



Oxygen & Other Gases Measurement and Analysis

Protect processes, reduce costs and maintain quality

Oxygen & Binary Gas Measurement and Analysis

A range of quality process analyzers from experts in control instrumentation



Precise measurement of oxygen and other gases is critical for processes in many industries, ranging from the purity of industrial gases and protecting against leaks in glove boxes to monitoring flue gas for optimum combustion efficiency. The requirements of various applications are very different, therefore Michell offers a range of analyzers to ensure that you can always select the best technology for your application.

Why Choose Michell?

With an oxygen analyzer from Michell Instruments you get:

- The right measurement technology for your application - thermo-paramagnetic, MSRS, MIPS, air referenced Zirconia or galvanic electrochemical
- Control over your process for safety, quality and to meet legislation
- Low cost of ownership – the analyzers are designed for minimum maintenance
- Support from a worldwide network of service engineers and customer service teams from Michell offices in 9 countries and distributors in over 50 countries
- Other gases can be measured with our thermal conductivity and infrared sensors
- Confidence in a company that has been providing solutions in process control and measurement for over 40 years

Typical Applications

- Inerting reactors or vessels
- Argon, helium or nitrogen purity
- Natural gas and biogas monitoring
- Combustion control on boilers and incinerators
- Cylinder filling and bottling plants
- Hydrogen cooled electricity generators
- Marine inert gas generation
- Carbon dioxide purity in breweries
- Annealing furnaces

Customers

Michell's customer base for oxygen analyzers includes leading companies in industries ranging from industrial gas, chemical, power, compressed air and petrochemical.

Customization

We also work with many smaller enterprises that rely on our market expertise. Due to the high degree of customization available, we are able to meet their specific needs in many applications.

Oxygen & Binary Gas Measurement and Analysis

Industrial Applications



Pharmaceutical

Oxygen analyzers play an important role in the safe production of pharmaceuticals. Using powders and solvents in large quantities leads to significant risk of explosions. Removing oxygen prevents this risk so a blanket gas, typically nitrogen, is used to replace air in the process. Oxygen analyzers are then used to measure the purity of the blanket gas.

- Reactors
- Centrifuges
- Ambient monitoring
- Laboratory measurements



Power Generation

Coal or gas power stations burn fuel in oxygen to produce heat that is converted to energy. Combustion control analyzers allow this process to be more accurately controlled, reducing fuel usage and emissions. Some generators are cooled by hydrogen, which also needs to be monitored to ensure safe and efficient operation.

- Economize control
- H₂ & CO₂ measurement on generators
- Boiler control



Petrochemical

Nitrogen is also used as a blanketing gas in the petrochemical industry. Storage tanks, for example, contain highly flammable vapour above the liquid level that could easily explode if exposed to a heat source or static electricity. In order to prevent this from happening, the oxygen level must be maintained to below the Lower Explosive Limit (LEL).

- Storage tanks
- Vapor recovery
- N₂ generators



Metallurgy

Metallurgical processes rely on controlled atmospheres to have protective or reactive effects on the metals being treated. Monitoring oxygen levels increases efficiency in the combustion control of a furnace and indicates the oxidising potential of a controlled atmosphere.

- Annealing, sintering and brazing furnaces
- Boilers and process heaters
- Bell ovens

Sensor Technologies

A range of sensor technologies unique to each instrument, maximizing measurement ranges and applications

Thermo-Paramagnetic

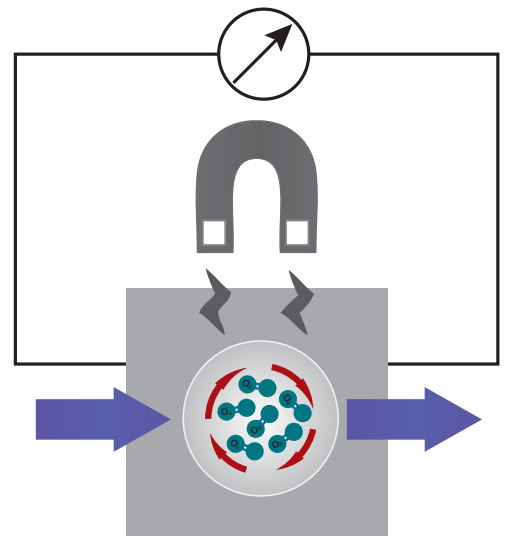
Michell's thermo-paramagnetic sensor uses a combination of paramagnetic and thermal conductivity techniques to accurately measure the oxygen content within a process gas.

