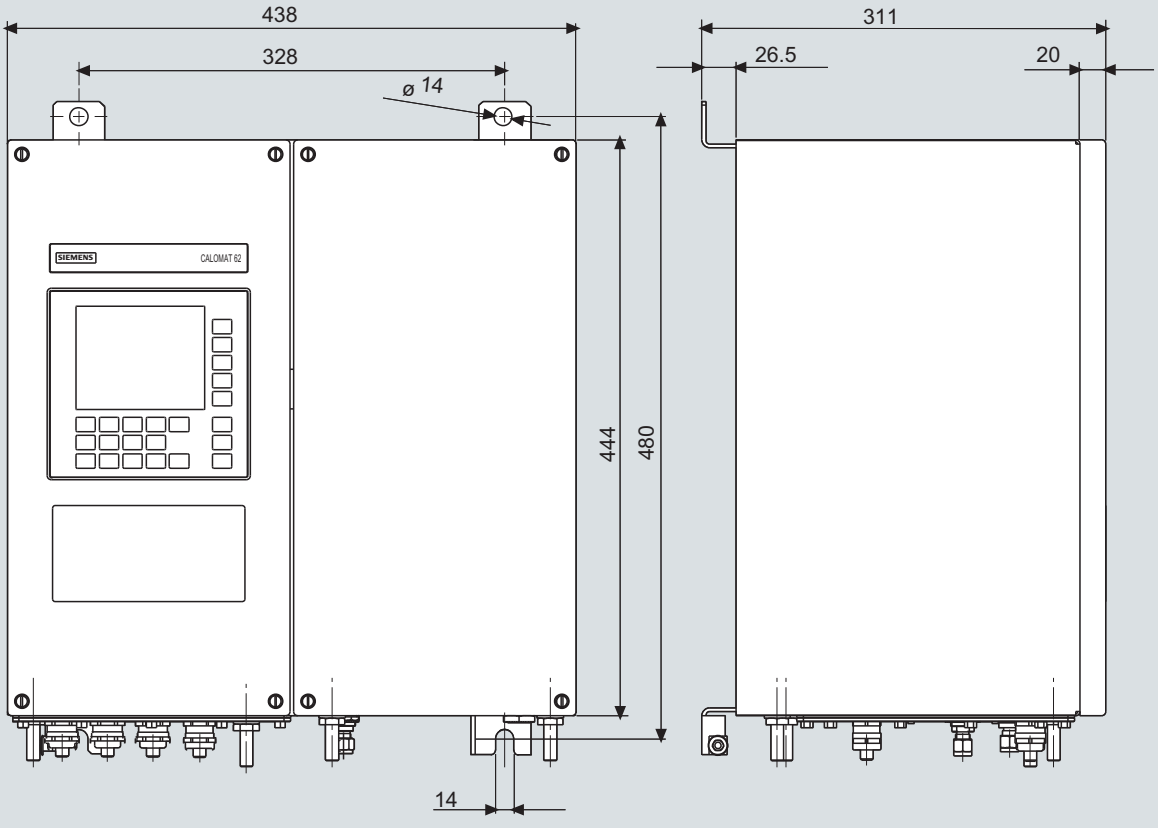
Selection and ordering data

Additional versions	**Order code**
Add "-Z" to Order No. and specify order codes.	
TAG labels (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction with an application no., e.g. extended measuring range)	**Y12**
Extended special setting (only in conjunction with an application no., e.g. determination of cross-interferences)	**Y13**
Retrofitting sets	**Order No.**
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function with 8 binary inputs/outputs	**A5E00064223**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS PA	**A5E00057315**
AUTOCAL function with 8 binary inputs/outputs and PROFIBUS DP	**A5E00057318**

