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
- 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 outputs
- Modbus interface

- Integral gas feed (optional)
- Simple menu-driven operator interface
- Clear-text status messages
- Configuration of rarely required functions with included configuration program
- Housing version for 19-inch rack mounting (3 height units, IP20)
- Modular design for ease of service
- Self-monitoring function indicates when maintenance is required
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
- Magnos206 oxygen analyzer for the measurement of O2 in process gas or in N2
- 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
- Electrochemical oxygen sensor for the measurement of O2

The electrochemical oxygen sensor can only be used in combination with the Uras26 infrared photometer.

The Magnos206 oxygen analyzer and the Caldos27 thermal conductivity analyzer can also be used in combination with the Uras26 infrared photometer.

Integral Gas Feed

The integral gas feed (option) is available in two versions. It either includes:

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

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 service and configuration purposes)
- as well as the integrated I/O modules depending on the functional range and order
- Analog output module with 2 analog outputs,
- Digital I/O module with 4 digital inputs and 4 digital outputs and
- Modbus module with RS485 and RS232 interfaces.

Housing Design

The housing for the EL3020 gas analyzer model is designed as a 19-inch housing with 3 height units and degree of protection IP20.

Note Regarding the Performance Characteristics of the Analyzers

The performance characteristics of the analyzers have been determined according to the international standard IEC 1207-1: 1994 “Expression of performance of gas analyzers”. They are based on N2 as the associated gas. Compliance with these characteristics when measuring other gas mixtures can only be assured if their composition is known.
**Measurement Principle**

Non-dispersive infrared absorption in the $\lambda = 2.5–8 \, \mu m$ wavelength range

Photometer to measure up to 4 components with 1 or 2 beam paths and 1 or 2 receivers per beam path in one gas path or two separate gas paths.

**Sample Components and Measurement Ranges**

The analyzer has one physical measurement range per sample component. The smallest measurement ranges are shown in the following table.

<table>
<thead>
<tr>
<th>Sample Component</th>
<th>Smallest Measurement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>0–100 ppm</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>0–100 ppm</td>
</tr>
<tr>
<td>NO</td>
<td>0–150 ppm</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>0–100 ppm</td>
</tr>
<tr>
<td>N$_2$O</td>
<td>0–100 ppm</td>
</tr>
<tr>
<td>CH$_4$</td>
<td>0–100 ppm</td>
</tr>
</tbody>
</table>

**Stability**

The following data apply only if all influence factors (e.g. flow rate, temperature, atmospheric pressure) are constant.

**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** ($2 \, \sigma$)

$\leq 0.2$ % of span at electronic T90 time (static/dynamic) = 5/0 sec

**Detection Limit** ($4 \, \sigma$)

$\leq 0.4$ % 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 tubing is used for internal gas lines the pressure sensor is routed to the outside via a hose.

Pressure sensor working range: $p_{\text{min}} = 600–1250$ hPa

**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
- \( T_{90} = 2.5 \text{ sec} \) for measurement cell length = 175 mm, sample gas flow = 60 l/h and electronic \( T_{90} \) time (static/dynamic) = 5/0 sec.

Calibration

Zero-Point Calibration
- With inert gas, e.g. \( N_2 \), 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; Window: CaF\(_2\) or BaF\(_2\); Connectors: Stainless steel 1.4305

Gas Lines and Connectors
- FPM (Fluorocarbon rubber) hoses, PVDF connectors; Option: Stainless steel tubes 1.4571, stainless steel connectors 1.4305

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.

Inlet Pressure
- \( p_i = 2-500 \text{ hPa} \)
- Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet Pressure
- Atmospheric pressure

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. Please observe the special conditions (see operator’s manual).

Gas Connections
- see page 16
Oxygen Analyzer Magnos206

Measurement Principle
Paramagnetic behavior of oxygen
Magnetomechanical oxygen analyzer; short 90% response time

Sample Component and Measurement Range
Sample Component
Oxygen (O₂)

Smallest Measurement Range
0–2 Vol.-% O₂

Measurement Range Limits
The measurement range limits are freely adjustable; they are factory-set per order to 0–100 Vol.-% O₂ 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
Smallest span 2 Vol.-% O₂. The suppressed measurement range is factory-set to 98–100 Vol.-% O₂. 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. They are based on a span of 2 Vol.-% O₂.

Linearity Deviation
≤ 0.5 % of span

Repeatability
≤ 1% of span (time base for gas exchange 3 minutes)

Zero Drift
≤ 0.1 Vol.-% 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.