Oxygen is a paramagnetic gas, which means that it is attracted to a magnetic field. It is this property that can be exploited to help determine the level of oxygen in many background gases. The magnetic susceptibility of oxygen decreases inversely with its temperature. Michell's thermo-paramagnetic analyzer uses a temperature-controlled measuring chamber to create a flow of the process gas (known as a 'magnetic wind') between a pair of thermistors. This 'magnetic wind' alters the equilibrium temperature between the thermistors. The resulting change in the electrical resistance produces a signal that is proportional to the oxygen concentration in the sample gas.

Advantages of Thermo-Paramagnetic:

- The thermo-paramagnetic sensor has no moving parts or consumable items which means lower cost of ownership
- Units are calibrated specifically to maximize the accuracy at the required measurement range
- Resistant to corrosive sample gases
- Stable measurements
- Good balance of price and performance
- Compact design (especially for hazardous areas)

Instrument: XTP601



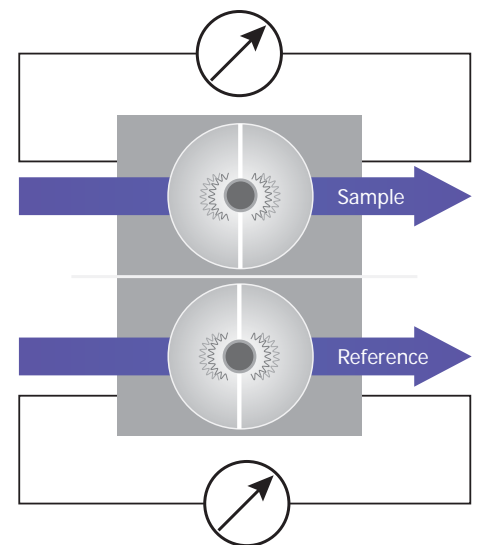
Thermal Conductivity

Thermal conductivity (TC) is a property of all gases. This can be exploited as each gas has a different TC value and is used to determine the level of one gas in a binary or pseudo-binary mix. Air is a good example of a pseudo binary mix as it has a fixed proportion of oxygen and nitrogen (both with very similar thermal conductivities).

Advantages of Thermal Conductivity:

- Zero point stability of 0.5% of span per month means less frequent calibrations
- No moving parts or consumable items
- Stable and accurate measurement from symmetrical cell design
- Cost-effective measurement, especially in hazardous areas
- Flexible technology allows many target gas measurements

Instrument: XTC601



Sensor Technologies

A range of sensor technologies unique to each instrument, maximizing measurement ranges and applications

Infrared Sensor

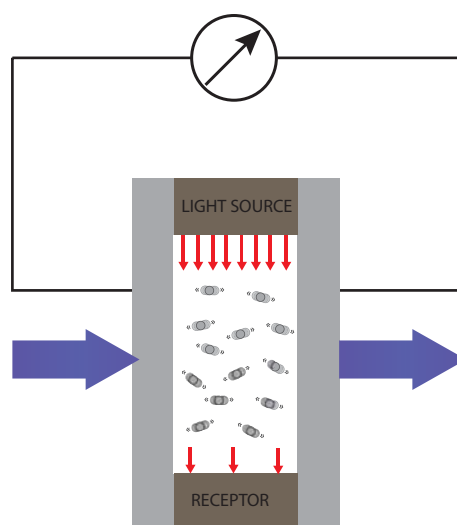
The two major gases in our atmosphere nitrogen (circa 78%) and oxygen (circa 21%) are diatomic molecules and do not absorb infra-red radiation. Most of the other gases have asymmetric or complex bonds and do absorb infra-red radiation at specific wavelengths as a light source is passed through them.