2

Dimensional drawings

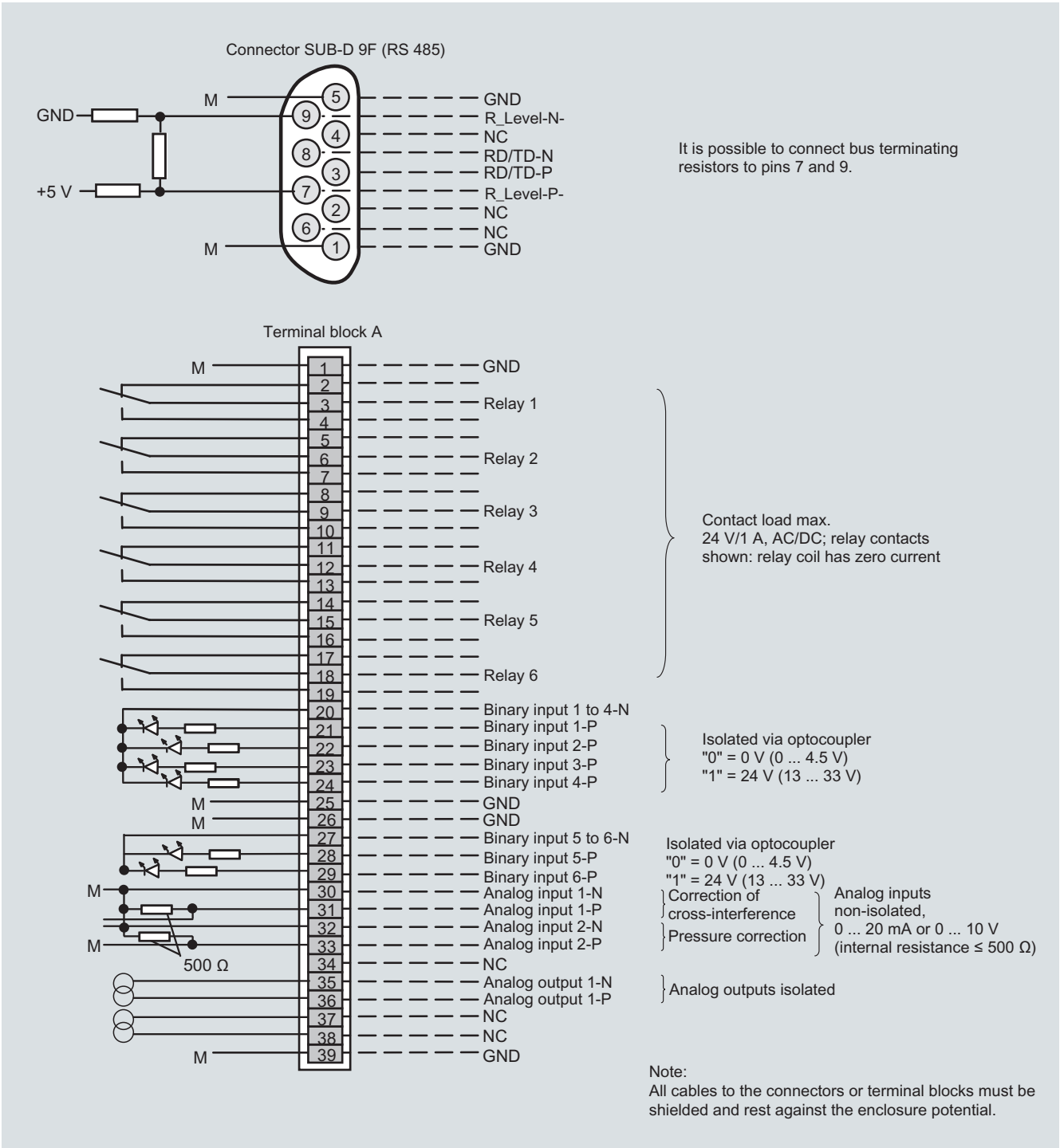




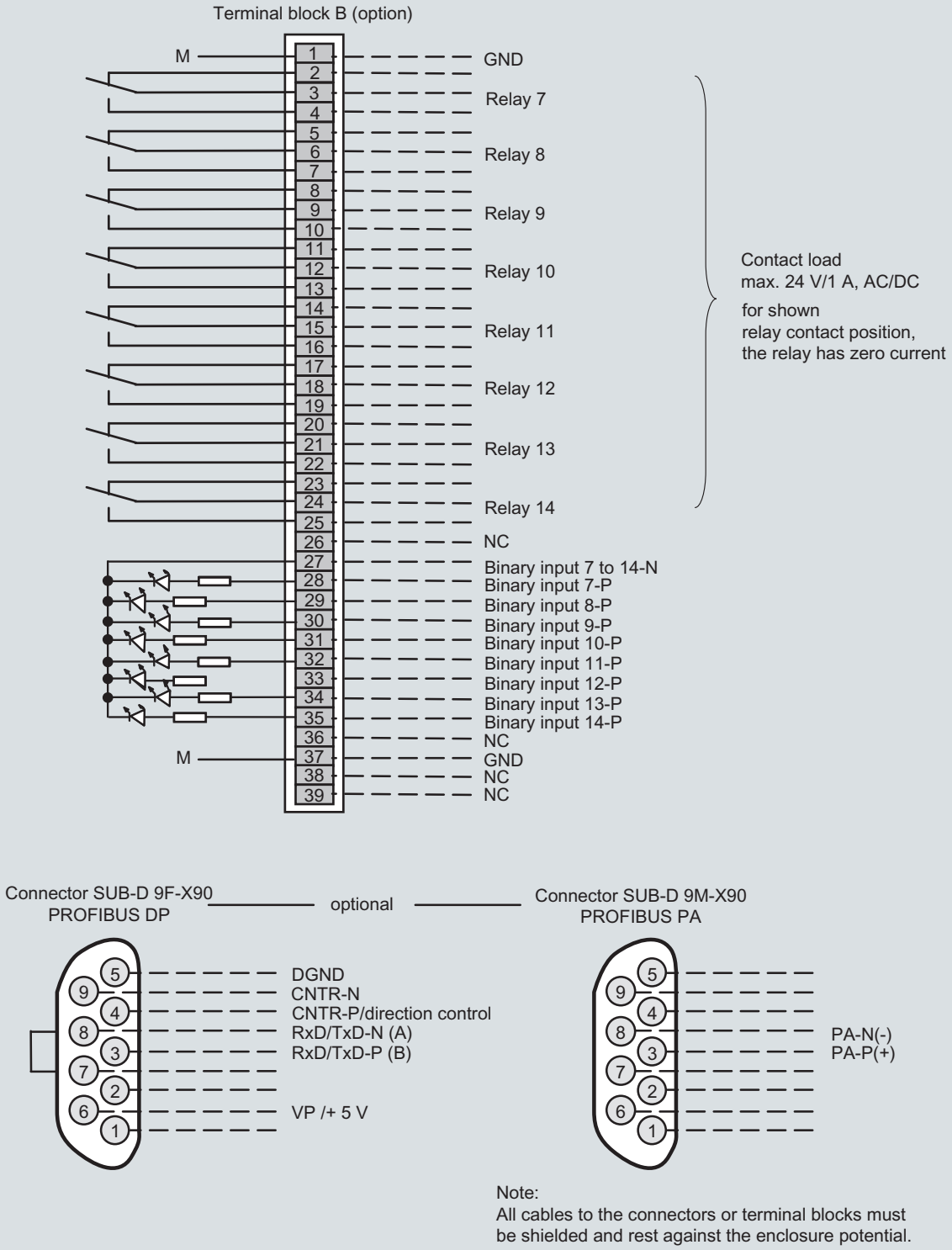
CALOMAT 62, field device, dimensions in mm

Schematics

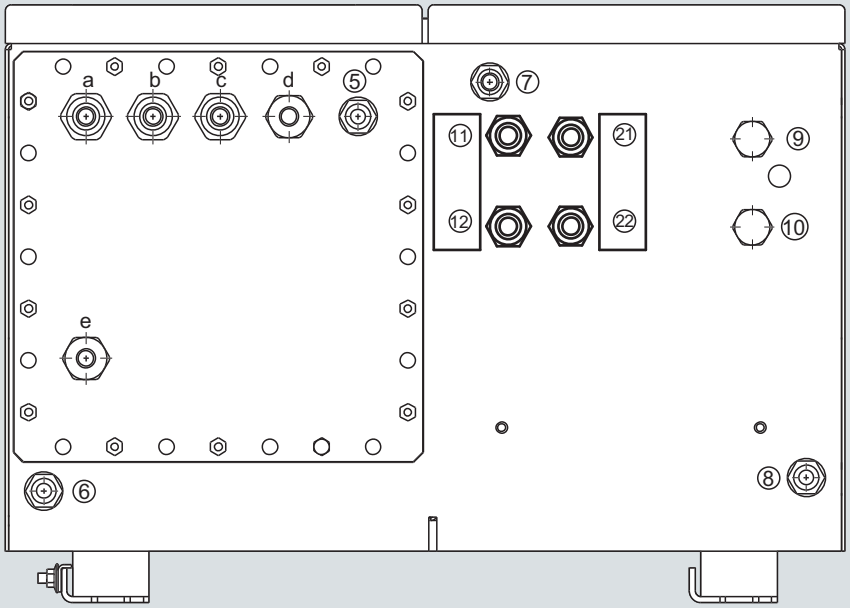
Pin assignment (electrical and gas connections)



CALOMAT 62, field device, pin and terminal assignment



CALOMAT 62, field device, pin and terminal assignment of the AUTOCAL board and PROFIBUS connectors



Gas connections

⑪	Sample gas inlet	Internal thread 1/8" - 27 NPT
⑫	Sample gas outlet	
㉑	Reference gas inlet	
㉒	Reference gas outlet	
⑤-⑧	Purge gas inlets/outlets	Fittings Ø 10 mm or 3/8"
⑨	Unassigned	
⑩	Unassigned	

Electrical connections

a - c	Signal cable (Ø 10 ... 14 mm) (analog + digital): cable gland M20x1.5
d	Interface connection: (Ø 7 ... 12 mm) cable gland M20x1.5
e	Power supply: (Ø 7 ... 12 mm) cable gland M20x1.5

CALOMAT 62, field device, gas connections and electrical connections

Documentation

Selection and ordering data

Operating instructions		Order No.
CALOMAT 62		
Thermal conductivity gas analyzer		
• German		**A5E00881392**
• English		**A5E00881393**
• French		**A5E00881395**
• Italian		**A5E00881398**
• Spanish		**A5E00881396**
Gas analyzers of Series 6 and ULTRAMAT 23		
PROFIBUS DP/ PA interface		
• German and English	D)	**A5E00054148**

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

Suggestions for spare parts

Selection and ordering data

Description	7MB2541	7MB2531	2 years (quantity)	5 years (quantity)	Order No.
Temperature limiter		x	–	1	**A5E00891855**
Adapter plate, LC display/keypad	x	x	1	1	**C79451-A3474-B605**
Temperature sensor		x	–	1	**C79451-A3480-B25**
LC display	x		–	1	**W75025-B5001-B1**
Line transformer, 115 V	x	x	–	1	**W75040-B21-D80**
Line transformer, 230 V	x	x	–	1	**W75040-B31-D80**
Fuse, T 0.63 A, line voltage 200 to 240 V	x	x	2	3	**W79054-L1010-T630**
Fuse, T 1 A, line voltage 100 … 120 V	x	x	2	3	**W79054-L1011-T100**
Heating cartridge		x	–	1	**W75083-A1004-F120**

Overview

The FIDAMAT 6 gas analyzer is suitable for the determination of the total hydrocarbon content in the air and high-boiling gas mixtures.

Benefits

The FIDAMAT 6 gas analyzer is distinguished by its wide range of applications:

- In the presence of up to 100 % H_2O vapor
- In ultra-pure gas applications
- With high-boiling components (up to 200 °C)
- In the presence of corrosive gases (with preliminary filter).

The FIDAMAT 6 exhibits:

- Extremely low cross-sensitivity to interfering gases
- Low consumption of combustion air
- Low influence of oxygen on measured value

The analyzer is additionally equipped with warning and fault messages:

- For failure of combustion gas
- If the flame is extinguished
- To indicate pump and filter faults

Application

Areas of application

- Environmental protection
- Wastewater (in conjunction with a stripping device, verification of the hydrocarbon content of liquids)
- TLV (Threshold Limit Value) monitoring at places of work
- Quality monitoring
- Process exhaust monitoring
- Ultra-pure gas measurements in media such as O_2, CO_2, inert gases and cold sample gases
- Measurement of corrosive and condensing gases
- Process optimization

Further applications

- Chemical plants
- Gas manufacturers (ultra-pure gas monitoring)
- Research and development
- Cement industry (measurement of emissions)
- Paint shops and dry-cleaning systems
- Refineries (tank farms, wastewater)
- Drying systems
- Solvent recovery systems
- Pharmaceutical industry
- Automotive industry (engine development, engine and transmission development and certification)

Special applications

Special applications

Special applications are available on request in addition to the standard combinations, e.g. measuring range 0 to 100 %.

