

EasyLine EL3000 Series Continuous gas analyzers Models EL3020, EL3040

Measurement made easy

So smart, they're simple



Detectors with different measurement principles for numerous process and emission monitoring applications

Up to five measurement components per gas analyzer

Suitable for measuring flammable gases

Version with protection type II 3G for measurement of non-flammable gases

Performance-tested versions for emission monitoring according to EN 15267

QAL3 monitoring according to EN 14181 (optional)

Automatic calibration including pump and valve control

Simplified calibration with air or integral calibration cells eliminating the need for test gas cylinders

Customizable analog outputs, digital inputs and digital outputs

Modbus and Profibus interfaces

Simple menu-driven operator interface

Clear-text status messages

Configuration of rarely required functions with included configuration program

Self-monitoring function indicates when maintenance is required

Housing versions for 19-inch rack mounting (Model EL3020) and wall mounting (Model EL3040)

Integral gas feed (optional in Model EL3020)

Overview of the gas analyzers

Measuring technology (analyzers)

The following analyzers are available for selection:

- Uras26 infrared photometer for the measurement of infrared-active gas components e.g. CO, NO, SO₂
- Limas23 ultraviolet photometer for the measurement of NO, NO₂ and SO₂
- Magnos206 oxygen analyzer for the measurement of O₂ in process gas or in N₂
- Magnos27 oxygen analyzer for the measurement of O₂ in flue gas or in N₂
- ZO23 trace oxygen analyzer for the measurement of O₂ in pure gases (N₂, CO₂, Ar)
- Caldos27 thermal conductivity analyzer for the measurement of binary gas mixtures with different thermal conductivity e.g. Ar in O₂, H₂ in Ar, CH₄ in N₂
- Fidas24 flame-ionization detector for the measurement of hydrocarbons
- Electrochemical oxygen sensor for the measurement of O₂

Magnos206 can also be used in combination with Uras26 or Limas23.

Magnos27 and Caldos27 can also be used in combination with Uras26.

Fidas24 and ZO23 cannot be used in combination with one of the other analyzers.

The electrochemical oxygen sensor can only be used in combination with Uras26 or Limas23. Two electrochemical oxygen sensors can be used in combination with Uras26 with separate gas paths (only in model EL3020).

Each analyzer has one physical measurement range per sample component. A section of the physical measurement range can be mapped to the current output (analog output) by on-site configuration.

Calibration is always executed in the physical measurement range. The permissible measurement range limits are given by the specification of the smallest and largest measurement ranges for the individual analyzers.

A total of up to five measurement components can be measured with one gas analyzer.

Calibration

Calibration can be performed automatically or manually or externally controlled via the Modbus.

Automatic calibration – for all sample components together – is normally started on a cyclically time-controlled basis; it can also be started by an external control signal or via the Modbus as well as manually on the display and operator control unit of the gas analyzer.

Normally, simplified calibration methods with the built-in calibration cells or the so-called single-point calibration are used for automatic calibration. If calibration with test gases is required the control of solenoid valves for switching on five test gases, zero gas and sample gas via digital outputs can be configured.

Concept of operation

The functions required in normal operation are operated and configured directly on the gas analyzer.

The functions which are only seldom required, e.g. during start-up, are configured offline using the configuration software ECT ("EasyLine Configuration Tool" on the enclosed DVD-ROM) and then loaded into the gas analyzer.

QAL3 monitoring

QAL3 monitoring is available as an option in the gas analyzer. It is used to fulfill the requirements according to EN 14181 for storage and analysis of device adjustment data. The QAL3 monitoring option features the following functions:

- Automatic acquisition, verification and documentation of drift and precision at zero and reference points
- Reporting via CUSUM and Shewhart control charts
- QAL3 data storage in the gas analyzer (maximum 1 year)
- QAL3 data display and read-out as well as parameter setting via web browser
- Status messages on deviations beyond requirements
- Data export for further processing with spreadsheet programs

Overview of the gas analyzers

Electrical interfaces

The electrical interfaces for the output of measured values and communication with external systems include

- The integrated Ethernet-10/100BASE-T interface for
 - gas analyzer configuration with configuration software ECT
 - QAL3 data transfer if the QAL3 monitoring option is integrated in the gas analyzer
 - data transmission with Modbus TCP/IP protocol (measured values, status signals and control signals)

as well as the integrated I/O modules depending on the functional range and order

- 2-way and 4-way analog output modules with two or four analog outputs,
- Digital I/O module with four digital inputs and four digital outputs,
- Modbus module with one RS485 and one RS232 interface (also according to VDI 4201 Part 3),
- Profibus module with one RS485 and one MBP interface (also according to VDI 4201 Part 2).

Integral gas feed

The integral gas feed (optional in model EL3020) is available in two versions. It includes

- either the solenoid valve, pump, coarse filter, capillary tube and flow sensor modules
- or a flow sensor module.

Housing design

The housing for the EL3020 gas analyzer model is designed as 19-inch housing with 3 height units (4 height units with Magnos27) and degree of protection IP20 (IP40 with version for emission monitoring).

The housing for the EL3040 gas analyzer model is designed as wall-mount housing with degree of protection IP65.

Infrared photometer Uras26

Measurement principle

Non-dispersive infrared absorption

Photometer with 1 or 2 beam paths (gas paths) to measure up to 4 components

Sample components and measurement ranges

Sample components and smallest measurement ranges

Sample component	Smallest measurement range
CO	0–100 ppm
CO ₂	0–100 ppm
NO	0–150 ppm
SO ₂	0–100 ppm
N ₂ O	0–100 ppm
CH ₄	0–100 ppm

Measurement range quantity

2 measurement ranges

Measurement range limits

Smallest measurement range	Largest measurement range
0–100 ppm (NO: 0–150 ppm)	0–500 ppm (NO: 0–750 ppm)
0–200 ppm	0–1000 ppm
0–600 ppm	0–3000 ppm
0–2000 ppm	0–10000 ppm
0–0.6 vol. %	0–3 vol. %
0–2 vol. %	0–10 vol. %
0–6 vol. %	0–30 vol. %
0–20 vol. %	0–100 vol. %

An individual measurement range within the limits shown in the table can be factory-set on special order.

Measurement ranges are freely adjustable within the limits shown in the table.

Measurement ranges should not be set within ignition limits.

Version for use in air separation units

Only for binary gas mixtures consisting of the sample component in Ar, N₂ or O₂

Sample component	Smallest/Largest measurement range
CO	0–10 ppm / 0–50 ppm
CO ₂	0–5 ppm / 0–25 ppm
N ₂ O	0–10 ppm / 0–50 ppm
CH ₄	0–20 ppm / 0–100 ppm

Other than the data valid for the standard version the following data apply for this version (in % of the smallest measurement range shown in the table):

Zero drift: $\leq 1.5\%$ per day

Sensitivity drift: $\leq 1\%$ per week

Output fluctuation (2σ): $\leq 0.5\%$ at T90 = 15 s

Temperature effect: $\leq 2\%$ per 10 °C

Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to the smallest measurement range.

Linearity deviation

$\leq 1\%$ of span

Repeatability

$\leq 0.5\%$ of span

Zero drift

$\leq 1\%$ of span per week

Sensitivity drift

$\leq 1\%$ of measured value per week

Output fluctuation (2σ)

$\leq 0.2\%$ of span at electronic T90 time (static/dynamic)

= 5/0 sec

Detection limit (4σ)

$\leq 0.4\%$ of span at electronic T90 time (static/dynamic)

= 5/0 sec

Influence effects

Flow effect

Flow rate in the 20–100 l/h range: within detection limits

Associated gas effect/cross sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect (optional):

Incorporation of interference filters or filter cells, internal electronic cross-sensitivity correction for one sample component by other sample components measured with the gas analyzer.

Temperature effect

Ambient temperature in permissible range

– At zero-point: $\leq 2\%$ of span per 10 °C

– On sensitivity without thermostat:

$\leq 3\%$ of measured value per 10 °C

– On sensitivity with thermostat (optional):

$\leq 2\%$ of measured value per 10 °C

Thermostat temperature = 55 °C

Air pressure effect

– At zero-point: No effect

– On sensitivity with pressure correction by means of integral pressure sensor: $\leq 0.2\%$ of measured value per 1% barometric pressure change

The pressure sensor is located in the sample gas path if hoses are used as the internal gas lines.

If stainless-steel tubing is used for internal gas lines the pressure sensor is routed to the outside via a hose.

Power supply effect

Voltage and frequency in the permissible range: No effect

Infrared photometer Uras26

Dynamic response

Warm-up time

Approx. 30 minutes without thermostat; approx. 2 hours with thermostat

90% response time

$T_{90} \leq 2.5$ sec for sample gas flow = 60 l/h and electronic T90 time (static/dynamic) = 5/0 sec

Calibration

Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component.

End-point calibration

With gas-filled calibration cells (optional) or with test gas mixtures. It is recommended to verify the calibration cell set values once a year.

Materials in contact with the sample medium

Analyzer (sample cells)

Tubing: aluminum; windows: CaF_2 or BaF_2 ; connectors: stainless steel 1.4305 (SAE 303)

Gas lines and connectors

Gas lines: FPM hoses or PTFE tubes; connectors: stainless steel 1.4305 (SAE 303); solenoid valve (option in model EL3020): PVDF.
When flammable components are present in the sample gas:
Gas lines: stainless steel tubes 1.4571 (SAE 316Ti); connectors: stainless steel 1.4305 (SAE 303).

Gas connections

See page 25 and page 26

Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Pressure

The analyzer is operated under atmospheric pressure; the sample gas outlet is open to atmosphere. Internal pressure drop < 5 hPa with standard flow rate 60 l/h. Permissible absolute pressure range: 800–1250 hPa. Operation under lower absolute pressure (e.g. at altitudes above 2000 m) on request. Overpressure in the sample cell max. 500 hPa.

Flow rate

20–100 l/h

Corrosive gases

Highly corrosive associated gas components, e.g. chlorine (Cl_2) and hydrogen chloride (HCl), as well as gases or aerosols containing chlorine must be cooled or undergo prior absorption.

Flammable gases

In the version with gas lines and connectors made of stainless steel the analyzer is suitable for measuring flammable gases in general purpose environment (see page 20).

Ultraviolet photometer Limas23

Measurement principle

UV-RAS (UV Resonance Absorption Spectroscopy) method for sample component NO,
NDUV (Non-Dispersive UV Absorption Spectroscopy) method for sample components NO₂ and SO₂

Photometer to measure up to 3 components

Sample components and measurement ranges

Sample components and measurement ranges

Sample component	Smallest/Largest measurement range
NO	0–50 ppm / 0–5000 ppm
NO ₂	0–50 ppm / 0–500 ppm
SO ₂	0–100 ppm / 0–5 vol.%

The NO_x measurement value can be evaluated as the sum of the NO and NO₂ measurement values and output at an analog output. The NO_x measurement range results from the sum of the NO and NO₂ measurement ranges.

NO processed through a converter can be indicated as sample component "NO_x" on the display (factory-set).

For indication of the NO_x measurement value in mg/m³, the factor 1.53 is taken into account for conversion of NO to NO_x (factory-set).

Measurement range quantity
2 measurement ranges

Measurement range limits

Smallest measurement range	Largest measurement range
0–50 ppm	0–250 ppm
0–100 ppm	0–500 ppm
0–200 ppm	0–1000 ppm
0–400 ppm	0–2000 ppm
0–1000 ppm	0–5000 ppm
0–4000 ppm	0–20000 ppm
0–1 vol.%	0–5 vol.%

An individual measurement range within the limits shown in the table can be factory-set on special order.

Measurement ranges are freely adjustable within the limits shown in the table.

Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to the smallest measurement range.

Linearity deviation
≤ 1 % of span

Repeatability
≤ 0.5 % of span

Zero drift

- For NO: ≤ 2 % of span per week
- For NO₂ and SO₂: ≤ 3 ppm per week for measurement ranges ≤ 100 ppm (daily automatic baseline check is recommended), ≤ 2.5 % of span per week for measurement ranges > 100 ppm

Sensitivity drift
≤ 1 % of measured value per week

Output fluctuation (2 σ)
≤ 0.5 % of span at electronic T90 time = 20 sec

Detection limit (4 σ)
≤ 1 % of span at electronic T90 time = 20 sec

Influence effects

Flow effect

Flow rate in the 20–100 l/h range: within detection limits

Associated gas effect / cross sensitivity

The knowledge of the sample gas composition is necessary for the analyzer configuration.

Selectivity measures to reduce associated gas effect (optional):
Internal adjustment or internal electronic cross-sensitivity correction for one sample component by other sample components measured with the gas analyzer.

Temperature effect

- Ambient temperature in permissible range
- At zero-point: ≤ 1 % of span per 10 °C
 - On sensitivity: ≤ 1.5 % of measured value per 10 °C

Air pressure effect

- At zero-point: No effect
- On sensitivity with pressure correction by means of integral pressure sensor: ≤ 0.2 % of measured value per 1 % barometric pressure change

The pressure sensor is located in the sample gas path.

Power supply effect

Voltage and frequency in the permissible range: No effect

Dynamic response

Warm-up time

Approx. 2 hours

90% response time

$T_{90} \leq 3$ sec for sample gas flow = 60 l/h and electronic T90 time = 0 sec

Calibration

Zero-point calibration

With inert gas, e.g. nitrogen, or with ambient air that is free of the sample component.

End-point calibration

With gas-filled calibration cells (optional) or with test gases (for each sample component). It is recommended to verify the calibration cell set values once a year.

Materials in contact with the sample medium

Analyzer (sample cell)

Tubing: aluminum; windows: CaF_2 ; connectors: stainless steel 1.4305 (SAE 303). Option: Tubing, windows and connectors made of quartz glass.

Gas lines and connectors

Gas lines: FPM hoses; gas connectors: stainless steel 1.4305 (SAE 303)

Gas connections

See page 27

Sample gas inlet conditions

The analyzer must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

The internal temperature of the gas analyzer is at least 10 °C above ambient temperature.

Pressure

The analyzer is operated under atmospheric pressure; the sample gas outlet is open to atmosphere. Internal pressure drop < 5 hPa with standard flow rate 60 l/h. Permissible absolute pressure range: 800–1250 hPa. Operation under lower absolute pressure (e.g. at altitudes above 2000 m) on request.

Overpressure in the sample cell max. 500 hPa.

Flow rate

20–100 l/h

Corrosive gases

Highly corrosive associated gas components, e.g. chlorine (Cl_2) and hydrogen chloride (HCl), as well as gases or aerosols containing chlorine must be cooled or undergo prior absorption.

Note

The analyzer cannot be used in combination with the integral gas feed.

Measurement principle

Paramagnetic behavior of oxygen
Magnetomechanical oxygen analyzer

Sample component and measurement ranges

Sample component
Oxygen (O₂)

Smallest measurement range
0–2 vol.% O₂

Measurement range quantity
2 measurement ranges

Measurement range limits
Measurement ranges are freely adjustable; they are factory-set per order to 0–5 or 0–100 or 98–100 vol.% O₂.

Largest measurement range
0–100 vol.% O₂
Measurement ranges should not be set within ignition limits.