At the core of an IR analyzer is a sample tube with an infra-red light source at one end and a detector at the other. Filters are employed to select the specific wavelength and lenses to focus the light. The difference in the level of light that reaches the detector is proportional to the concentration of the target gas to be measured.

Advantages of Infrared:

- Non-depleting and should last the life of the instrument
- Does not alter or consume the sample
- Simple to use and calibrate
- Can be calibrated (range and background) for the particular application

Instruments: XGA301



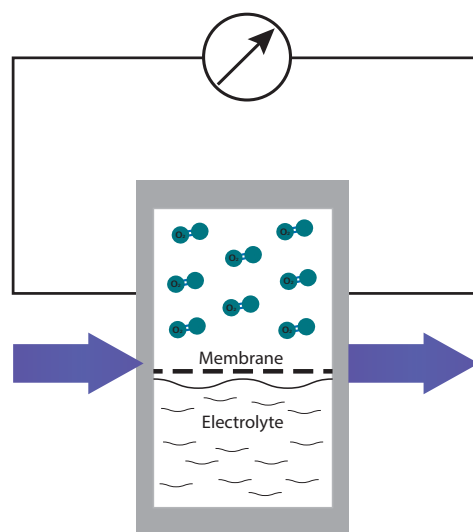
Galvanic Electrochemical Sensor

Galvanic sensors generally consist of four elements: a membrane, electrolyte, a lead anode and a cathode. As oxygen comes into contact with the sensor it pushes through the membrane and reacts with the electrolyte, generating a current. The more O_2 , the stronger the signal and the quicker the sensor is consumed, much like a regular battery.

Advantages of Galvanic Electrochemical:

- Cost-effective
- Small in size with low power consumption
- Simple to use and calibrate, in most cases with air
- Can measure trace oxygen in the presence of hydrocarbons or in flammable gases such as hydrogen

Instruments: XGA301



Zirconium Oxide Based Sensors

Zirconium oxide sensors are based on the principle of a solid-state electrochemical cell. A layer of yttria-stabilized zirconium oxide is heated to between +600°C and +700°C, allowing oxygen ions to pass through it from a higher concentration to a lower concentration. The movement of ions produces an electromotive force which is used to determine the oxygen concentration. The greater the differential of oxygen on either side, the higher the voltage produced, allowing measurements from 100% to less than one part per million.

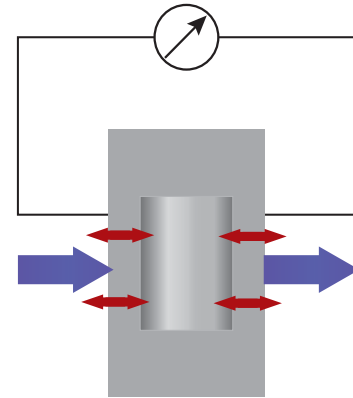
Metallic Sealed Reference Sensor (MSRS)

Michell's zirconium oxide sensor contains a metallic sealed reference which eliminates the need for reference air. The sensor technology was developed to measure oxygen levels in gas in extreme conditions, so is robust enough to withstand extreme heat and highly corrosive gases. These properties combined with careful packaging make the MSRS very effective for high-temperature applications (up to +1300°C) such as flue-gas analysis, which helps save fuel and reduce emissions.