TÜV version

Measurement of flue gases according to 13th BImSchV/17th BImSchV and TA Luft for oil, coal, gas, and waste as fuels.

Furthermore, the TÜV-approved versions of the FIDAMAT 6 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.

General information

Design

- 19" rack unit with 4 HU for installation
  - in hinged frame
  - in cabinets with or without telescopic rails
- Front plate can be swung down for servicing purposes (laptop connection)
- Gas connections for sample gas inlet and outlet as well as combustion gas and combustion air; pipe diameter 6 mm or ¼"
- Gas and electrical connections at the rear
- Internal gas paths: stainless steel (mat. no. 1.4571)

Display and control panel

- Large LCD field for simultaneous display of:
  - Measured value
  - Status bar
  - Measuring ranges
- Contrast of LCD panel adjustable using menu
- Permanent LED backlighting
- Washable membrane keyboard with five softkeys
- Menu-driven operation for parameterization, test functions, adjustment
- User help in plain text
- Graphic display of concentration trend; programmable time intervals

Input and outputs

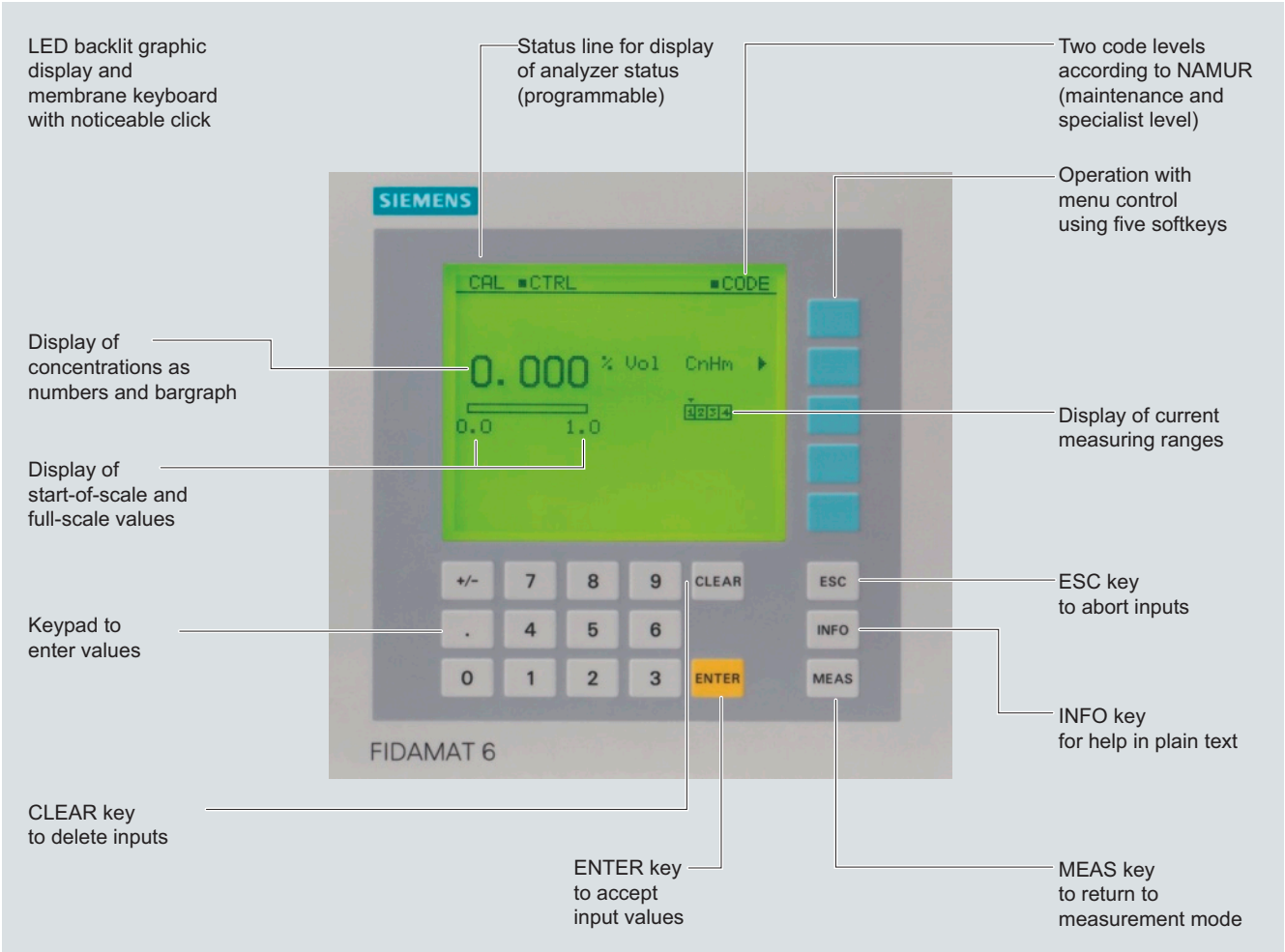
- One analog output for each measured component
- Two programmable analog inputs
- Six binary inputs freely configurable (e.g. for measurement range switchover, processing of external signals from sample preparation)
- Six relay outputs freely configurable (failure, maintenance request, maintenance switch, limit alarm, external solenoid valves, measuring point switchover)
- Extension with eight additional binary inputs and eight additional relay outputs for autocalibration with up to four calibration gases

Communication

RS 485 present in basic unit (connection from the rear).

Options

- RS 485/RS 232 converter
- RS 485/Ethernet converter
- RS 485/USB converter
- Incorporation in networks via PROFIBUS DP/PA interface
- SIPROM GA software as service and maintenance tool