Measurement ranges with suppressed zero-point
Suppressed measurement ranges are freely adjustable in the range 0–100 vol.% O₂. Smallest span 2 vol.% O₂. The combination of a suppressed and an initial measurement range is not possible.
Pressure correction with a pressure sensor is required.
A pressure sensor is installed when the analyzer has been ordered with suppressed measurement range.

Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. Relative data refer to the span of the selected measurement range. The smallest span is 2 vol.% O₂.

Linearity deviation
≤ 0.5 % of span

Repeatability
≤ 50 ppm O₂ (time base for gas exchange ≥ 5 minutes)

Zero drift
≤ 3 % of span of the smallest measurement range (per order) per week, minimum 300 ppm O₂ per week; following prolonged transport and storage time the drift can be higher during the first weeks of operation.

Sensitivity drift
≤ 0.1 vol.% O₂ per week or ≤ 1 % of measured value per week (not cumulative), whichever is smaller.
≤ 0.25 % of measured value per year, minimum 0.05 vol.% O₂ per year

Output fluctuation (2 σ)
≤ 25 ppm O₂ at electronic T90 time (static/dynamic) = 3/0 sec

Detection limit (4 σ)
≤ 50 ppm O₂ at electronic T90 time (static/dynamic) = 3/0 sec

Influence effects

Flow effect
≤ 0.1 vol.% O₂ in the 30–90 l/h range

Associated gas effect
Data regarding the effect of associated gases can be found in IEC 61207-3:2002 "Gas analyzers – Expression of performance – Part 3: Paramagnetic oxygen analyzers".

Temperature effect
Ambient temperature in the permissible range
– At zero-point: ≤ 1 % of span per 10 °C, ≤ 2 % of span per 10 °C in combination with Uras26
– On sensitivity: ≤ 0.2 % of measured value per 10 °C
Thermostat temperature = 64 °C

Air pressure effect
– On sensitivity with no pressure correction:
≤ 1 % of measured value per 1 % air pressure change
– On sensitivity with pressure correction using integrated pressure sensor (optional):
≤ 0.1 % of measured value per 1 % air pressure change; for highly suppressed measurement ranges ≤ 0.01 % of measured value per 1 % air pressure change or ≤ 0.002 vol.% O₂ per 1 % air pressure change, whichever is greater.

Power supply effect
Voltage and frequency in the permissible range: ≤ 0.2 % of span

Position effect
Zero-point shift ≤ 0.05 vol.% O₂ per 1° deviation from horizontal orientation. Position has no effect on the hard-mounted unit.

Oxygen analyzer Magnos206

Dynamic response

Warm-up time
< 1 hour

90% response time

T_{90} approx. 4 sec at a sample gas flow of 90 l/h and electronic
 T_{90} time (static/dynamic) = 3/0 sec, gas change from nitrogen to air

Calibration

Zero-point calibration

With oxygen-free process gas or substitute gas

End-point calibration

With process gas with a known oxygen concentration or a substitute gas such as dried air

Single-point calibration

Zero-point calibration with any oxygen concentration, e.g. with nitrogen or ambient air, processed through a cooler or H₂O absorber.

Pressure correction by means of pressure sensor is recommended for single-point calibration with air.

Depending on the measurement task involved, the zero- and end-points should be verified periodically (recommendation: once a year).

Calibration of measurement ranges with suppressed zero-point

Highly suppressed measurement ranges (≥ 95 –100 vol.% O₂) should only be calibrated with test gases with concentrations in the selected measurement range.

Materials in contact with the sample medium

Analyzer

Sample chamber (direct connection): stainless steel 1.4305 (SAE 303), glass, platinum, rhodium, epoxy resin; seals: FPM (Fluorocarbon rubber), PEEK, FFKM

Gas connectors of the solenoid valve (option in model EL3020)

PVDF

Gas connections

See page 28

Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

Pressure

The analyzer is operated under atmospheric pressure; the sample gas outlet is open to atmosphere. Internal pressure drop < 5 hPa with standard flow rate 60 l/h. Permissible absolute pressure range: 800–1250 hPa. Operation under lower absolute pressure (e.g. at altitudes above 2000 m) on request.

The analyzer module is type-tested for 5000 hPa internal pressure without damage.

Flow rate

30–90 l/h

Corrosive gases

Consultation with ABB Analytical is required if the sample gas contains Cl₂, HCl, HF or other corrosive components.

The AO2000-Magnos206 analyzer should be used if the sample gas contains NH₃.

Flammable gases

The analyzer is suitable for measuring flammable gases in general purpose environment (see page 20).

Measurement principle

Paramagnetic behavior of oxygen
Heavy-duty thermomagnetic analyzer

Sample component and measurement ranges

Sample component

Oxygen (O₂) in flue gas or in nitrogen (N₂)

Smallest measurement range

0–10 vol.% O₂

Measurement range quantity

2 measurement ranges

Measurement range limits

The measurement range is factory-set per customer order.

Largest measurement range

0–100 vol.% O₂

Measurement ranges within ignition limits cannot be provided.

Stability

Linearity deviation

≤ 2 % of span

Repeatability

≤ 1 % of span

Zero drift

≤ 1 % of span per week

Sensitivity drift

≤ 2 % of measured value per week

Output fluctuation (2 σ)

≤ 0.5 % of smallest measurement range span at electronic T90
time = 0 sec

Detection limit (4 σ)

≤ 1 % of smallest measurement range span at electronic
T90 time = 0 sec

Influence effects

Flow effect

≤ 1 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect

Magnos27 calibration applies only to the sample gas shown on the identification plate (= sample component + associated gas).

Temperature effect

Ambient temperature in permissible range

- At zero-point: ≤ 2 % of span per 10 °C
 - On sensitivity: ≤ 0.5 % of measured value per 10 °C relative to temperature at the time of calibration
- Thermostat temperature = 63 °C

Air pressure effect

- At zero-point: < 0.05 vol.% O₂ per 1 % air pressure change
 - On sensitivity without pressure correction: ≤ 1.5 % of measured value per 1 % air pressure change
 - On sensitivity with pressure correction using integrated pressure sensor (optional): ≤ 0.25 % of measured value per 1 % air pressure change
- Option: Operating altitude over 2000 m

Power supply effect

24 VDC ± 5 %: ≤ 0.2 % of span

Position effect

Approx. 3 % of smallest measurement range span per 1° deviation from horizontal orientation. Position has no effect on the hard-mounted unit.

Oxygen analyzer Magnos27

Dynamic response

Warm-up time
2–4 hours

90% response time

T_{90} = 10–22 sec, depending on sample gas flow and on measurement cell connection (see “Gas connections”, applies to an analyzer unit with 1 analyzer module)

Calibration

Zero-point calibration

With oxygen-free process gas or substitute gas

End-point calibration

With process gas having a known oxygen concentration or with substitute gas

Materials in contact with the sample medium

Analyzer

Rust- and acid-resistant steel 1.4580 (SAE 316Cb) and 1.4305 (SAE 303), glass

Gas lines and connectors

Rust- and acid-resistant steel 1.4571 (SAE 316Ti) and 1.4305 (SAE 303), PVC-C, FPM

Gas connections

See page 29

Sample gas inlet conditions

The analyzer must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

Pressure

The analyzer is operated under atmospheric pressure; the sample gas outlet is open to atmosphere. Internal pressure drop < 5 hPa with standard flow rate 60 l/h. Permissible absolute pressure range: 800–1250 hPa. Operation under lower absolute pressure (e.g. at altitudes above 2000 m) on request. Overpressure in the sample cell max. 100 hPa.

Flow rate

20–90 l/h

Note

The analyzer can only be mounted in the 19-inch housing (dimensional drawing see page 29). The analyzer cannot be used in combination with the integral gas feed.

Measurement principle

Potentiometric measurement; zirconium dioxide cell for determination of the oxygen concentration in accordance with Nernst's equation; reference gas: ambient air.

The analyzer is used for the continuous measurement of oxygen in pure gases (N₂, CO₂, Ar). The measuring cell is catalytically inactivated to the extent that flammable carrier components in stoichiometric concentrations only negligibly reduce the oxygen value.

Sample component and measurement ranges

Sample component

Oxygen (O₂)

Measurement range quantity

2 measurement ranges

Measurement range limits

Measurement ranges are freely adjustable within the range 0–1 ppm to 0–250,000 ppm O₂; they are factory-set to 0–1/0–10 ppm O₂.

The following measurement data refer to a measurement span of 100 ppm O₂ with a regulated flow rate of 8 ± 0.2 l/h.

Stability

Linearity

Owing to the measurement principle, zirconium dioxide cells are base linear.

Repeatability

< 1 % of the measurement range or 100 ppb O₂ (whichever is greater)

Zero drift

The zero point (reference point) is displayed if ambient air is present on the sample gas side. The value for air of 20.6 % vol. of O₂ (for 25 °C and 50 % relative humidity) may deviate through aging of the cell.

< 1 % of the measurement range per week or 250 ppb O₂ (whichever is greater)

Sensitivity drift

Depends on possible interfering components (catalyst poisons) in the sample gas and the aging of the cell.

For pure gas measurements in N₂ and Ar:

< 1 % of the measurement range per week or 250 ppb O₂ (whichever is greater)

Output fluctuation (2 σ)

< ± 0.5 % of the measured value or 50 ppb O₂ (whichever is greater)

Influence effects

Flow effect

≤ 300 ppbv O₂ in the permissible range

Associated gas effect

Inert gases (Ar, CO₂, N₂) have no effect. Flammable gases (CO, H₂, CH₄) in stoichiometric concentrations to the oxygen content: Conversion of O₂ < 20 % of the stoichiometric conversion. If higher concentrations of flammable gases are present, higher O₂ conversions must be expected. The concentration of flammable gases in the sample gas must not exceed 100 ppm.

Temperature effect

The effect of the ambient temperature in the permissible range of +5 to +45 °C is < 2 % of the measured value or 50 ppb O₂ per 10 °C change in the ambient temperature (whichever is greater).

Air pressure effect

No effect through a change in air pressure; the sample gas must flow out of the outlet without back pressure.

Power supply effect

24 V DC ± 5 %: no effect

Position effect

No position effect for permanently installed instruments

Trace oxygen analyzer Z023

Dynamic response

Warm-up time

The operating temperature of the cell is reached after approx. 15 minutes. Offset calibration with reference gas (ambient air) after 2 hours flow. The measurement is ready-to-run after valves and lines have been purged with sample gas. Typical purging time for valves and lines: approx. 2–5 hours.

90% response time

$T_{90} < 60$ sec for the alternation of 2 test gases in the measurement range 10 ppm with a sample gas flow rate = 8 l/h and electronic T90 time = 3 sec

Calibration

Offset calibration

The reference value for ambient air is calibrated at 20.6 vol.% O₂ by means of ambient air on the sample gas side.

End-point calibration

By means of test gas O₂ in N₂ (or in CO₂ or in Ar);
O₂ concentration in the measurement range, e.g. 10 ppm O₂

Function test

An extended response time or reduced sensitivity are dimensions for the correct functioning of the measuring cell. The function test can be carried out by feeding the sample gas without any additional test gases. On the basis of the progression of the test, it can be assessed whether the reaction time of the sensor lies within a specified tolerance. The function test is started manually and lasts approx. 15 min.

Materials in contact with the sample medium

Analyzer

Zirconium dioxide cell: ZrO₂, electrodes containing platinum;
dust filter (option): PP; flow sensor (option): on semiconductor basis, nickel-plated brass

Gas lines and connectors

Stainless steel 1.4571 (SAE 316Ti), FPM and silicon hoses in the gas outlet; gas connections: stainless steel 1.4401 (SAE 316)/1.4305 (SAE 303)

Gas connections

See page 30

Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature

+5 to +50 °C

Inlet pressure

$p_e \leq 70$ hPa

Outlet pressure

Atmospheric pressure

Flow rate

4–20 l/h. Use a metering valve to set the flow rate.

Corrosive gases

The presence of corrosive gases and catalyst poisons, e.g. halogens, gases containing sulfur and heavy-metal dust, leads to faster aging and/or destruction of the ZrO₂ cell.

Flammable gases

The analyzer is suitable for measuring flammable gases in general purpose environment (see page 20). The concentration of flammable gases in the sample gas must not exceed 100 ppm.

Purge gas

If case purging is selected, purging may only be carried out with air (not with nitrogen), since the ambient air is used as a reference gas.

Note

The analyzer cannot be used in combination with the integral gas feed.

Thermal conductivity analyzer Caldos27

Measurement principle

Difference in thermal conductivity of various gases
Micromechanical silicon sensor with especially short T₉₀ time

Sample components and measurement ranges

Sample component and associated gas	Smallest meas. range	Smallest meas. range with suppr. zero-point
Air in Ar	0– 6 vol.%	94–100 vol.%
Ar in air	0– 6 vol.%	94–100 vol.%
Air in CO ₂	0– 10 vol.%	90–100 vol.%
CO ₂ in air	0– 10 vol.%	90–100 vol.%
Air in H ₂	0– 3 vol.%	–
H ₂ in air	0– 1 vol.%	–
Air in He	0– 3 vol.%	98–100 vol.%
He in air	0– 2 vol.%	97–100 vol.%
Ar in CO ₂	–	50–100 vol.%
CO ₂ in Ar	0–50 vol.%	–
Ar in H ₂	0– 3 vol.%	99–100 vol.%
H ₂ in Ar	0– 1 vol.%	97–100 vol.%
Ar in He	0– 3 vol.%	99–100 vol.%
He in Ar	0– 1 vol.%	97–100 vol.%
Ar in N ₂	0– 6 vol.%	94–100 vol.%
N ₂ in Ar	0– 6 vol.%	94–100 vol.%
Ar in O ₂	0– 10 vol.%	90–100 vol.%
O ₂ in Ar	0– 10 vol.%	90–100 vol.%
CH ₄ in H ₂	0– 4 vol.%	99–100 vol.%
H ₂ in CH ₄	0– 1 vol.%	96–100 vol.%
CH ₄ in N ₂	0– 6 vol.%	94–100 vol.%
N ₂ in CH ₄	0– 6 vol.%	94–100 vol.%
CO in H ₂	0– 3 vol.%	99–100 vol.%
H ₂ in CO	0– 1 vol.%	97–100 vol.%
CO ₂ in H ₂	0– 3 vol.%	99–100 vol.%
H ₂ in CO ₂	0– 1 vol.%	97–100 vol.%
CO ₂ in N ₂	0– 10 vol.%	90–100 vol.%
N ₂ in CO ₂	0– 10 vol.%	90–100 vol.%
H ₂ in N ₂	0– 1 vol.%	97–100 vol.%
N ₂ in H ₂	0– 3 vol.%	99–100 vol.%
H ₂ in NH ₃	0– 10 vol.%	90–100 vol.%
NH ₃ in H ₂	0– 10 vol.%	90–100 vol.%
He in N ₂	0– 2 vol.%	97–100 vol.%
N ₂ in He	0– 3 vol.%	98–100 vol.%

Sample components and measurement ranges for monitoring hydrogen-cooled turbo generators

Sample component and associated gas	Measurement range
CO ₂ in air or Ar in air	0–100 vol.%
H ₂ in CO ₂ or H ₂ in Ar	100–0 vol.%
H ₂ in air	100–80 vol.%

Other sample components on request.