Advantages of MSRS:

- Capable of measuring oxygen in a wide variety of applications
- Resistant to pollution (in stack gases)
- Does not get 'sleepy' in clean gases
- The measurement is stable, especially when compared to electrochemical sensors
- Only one calibration gas is required

Instruments: XZR400 Series and XZR500



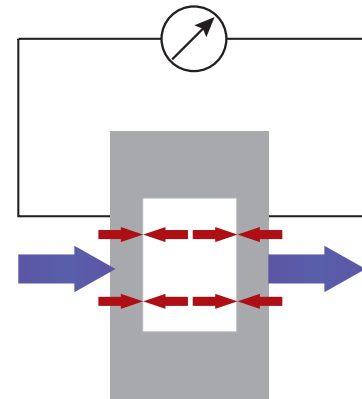
Micro Ion Pump Sensor (MIPS)

The MIPS offers a compact, cost-effective oxygen sensor for sampling in temperatures up to +400°C. It has a different approach to our MSRS in that it continuously 'pumps' oxygen ions from the sample around the sensor into a sealed chamber and back out again. The cycle time determines the amount of oxygen present. Again, it uses the properties of zirconium oxide heated to +700°C as the basis of its measuring technique.

Advantages of Micro Ion Pump Sensor:

- Cost-effective transmitter that is simple to use
- Semi-automatic calibration feature (using air or a known gas)
- Short warm-up time compared to other zirconia sensors

Instrument: XZR200



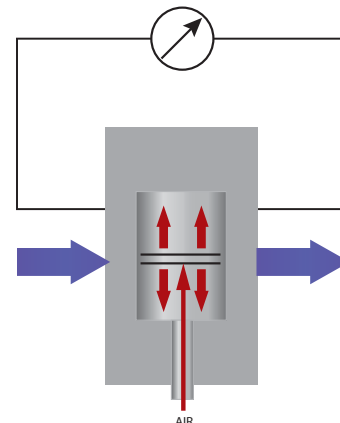
Air Referenced Zirconia

The majority of Zirconia sensors use ambient or compressed air as a reference, but function similar to our MSRS and MIPS cells. It is ideal for laboratory and clean industrial applications.

Advantages of Air Reference Zirconia:

- Fast response
- Capable of measuring oxygen in a wide variety of applications
- Cost-effective
- Easy to calibrate

Instruments: XGA301



Sample Systems

The majority of oxygen analyzers will require some form of sample gas conditioning prior to a measurement being made. Michell Instruments can supply standard or customized sample handling solutions to ensure optimum performance of the analyzer and minimum cost of ownership.



Basic PS601 with particle filter, pressure regulator, flow meter and pressure gauge with sample and calibration gas inlets all mounted on an open panel.

Applications:

Blanketing processes with a positive pressure or O₂/N₂ generators.



PS601 as left, with the addition of a flow alarm and a bypass leg, to allow increased flow of gas to reduce response time. The panel also has junction boxes fitted so the analyzer does not need to be opened on installation.

Applications:

Ideal for monitoring processes for safety (increased oxygen from a leak) or storage tanks.



PS601 shown with cooling coil, liquid dump, coalescing filter with bypass leg, sample flow meter and educator to draw the sample through the system. The whole panel is mounted in a stainless steel enclosure with thermostatically controlled heating for outdoor installation.

Applications:

Biogas or Bio-methane monitoring or other processes that are saturated.



PS601 shown in enclosure with a glass window.

Applications:

Any application where it would be beneficial to be able to see the analyzer without opening the door, such as outdoors (very cold/hot or raining) or where there are water jets operating, like food processing plants.



Product Guide

601 Process Analyzers

Michell has developed a platform approach to process gas analyzers with the 601 series using one compact enclosure to allow ease of integration and the same common HMI to facilitate operator familiarity and ease of use.

XTP601 Oxygen Analyzer

Technology: Thermo-Paramagnetic

The XTP601 process oxygen analyzer can help to increase safety and enhance product quality. Utilizing thermo-paramagnetic technology, it is rugged, reliable and gives precise measurements of oxygen in process gases. Typical applications include oil tanker or reactor blanketing, process control, biogas monitoring and nitrogen generator quality.