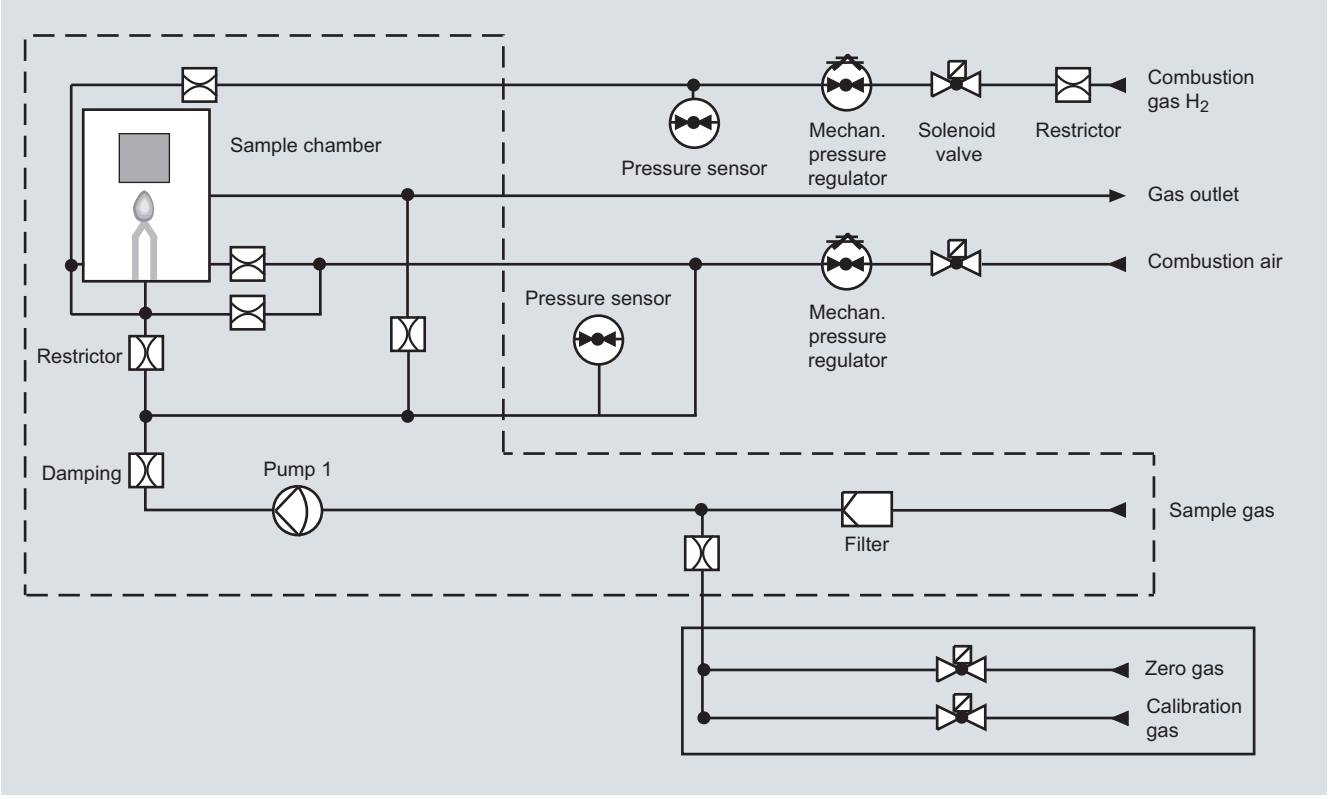


FIDAMAT 6, membrane keyboard and graphic display

Designs – parts wetted by sample gas

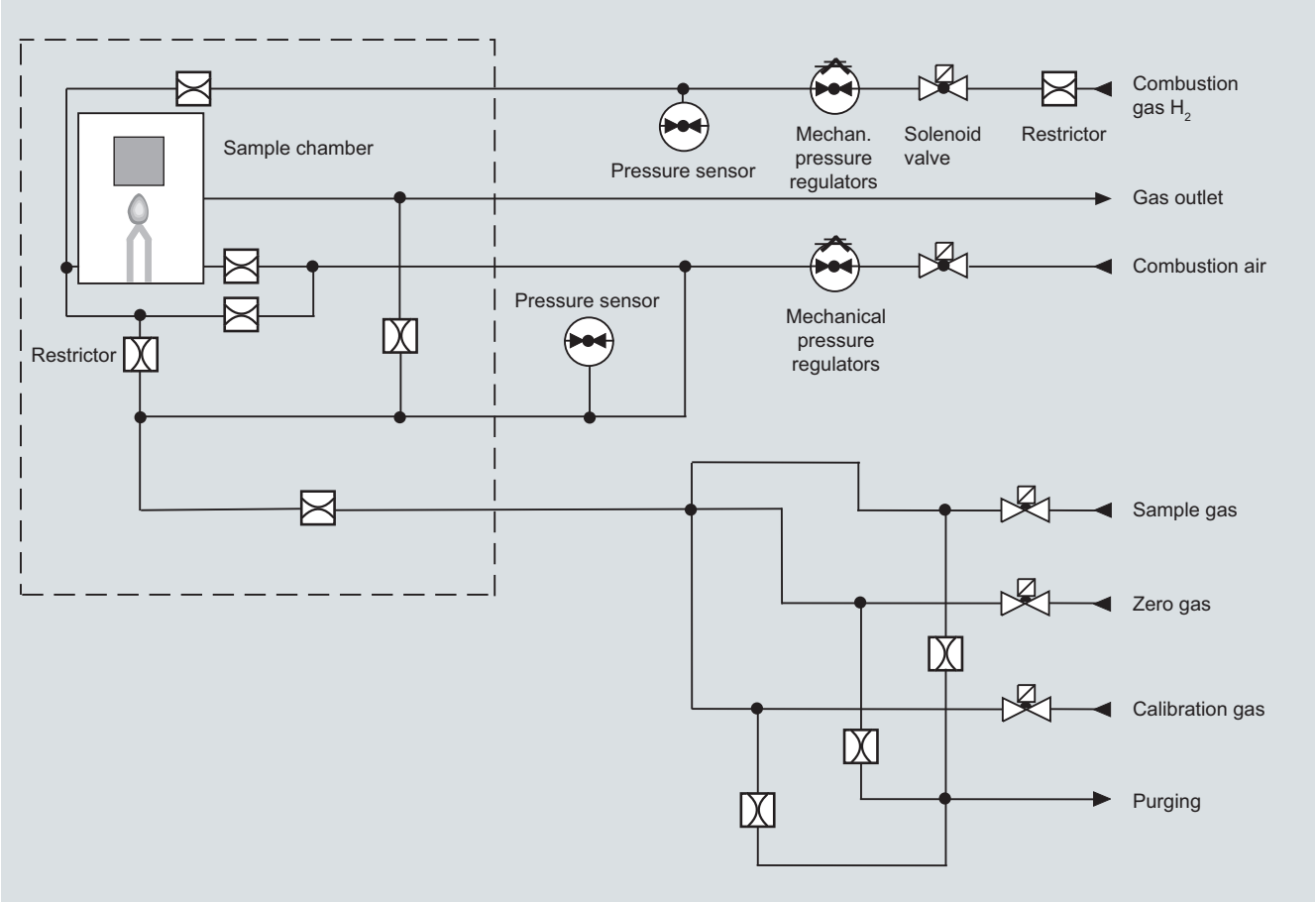
Gas path	Material
Piping	Stainless steel, mat. no. 1.4571
Gas inlet	Stainless steel, mat. no. 1.4571
Gaskets	Graphite
Sample gas restrictor	Quartz
Auxiliary gas restrictors	Stainless steel, mat. no. 1.4571
Pump membrane	PTFE
Pump head	Stainless steel, mat. no. 1.4571
Detector	
• Nozzle	Quartz
• FID housing	Stainless steel, mat. no. 1.4571

Gas path



FIDAMAT 6 total hydrocarbon analyzer, gas path with pump and with connection for combustion air

General information



FIDAMAT 6 total hydrocarbon analyzer, gas path without pump and with connection for combustion air

Function

Principle of operation

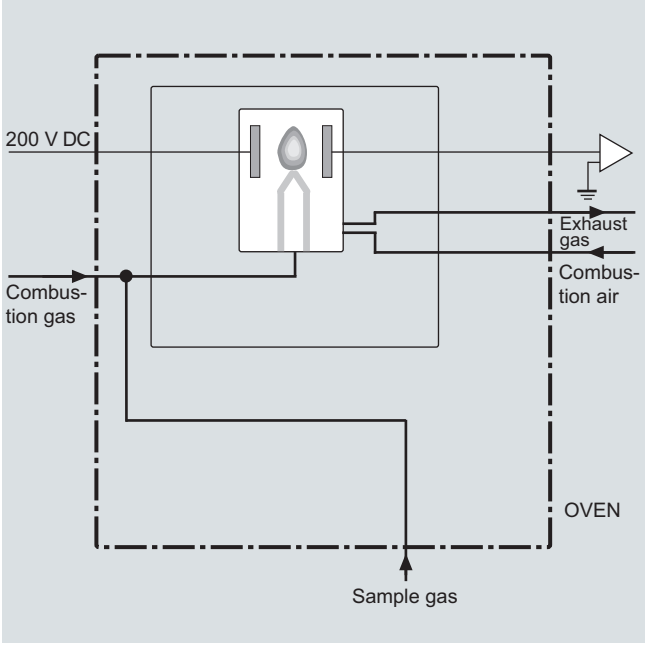
The FIDAMAT 6 carries out substance-specific measurements and not component-specific measurements. It measures the total of all hydrocarbons in a sample gas, but with different weighting of the hydrocarbon molecules. To a first approximation, the display is proportional to the number of C atoms in the respective molecule. However, there are fluctuations in practice. The display deviation for the respective molecule is expressed by the response factor.

The sample gas is supplied to the FIDAMAT 6 through overpressure or drawn in by the built-in diaphragm pump (optionally via a heated line and an additional filter) and passed on to the flame ionization detector via an obstruction-proof fused-silica restrictor.

In the detector, the hydrocarbons in the sample gas are burned in an oxyhydrogen gas flame. Burning partially ionizes the proportion of organically-bound hydrocarbons. The released ions are converted into an ionic current by the voltage present between two electrodes, and measured using a highly sensitive amplifier. The current measured is proportional to the quantity of organically-bound C atoms in the sample gas.

A pressure regulator keeps the combustion gas pressure constant. The balanced system of pump, capillary tubes, and pressure regulator for combustion air ensures that the sample gas pressure is kept constant.

When the analyzer is switched on, ignition is carried out automatically when the setpoint temperature has been reached and, for versions "with pump", the pump is also started up.



