



Oxygen Analyser BA 6000 O2

The BA 6000 - O₂ gas analyser uses the paramagnetic alternating pressure method and is used to measure oxygen in gas mixtures. The analyser may only be used in non-explosive areas.

Four programmable measuring ranges, all measuring ranges linear, including with suppressed zero point

Electrically isolated measurement output 0/2/4 to 20 mA (including inverted), automatic or manual measuring range switchover option

Menu-guided control for ease of use

Fast response time

Low long-term drift

External pressure sensor input

Programmable automatic measuring range adjustment

Operation based on NAMIR

Monitoring sample and/or reference gas (optional)

RS 485 serial port

Various smallest ranges (0.5 %, 2.0 % or 5.0 % O₂)



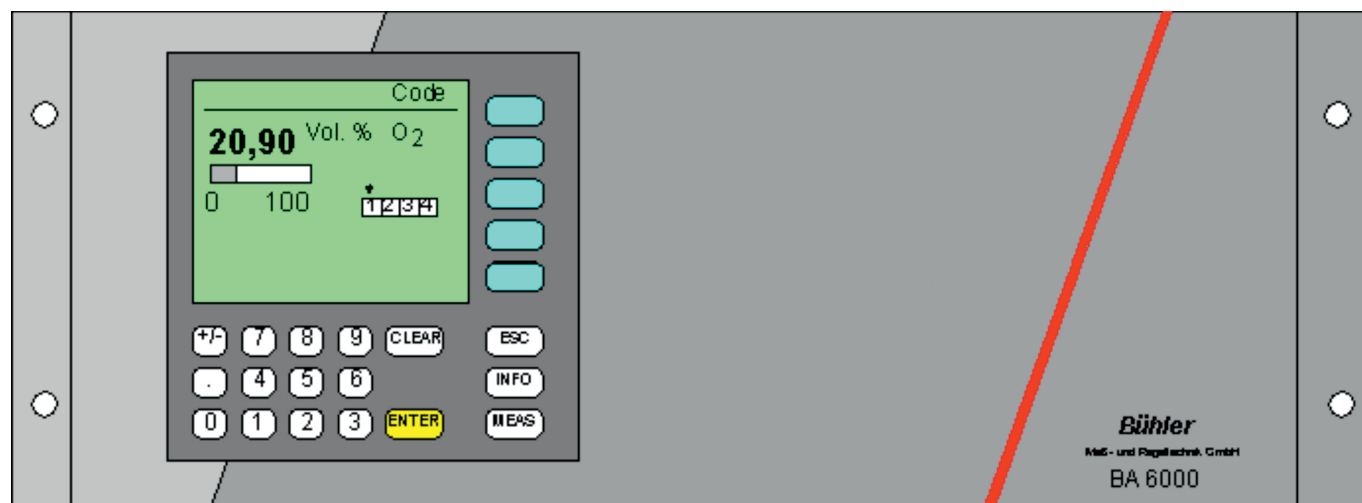
Design and Features

Housing

- 19" rack, 4 HE for installation in swing frames
- 19" rack, 4 HE for installation in cabinets, with or without telescopic rails
- Front panel can be swivelled down (laptop connection)
- Internal pressure sensor for correcting sample gas pressure fluctuations
- Internal gas paths: FPM (Viton) tube or titanium pipe
- Measuring chamber (with or without compensation path under flow) made from stainless steel or tantalum for highly corrosive sample gases. (such as HCL, CL₂, SO₂, SO₃, etc.)
- Gas connections for sample gas inlet and outlet as well as

Display and control panel

- large LCD panel simultaneously displays:
 - Measurement (digital and analog display)
 - Status line
 - Measuring ranges
- LCD panel contract adjustable in menu
- permanent LED backlight
- wipe-clean membrane keyboard with five soft keys
- menu-guided operation for parametrisation, test function and adjustment
- Plain text help
- graphic display of concentration gradient; programmable time intervals



Inputs/outputs

- six programmable binary inputs for e.g. measuring range changeover
- six programmable relay outputs for e.g. failure, maintenance requests, maintenance switch, limit alarm, external solenoid valves
- two analog outputs configurable to e.g. cross-sensitivity correction, external pressure transmitter
- Optional expansion, eight each additional binary inputs and relay outputs for automatic adjustment with max. four test gases