- Ranges available: 0-1% up to 0-50% & 20-100% up to 90-100%
- Intrinsic error of better than 1% of span (0.2% O₂ in the suppressed zero ranges)
- Zero stability of better than 0.25% of span per month

XTC601 Binary Gas Analyzer

Technology: Thermal Conductivity

The XTC601 binary gas analyzer utilizes thermal conductivity technology to accurately measure one of the two gases present in the sample. The instrument is very stable which gives the user confidence in the measurement. This is important in safety applications such as CO₂/H₂ membrane monitoring. The analyzer can be supplied with a fixed or flowing reference.

- Accuracy of better than ±2% full scale
- Ranges 0-1% to 0-100% or 50-100% to 90-100%
- Multi-phase version for use with hydrogen cooled electricity generators

Common Features of the Series

- Suitable for use in ATEX, IECEx, TC TR Ex & cCSA_{US} certified Hazardous Areas
- No moving parts or consumables
- Touch-screen display allows calibration or adjustment without the need for a hot works permit
- Password protection, to stop unwanted tampering
- Optional light guide following NAMUR standard
- 2 off 4-20 mA outputs (one freely user-configurable)
- Weatherproof or EExd enclosures that are IP66 rated





Product Guide

XZR400 Series Trace Oxygen Analyzers



The XZR400 series detects trace oxygen in inert background gases. Designed for applications in industrial gas production, welding, laboratories and cylinder filling. The main application is monitoring for low level (<4 ppm) O₂ in nitrogen, argon, helium, carbon dioxide and other inert gases to verify their purity. The fast response of the MSRS enables users to respond quickly to leaks and prevent contamination in silicon wafer production. The very low sample gas requirements (1 to 3 NI/hr) of the XZR400 makes it ideal for measuring expensive gases such as krypton or xenon.

XZR400 Rack Mount

Technology: MSRS

XZR400 rack mount comes in a 3U high, 19" rack mount chassis and is supplied with 2 off 4-20 mA outputs and ModBus RS485 as standard. Now has the option of an Easidew fitted inside.



XZR400 Wall Mount

Technology: MSRS

XZR400 wall mount is primarily designed for cylinder filling or applications where the analyzer needs to be mounted as close to the process as possible.

XZR400 Bench Mount

Technology: MSRS

Transportable version with a carry handle and rubber feet for use in laboratories or processes where multiple sample points are required.

XZR400 Transportable

Technology: MSRS

Essentially this is an XZR400 wall mount in an aluminium flight case designed to be protected in transport when moving between sites.



Common Features of the Series

- Simple and easy operation through touch screen HMI
- Fast response time (<2 secs for sensor)
- High accuracy with built-in barometric pressure compensation
- Stable sensor with repeatability of $\pm 0.1\%$ of reading
- 4-20 mA output and digital communications available
- Alarm relays for concentration, flow, and general fault available
- Universal power supply



Product Guide



XZR200

Oxygen Analyzer

Technology: MIPS

The XZR200 is a cost-effective compact oxygen transmitter designed for use in packaged boilers and lower temperature combustion processes. Utilizing our MIPS technology allows for easy integration of this compact oxygen transmitter. Capable of being quickly calibrated with ambient air makes the XZR200 a simple unit to operate and provides low cost of ownership.

- +250°C or +400°C sample temperatures
- IP65 aluminium housing with stainless steel probe
- 4-20 mA & 0-10 V DC or RS232 can be selected
- 3.3 V DC heartbeat (Pin 5) for diagnostic purposes

XZR500

Combustion Control Analyzer

Technology: MSRS

The XZR500 oxygen analyzer is designed to determine the amount of excess air required for optimum combustion control. It uses Michell's Metallic Sealed Reference Sensor (MSRS) technology to measure levels of oxygen in harsh conditions such as boilers, incinerators and furnaces. Installation is made simple because the inter-connection between the control unit and the sensor head is supplied. The customer only needs to apply power to the control unit and extract the signals.