FIDAMAT 6, principle of operation

The FIDAMAT 6 provides various messages in the form of floating contacts:

- Maintenance request
  E.g. sample gas flow (filter/pump)
  Fan failure (advance warning for measuring accuracy)
  The measured value remains unaffected.
- Fault
  E.g. hydrogen, combustion air and sample gas pressures, temperature, analyzer part and pump, fault in the electronics (temperature).
  The measured value may be influenced.
- Failure
  In the event of failure of, for example, the electronics, power supply, combustion gas, combustion air or sample gas, the analyzer automatically shuts down (the combustion gas valve is closed).

Note

The sample gases must be fed into the analyzers free of dust. Condensation should be avoided. Therefore appropriate gas preparation is required for most applications.

Essential characteristics

- Four freely parameterizable measuring ranges, also with suppressed zero, all measuring ranges linear
- Galvanically isolated measured-value output 0/2/4 to 20 mA (also inverted)
- Autoranging possible; remote switching is also possible
- Storage of measured values possible during adjustments
- Measuring range identification
- Measuring point switchover for up to 6 measuring points
- Measuring point identification
- Wide range of selectable time constants (static/dynamic noise suppression); i.e. the response time of the device can be adapted to the respective measuring task
- Easy handling thanks to menu-driven operation
- Low long-term drift
- Two control levels with their own authorization codes for the prevention of accidental and unauthorized operator interventions
- Automatic range calibration can be parameterized
- Operation based on the NAMUR recommendation
- Customer-specific analyzer options such as:
  - Customer acceptance
  - TAG labels
  - Drift recording
- Wear-free, corrosion-proof filter housing
- No blocking of the sample gas capillaries through the use of a quartz restrictor
- Purge function in the event of analyzer or power supply failure (avoids build-up of toxic and corrosive substances in the device)
- Low consumption of combustion air
- Response factors comply with the minimum requirements in accordance with German air purity guidelines and the Working Group of the German automotive Industry
- Simple handling using a numerical membrane keyboard and operator prompting

General information

Response factors (examples, mean values)

Substance	Mean response factor
n-butane	1.00
n-propane	1.00
n-heptane	1.00
Cyclohexane	1.08
Isopropanol	0.81
Toluene	1.06
Acetone	0.92
Ethyl acetate	0.76
Isobutyl acetate	0.83
Methane	1.06
Ethane	0.99
n-hexane	1.01
iso-octane	1.04
Ethine (acetylene)	0.91
Propene	0.84
Methanol	0.87
Ethanol	0.83
Ethanoic acid	1.13
Methyl acetate	0.67
Benzene	1.01
Ethyl benzene	0.96
p-xylene	1.03
Dichloromethane	1.13
Trichloroethene	1.01
Tetrachlorethene	1.07
Chloroform	0.72
Chlorobenzene	1.15

Cross-interferences (examples)[1)]

Interfering component	Concentration of the interfering component	Induced cross-interference
O_2 in N_2	(21 vol.%)	< 0.3 mg/m^3
SO_2 in N_2	(258 mg/m^3)	< 0.15 mg/m^3
NO in N_2	(310 mg/m^3)	< 0.5 mg/m^3
NO_2 in synth. air	(146 mg/m^3)	< 0.1 mg/m^3
CO in N_2	(461 mg/m^3)	< 0.15 mg/m^3
CO_2 in N_2	(18 vol.%)	< 0.1 mg/m^3
HCl in N_2	(78 mg/m^3)	< 0.3 mg/m^3

[1)] With measuring range 0 to 15 mg/m^3.

Technical specifications

General information	
Measuring ranges	4, internally and externally switchable; manual and autoranging possible
Smallest possible measuring span	0 ... 10 vpm
Largest possible measuring span	99.999 vpm*)
Concentration units	ppm, C_1, C_3, C_6 or mgC/m^3
Autoranging	Hysteresis, selectable
Measured-value display	Digital concentration display (5 digits with floating point)
Resolution of digital display	0.1 % of measured value
Operating position	Front wall, vertical
Conformity	CE mark in accordance with EN 50081-1, EN 50082-2
Oven temperature	Adjustable, 100 ... 200 °C
Design, enclosure	
Degree of protection	IP20 according to EN 60529
Weight	Approx. 23 kg
Electrical characteristics	
Power supply	100 ... 120 V AC (nominal range of use 90 ... 132 V), 48 ... 63 Hz or 200 ... 240 V AC (nominal range of use 180 ... 264 V), 48 ... 63 Hz
Power consumption	• Approx. 150 VA during operation, • approx. 350 VA during warm-up phase
EMC (**E**lectro**m**agnetic **C**ompatibility)	In accordance with standard requirements of NAMUR NE21 (08/98)
Electrical safety	In accordance with EN 61010-1, overvoltage category II
Fuse values	• 100 ... 120 V: 4.0T/250 • 200 ... 240 V: 2.5 T/250
Gas inlet conditions	
Permissible sample gas pressure	
• Without pump	< 2 000 hPa abs.
• With integrated pump	600 ... 1 100 hPa
Sample gas flow	18 ... 60 l/h (0.3 ... 1 l/min)
Sample gas temperature	0 ... 200 °C
Sample gas humidity	< 90 % RH (RH: relative humidity)
Dynamic response	
Warm-up period	At room temperature, approx. 2 ... 3 h
Delayed display (T_{90})	2 ... 3 s
Damping (electrical time constant)	0 ... 100 s, parameterizable
Dead time (purging time of the gas path in the unit at 1 l/min)	With filter, 2 ... 3 s
Time for device-internal signal processing	< 1 s

Measuring response	
(relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Output signal fluctuation	< 0.75 % of the smallest possible measuring range according to rating plate, with electronic damping constant of 1 s (corresponds to ± 0.25 % at 2 σ)
Zero point drift	< 0.5 %/month of the smallest possible measuring span according to rating plate
Measured-value drift	< 1 %/week of the current measuring range
Repeatability	< 1 % of the current measuring range
Detection limit	0.1 ppm (version for ultra-pure gas measurement: 50 ppb)
Linearity error	< 1 % of the current measuring range
Influencing variables	
(relating to sample gas pressure 1 013 hPa absolute, 0.5 l/min sample gas flow and 25 °C ambient temperature)	
Ambient temperature	< 1 %/10 K referred to smallest possible span according to rating plate
Atmospheric pressure	< 1 %/50 hPa
Sample gas pressure	< 2 % of the current measuring range range/1 % pressure change (within 600 ... 1 100 hPa)
Power supply	< 1 % of the current measuring range with rated voltage ± 10 %
Position influence	< 1 % with < 15° inclination
Electrical inputs and outputs	
Analog output	0/2/4 ... 20 mA, isolated; max. load 750 Ω
Relay outputs	6, with changeover contacts, freely parameterizable, e.g. for measuring range identification; load: 24 V AC/DC/1 A, potential-free
Analog inputs	2, dimensioned for 0/2/4 to 20 mA for external pressure sensor and correction of influence of accompanying gas (correction of cross-interference)
Binary inputs	6, designed for 24 V, floating, freely parameterizable, e.g. for measuring range switchover
Serial interface	RS 485
Options	AUTOCAL function with 8 additional binary inputs and relay outputs each, also with PROFIBUS PA or PROFIBUS DP
Climatic conditions	
Permissible ambient temperature	5 ... 45 °C during operation, -30 ... +70 °C during storage and transportation
Permissible humidity	< 90 % RH (RH: relative humidity) as annual average, during storage and transportation (must not fall below dew point)

*) 100 % as special application

19" rack unit

FIDAMAT 6 with pump and heated oven, with combustion air connection					
Gases	**Inlet pressure**	**Operating pressure Pump startup**		**Flow through FID**	**Flow through bypass**
		Without	**With**		
	hPa (abs.)	**hPa (abs.)**	**hPa (abs.)**	**ml/min**	**ml/min**
Combustion gas	3 000 ... 5 000	2 000 ± 20		~ 25	—
Combustion air	3 000 ... 5 000	1 420 ± 20	1 500	~ 320	~ 500
Sample gas	~ 1000	—	1 500 ± 2	~ 3	~ 1 000
Zero gas	3 500 ... 4 000	—	1 500 ± 2	~ 3	~ 1 000
Calibration gas	3 500 ... 4 000	—	1 500 ± 2	~ 3	~ 1 000

FIDAMAT 6 without pump, with heated oven, with combustion air connection					
Gases	**Inlet pressure**	**Operating pressure Sample/calibration gas**		**Flow through FID**	**Flow through bypass**
		Without	**With**		
	hPa (abs.)	**hPa (abs.)**	**hPa (abs.)**	**ml/min**	**ml/min**
Combustion gas	3 000 ... 5 000	2 000 ± 20		~ 25	—
Combustion air	3 000 ... 5 000	1 480 ± 5	—	~ 320	~ 300
Sample gas	1 500 ... 2 000	—	1 500 ± 2	~ 3	~ 500
Zero gas	1 500 ... 2 000	—	1 500 ± 2	~ 3	~ 500
Calibration gas	1 500 ... 2 000	—	1 500 ± 2	~ 3	~ 500

The supply gases (combustion gas, combustion air) must have a degree of purity of 5.0 in order to guarantee correct measurements. The degree of purity must be increased in the case of very small hydrocarbon concentrations (< 1 ppm).