Port

- RS 485 serial

Chart of reference gases

Measuring range	Recommended reference gas	Reference gas connection pressure	Note
0 to ... Vol.% O ₂	N ₂	2 to 4 above sample gas pressure (max. 5 bar absolute)	The flow of the reference gas automatically adjusts to 5 to 10 ml/min (up to 20 ml/min for compensation path under flow).
Up to 100 Vol.% O ₂ (suppressed zero point with measuring range value 100 Vol.% O ₂)	O ₂		
About 21 % O ₂ (suppressed zero point with 21 Vol.% O ₂ within the span)	Air	0.1 bar against sample gas pressure, which can fluctuate max. ± 50 mbar around the air pressure	

Function

Unlike almost all other gases, oxygen is paramagnetic. This the BA 6000 - O₂ analyser uses this attribute as measuring effect.

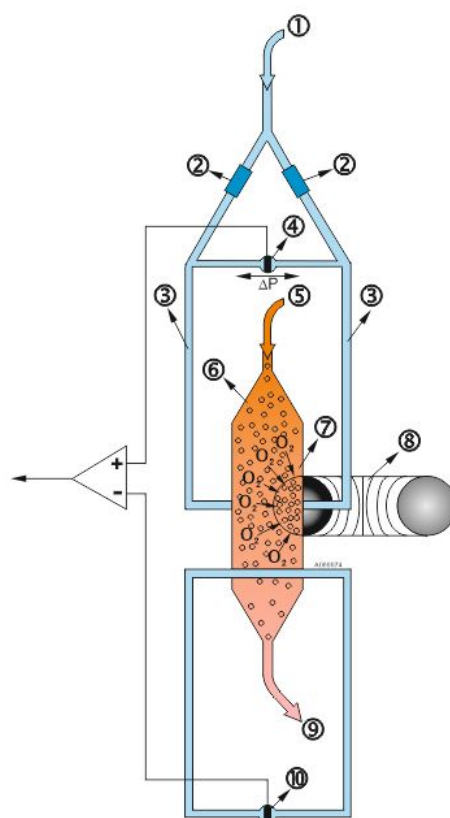
Due to their paramagnetism, oxygen molecules are moved toward the higher field intensity in an inhomogeneous magnetic field. When mixing two gases with different oxygen content in a magnetic field, a pressure difference arises between them.

On the BA 6000 - O₂, one gas (1) is a reference gas (N₂, O₂ or air), the other the sample gas (5). The reference gas enters the measuring chamber (6) through two channels (3). One of these reference streams encounters the sample gas around the pulsing magnetic field (7). Since the channels are connected, the pressure, which is proportional to the oxygen content, causes a flow which a microflow sensor (4) converts into an electric signal. The microflow sensor consists of two nickel grids which are heated to 120 °C, which together with two additional legs forms a Wheatstone bridge. The pulsing flow causes a change in resistance in the Ni grids of the microflow sensors. This causes bridge detuning which varies by the oxygen concentration of the sample gas.

Since the microflow sensor is inside the reference gas stream, the measurement is not affected by thermal conductivity, the specific heat or the internal friction of the sample gas. Additionally, this achieves good corrosion protection, as the microflow sensor is not directly exposed to the sample gas. By using a magnetic field with variable flow rate (8), the microflow sensor does not detect the basic flow, so that the measurement is not affected by the position of the measuring chamber. The measuring chamber with direct stream has a small volume, and the microflow sensor has a low lag. The BA 6000 - O₂ therefore has a very fast response time.

Vibration is common at the measuring site. These may distort the measurement signal (static). An additional microflow sensor (10) without flow was therefore built in as a vibration transducer. Its signal, as the compensation signal, is interconnected with the measurement signal.

If the average density of the sample gas deviates more than 50 % from the density of the reference gas in an application, the compensation microflow sensor (10), like the measurement microflow sensor (4), will also receive reference gas.