- Multiple probe material options for different applications
- No aspirator or reference air required for operation
- Reliable and repeatable measurements
- Simple to maintain, easy to calibrate
- Robust design



Product Guide



XGA301 Single Sensor Unit



XGA301 Dual Sensor Unit



XGA301 Triple Sensor Unit

XGA Series

Industrial Gas Analyzer

Technology: zirconia, galvanic electrochemical, infra-red or ceramic impedance

The XGA301 Industrial Gas Analyzer from Michell Instruments provides a convenient platform to measure oxygen, dew-point and other gases such as CO₂, CO and CH₄. Primarily designed for laboratory use, the XGA301 can be used in many industrial applications, such as welding gas or glove box monitoring.

- Variable speed pump (optional)
- Zirconia sensor cleaning facility which can be operated at any time during use
- Two fully-programmable alarms
- 2 x voltage outputs and 2 x 4–20 mA outputs
- Software package includes live graphing and Excel™ compatible data-logging
- Up to 3 sensors in one box
- Flying lead sensor available for O₂, H₂O, pressure or temperature

Michell Instruments operates in the following markets:

- Compressed Air Dryers
- Pharmaceutical
- Standards Laboratories and Metrology
- Semiconductors
- Natural Gas and Petrochemicals
- Industrial Gas Production (air separation)
- Power Generation

Other Product Ranges

Dew-Point Transmitters

Michell offers the widest range of dew-point sensors and transmitters on the market. From the industry standard Easidew 2-wire transmitter to the Easidew PRO I.S. for hazardous areas, all are supplied with sensors traceable to national standards.

Portable Instruments

Michell's range of easy-to-operate portable instruments provides fast, accurate and stable measurement of dew point, relative humidity and moisture concentration. They are designed to satisfy the most demanding industrial conditions, and are unique in the market for giving repeatedly fast response to low dew points.

Chilled Mirror Instruments

Chilled Mirror is a fundamental measuring technology offering the user exceptionally accurate, reliable and repeatable measurements from trace moisture to high humidity. Michell offers a range of instruments based on a robust sensor design that is equally suitable for installation in demanding process environments or for use as an accurate reference instrument in a National Standards Laboratory.

Process Analyzers

Michell's range of analyzers is specifically designed to provide reliable online measurement in process applications such as dedicated water and hydrocarbon dew-point determination in natural gas. Three sensing technologies are used: the Ceramic Impedance sensor for measurements in gas and liquid phase; Quartz Crystal Microbalance for trace moisture in process gases; Tunable Diode Laser Absorption Spectroscopy for moisture in natural gas and the Dark Spot Chilled Mirror for hydrocarbon dew-point.

Calibration Instruments

Michell has a wide offering of calibration equipment for the verification of trace moisture, dew point and relative humidity sensors. A modular concept means that Michell's engineers can build a customized calibration solution that meets your exact needs. Components may include air compressor and dryer; low range or high range humidity generator; simple sensor housing or environmentally controlled test chamber and finally, verification using a traceable Michell Chilled Mirror Hygrometer.

Relative Humidity Instruments

Michell's own RH sensing technology provides excellent resolution, long-term stability and speed of response. We offer a wide range of humidity and temperature measuring sensors and instruments, including relative humidity transmitters, humidity and temperature transmitters as well as handheld indicators. The humidity generator range includes the most stable humidity generator on the market.



Other Product Ranges

[Portable Instruments](#) | [Dew-Point Transmitters & Instruments](#) | [Process Analyzers](#)

[Calibration Instruments](#) | [Relative Humidity Instruments](#) | [Chilled Mirror Instruments](#)

Michell Instruments 48 Lancaster Way Business Park, Ely, Cambridgeshire, CB6 3NW

Tel: +44 (0) 1353 658000, Fax: +44 (0) 1353 658199, Email: uk.info@michell.com, Web: www.michell.com/uk

Michell Instruments adopts a continuous development programme which sometimes necessitates specification changes without notice.
Issue no: Oxygen Analyzers_97301_V4_UK_1216