Measurement range quantity
2 measurement ranges.

Measurement range limits
Measurement ranges are freely adjustable within the limits shown in the table.

Largest measurement range
0–100 vol.% or 0 vol.% to saturation, depending on measurement task
Measurement ranges should not be set within ignition limits.

Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They relate to the smallest measurement ranges given in the table. The deviations may be larger for smaller measurement ranges.

Linearity deviation	≤ 2 % of span
Repeatability	≤ 1 % of span
Zero drift	≤ 2 % of smallest possible measurement range per week
Sensitivity drift	≤ 0.5 % of smallest possible measurement range per week
Output fluctuation (2 σ)	≤ 0.5 % of smallest measurement range span at electronic T90 time = 0 sec
Detection limit (4 σ)	≤ 1 % of smallest measurement range span at electronic T90 time = 0 sec

Influence effects

The following data relate to smallest measurement ranges given in the table. The influence effects will be larger at operating altitudes > 2000 meters.

Flow effect
≤ 0.5 % of span at a flow change of ±10 l/h. At an identical flow rate for test and sample gases the flow rate effect is automatically compensated.

Associated gas effect
The knowledge of the sample gas composition is necessary for the analyzer configuration. If the sample gas contains components in addition to the sample component and associated gas (binary gas mixture), this will result in erroneous measurements.

Temperature effect
Ambient temperature in the permissible range at each point in the measurement range: ≤ 1 % of span per 10 °C, based on temperature at the time of calibration
Thermostat temperature = 60 °C

Air pressure effect
≤ 0.25 % of span per 10 hPa for the smallest possible ranges given; for larger spans the effect is correspondingly lower.

Power supply effect
Voltage and frequency in the permissible range: ≤ 0.2 % of span

Position effect
< 1 % of span up to 30° deviation from horizontal orientation

Thermal conductivity analyzer Caldos27

Dynamic response

Warm-up time

Approx. 30 minutes

90% response time

$T_{90} \leq 2$ sec at sample gas flow of 60 l/h and electronic T90 time
(static/dynamic) = 0/0 sec

Calibration

Zero-point calibration

With test gas, measurement component-free process gas or substitute gas

End-point calibration

With test gas, process gas having a known sample gas concentration or substitute gas

Single-point calibration

A single-point calibration can be performed with standard gas, since the zero- and end-points will not drift independently due to the sensor principle employed. This technique leaves out safety-related measurements. Depending on the measurement task involved, the zero- and end-points should be verified periodically (recommendation: once a year).

Materials in contact with the sample medium

Analyzer

Sample chamber (direct connection): stainless steel 1.4305 (SAE 303); sensor: gold, silicon oxo-nitride; seal: FFKM75 (Perfluoro rubber)

Gas connectors of the solenoid valve (option in model EL3020)
PVDF

Gas connections

See page 31

Sample gas inlet conditions

The analyzer must not be used for measurement of ignitable gas/air or gas/oxygen mixtures.

Temperature

+5 to +50 °C

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required. Water vapor content variations cause volume errors.

Pressure

The analyzer module is operated under atmospheric pressure; the sample gas outlet is open to atmosphere. Internal pressure drop < 5 hPa with standard flow rate 60 l/h. Permissible absolute pressure range: 800–1250 hPa. Operation under lower absolute pressure (e.g. at altitudes above 2000 m) on request. Overpressure in the sample cell max. 100 hPa.

Flow rate

Normally 10–90 l/h, minimum 1 l/h

Pressure drop

< 2 hPa at 60 l/h nitrogen

Corrosive gases

Consultation with ABB Analytical is required if the sample gas contains Cl₂, HCl, HF, SO₂, NH₃, H₂S or other corrosive components.

Flammable gases

The analyzer is suitable for measuring flammable gases in general purpose environment (see page 20).

Measurement principle

Flame-ionization detector

The analyzer module complies with the requirements for measuring instruments with flame ionization detection according to EN 12619.

Sample components and measurement ranges

Sample components

Hydrocarbons (THC). The sample component concentration in the sample gas should not exceed 100 % of the LEL.

Number of sample components

1 sample component

Smallest measurement range

0–5 to 0–1500 mg org. C/m³ or
0–10 to 0–3000 ppm C1

Largest measurement range

0–18 to 0–5000 mg org. C/m³ or
0–35 to 0–10000 ppm C1

Measurement range quantity

2 measurement ranges

Measurement range limits

The measurement range limits can be freely set in the ranges specified above.

Stability

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant. They apply to measurement ranges ≥ 50 mg org. C/m³, for smaller ranges these only apply if they are factory-set per customer order.

Linearity deviation

$\leq 2\%$ of the span to 5000 mg org. C/m³
this value applies in one (calibrated) measurement range

Repeatability

$\leq 0.5\%$ of measurement range

Zero-point and sensitivity drift

≤ 0.5 mg org. C/m³ per week

Output fluctuation (2 σ)

$\leq 0.5\%$ of span at electronic T90 time = 20 sec,
not smaller than 10 μ g org. C/m³

Detection limit (4 σ)

$\leq 1\%$ of span at electronic T90 time = 20 sec,
not smaller than 20 μ g org. C/m³

Influence effects

Oxygen dependence

$\leq 2\%$ of measured value for 0–21 vol.% O₂ or
 ≤ 0.3 mg org. C/m³, the larger value applies

Temperature effect

Ambient temperature in permissible range
at zero-point and on sensitivity: $\leq 2\%$ per 10 °C in measurement
range of 0–15 mg org. C/m³

Pressure effect

No effect of ambient pressure or process pressure fluctuations
within the permissible sample gas inlet pressure range

Power supply effect

24 VDC $\pm 5\%$: $\leq 0.2\%$ of span or
230 VAC $\pm 10\%$: $\leq 0.2\%$ of span

Flame-ionization detector Fidas24

Dynamic response

Warm-up time
≤ 2 hours

90% response time
 $T_{90} < 1.5$ s at sample gas flow = 80 l/h and electronic T90 time = 1 sec

Calibration

Zero-point calibration
With synthetic air or catalytically purified air or nitrogen, depending on application

Sensitivity calibration
With propane or another hydrocarbon (substitute gas) in air or nitrogen, depending on application

Materials in contact with the sample medium

Analyzer, gas lines and connectors
Stainless steel 1.4305 (SAE 303) and 1.4571 (SAE 316Ti), FPM, PTFE, FFKM

Gas connections

See page 32

Operating gases and test gases

Instrument air

Quality per ISO 8573-1 class 2 (max. particle size 1 μm , max. particle concentration 1 mg/m^3 , max. oil content 0.1 mg/m^3 , pressure dew point at least 10 °C below the lowest foreseeable ambient temperature)

Inlet pressure $p_e = 4000 \pm 500$ hPa

Flow rate typically approx. 1500 l/h (1200 l/h for air injector and approx. 300 l/h for housing purge), maximum approx. 2300 l/h (1800 l/h + 500 l/h)

Combustion air

Synthetic air or catalytically purified air with an organic C content < 1% span

Inlet pressure $p_e = 1200 \pm 100$ hPa

Flow rate < 20 l/h

Combustion gas

Hydrogen, grade 5.0, or H_2/He mixture (40/60%)

Inlet pressure $p_e = 1200 \pm 100$ hPa

Flow rate ≤ 3 l/h (H_2) or approx. 10 l/h (H_2/He)

A flow limiting device must be provided on the hydrogen supply (see section "Safe operation of the gas analyzer").

Test gases

Zero-point calibration: Nitrogen, grade 5.0, or synthetic air or catalytically purified air

Sensitivity calibration: Sample component or substitute gas component in nitrogen or air

Inlet pressure $p_e = 1000 \pm 100$ hPa

Flow rate 130–250 l/h

Sample gas inlet conditions

The sample gas may not be explosive at any time.

The analyzer module must not be used for measurement of gases containing organometallic compounds, e.g. leaded gasoline additives or silicone oils.

Temperature

≤ thermostat temperature

(Thermostat temperature for measurement gas path, detector and air injector ≤ 200 °C, factory-set to 180 °C)

Inlet pressure

$p_{\text{abs}} = 800\text{--}1100$ hPa

Outlet pressure

Atmospheric pressure

Flow rate

Approx. 80–100 l/h at atmospheric pressure (1000 hPa)

Humidity

≤ 40% H_2O

Flammable gases

The analyzer can be used for measurement of flammable gases as long as the total flammable portion does not exceed 15 vol.% CH_4 or C1 equivalents.

Note

The analyzer cannot be used in combination with the integral gas feed.

Safe operation of the gas analyzer

The device concept ensures that a concentration of combustible gas or an explosive mixture of combustible gas and ambient air cannot occur in the interior of the gas analyzer during normal operation. The interior of the gas analyzer cannot be allocated to an (explosion protection) zone; an explosive gas mixture cannot escape to the outside.

The end user must make the following provisions to ensure safe operation of the gas analyzer:

- The combustion gas flow rate must be limited to a maximum of 10 l/h of H_2 or 25 l/h of H_2/He mixture. For this purpose, the end user has to provide suitable measures outside the gas analyzer.
- A shut-off valve must be installed in the combustion gas supply line to increase the safety in the following operating states: Shutting down the gas analyzer, failure of the instrument air supply, leakage in the combustion gas feed path inside the gas analyzer. This shut-off valve should be installed outside the analyzer house in the vicinity of the combustion gas supply.

Electrochemical oxygen sensor

Measurement principle

Electrochemical oxygen sensor

Sample component and measurement range

Sample component

Oxygen (O₂)

Smallest measurement range

0–5 vol.% O₂

Measurement range

Factory-set to 0–25 vol.% O₂.

Adjustable from 0–5 vol.% O₂ to 0–25 vol.% O₂

Stability

Linearity deviation

Linear in the range > 1 vol.% O₂

Repeatability

≤ 0.5 % of span

Zero drift

Stable over long-term due to absolute zero point

Sensitivity drift

≤ 1 % of the measurement range per week

Output fluctuation (2 σ)

≤ 0.2 % of the measurement range at electronic T90 time
(static/dynamic) = 5/0 sec

Detection limit (4 σ)

≤ 0.4 % of the measurement range at electronic T90 time
(static/dynamic) = 5/0 sec

Influence effects

Flow effect

Flow rate in the 20–100 l/h range:
≤ 2 % of the measurement range

Temperature effect

Ambient temperature in the +5 to +40 °C range:
≤ 0.2 vol.% O₂ per 10 °C

Air pressure effect

- At zero-point: No effect
- On sensitivity with no pressure correction:
≤ 1 % of measured value per 1 % air pressure change
- On sensitivity with pressure correction:
≤ 0.2 % of sample value per 1 % air pressure change
Pressure correction is only possible if the oxygen sensor is connected to the Uras26 infrared photometer with an integral pressure sensor.

Power supply effect

Voltage and frequency in the permissible range: ≤ 0.2 % of span

Dynamic response

90% response time

T₉₀ ≤ 30 sec at sample gas flow of 60 l/h and electronic T90 time
(static/dynamic) = 5/0 sec

Calibration

Zero-point calibration

The oxygen sensor zero is not calibrated since it is fundamentally stable.

End-point calibration

With ambient air at 20.96 vol.% O₂

Materials in contact with the sample medium

Sensor: Polystyrol-ABS, PTFE, FPM (Fluorocarbon rubber);

Housing body: PVC, FPM (Fluorocarbon rubber) seals;

Gas ports: Stainless steel 1.4571 (SAE 316Ti)

Sample gas inlet conditions

The oxygen sensor must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Pressure

The sample gas pressure is determined by the analyzer the oxygen sensor is combined with (see Note below).

Flow rate

20–100 l/h

Moisture content

H₂O dew point ≥ 2 °C

The oxygen sensor should not be used with dry sample gas.

Associated gas

The oxygen sensor must not be used if the associated gas contains the following components: H₂S, chlorine or fluorine compounds, heavy metals, aerosols, mercaptans, and alkaline components.

Note

The oxygen sensor can only be used in combination with Uras26 or Limas23 in the sample gas path. Two oxygen sensors can be used in combination with Uras26 with separate gas paths (only in model EL3020). The oxygen sensor cannot be used when the internal gas lines in the Uras26 are made up of stainless steel or PTFE pipes.

Integral gas feed

Versions

The integral gas feed (optional in model EL3020) is available in two versions. It includes

- either the solenoid valve, pump, coarse filter, capillary tube and flow sensor modules
- or the flow sensor module.

Test gas supply

Type

3/2-way solenoid valve

Power consumption

Approx. 3 W

Materials in contact with the sample medium

PVDF, FPM

Gas feed

Type

Magnetic piston pump

Feed rate

Max. 60 l/h, depending on the analyzer type and inlet/outlet pressure

Flow rate

Adjustable

Power consumption

Approx. 10 W

Materials in contact with the sample medium

PVDF, EPDM, stainless steel 1.4571 (SAE 316Ti)

Flow monitor

Type

Miniature flow sensor

Materials in contact with the sample medium

Al₂O₃, silicon, gold, GRP

Sample gas inlet conditions

The integral gas feed modules must not be used for measurement of flammable gases and ignitable gas/air or gas/oxygen mixtures.

Temperature

+5 to +45 °C

The sample gas dew point should be at least 5 °C below the temperature throughout the sample gas path. Otherwise a sample gas cooler or condensate trap is required.

Flow rate

30–60 l/h

Corrosive gases

Corrosive associated gas components and aerosols must be cooled or undergo prior absorption.

Note

The integral gas feed cannot be used when the internal gas lines are made up of stainless steel or PTFE pipes. It cannot be used in combination with Limas23, Magnos27, ZO23 or Fidas24.

Special versions

Version for measurement of flammable gases

In the version with gas lines and connectors made of stainless steel the gas analyzer (Models EL3020 and EL3040) with Uras26, Magnos206, Caldos27 and ZO23 (concentration max. 100 ppm) is suitable for measuring flammable gases in general purpose environment.

In model EL3040, housing purge with nitrogen (ZO23: with air) must be provided.

The positive pressure in the sample gas feed path may not exceed a maximum value of 100 hPa in normal operation and a maximum value of 500 hPa in the event of a fault.

The special requirements must be observed (see operator's manual).

Version with protection type II 3G for installation in hazardous location for measurement of non-flammable gases and vapors

The gas analyzer (Model EL3040) with Uras26, Limas23, Magnos206, Caldos27 and oxygen sensor is tested for explosion protection. It is suitable for installation in hazardous locations when the technical data and the special requirements (see operator's manual) are observed.

The gas analyzer may be used for measurement of non-flammable gases and vapors. It is marked according to the European directive 2014/34/EU with

 II 3G Ex nA nC IIC T4 Gc

In undisturbed operation there cannot be any sparking, arcing or impermissible temperatures inside the device. Explosion protection through: Non-sparking instruments and devices with low power consumption; sealed or encapsulated devices.