Output Fluctuation (2 σ)
≤ 0.5 % of smallest measurement range span at electronic T90 time (static/dynamic) = 3/0 sec

Detection Limit (4 σ)
≤ 1 % of smallest measurement range span 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
The effect of associated gases as a shift of the zero-point – expressed in Vol.-% O₂ – can be estimated using the approximate values in the following table:

<table>
<thead>
<tr>
<th>Associated Gas Concentration</th>
<th>Zero-Point Shift in Vol.-% O₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen H₂</td>
<td>+0.28</td>
</tr>
<tr>
<td>Hydrogen Sulfide H₂S</td>
<td>–0.45</td>
</tr>
<tr>
<td>Argon Ar</td>
<td>–0.26</td>
</tr>
<tr>
<td>Helium He</td>
<td>+0.30</td>
</tr>
<tr>
<td>Neon Ne</td>
<td>+0.13</td>
</tr>
<tr>
<td>Nitrogen N₂</td>
<td>0</td>
</tr>
<tr>
<td>Nitrogen Oxide NO</td>
<td>+43</td>
</tr>
<tr>
<td>Nitrogen Dioxide NO₂</td>
<td>+28</td>
</tr>
<tr>
<td>Nitrous Oxide N₂O</td>
<td>–0.20</td>
</tr>
<tr>
<td>Carbon Monoxide CO</td>
<td>–0.01</td>
</tr>
<tr>
<td>Carbon Dioxide CO₂</td>
<td>–0.32</td>
</tr>
<tr>
<td>Carbon Oxysulfide COS</td>
<td>–0.90</td>
</tr>
<tr>
<td>Ethane C₂H₆</td>
<td>–0.46</td>
</tr>
<tr>
<td>Ethylene C₂H₄</td>
<td>–0.29</td>
</tr>
<tr>
<td>Methane CH₄</td>
<td>–0.24</td>
</tr>
<tr>
<td>Propane C₃H₈</td>
<td>–0.98</td>
</tr>
<tr>
<td>Propylene C₃H₆</td>
<td>–0.55</td>
</tr>
<tr>
<td>Trichloroethane C₂HCl₃</td>
<td>–2.17</td>
</tr>
<tr>
<td>Vinyl Chloride CH₂CHCl</td>
<td>–0.75</td>
</tr>
</tbody>
</table>

For further associated gases refer to EN 61207-3

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
– 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 using integrated pressure sensor (optional):
≤ 0.01 % of measured value per 1 % pressure change or
≤ 0.002 Vol.-% O₂ per 1 % pressure change, whichever is greater
Pressure sensor working range: pₐₐᵋ = 600–1250 hPa

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.
Dynamic Response

Warm-Up Time
< 1 hour

90% Response Time
$T_{90} \leq 4$ sec at a sample gas flow of 90 l/h and electronic $T_{90}$ time (static/dynamic) = $3/0$ sec, gas change from $N_2$ 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
For measurement ranges from 0 to 5 Vol.-% $O_2$ to 0 to 25 Vol.-% $O_2$
Zero-point calibration with any oxygen concentration, e.g. with nitrogen ($N_2$) or ambient air, processed through a cooler or $H_2O$ absorber; sensitivity deviation $\leq 0.05$ Vol.-% $O_2$ per year.
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.

Calibration of Measurement Ranges with Suppressed Zero-Point
Highly suppressed measurement ranges ($\geq 95–100$ Vol.-% $O_2$) 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, glass, platinum, rhodium, epoxy resin;
Seals: FPM (Fluorocarbon rubber), PEEK

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.

Inlet Pressure
$p_{in} = 2–100$ hPa
Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet Pressure
Atmospheric pressure

Flow Rate
30–90 l/h
Abrupt changes in gas flow rates should be avoided when using highly suppressed measurement ranges.

Corrosive Gases
Consultation with ABB Analytical is required if the sample gas contains $Cl_2$, $HCl$, $HF$ or other corrosive components.
The AO2000-Magnos106 analyzer should be used if the sample gas contains $NH_3$.

Flammable Gases
The analyzer is suitable for measuring flammable gases in general purpose environment. Please observe the special conditions (see operator’s manual).