Selection and ordering data		Order No.
FIDAMAT 6 gas analyzer 19" rack unit for installation in cabinets	D)	**7MB2421-** ■■■■■-■■A■
Gas connections		
Pipe with 6 mm outer diameter		**0**
Pipe with ¼" outer diameter		**1**
Version		
Without pump, for sample gas with overpressure[1)]		**A**
Without pump, for sample gas with overpressure; ultra-pure gas measurement		**B**
With heated pump, for sample gas with atm. pressure		**D**
With heated pump, for sample gas with atm. pressure, ultra-pure gas measurement O_2		**E**
Combustion air feed		
With connection for combustion air		**A**
Number of channels		
1-channel version		**1**
Add-on electronics		
Without		**0**
AUTOCAL function		
• With 8 additional binary inputs/outputs		**1**
• With 8 binary inputs/8 binary outputs, PROFIBUS PA interface		**6**
• With 8 binary inputs/8 binary outputs, PROFIBUS DP interface		**7**
Power supply		
100 ... 120 V AC, 48 ... 63 Hz		**0**
200 ... 240 V AC, 48 ... 63 Hz		**1**
Combustion gases		
H_2		**A**
Language (supplied documentation, software)		
German		**0**
English		**1**
French		**2**
Spanish		**3**
Italian		**4**

Additional versions	Order code
Add "-Z" to Order No. and specify Order code	
Telescopic rails (2 units)	**A31**
Set of Torx screwdrivers	**A32**
TAG labels (specific inscription based on customer information)	**B03**
Clean for O_2 service (specially cleaned gas path)	**Y02**
Measuring range indication in plain text, if different from the standard setting	**Y11**
Special setting (only in conjunction with an application No.)	**Y12**
Extended special setting (only in conjunction with an application No.)	**Y13**
TÜV version acc. to 17th BImSchV	**Y17**

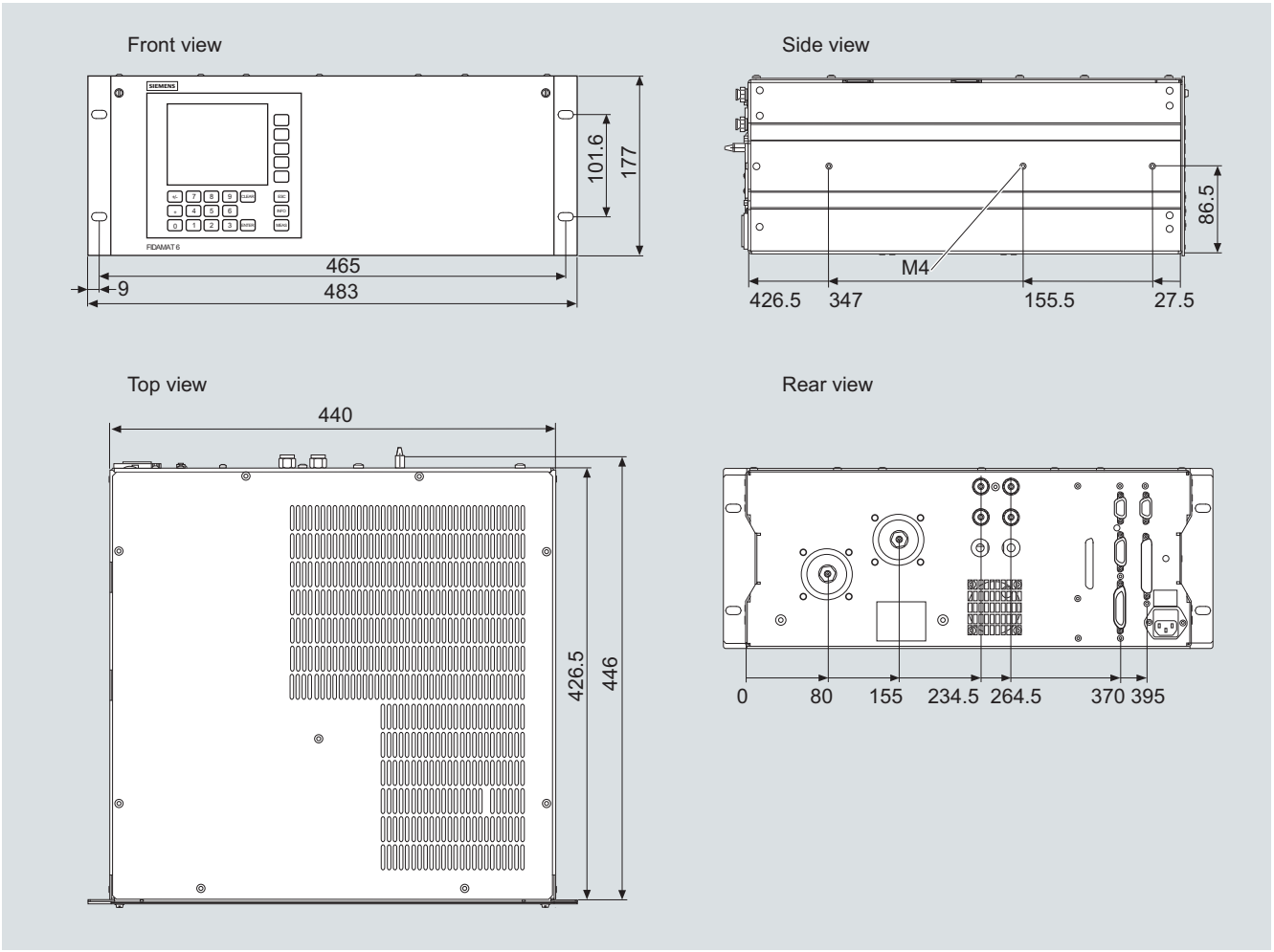
Retrofitting sets	Order No.
RS 485/Ethernet converter	**A5E00852383**
RS 485/RS 232 converter	**C79451-Z1589-U1**
RS 485/USB converter	**A5E00852382**
AUTOCAL function each with 8 binary inputs/outputs	**C79451-A3480-D511**
AUTOCAL function 8 binary inputs/outputs each and PROFIBUS PA	**A5E00057307**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

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

1) On request.