- 1 Reference gas inlet
- 2 Throttle
- 3 Reference channels
- 4 Microflow sensor for measurement signal
- 5 Sample gas input
- 6 Measuring chamber
- 7 Paramagnetic measurement effect
- 8 Solenoids with alternating flow rate
- 9 Measurement and reference gas output
- 10 Microflow sensor in the compensation system (no flow)

Technical Data

BA 6000 O₂ Technical Data

Measuring ranges	4, internal and external changeover; also automatic measuring range changeover possible
Measuring ranges	
Smallest possible	0.5 Vol.%, 2 Vol.% or 5 Vol.% O ₂
Largest possible	100 Vol.% O ₂
Measuring ranges with suppressed zero point	any zero point can be implemented within 0 to 100 Vol.% when using a suitable reference gas (see chart)
Characteristic	linear (based on principle)
Control panel	LCD with LED backlight and adjustable contrast, soft keys, number keypad and function keys
Measurement display	4 ½ character, resolution varies by the measuring range selected, decimal places selection
EMC	
Immunity	as required by standard NAMUR NE21 (05/93); CE mark EN 50081-1, EN 50082-2 and EN 61010
Position of use	Front panel vertical
Dimensions (H x W x D)	19", 4 HE = 177 x 483 x 476 mm
Weight	approx. 20 kg
Auxiliary energy	
Electric supply	AC 100 to 120 V, 48 to 63 Hz (rated range 90 V to 132 V) AC 200 to 240 V, 48 to 63 Hz (rated range 180 V to 264 V)
Power input	approx. 35 VA
Sample gas input condition	
Pressure	0.5 to 1.5 bar absolute for devices with hoses, 0.5 to 3 bar absolute for devices with pipes
Pressure flow	20 to 60 L/h (0.3 to 1 L/min)
Temperature	0 to 50 °C
Humidity	< 90% RH ¹⁾
Time behaviour	
Heat-up time	at room temperature: < 30 min ²⁾
Display lag (T ₉₀ time)	min. 1.5 to 3.5 s depending on version
Damping	0 to 100 s, programmable (electric time constant)
Time lag	approx. 0.5 to 2.5 s depending on version (washout time of the gas path inside the device at 1 L/min.)
Time for internal signal processing	< 1 s
Measuring performance	
Static	< 0.5% from smallest possible measuring range per type plate (electric time constant 1 s, range 2 δ)
Zero point	< 0.5% / 3 months from smallest possible measuring range per type plate
Measurement value drift	< 0.5% / 3 months from respective measuring range
Factors³⁾	
Ambient temperature	< 0.5 % / 10 K < 1 % at 0.5 Vol.% O ₂ span, based on the smallest possible measuring range per type plate
Sample gas pressure	with pressure compensation off: < 2 % from measuring range at 1 % pressure change; with pressure compensation on: < 0.2 % from measuring range at 1 % pressure change
Carrier gases	Zero drift per paramagnetic or diamagnetic deviation of the carrier gas (see application note AD 55 0012)
Sample gas flow rate	< 1% from smallest possible measuring range per type plate at a flow variation of 0.1 L/min within the permissible flow range
Auxiliary energy	< 0.1% from output signal range at a rated voltage of ± 10 %
Electric inputs and outputs	
Analog output	0 / 2 / 4 to 20 mA, potential-free, load ≤ 750 Ω
Binary outputs	6 relay outputs with change-over contacts, programmable e.g. to measuring range identification; rating: AC/DC 24V/1A potential-free

BA 6000 O₂ Technical Data

Analog inputs	2, configured for 0 / 2 / 4 to 20 mA for external pressure sensor and carrier gas influence (cross-gas correction)
Binary inputs	6, configured for 24 V, potential-free, programmable e.g. to measuring range changeover
Port	RS 485 serial
Options	Add-on electronics with 8 each additional binary inputs and relay outputs, e.g. to trigger automatic adjustment

Permissible climatic conditions

Ambient temperature	- 30 to + 70 °C during storage and transport, + 5 to + 45 °C during operation
Humidity	< 90% RH ¹⁾ annual average during storage and transport ⁴⁾
IP rating	IP 20 (EN 60529)

¹⁾ RH: relative humidity

²⁾ highest accuracy is reached after 2 hours

³⁾ based on sample gas pressure 1 bar absolute, 0.5 L/min sample gas flow and 25 °C ambient temperature