Gas Connections
see page 17
Measurement Principle
Difference in thermal conductivity of various gases
Micromechanical silicon sensor with especially short T90 time

Sample Components and Measurement Ranges

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Air in Ar</td>
<td>0–6 Vol.-%</td>
<td>94–100 Vol.-%</td>
</tr>
<tr>
<td>Ar in air</td>
<td>0–6 Vol.-%</td>
<td>94–100 Vol.-%</td>
</tr>
<tr>
<td>Air in CO2</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>CO₂ in air</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>Air in H₂</td>
<td>0–3 Vol.-%</td>
<td>–</td>
</tr>
<tr>
<td>H₂ in air</td>
<td>0–1 Vol.-%</td>
<td>–</td>
</tr>
<tr>
<td>Air in He</td>
<td>0–3 Vol.-%</td>
<td>98–100 Vol.-%</td>
</tr>
<tr>
<td>He in air</td>
<td>0–2 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>Air in CO₂</td>
<td>–</td>
<td>50–100 Vol.-%</td>
</tr>
<tr>
<td>CO₂ in Ar</td>
<td>0–60 Vol.-%</td>
<td>–</td>
</tr>
<tr>
<td>Ar in H₂</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in Ar</td>
<td>0–1 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>Ar in He</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>He in Ar</td>
<td>0–1 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>Ar in N₂</td>
<td>0–6 Vol.-%</td>
<td>94–100 Vol.-%</td>
</tr>
<tr>
<td>N₂ in Ar</td>
<td>0–6 Vol.-%</td>
<td>94–100 Vol.-%</td>
</tr>
<tr>
<td>Ar in O₂</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>O₂ in Ar</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>CH₄ in H₂</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in CH₄</td>
<td>0–1 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>CH₄ in N₂</td>
<td>0–6 Vol.-%</td>
<td>94–100 Vol.-%</td>
</tr>
<tr>
<td>N₂ in CH₄</td>
<td>0–6 Vol.-%</td>
<td>94–100 Vol.-%</td>
</tr>
<tr>
<td>CO in H₂</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in CO</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>CO₂ in H₂</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in CO₂</td>
<td>0–1 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>CO₂ in N₂</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>N₂ in CO₂</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in N₂</td>
<td>0–1 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>N₂ in H₂</td>
<td>0–3 Vol.-%</td>
<td>99–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in NH₃</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>NH₃ in H₂</td>
<td>0–10 Vol.-%</td>
<td>90–100 Vol.-%</td>
</tr>
<tr>
<td>He in N₂</td>
<td>0–2 Vol.-%</td>
<td>97–100 Vol.-%</td>
</tr>
<tr>
<td>N₂ in He</td>
<td>0–3 Vol.-%</td>
<td>98–100 Vol.-%</td>
</tr>
</tbody>
</table>

Measurement Ranges for Monitoring Hydrogen-Cooled Turbo Generators

<table>
<thead>
<tr>
<th>Sample Component and Associated Gas</th>
<th>Measurement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂ in air or Ar in air</td>
<td>0–100 Vol.-%</td>
</tr>
<tr>
<td>H₂ in CO₂ or H₂ in Ar</td>
<td>100–0 Vol.-%</td>
</tr>
<tr>
<td>H₂ in air</td>
<td>100–80 Vol.-%</td>
</tr>
</tbody>
</table>

Other sample components on request.
Measurement Range Limits
Ranges are freely adjustable within the range limits given 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 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 (2σ) ≤ 0.5 % of smallest measurement range span at electronic T90 time = 0 sec
- Detection Limit (4σ) ≤ 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
  ≤ 0.2 % of span per 10 hPa for the smallest possible ranges given; for larger spans the effect is correspondingly lower. Pressure sensor working range: pₐₙ₉ = 600–1250 hPa

- 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
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
$T_{90}$ 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; Sensor: Gold, silicon oxi-nitride; Seal: FFKM75 (Perfluoro rubber)

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.

Inlet Pressure
$p_i = 2$–100 hPa

Lower pressures require a sample gas pump and higher pressures require a pressure reducer.

Outlet Pressure
Atmospheric pressure

Flow Rate
Normally 10–90 l/h, minimum 1 l/h

Pressure Drop
$< 2$ hPa at 60 l/h $N_2$

Corrosive Gases
Consultation with ABB Analytical is required if the sample gas contains $Cl_2$, $HCl$, $HF$, $SO_2$, $NH_3$, $H_2S$ or other corrosive components.

Flammable Gases
The analyzer is suitable for measuring flammable gases in general purpose environment. Please observe the special conditions (see operator’s manual).

Gas Connections
see page 17
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
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 (2σ)
≤ 0.2 % of the measurement range at electronic T90 time
(static/dynamic) = 5/0 sec

Detection Limit (4σ)
≤ 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

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.

Moisture Content
H₂O dew point ≥ 2 °C
The oxygen sensor should not be used with dry sample gas.