19" rack unit

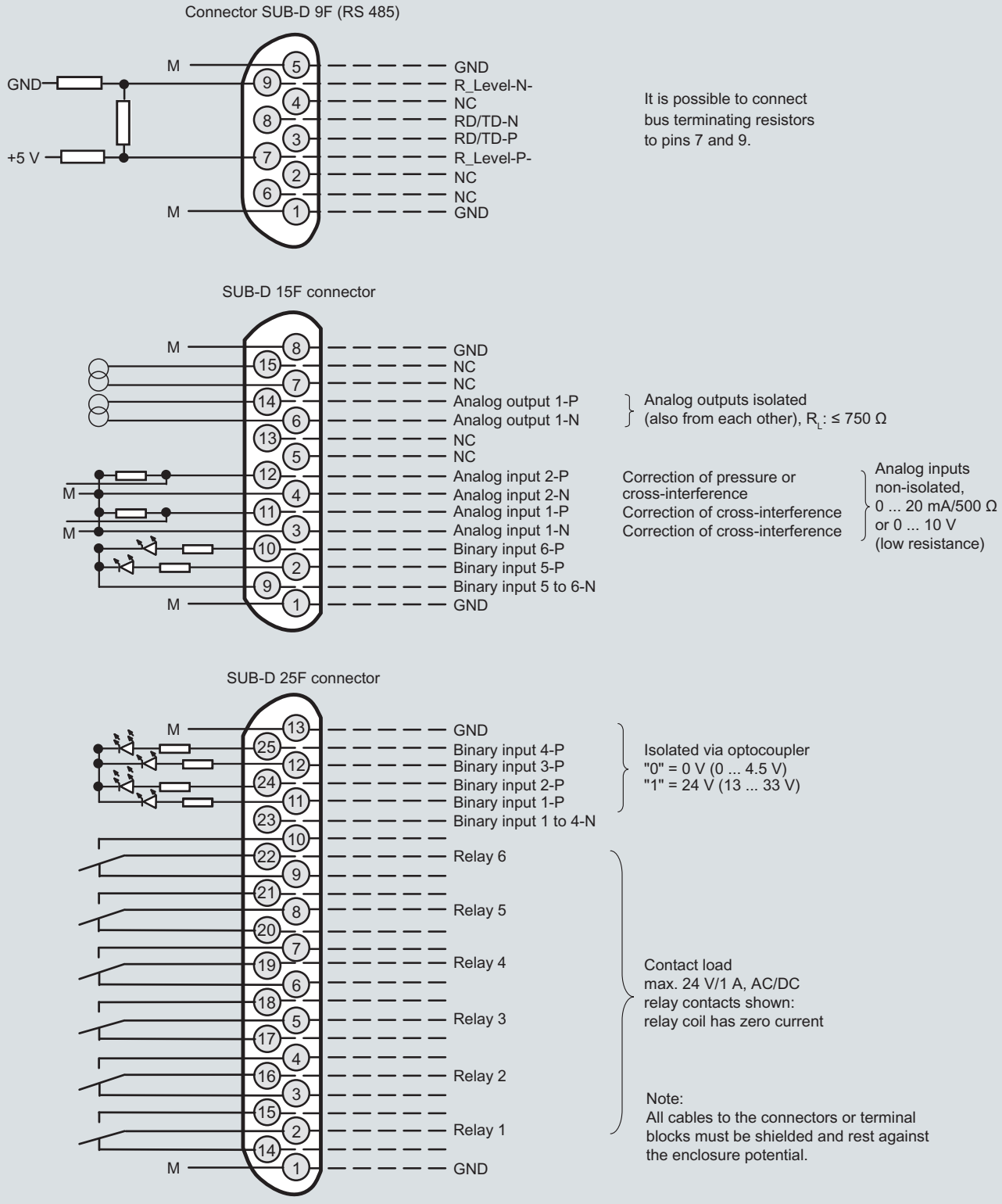
Dimensional drawings



FIDAMAT 6, 19“ unit, dimensions in mm

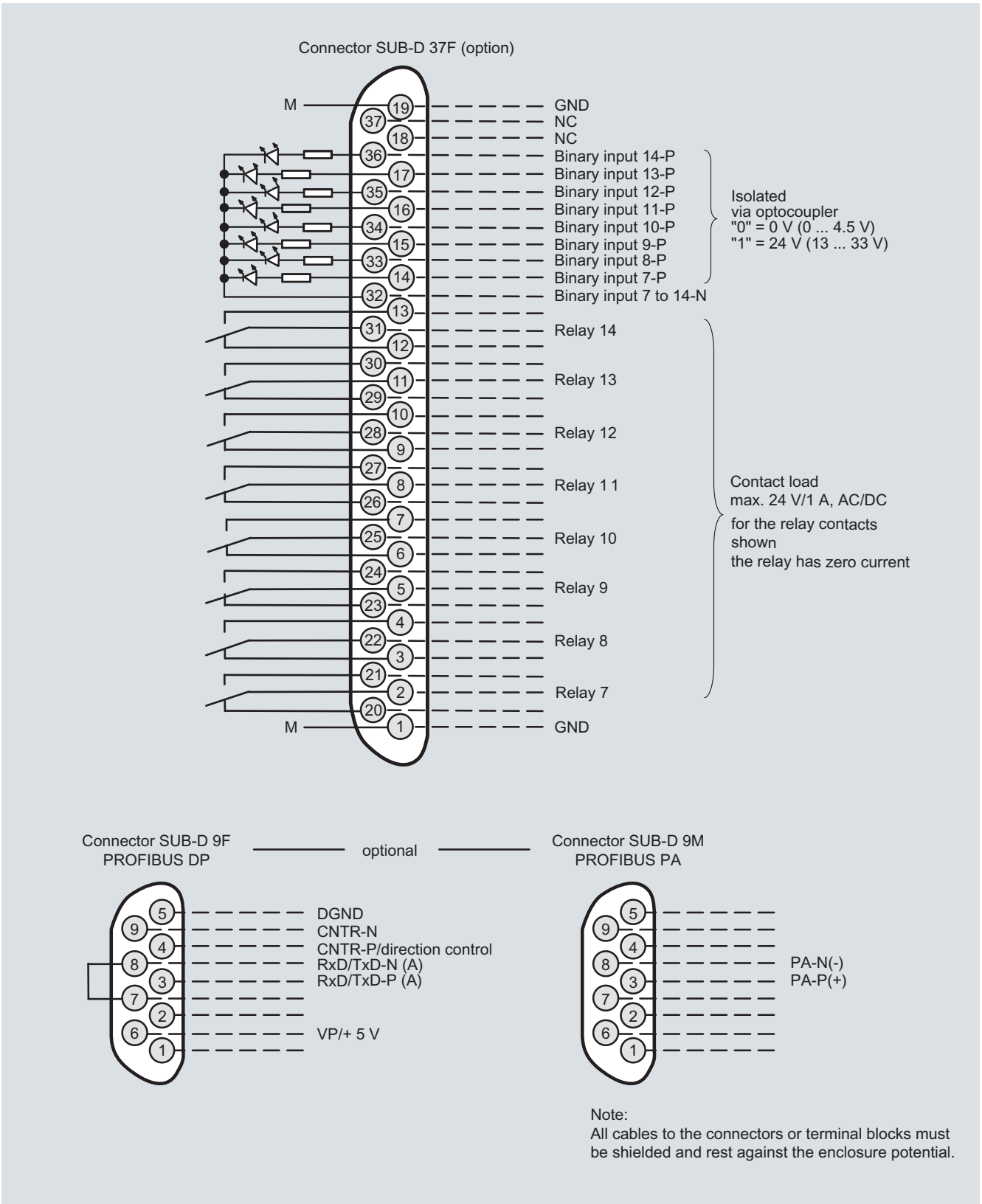
Schematics

Pin assignment (electrical and gas connections)