Type Examination Certificate No. BVS 16 ATEX E 085 X

Housing degree of protection IP65

The special requirements must be observed (see operator's manual).

General data

Display and operation

Display

Backlit graphics display with 240 x 160-pixel resolution

Measured value display

- Numerical value with physical unit, also with bar graph indication in single display
- Resolution better than 0.2 % of the measurement span
- Simultaneous display of up to 5 measured values
- Flow: bar graph indication

Status display

Symbols in the display; the active status messages can be accessed directly from the measured value display

Operation

5 keys (cursor cross and OK); menu-assisted operation

Measuring range switch-over and feedback

There are three ways of executing the measuring range switch-over:

- Manually on the gas analyzer
 - Automatically by means of appropriate configured switch-over thresholds ("autorange")
 - Externally controlled via appropriately configured digital inputs.
- The measuring range feedback can be implemented via appropriately configured digital outputs; it is independent of the selected type of measuring range switch-over.

The gas analyzer is set ex works to measuring range 2 and to manual measuring range switch-over.

Limit value monitoring

Limit values can be set using the configuration software ECT. The limit value signals (alarms) are output via digital outputs.

Housing

	Model EL3020	Model EL3040
Version	19-inch housing	Wall-mount housing
Protection type	IP20 (IP40 ¹⁾)	IP65
Materials		
Housing	Galvanized sheet steel	Stainless steel 1.4016 (SAE 430)
	Outer surfaces varnished	
Analyzer rear panel	Aluminum, PVC-C	Aluminum, PVC-C
Keypad sheet	Polyester	Polyester
Colors	Light gray (RAL 7035), basalt gray (RAL 7012)	
Weight	Approx. 7–15 kg	Approx. 13–21 kg
Dimensions	See page 33	See page 34

1) with version for emission monitoring

Housing purge

Possible only with model EL3040 (wall-mount housing).

Housing purge is mandatory when measuring flammable gases (see page 20). Purge gas flow during operation min. 10 l/h, max. 20 l/h. Purge gas pressure $p_e = 2-4$ hPa.

General data

Pressure sensor

Use

Standard: with Uras26, Limas23, Caldos27,
Option: with Magnos206 and Magnos27

Working range

$p_{abs} = 600\text{--}1250\text{ hPa}$

Materials in contact with the sample medium

Silicone gel, plastics, FPM (Fluorocarbon rubber)

Sample gas composition

The pressure sensor must not be connected to the sample gas path when the sample gas is corrosive, flammable or explosive.

Fine filtration

Version

Disposable filter with borosilicate glass microfiber filter element (supplied as accessory)

Retention rate

99.99 % for particles > 0.1 μm

Materials in contact with the sample medium

Polyamide, borosilicate glass with PVDF binder

Safety

Tested per EN 61010-1:2010

Protection class I

Overvoltage category/pollution degree
II/2

Safe isolation

The power supply is galvanically isolated from other circuits by means of reinforced or double insulation. Protective extra-low voltage (PELV) on low-voltage side

Electromagnetic compatibility

Noise immunity

Tested to EN 61326-1:2013. Inspection severity: Industrial area, fulfills at least the test requirements to table 2 of EN 61326.

Emitted interference

Tested to EN 61326-1:2013. Limit value class B for interference field strength and interference voltage is met.

Mechanical stress

Operation

Vibration test to EN 60068-2-6:1996
Vibrations up to 0.5g/150 Hz have no influence on the measured value. In Uras26, slight transient effects on the measured value can occur in the region of the modulation frequency.

Transport

Vibration test to EN 60068-2-6:1996,
shock test to EN 60068-2-27:1995
In its original packaging, the gas analyzer will withstand normal shipping conditions.

Installation site requirements

Installation location

The gas analyzer is intended for indoor installation only. Installation location altitude max. 2000 m above sea level (over 2000 m on request)

Ambient temperature

Operation: +5 to +45 °C

Uras26 in combination
with another analyzer,

Limas23, Fidas24: +5 to +40 °C

Storage and transport: -25 to +65 °C

Relative humidity

< 75 %, slight condensation allowed

Air circulation

For sufficient air circulation, multiple housings in a 19-inch rack must be installed with a separation of at least one height unit between housings.

Power supply

Input voltage

100 to 240 VAC - 15/+ 10 %, 50 to 60 Hz \pm 3 Hz

Power consumption

Max. 187 VA

Connection

3-pin plug per EN 60320-1/C14; connection cable supplied.
Connection diagrams see page 22.

Fidas24: Heating of detector and sample gas inlet

Input voltage

115 VAC or 230 VAC, \pm 15 % (max. 250 VAC), 47 to 63 Hz

Power consumption

Max. 325 VA

Connection

4-pin plug; connection cable supplied.
Connection diagrams see page 32.

Individual analyzers

Input voltage

24 V DC \pm 5 %

Power consumption

Uras26: max. 95 W

Limas23: max. 100 W

Magnos206: max. 50 W

Magnos27: max. 35 W

ZO23: max. 35 W

Caldos27: max. 17 W

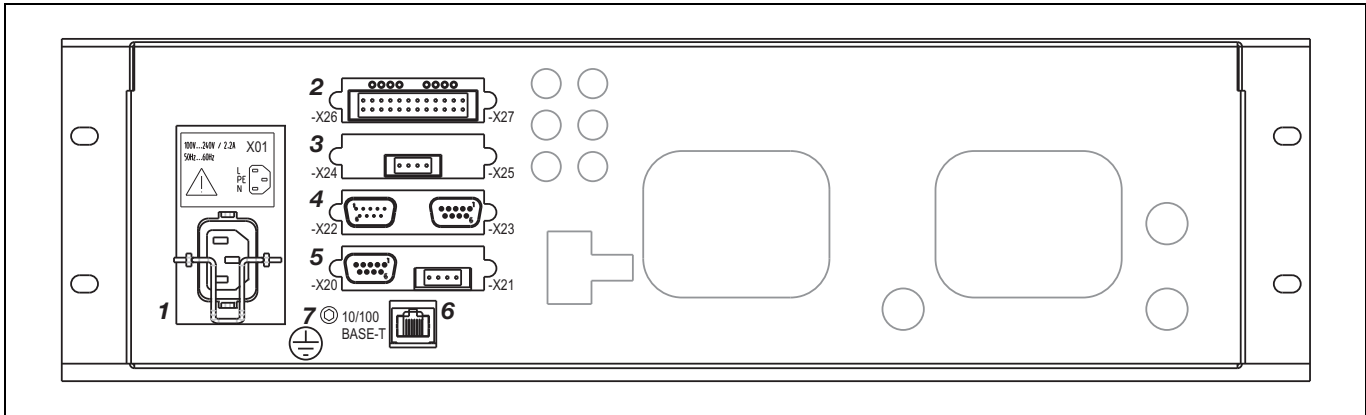
Fidas24: max. 40 W

Note regarding the analyzers performance characteristics

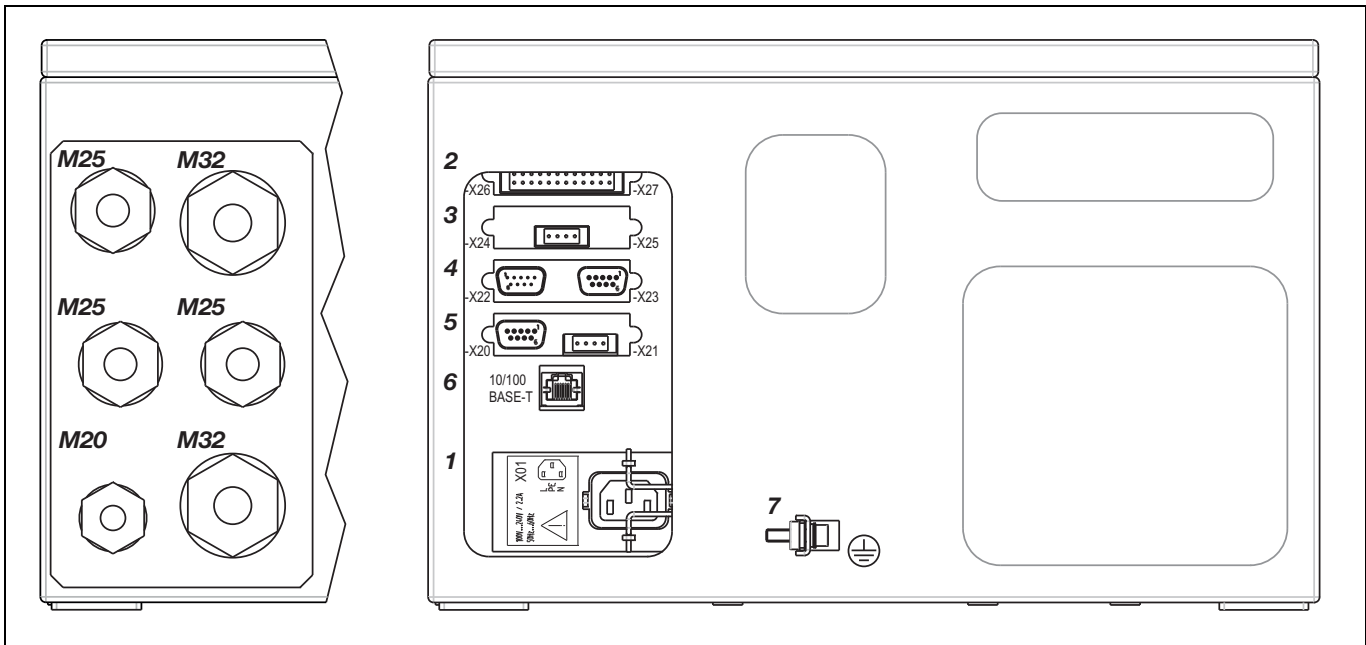
The performance characteristics of the analyzers have been determined according to IEC 61207-1:2010 "Expression of performance of gas analyzers - Part 1: General". They are based on operation at atmospheric pressure (1013 hPa) and nitrogen as the associated gas. Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.

Electrical connections

Power supply and signal lines model EL3020 (view from behind)



Power supply and signal lines model EL3040 (view from below)



- 1 Power supply connection
(3-pin plug per EN 60320-1/C14; connection cable supplied)
- I/O modules (4 slots), options:
- 2 Digital I/O module (max. 3 modules, see page 24)
- 3 Analog output module (max. 2 modules, see page 23)
- 4 Modbus module (RS232 & RS485 interface, see page 23)
- 5 Profibus module (RS485 & MBP interface, see page 23)
- 6 Ethernet-10/100BASE-T interface (8-pin RJ45 plug)
- 7 Potential compensation connection (max. 4 mm²)

Screwed cable glands for cable diameter:

M20	Power supply	5–13 mm
M25	Modbus/Profibus	8–17 mm
M25	Network	8–17 mm
M25	Analog outputs	8–17 mm
M32	Digital inputs/outputs	12–21 mm
M32	Digital inputs/outputs	12–21 mm

Note: Both drawings show examples for the I/O modules equipment.

Notes for I/O module connection

- The maximum capacity of terminals for stranded or solid conductors is 1 mm² (17 AWG).
- The stranded conductor may be tinned on the tip or twisted for simplified connection.
- When using wire end ferrules the total section should not exceed 1 mm², i.e. the maximum stranded conductor section is 0.5 mm². The Weidmüller PZ 6/5 crimping tool must be used for crimping the ferrules.

I/O modules

Profibus module

Electrical connections

RS485 interface:

- 1 – Not used
- 2 M24 24 V output ground, max. 0.2 A
- 3 RxD/TxD-P Receive/transmit data plus, B-line
- 4 – Not used
- 5 DGND Data transmission potential (Ref. pot. for VP)
- 6 VP Supply voltage plus (5 V)
- 7 P24 24 V output voltage plus
- 8 RxD/TxD-N Receive/transmit data N, A-line
- 9 – Not used

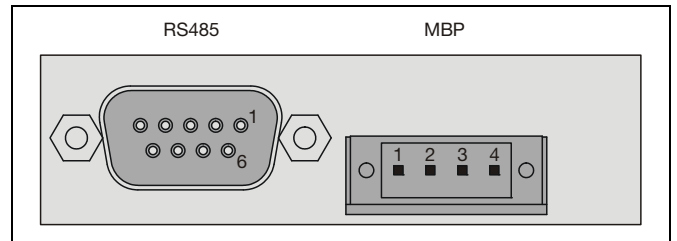
Design: 9-pin sub-D female connector

MBP interface (non-intrinsically safe):

- 1 +
- 2 Shield
- 3 –
- 4 Not used

Design: 4-pin terminal strip. Observe the notes regarding I/O module connection (see page 22)!

Connection diagram



Modbus module

Electrical connections

RS232 interface:

- 2 RxD
- 3 TxD
- 5 GND

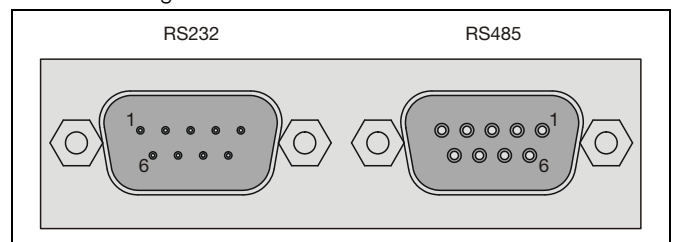
Design: 9-pin sub-D male connector

RS485 interface:

- 2 RTxD-
- 3 RTxD+
- 5 GND

Design: 9-pin sub-D female connector

Connection diagram



Analog output modules

Analog outputs (AO1 to AO4)

0/4–20 mA (configurable, factory-set to 4–20 mA), common negative pole, galvanically isolated from ground, freely connectable to ground, max. gain relative to protective ground potential 50 V, max. working resistance 750 Ω. Resolution 16 bit. The output signal cannot be lower than 0 mA.

Terminal assignment

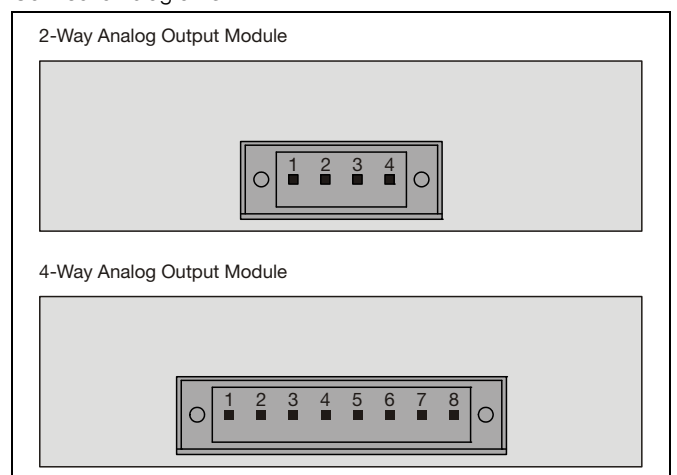
An analog output is allocated in the sequence of the sample components for each sample component. The sequence of the sample components is documented in the analyzer data sheet and on the type plate.