Inlet Pressure
pₑ = 2–500 hPa

Outlet Pressure
Atmospheric pressure

Flow Rate
20–100 l/h

Associated Gas
The oxygen sensor should not be used if the associated gas contains the following components: H₂S, chlorine or fluorine compounds, heavy metals, aerosols, mercaptane, base components.
Integral Gas Feed

**Fine Filtration**

Version
- Disposable filter with Borosilicate glass microfiber filter element

Retention Rate
- 99.99 % for particles > 0.1 µm

Materials in Contact with the Sample Medium
- Polyamide, borosilicate glass with PVDF binder

**Test Gas Supply**

Version
- 3/2-way solenoid valve

Power Consumption
- Approx. 3 W

Materials in Contact with the Sample Medium
- PVDF, FPM

**Gas Feed**

Version
- Magnetic piston pump

Feed Rate
- Max. of 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

**Flow Monitor**

Version
- Miniature flow sensor

Materials in Contact with the Sample Medium
- Al₂O₃, silicon, gold, GFK

**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.

Gas Inlet Conditions

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.
General Data

**Housing**

Version
19-inch housing (3 height units) for rack-mounting

Protection Type
IP20 per EN 60529

Materials
- Housing: Galvanized sheet steel, outer surfaces varnished;
- analyzer rear panel: aluminum, PVC-C;
- keypad sheet: Polyester

Color
Light gray (RAL 7035), basalt gray (RAL 7012)

Weight
approx. 7–15 kg

Dimensions
See dimensional drawing on page 13

**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

**Limit Value Monitoring**

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

**Pressure Sensor**

Use
Standard for Uras26 and Caldos27, option for Magnos206

Materials in Contact with the Sample Medium
Silicon gel, plastics, FPM (Fluorocarbon rubber)

**Electromagnetic Compatibility**

Noise Immunity
Inspection severity: Industrial area, fulfills at least the rating “continuously monitored operation” to Table 2 of EN 61326.

Emitted Interference
Limit value class B for interference field strength and interference voltage is met.

**Electrical Safety**

Tested per EN 61010-1: 2001

Protection Class
I

Overload Category/Pollution Level
- Power supply: III / 2
- Signal inputs and outputs: III / 2

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

**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 beam 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.

**Ambient Conditions**

Ambient Temperature
- Operation: +5 to +45 °C
- Uras26 in combination with another analyzer: +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
100–240 V AC (− 15 %, + 10 %) 50–60 Hz (± 3 Hz)

Power Consumption
Max. 187 W

Connection
3-pin plug per EN 60320-1/C14; connection cable supplied, length 2 m
19-Inch Rack Housing (dimensions in mm)
Electrical Connections

Power Supply and Signal Lines

1 Power Supply Connection
(3-pin plug per EN 60320-1/C14; connection cable supplied, length 2 m)

I/O Modules (4 slots, assembly example):
2 Digital I/O Module
3 Analog Output Module
4 RS232/RS485 Module
5 Profibus Module (in preparation)
6 Ethernet-10/100BASE-T Interface (8-pin RJ45 plug)
7 Potential Compensation Connection (M5 internal thread)

Notes Regarding Conductor Section 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.

Analog Output Module

Analog Outputs (AO1, AO2)
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.
The output signal cannot be lower than 0 mA.

Electrical Connections
1 AO1+
2 AO1–
3 AO2+
4 AO2–
Design: 4-pin terminal strip for braided or solid conductors with a maximum section of 1 mm² (17 AWG). Observe the notes regarding conductor section (see above)!

RS232/RS485 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
Electrical Connections

Digital I/O Module

Digital Inputs (DI1 to DI4)
Optocouplers with internal 24 VDC power supply. 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
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).

Digital input and output signals

<table>
<thead>
<tr>
<th>Signal</th>
<th>Standard assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error</td>
<td>Digital I/O Module</td>
</tr>
<tr>
<td>Maintenance request</td>
<td>1</td>
</tr>
<tr>
<td>Maintenance mode</td>
<td>2</td>
</tr>
<tr>
<td>Overall status</td>
<td>DO1</td>
</tr>
<tr>
<td>Start automatic calibration</td>
<td>DI1</td>
</tr>
<tr>
<td>Stop automatic calibration</td>
<td></td>
</tr>
<tr>
<td>Disable automatic calibration</td>
<td>DI2</td>
</tr>
<tr>
<td>Sample gas valve</td>
<td>DO4</td>
</tr>
<tr>
<td>Zero gas valve</td>
<td></td>
</tr>
<tr>
<td>Span gas valve</td>
<td></td>
</tr>
<tr>
<td>Pump on/off</td>
<td></td>
</tr>
<tr>
<td>Limit 1</td>
<td>DO2</td>
</tr>
<tr>
<td>Limit 2</td>
<td>DO3</td>
</tr>
<tr>
<td>Limit 3</td>
<td>DO1</td>
</tr>
<tr>
<td>Limit 4</td>
<td>DO2</td>
</tr>
<tr>
<td>Limit 5</td>
<td>DO3</td>
</tr>
<tr>
<td>Limit 6</td>
<td>DO4</td>
</tr>
<tr>
<td>Limit 7</td>
<td></td>
</tr>
<tr>
<td>Limit 8</td>
<td></td>
</tr>
<tr>
<td>Limit 9</td>
<td></td>
</tr>
<tr>
<td>Limit 10</td>
<td></td>
</tr>
<tr>
<td>Bus DI 1–8</td>
<td></td>
</tr>
<tr>
<td>External failure</td>
<td>DI3</td>
</tr>
<tr>
<td>External maintenance request</td>
<td>DI4</td>
</tr>
</tbody>
</table>