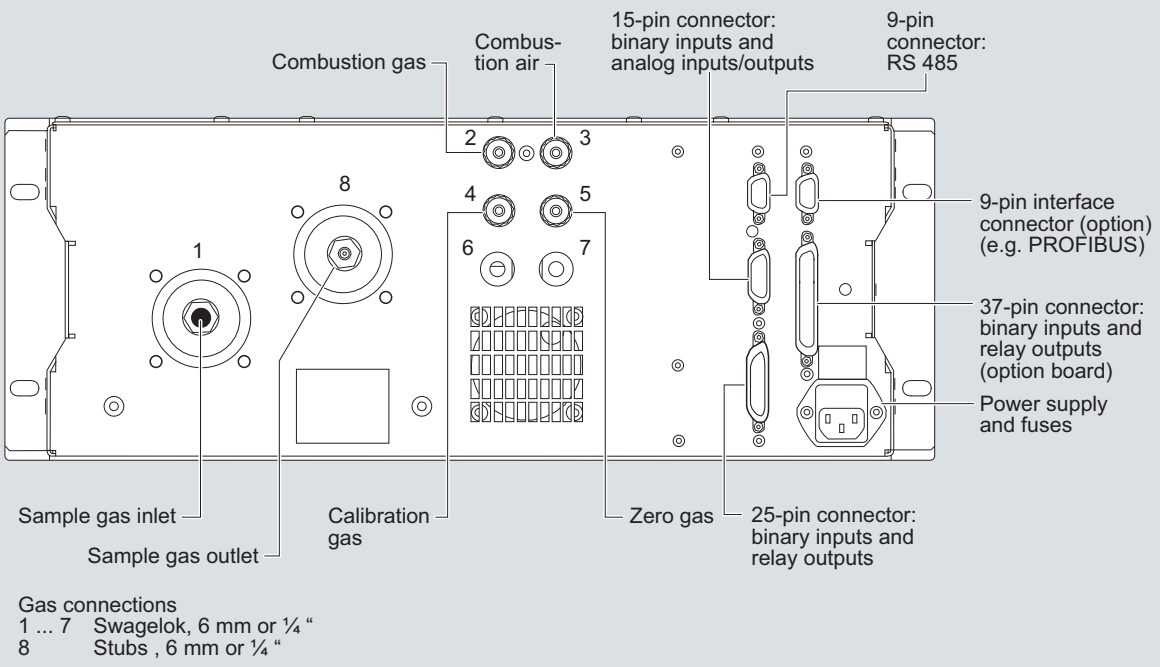


FIDAMAT 6, 19" rack unit, pin assignment

19" rack unit

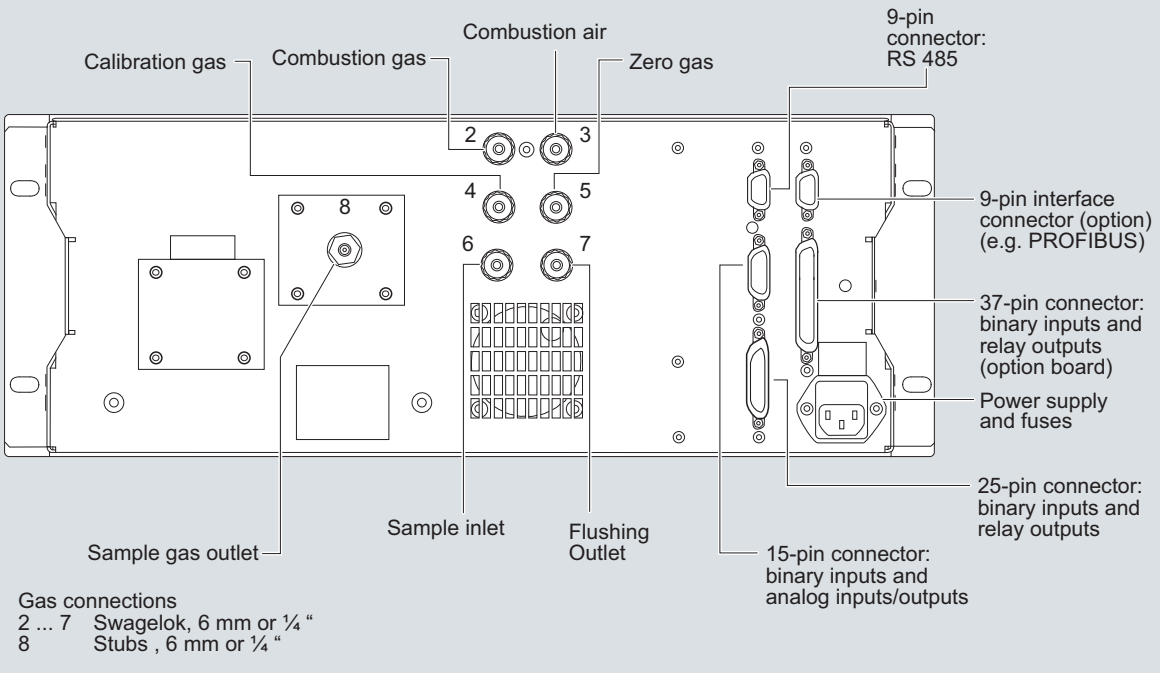


FIDAMAT 6, 19" rack unit, pin assignment of the AUTOCAL board and PROFIBUS connectors



Gas connections
1 ... 7 Swagelok, 6 mm or ¼ “
8 Stubs , 6 mm or ¼ “

FIDAMAT 6, gas connections and pin assignment, version with pump



Gas connections
2 ... 7 Swagelok, 6 mm or ¼ “
8 Stubs , 6 mm or ¼ “

FIDAMAT 6, gas connections and pin assignment, version without pump

Documentation

Selection and ordering data

Operating instructions	Order No.
FIDAMAT 6	
Gas analyzer for determination of total hydrocarbon concentration	
• German	**A5E00221703**
• English	**A5E00222135**
• French	**A5E00222138**
• Spanish	**A5E00222141**
• Italian	**A5E00222144**
FIDAMAT 6-G	
Gas analyzer for determination of total hydrocarbon content	
• German	**A5E00476038**
• English	**A5E00478463**
• French	**A5E00478466**
• Spanish	**A5E00478468**
• Italian	**A5E00478469**

Selection and ordering data

Description	2 years (quantity)	5 years (quantity)		Order No. FIDAMAT 6 With pump		Without pump
Analyzer unit						
FI detector, complete		1		**A5E00295816**		**A5E00295816**
Sample gas path						
Pump (KNF)	1	1	D)	**A5E00882121**		
Set of gaskets for pump (KNF)	4	10	D)	**C79451-Z1030-U2**		
Filter, with gasket for sample gas	1	3		**A5E00248845**		
Pressure regulator	1	1		**A5E00248851**		**A5E00248851**
Gasket for pressure regulator	1	2	D)	**A5E00295107**	D)	**A5E00295107**
Filter, complete (sample gas inlet, 6 mm)		1		**A5E00295928**		
Filter, complete (sample gas inlet, ¼")		1		**A5E00295976**		
Solenoid valve (1-way)	1	2		**A5E00296562**		**A5E00296562**
Solenoid valve (2-way)	1	2		**A5E00296565**		
Gasket, PTFE, 1.5 mm (20 units)	1	2	D)	**C79451-A3040-D101**	D)	**C79451-A3040-D101**
Gasket, graphite, 0.5 to 1 mm (20 units)	1	2	D)	**C79451-A3040-D102**	D)	**C79451-A3040-D102**
Gasket, graphite, 1.5 mm (20 units)	1	2	D)	**C79451-A3040-D103**	D)	**C79451-A3040-D103**
Gasket, graphite, 3 mm (20 units)	1	2	D)	**C79451-A3040-D105**	D)	**C79451-A3040-D105**
Pressure ring, 1 mm (20 units)		1	D)	**C79451-A3040-D112**	D)	**C79451-A3040-D112**
Pressure ring, 1.5 mm (20 units)		1	D)	**C79451-A3040-D113**	D)	**C79451-A3040-D113**
Pressure ring, 3 mm (20 units)		1		**A5E00295333**		**A5E00295333**
Outer rings, 0.5 … 1 mm (20 units)		1	D)	**C79451-A3040-D121**	D)	**C79451-A3040-D121**
Outer rings, 1.5 … 3 mm (1/8") (20 units)		1	D)	**C79451-A3040-D122**	D)	**C79451-A3040-D122**
Electronics						
Front plate	1	1		**A5E00248790**		**A5E00248790**
Adapter plate	1	1	C)	**A5E00248795**	C)	**A5E00248795**
Temperature fuse (retrofitting set)	1	2		**A5E01040317**		**A5E01040317**
Temperature fuse (spare part), from N1-V3-940 onwards				**A5E01040312**		**A5E01040312**
Fuse, 230 V AC	2	3		**A5E00248819**		**A5E00248819**
Fuse, 110 V AC	2	3		**A5E00248822**		**A5E00248822**
LC display	1	1		**A5E00248920**		**A5E00248920**
Cable, temperature sensor for oven		1		**A5E00283770**		**A5E00283770**
Cable, temperature sensor for analyzer part		1		**A5E00283780**		**A5E00283780**
Cable, magnetic distributor		1		**A5E00283800**		**A5E00283800**
Cable, heater for oven, 230 V AC		1		**A5E00283817**		**A5E00283817**
Cable, heater for oven, 110 V AC		1		**A5E00295469**		**A5E00295469**
Cable, electrode voltage, complete		1		**A5E00284092**		**A5E00284092**
Cable, signal cable		1		**A5E00284094**		**A5E00284094**
Cable, connecting cable (4-pole)	1	1	C)	**A5E00284095**	C)	**A5E00284095**
Cable, connecting cable (5-pole)	1	1	C)	**A5E00284096**	C)	**A5E00284096**
Axial-flow fan, 24 V DC		1		**A5E00313839**		**A5E00313839**

C) Subject to export regulations AL: N, ECCN: EAR99

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

If the device was supplied with a specially cleaned gas path for high oxygen context ("Clean for O_2 service"), please ensure that you specify this when ordering spare parts. This is the only way to guarantee that the gas path will continue to comply with the special requirements for this version.

Notes