Electrical connections

- 1 AO1+ } for 2-way analog output module and
- 2 AO1- } 4-way analog output module
- 3 AO2+ } for 2-way analog output module and
- 4 AO2- } 4-way analog output module
- 5 AO3+ } for 2-way analog output module and
- 6 AO3- } 4-way analog output module
- 7 AO4+ } for 2-way analog output module and
- 8 AO4- } 4-way analog output module

Design: 4-pin or 8-pin terminal strip. Observe the notes regarding I/O module connection (see page 22)!

Connection diagrams



I/O modules

Digital I/O module

Digital inputs (DI1 to DI4)

Optocouplers with internal 24 VDC power supply, jointly galvanically isolated from ground. Control with floating contacts, with external voltage 12–24 VDC or with open collector drivers PNP or NPN.

Digital outputs (DO1 to DO4)

Floating double-throw contacts, max. contact load rating 30 VDC / 1 A, galvanically isolated from ground. Relays must at all times be operated within the specified data range. Inductive or capacitive loads are to be connected with suitable protective measures (self-induction recuperation diodes for inductive loads and series resistors for capacitive loads).

Terminal assignment

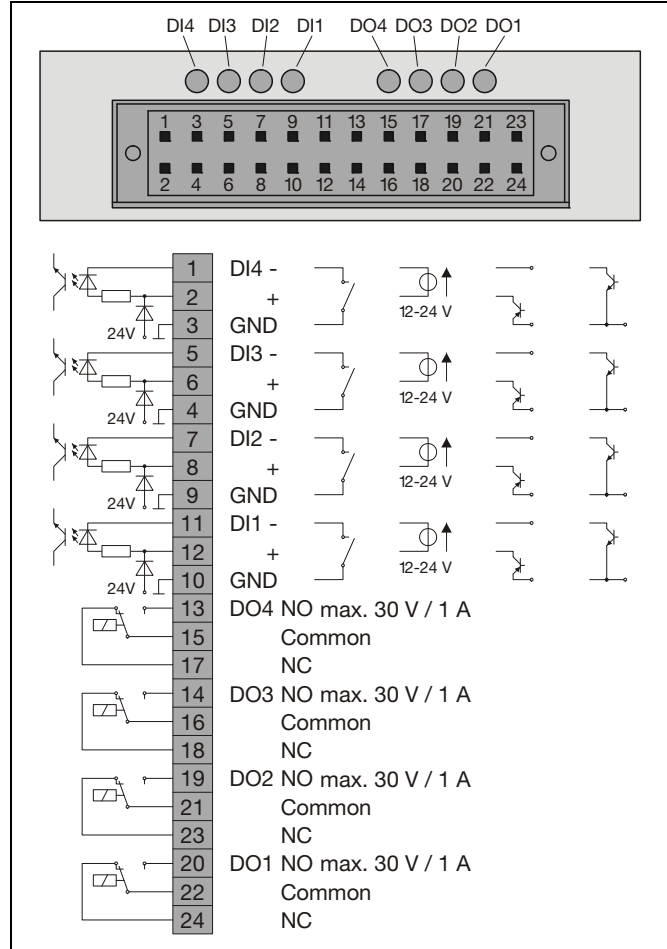
Digital input and output signals	Standard assignment ¹⁾ digital I/O module	
	1	2
Failure		
Maintenance request		
Maintenance mode		
Overall status	DO1	
Start automatic calibration	DI1	
Stop automatic calibration		
Disable automatic calibration	DI2	
Sample gas valve	DO4	
Zero gas valve		
Span gas valves 1–5		
Pump on/off ²⁾		
Limit 1	DO2	
Limit 2	DO3	
Limit 3		DO1
Limit 4		DO2
Limit 5		DO3
Limit 6		DO4
Limit 7		
Limit 8		
Limit 9		
Limit 10		
Measuring range switch-over		
Measuring range feedback		
Measuring component switch-over		
Measuring component feedback		
Bus DI 1–8		
External failure ³⁾	DI3	
External maintenance request ³⁾	DI4	

- 1) Factory-set, can be changed by on-site configuration
- 2) When a pump (integral gas feed) is installed
- 3) Multiple external status signals can be configured depending on the number of free digital inputs.

Electrical connections

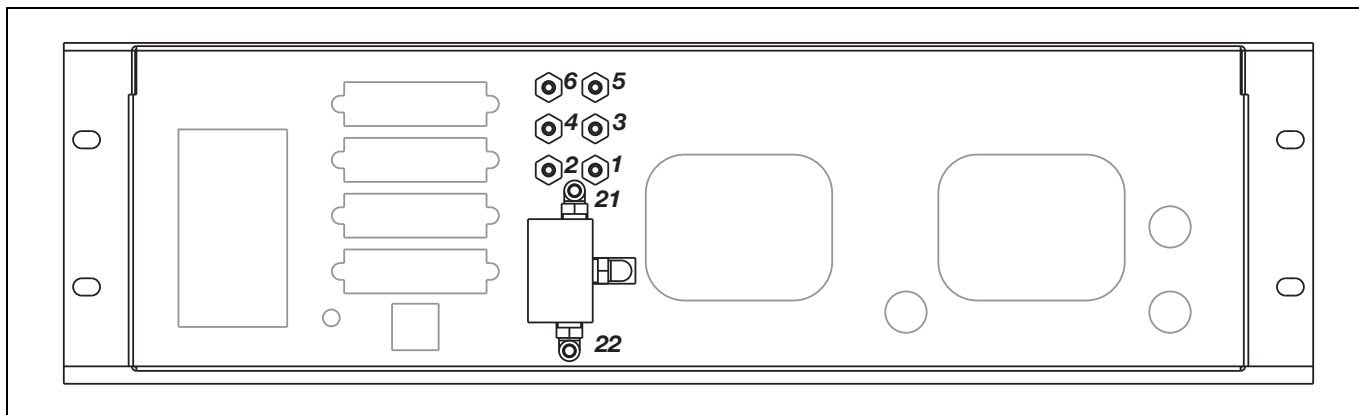
See connection diagram
 Design: 2x12-pin terminal strip. Observe the notes regarding I/O module connection (see page 22)!
 Relays are shown in the unpowered state. The unpowered state is the failure mode.

Connection diagram



Gas connections Uras26

Model EL3020 (Internal gas lines: FPM hoses)



- 1** Sample gas inlet gas path 1 without “Integral gas feed” option
- 2** Sample gas outlet gas path 1 connected to sample gas inlet of Magnos206 or Caldos27 if applicable
- 3** Sample gas outlet for “Integral gas feed” option, factory-connected to sample gas inlet gas path 1
- 4** Sample gas inlet for “Integral gas feed” option with flow sensor only (without solenoid valve) or pressure sensor (option)
- 5** Sample gas inlet gas path 2 or flowing reference gas inlet (option)
- 6** Sample gas outlet gas path 2 or flowing reference gas outlet (option)

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

- 21** Sample gas inlet at solenoid valve } for “Integral gas feed” option with
- 22** Test gas inlet at solenoid valve } solenoid valve, pump, filter, capillary and flow sensor

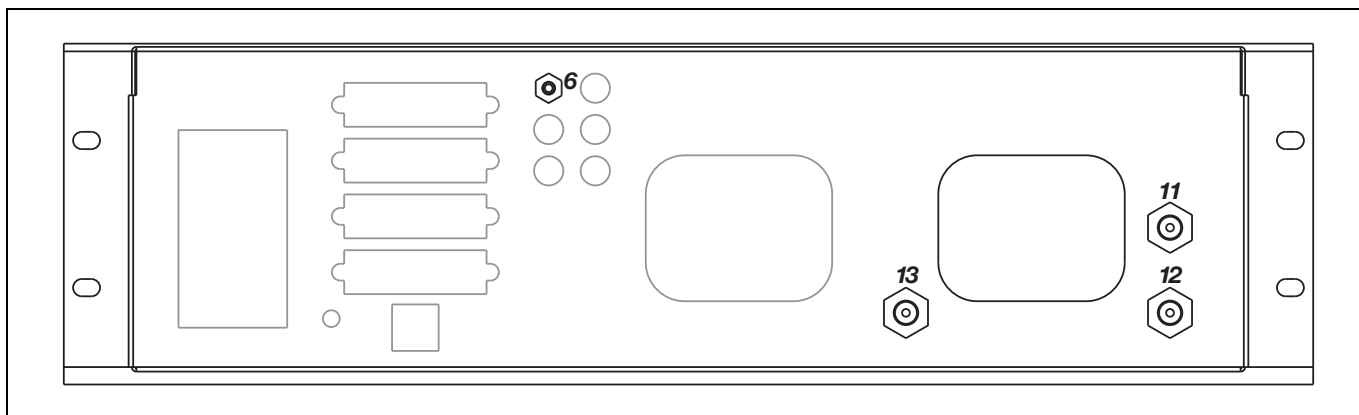
Design: Screwed fittings with hose nozzles (PVDF) for hoses with 4 mm inner diameter (supplied)

Notes: Pressure sensor (standard) and oxygen sensor (option) are connected internally as follows:
 downstream the sample cell 1 outlet for one sample cell or for two separate gas paths,
 downstream the sample cell 2 outlet for two sample cells in series.

The second oxygen sensor (option for version with two separate gas paths) is connected downstream the sample cell 2 outlet.

The pressure sensor can be directly connected to inlet **4** as an option.

Model EL3020 (Internal gas lines: PTFE or stainless steel pipes)



- 6** Pressure sensor

Design: Screwed fitting with hose nozzle (stainless steel 1.4305/SAE 303) for hose with 4 mm inner diameter (supplied)

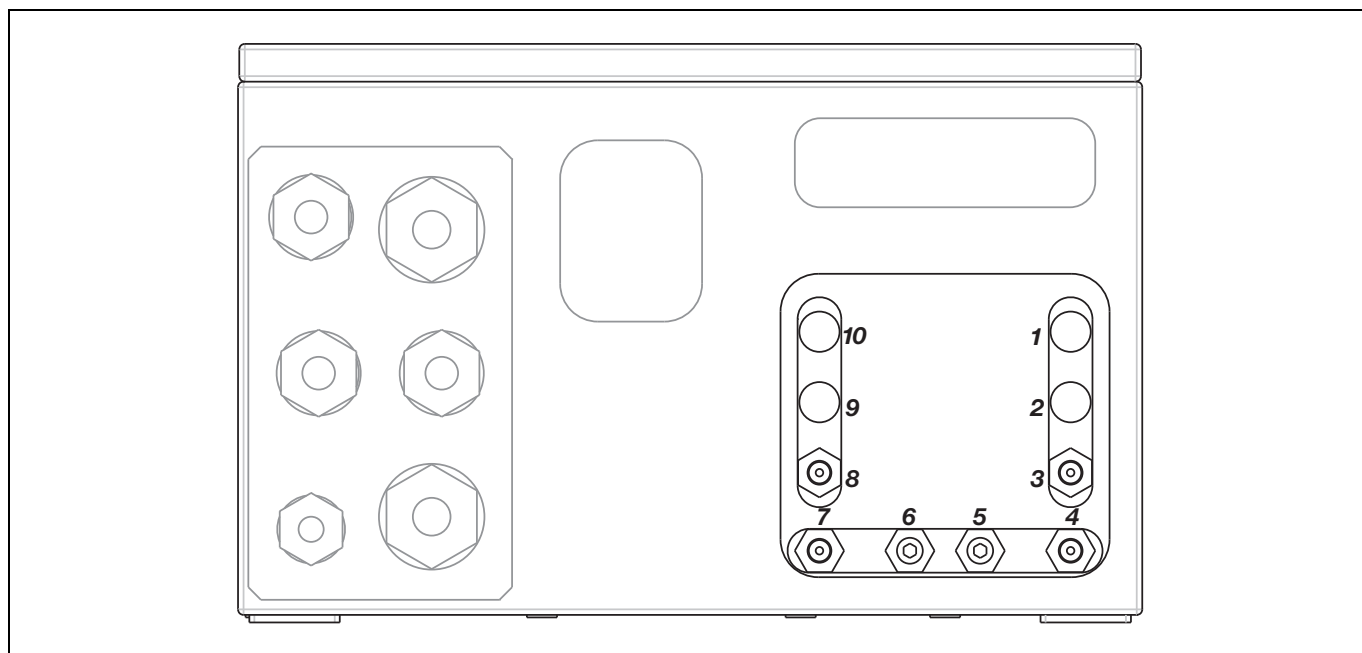
- 11** Sample gas inlet
- 12** Sample gas outlet for one sample cell } connected to sample gas inlet of
- 13** Sample gas outlet for two sample cells in series } Caldos27 or Magnos206 if applicable

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied)

Notes: Oxygen sensor, “Integral gas feed”, “Flowing reference gas” options and version with two separate gas paths cannot be provided.

Gas connections Uras26

Model EL3040 (Internal gas lines: FPM hoses or PTFE or stainless steel pipes)



One gas path with one sample cell or two sample cells in series

- 1** Pressure sensor (option)
- 2** not used
- 3** Sample gas inlet
- 4** Sample gas outlet for one sample cell
- 5** Purge gas inlet housing
- 6** Purge gas outlet housing
- 7** not used
- 8** Sample gas outlet for two sample cells in series
- 9** Flowing reference gas inlet (sample cell 1, option)
- 10** Flowing reference gas outlet (sample cell 1, option)

Two separate gas paths with one sample cell each

- 1** Pressure sensor (option)
- 2** not used
- 3** Sample gas inlet gas path 1
- 4** Sample gas outlet gas path 1
- 5** Purge gas inlet housing
- 6** Purge gas outlet housing
- 7** Sample gas inlet gas path 2
- 8** Sample gas outlet gas path 2
- 9** Flowing reference gas inlet (gas path 1, option)
- 10** Flowing reference gas outlet (gas path 1, option)

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied for purge gas connections and for sample gas connections when internal gas paths are made up of FPM hoses.)

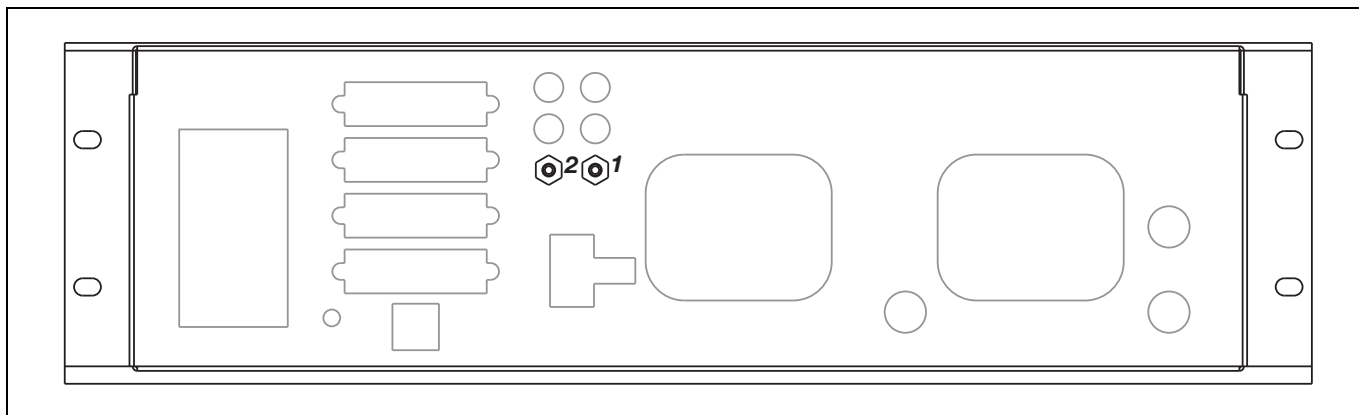
Notes: When the internal gas paths are made up of FPM hoses, pressure sensor (standard) and oxygen sensor (option) are connected internally as follows:
 downstream the sample cell 1 outlet for one sample cell,
 downstream the sample cell 1 or sample cell 2 outlet for two separate gas paths,
 downstream the sample cell 2 outlet for two sample cells in series.