Electrical Connections
see connection diagram on the right
Design: 2x12-pin terminal strip for braided or solid conductors with a maximum section of 1 mm² (17 AWG). Observe the notes regarding conductor section (see page 14)!

Relays are shown in the unpowered state. The unpowered state is the failure mode.
Gas Connections

Analyzer Uras26

Version with Hose Connections

1 Sample Gas Inlet Gas Path 1 without “Integral Gas Feeding” option
2 Sample Gas Outlet Gas Path 1 connected to sample gas inlet of Caldos27 or Magnos206 if applicable
3 Sample Gas Outlet Integral Gas Feeding option, factory-connected to 1 Sample Gas Inlet Sample Cell 1
4 Sample Gas Inlet Integral Gas Feeding option, only with flow sensor (without solenoid valve)
5 Sample Gas Inlet Gas Path 2 for separate gas paths (for NOx measurement with converter connected upstream)
6 Sample Gas Outlet Gas Path 2 for separate gas paths
21 Sample Gas Inlet Integral Gas Feeding option, with solenoid valve, pump, filter, capillary and flow sensor in gas path 1
22 Test Gas Inlet at solenoid valve with “Integral Gas Feeding” option

Design: Hose nozzles for hoses with 4 mm inner diameter

Note: In the version with hose connections, pressure sensor (standard) and O2 sensor (option) are connected internally as follows: downstream the sample cell 1 outlet for one sample cell or for separate gas paths, downstream the sample cell 2 outlet for two sample cells in series.

Version with Pipe Connections

6 Pressure Sensor
11 Sample Gas Inlet
12 Sample Gas Outlet for one sample cell connected to sample gas inlet of Caldos27 or Magnos206 if applicable
13 Sample Gas Outlet for two sample cells in series

Design: 1/8 NPT internal threads for commercially available adapters, e.g. Swagelok®

Note: In the version with pipe connections, O2 sensor, “Integral Gas Feeding” option and version with two separate gas paths cannot be provided.
Gas Connections

Analyzer Magnos206

1 Sample Gas Inlet  Direct Connection
2 Sample Gas Outlet  Direct Connection
Design: 1/8 NPT internal threads for commercially available adapters, e.g. Swagelok®
3 Sample Gas Outlet  Integral Gas Feeding option
4 Sample Gas Inlet  Integral Gas Feeding option, only with flow sensor (without solenoid valve)
6 Pressure Sensor  option
21 Sample Gas Inlet  Integral Gas Feeding option, with solenoid valve, pump, filter, capillary and flow sensor
22 Test Gas Inlet  at solenoid valve with “Integral Gas Feeding” option
Design: Hose nozzles for hoses with 4 mm inner diameter

Analyzer Caldos27

1 Sample Gas Inlet
2 Sample Gas Outlet
Design: 1/8 NPT internal threads for commercially available adapters, e.g. Swagelok®
3 Sample Gas Outlet  Integral Gas Feeding option
4 Sample Gas Inlet  Integral Gas Feeding option, only with flow sensor (without solenoid valve)
6 Pressure Sensor  option
21 Sample Gas Inlet  Integral Gas Feeding option, with solenoid valve, pump, filter, capillary and flow sensor
22 Test Gas Inlet  at solenoid valve with “Integral Gas Feeding” option
Design: Hose nozzles for hoses with 4 mm inner diameter
Certifications

CE Declaration of Conformity

The EL3000 Series gas analyzers satisfy the provisions of the following European directives:
73/23/EC (Low Voltage Directive)
89/336/EC (EMC Directive)

Compliance with the provisions of directive 73/23/EC is evidenced by full compliance with European standard:
EN 61010-1:2001

Compliance with the provisions of directive 89/336/EC is evidenced by full compliance with European standards:

Approval for USA and Canada – CSA