When the internal gas paths are made up of PTFE or stainless steel pipes, the options oxygen sensor and "Flowing reference gas" cannot be provided.

The pressure sensor can be directly connected to inlet **1** as an option.

Gas connections Limas23

Model EL3020



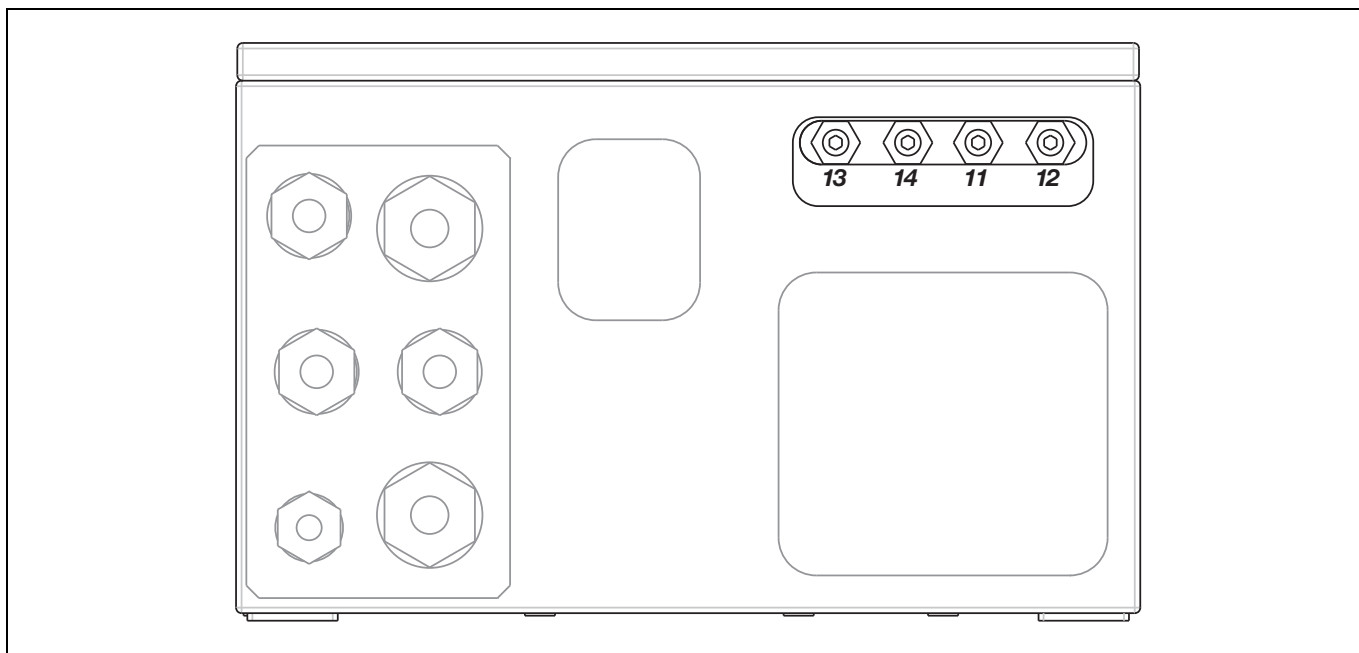
1 Sample gas inlet

2 Sample gas outlet (connected to sample gas inlet of Magnos206 if applicable)

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

Note: Pressure sensor (standard) and oxygen sensor (option) are connected internally downstream the sample cell.

Model EL3040



11 Purge gas inlet housing

12 Purge gas outlet housing

13 Sample gas inlet

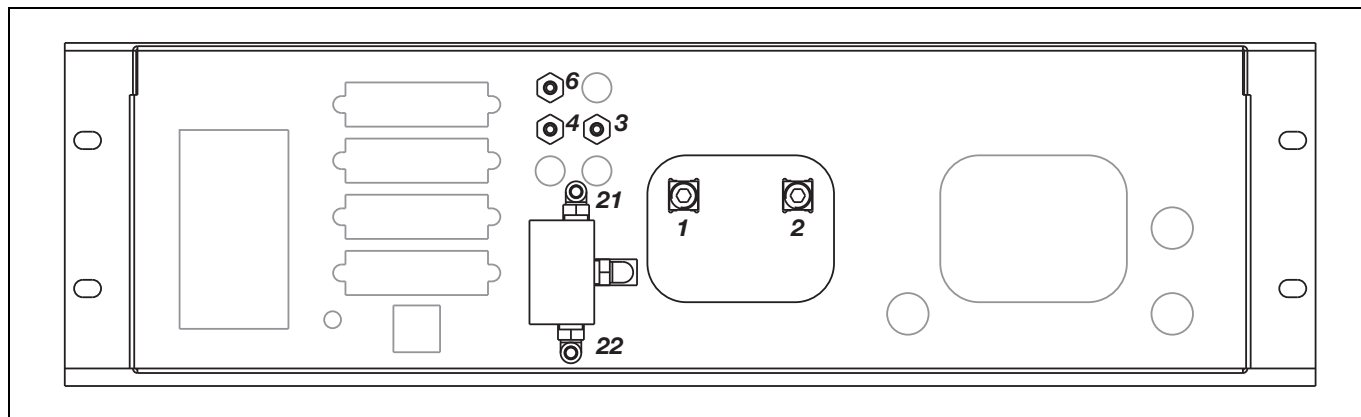
14 Sample gas outlet (connected to sample gas inlet of Magnos206 if applicable)

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

Note: Pressure sensor (standard) and oxygen sensor (option) are connected internally downstream the sample cell.

Gas connections Magnos206

Model EL3020



- 1** Sample gas inlet
- 2** Sample gas outlet

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

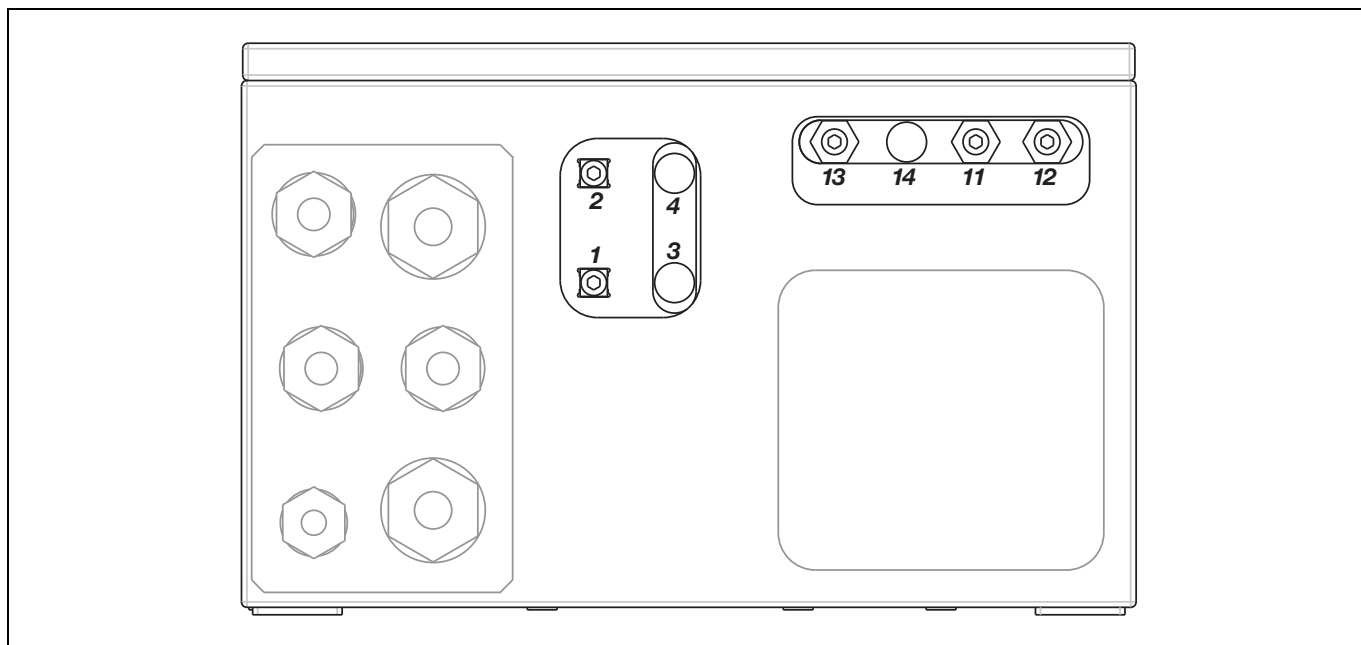
- 3** Sample gas outlet for "Integral gas feed" option, factory-connected to **1** sample gas inlet
- 4** Sample gas inlet for "Integral gas feed" option with flow sensor only (without solenoid valve)
- 6** Pressure sensor (option)

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

- 21** Sample gas inlet at solenoid valve
- 22** Test gas inlet at solenoid valve

Design: Screwed fittings with hose nozzles (PVDF) for hoses with 4 mm inner diameter (supplied)

Model EL3040

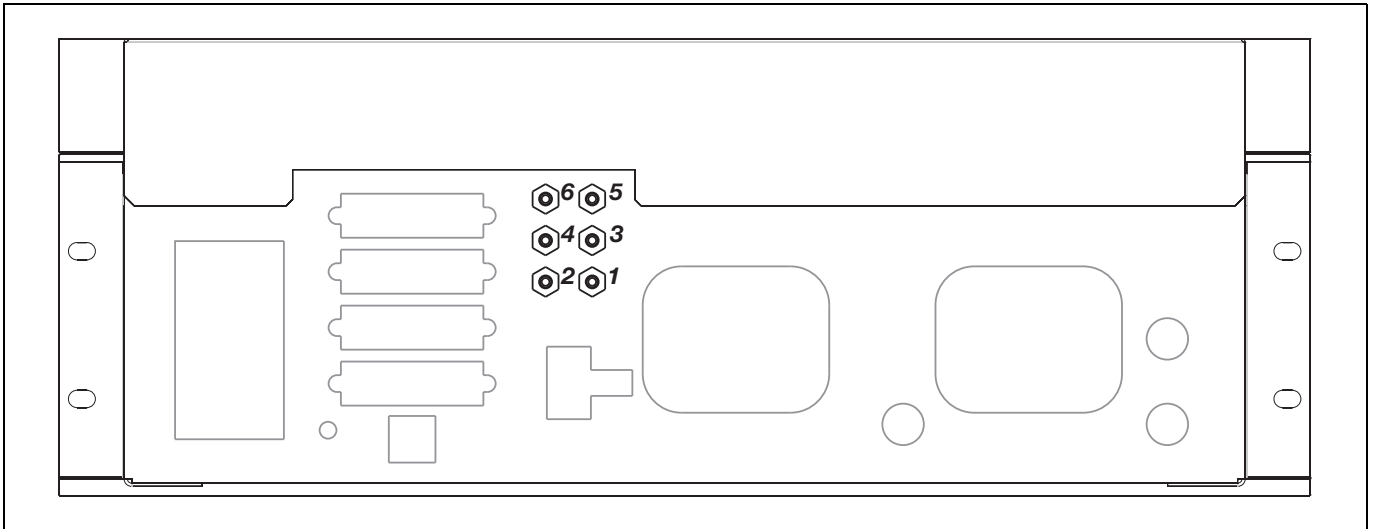


- 1** Sample gas inlet
- 2** Sample gas outlet
- 3** not used
- 4** not used
- 11** Purge gas inlet housing
- 12** Purge gas outlet housing
- 13** Pressure sensor (option)
- 14** not used

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied; screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

Gas connections and dimensional drawing Magnos27

Gas connections



Magnos27

- 1** Pressure sensor (option)
- 2** not used
- 3** Sample gas inlet
- 4** Sample gas outlet
- 5** Purge gas inlet analyzer
- 6** Purge gas outlet analyzer

Magnos27 in combination with Uras26 (one gas path, internal gas lines: FPM hoses)

- 1** Sample gas inlet Uras26
- 2** Sample gas outlet Uras26
- 3** Sample gas inlet Magnos27
- 4** Sample gas outlet Magnos27
- 5** Purge gas inlet Magnos27
- 6** Purge gas outlet Magnos27

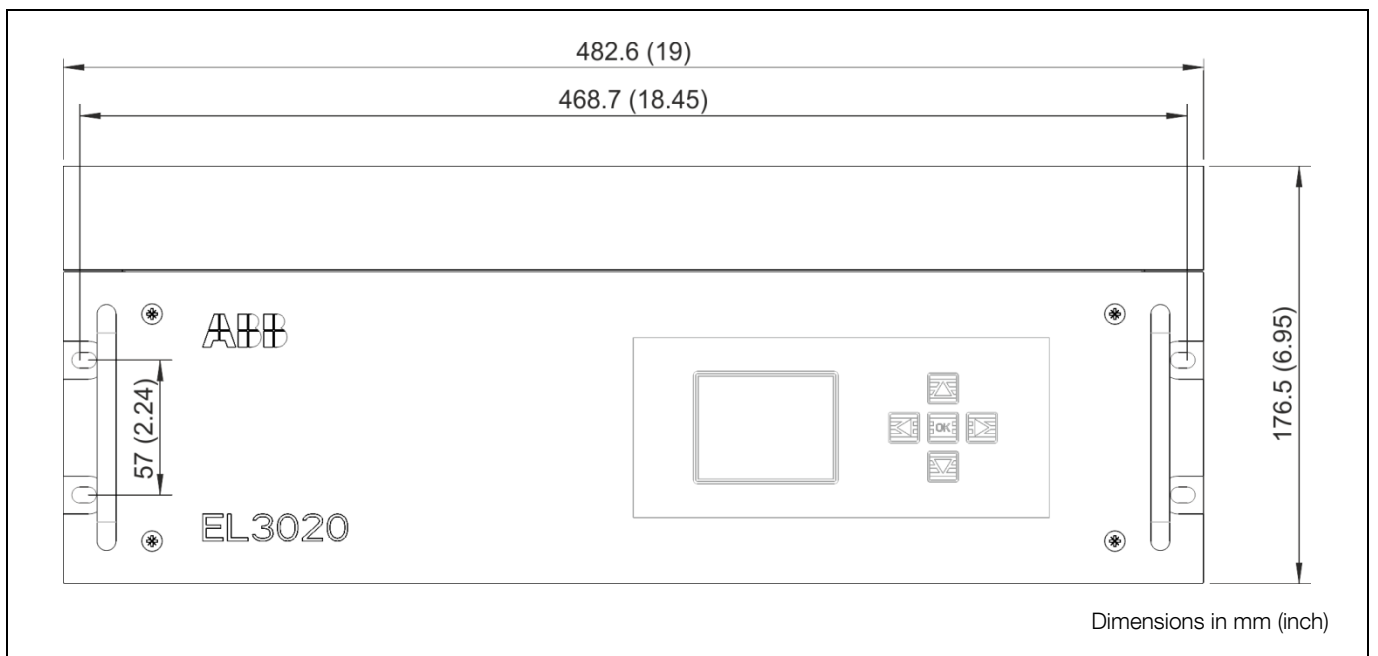
Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

Notes: (for Magnos27 in combination with Uras26)

The pressure sensor (standard) is connected internally downstream the Uras26 sample cell.

The pressure sensor can be directly connected to inlet **6** as an option (Magnos27 without sample chamber purging).

Dimensional drawing

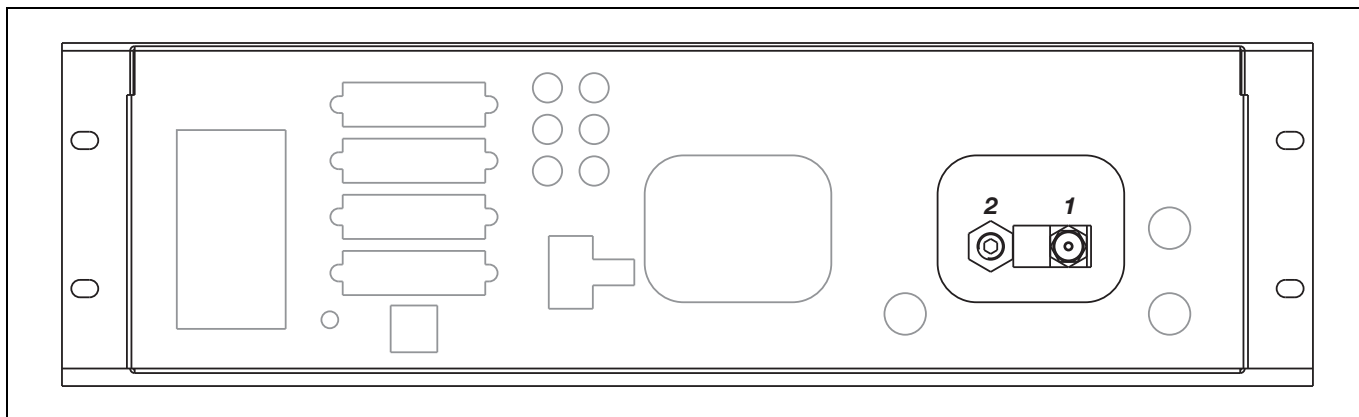


Dimensions in mm (inch)

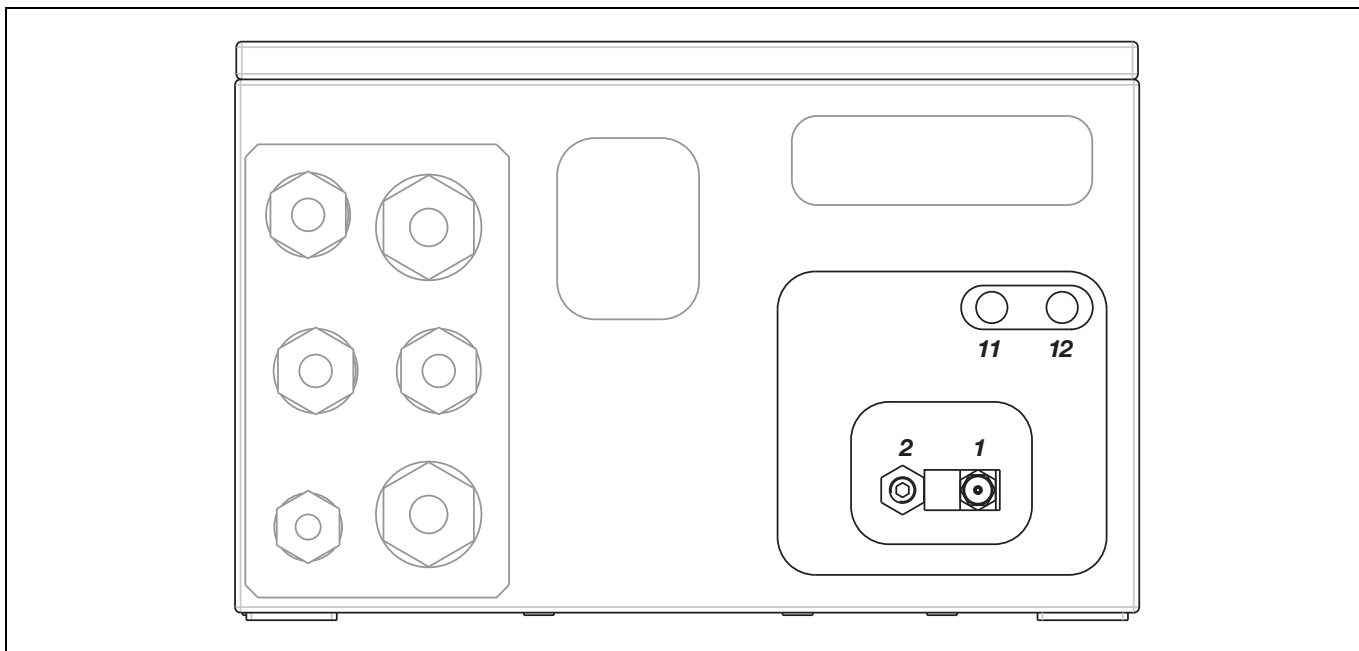
Note: Only the front view of the housing (with its height differing from the standard dimension) is depicted in this dimensional drawing. Refer to the dimensional drawing on page 33 for other views and dimensions of the housing.

Gas connections Z023

Model EL3020



Model EL3040

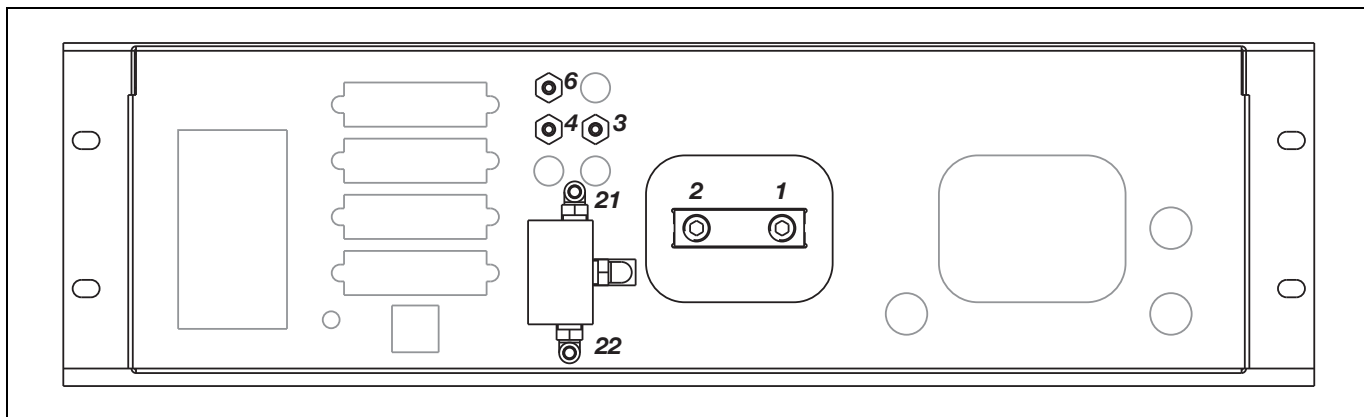


- 1** Sample gas inlet
- 2** Sample gas outlet
- 11** Purge gas inlet housing
- 12** Purge gas outlet housing

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied),
sample gas inlet 3 mm Swagelok® (stainless steel 1.4401/SAE 316)

Gas connections Caldos27

Model EL3020



- 1** Sample gas inlet
- 2** Sample gas outlet

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied);
screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

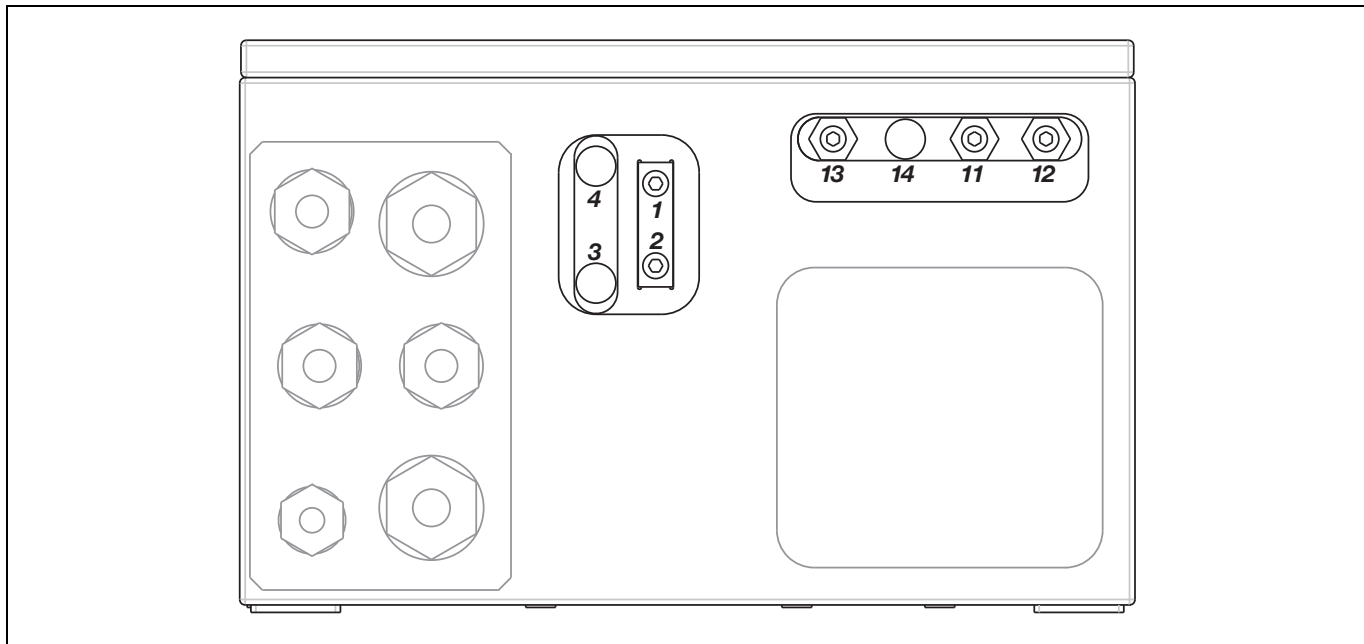
- 3** Sample gas outlet for "Integral gas feed" option, factory-connected to **1** sample gas inlet
- 4** Sample gas inlet for "Integral gas feed" option with flow sensor only (without solenoid valve)
- 6** Pressure sensor

Design: Screwed fittings with hose nozzles (stainless steel 1.4305/SAE 303) for hoses with 4 mm inner diameter (supplied)

- 21** Sample gas inlet at solenoid valve
- 22** Test gas inlet at solenoid valve

Design: Screwed fittings with hose nozzles (PVDF) for hoses with 4 mm inner diameter (supplied)

Model EL3040

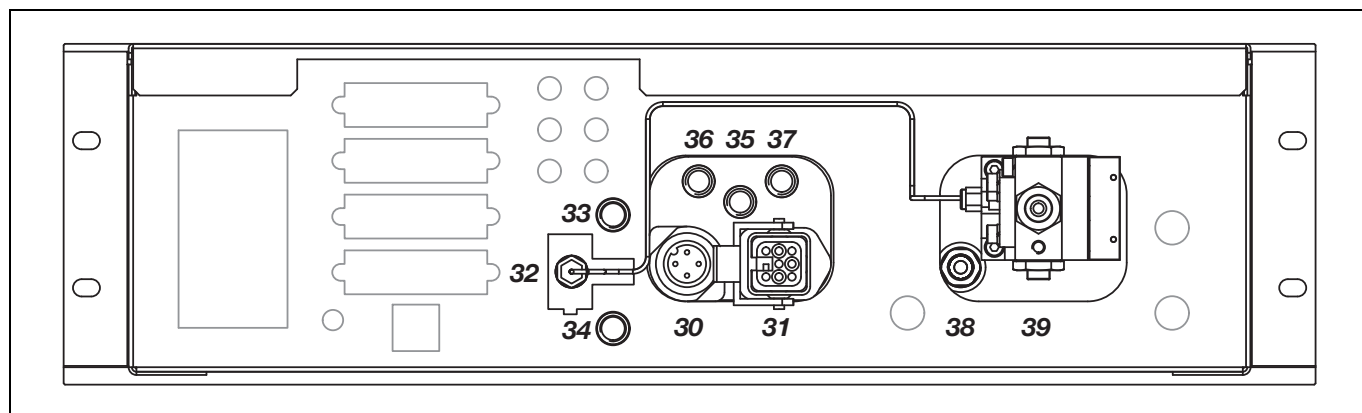


- 1** Sample gas inlet
- 2** Sample gas outlet
- 3** not used
- 4** not used
- 11** Purge gas inlet housing
- 12** Purge gas outlet housing
- 13** Pressure sensor
- 14** not used

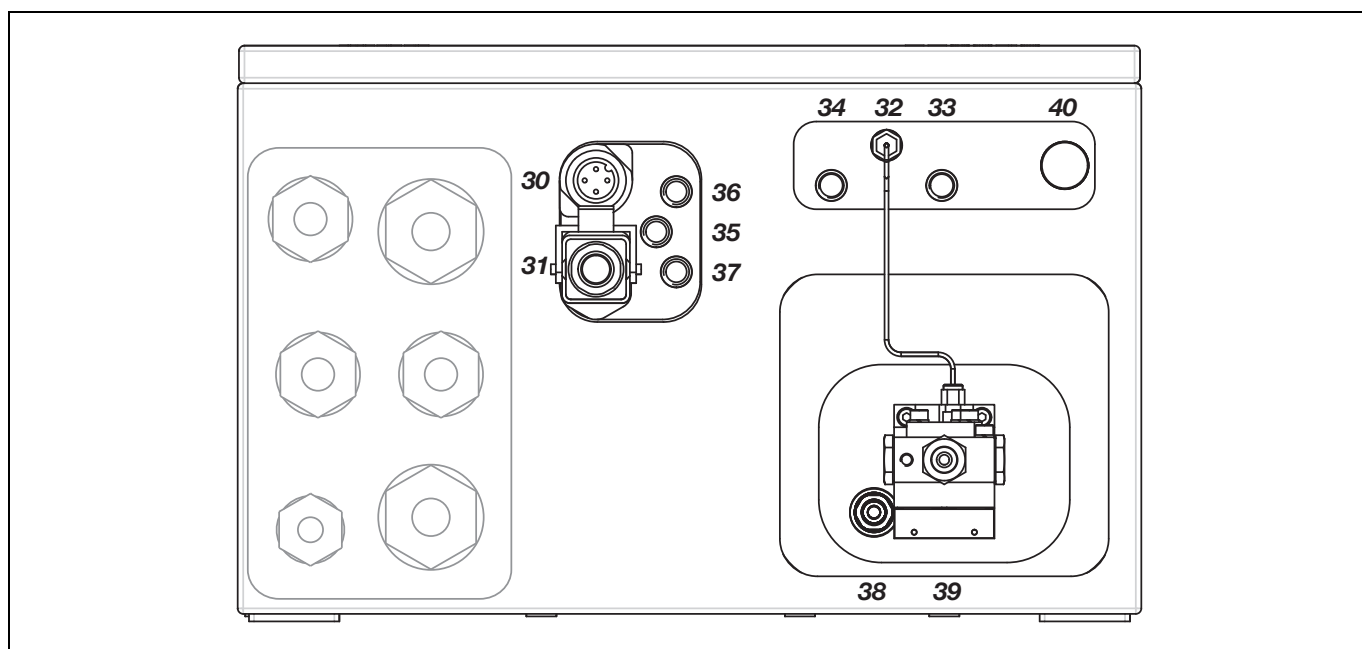
Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied);
screwed fittings with hose nozzles (PP) for hoses with 4 mm inner diameter supplied)

Gas connections and electrical connections Fidas24

Model EL3020



Model EL3040



30 Power supply 115 VAC or 230 VAC for heating of detector and sample gas inlet (4-pin male plug, connecting cable supplied)

31 Electrical connection to heated sample gas inlet (fixed)

32 Test gas outlet

33 Zero-point gas inlet

34 End-point gas inlet

35 Combustion air inlet

36 Combustion gas inlet

37 Instrument air inlet

Design: 1/8 NPT female thread (stainless steel 1.4305/SAE 303) for threaded connections (not supplied)

38 Exhaust outlet

Design: Threaded connection for 6-mm outer diameter tubing, permissible maximum length of 30 cm; after that point the inner diameter of the exhaust line should be increased to ≥ 10 mm.

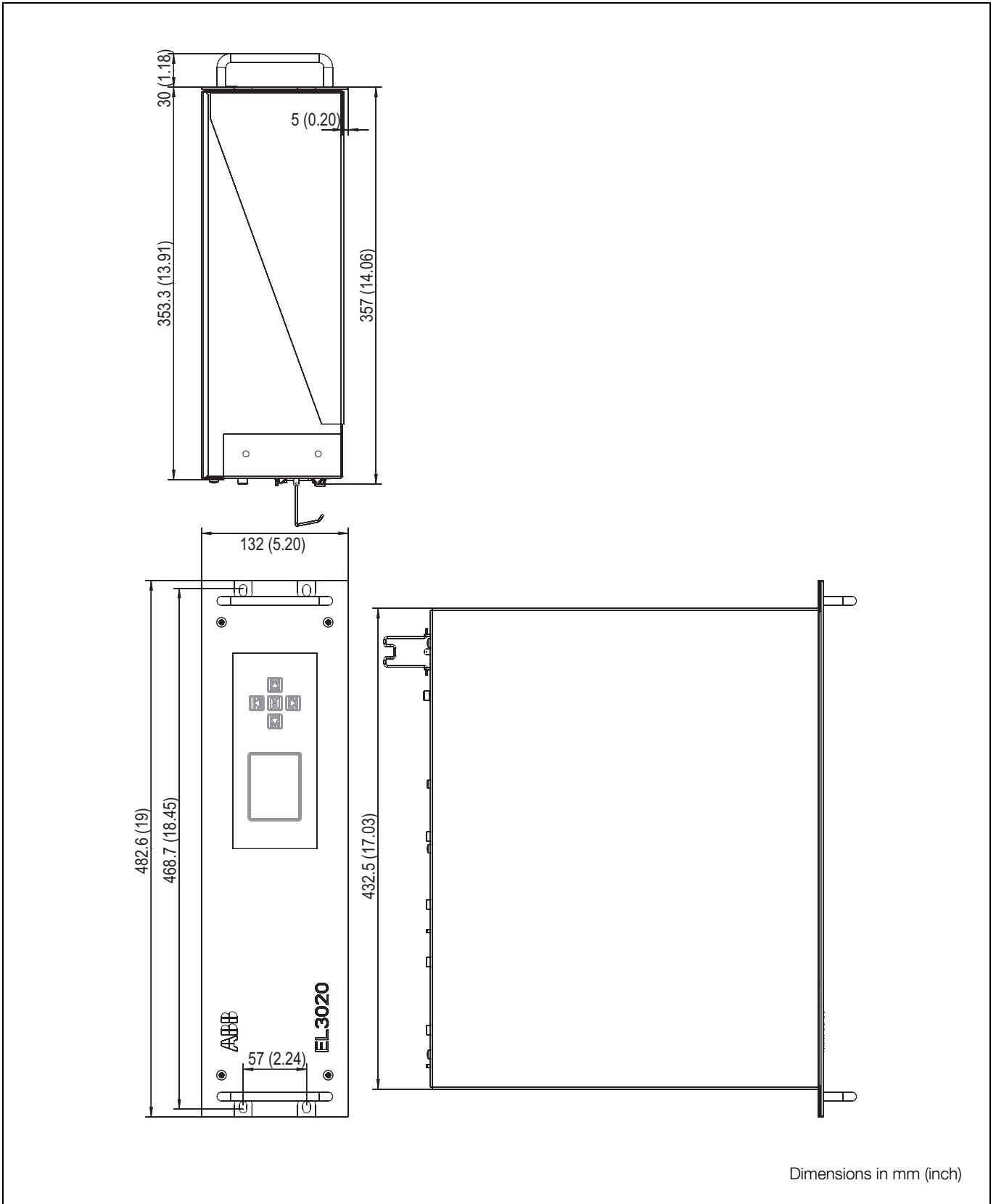
39 Sample gas inlet, heated or unheated

Design: Threaded connection for PTFE or stainless steel tubing with a 6-mm outer diameter

40 Pressure compensation opening with protection filter (only in wall-mount housing)

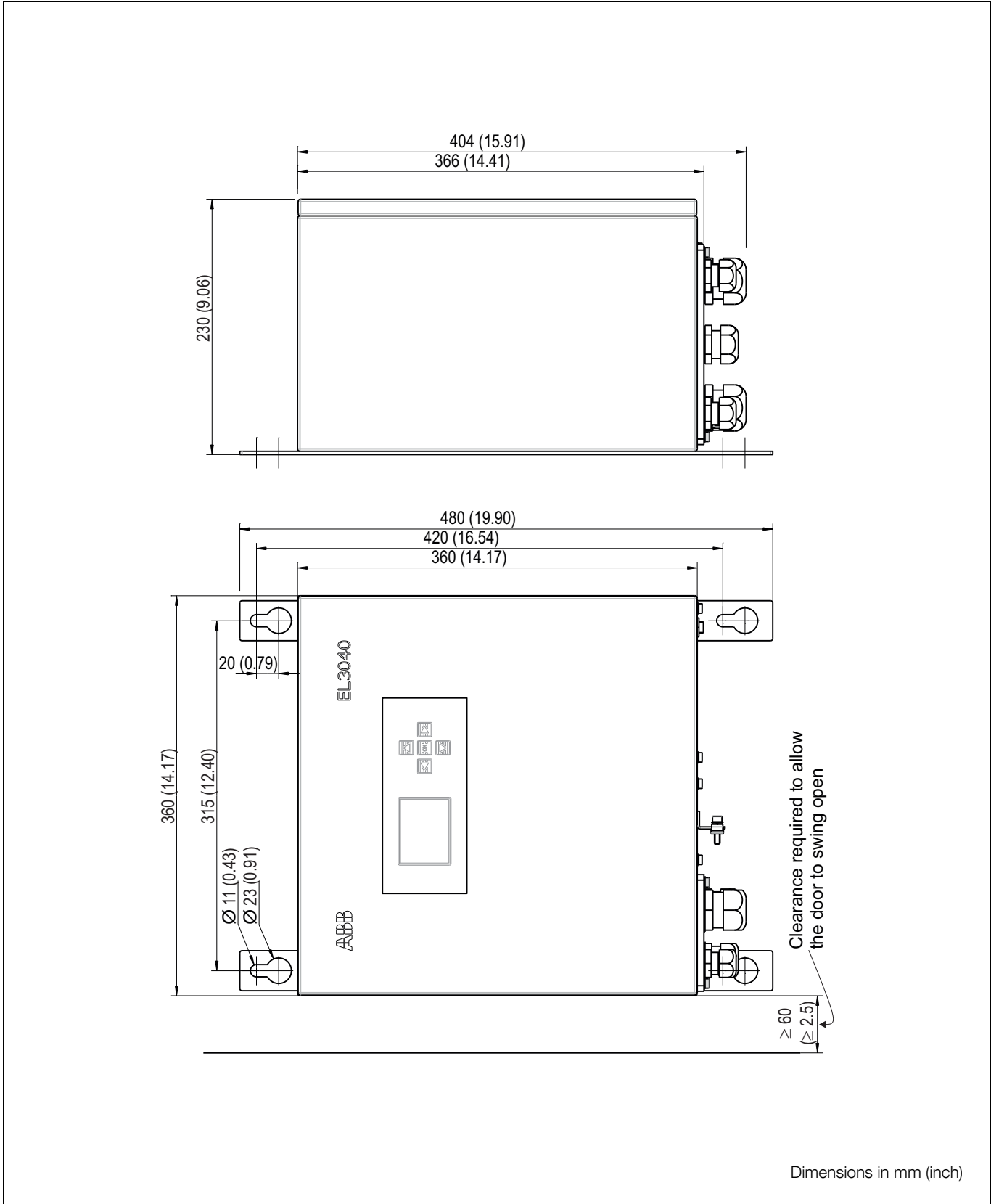
Dimensional drawings

19-inch rack housing (model EL3020)



Dimensional drawings

Wall-mount housing (model EL3040)



Certifications

CE conformity

The EL3000 series gas analyzers satisfy the requirements of the European directives
2014/35/EU Low voltage directive,
2014/30/EU EMC directive and
2014/34/EU ATEX directive (version in category 3G for measurement of non-flammable gases and vapors).

SIL conformity

The EL3000 series gas analyzer Magnos206 without flow and pressure sensor meets the requirements of the European standard for functional safety EN 61508:2010 Part 1 and Part 2 (identical to IEC 61508:2010).

Performance test

The EL3000 series gas analyzers Uras26 (sample components CO, NO, SO₂, CO₂, N₂O), Magnos206 (sample component O₂) and electrochemical oxygen sensor (sample component O₂) are certified for use in combustion plants according to Directive 2010/75/EU Chapter III (formerly Directive 2001/80/EG, 13th BlmSchV), waste incineration plants according to Directive 2010/75/EU Chapter IV (formerly Directive 2000/76/EG, 17th BlmSchV) and other plants requiring official approval. The requirements of QAL1 according to EN 15267 and EN 14181 are fulfilled.

Report No. 691317 of June 30, 2006. Notification:
Federal Gazette of October 14, 2006, No. 194, page 6715

Report No. 1669640 of September 30, 2011. Notification:
Federal Gazette of March 2, 2012, No. 36, page 925

Report No. 936/21217137/B of October 14, 2011. Notification:
Federal Gazette of March 2, 2012, No. 36, page 924

Certificate No. Sira MC 080122/12 of August 21, 2015

The EL3000 series gas analyzers Limas23 (sample components NO, NO₂, SO₂) and electrochemical oxygen sensor (sample component O₂) are certified for use in combustion plants according to Directive 2010/75/EU Chapter III (formerly Directive 2001/80/EG, 13th BlmSchV), waste incineration plants according to Directive 2010/75/EU Chapter IV (formerly Directive 2000/76/EG, 17th BlmSchV) and other plants requiring official approval. The requirements of QAL1 according to EN 15267 and EN 14181 are fulfilled.

Report No. 2231669.2 of September 30, 2015, Notification: Federal Gazette AT of March 14, 2016, No. B7, page 3.

Certificate No. Sira MC160294/00 of May 10, 2016

The EL3000 Series gas analyzer Fidas24 (sample component C-total) is certified for use in combustion plants according to Directive 2010/75/EU Chapter III (formerly Directive 2001/80/EG, 13th BlmSchV), waste incineration plants according to Directive 2010/75/EU Chapter IV (formerly Directive 2000/76/EG, 17th BlmSchV) and other plants requiring official approval. The requirements of QAL1 according to EN 15267 and EN 14181 are fulfilled.

Report No. 936/21230981/A of February 29, 2016, Notification:
Federal Gazette AT of August 1, 2016, No. B11, page 2.

Certificate No. Sira MC160308/00 of August 3, 2016

Approval for USA and Canada – CSA

The EL3000 series gas analyzers are certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 and UL Std. No. 61010-1 (2nd Edition).

Certificate No. 1714030

Approval for the customs union of Russia, Belarus and Kazakhstan – GOST TR CU

The EL3000 Series gas analyzers are certified for use in general purpose environment.

GOST TR CU certificate No. TC N RU Д-DE.AB72.B.02310
Pattern approval certificate for Russia No. DE.C.31.004.A
No. 37984.

Explosion protection to European standards

The EL3000 Series gas analyzers with Uras26, Limas23, Magnos206, Caldos27 and oxygen sensor in category 3G for measurement of non-flammable sample gas satisfy the European standards EN 60079-0:2012 + A11:2013 and EN 60079-15:2010.

Designation:  II 3G Ex nA nC IIC T4 Gc

Type Examination Certificate No. BVS 16 ATEX E 085 X

Contact us

ABB Limited

Industrial Automation

Howard Road, St. Neots
Cambridgeshire, PE19 8EU
United Kingdom

Phone: +44 870 600 6122

Fax: +44 1480 213 339

ABB Pte. Ltd.

Industrial Automation

2 Ayer Rajah Crescent
139935 Singapore, Singapore

Phone: +65 6773 5961

Fax: +65 6778 0222

ABB Engineering Ltd.

Industrial Automation

10 Jiuxianqiao Lu
100015 Beijing, China
Phone: +86 10 84566688 Ext. 6217
Fax: +86 10 84567650

ABB Inc.

Industrial Automation

3700 W Sam Houston Parkway South,
Suite 600, Houston, TX 77042, USA
Phone: +1 713 587 8000

www.abb.com/analytical

ABB Australia Pty Limited

Industrial Automation

Bapaume Road
2170 Moorebank
New South Wales, Australia

Phone: +61 2 9821 0968

Fax: +61 2 9400 7050

ABB Ltd.

Industrial Automation

14 Mathura Road
121003 Faridabad, Haryana, India

Phone: +91 129 2279627

Fax: +91 129 2279692

ABB Automation GmbH

Industrial Automation

Stierstaedter Strasse 5
60488 Frankfurt am Main, Germany
Fax: +49 69 7930 4566
E-mail: cga@de.abb.com

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Service