



In-Line Oxygen Measurement Solutions

Delivering Tangible Results For Your Process

METTLER TOLEDO

METTLER TOLEDO

Commitment to Innovation and Quality

METTLER TOLEDO Group

Our organization specializes in providing precision instrument equipment and related services to industrial customers. In 2010, METTLER TOLEDO generated revenues of approx. US\$ 2 billion. The company's stock has been publicly traded on the New York Stock Exchange since 1997.

Worldwide presence

METTLER TOLEDO has a worldwide distributor network and a workforce of more than 11,000 employees. We support our customers in industry by providing comprehensive solutions for each step of their manufacturing processes – extending from receipt of materials throughout all manufacturing stages with in-line process measurement through to final packaging control, logistics and shipping.

METTLER TOLEDO instruments are used in research and development, manufacturing process control and for quality control. The pharmaceutical, biotech, chemical, food and beverage, and cosmetic industries are among the principal users.

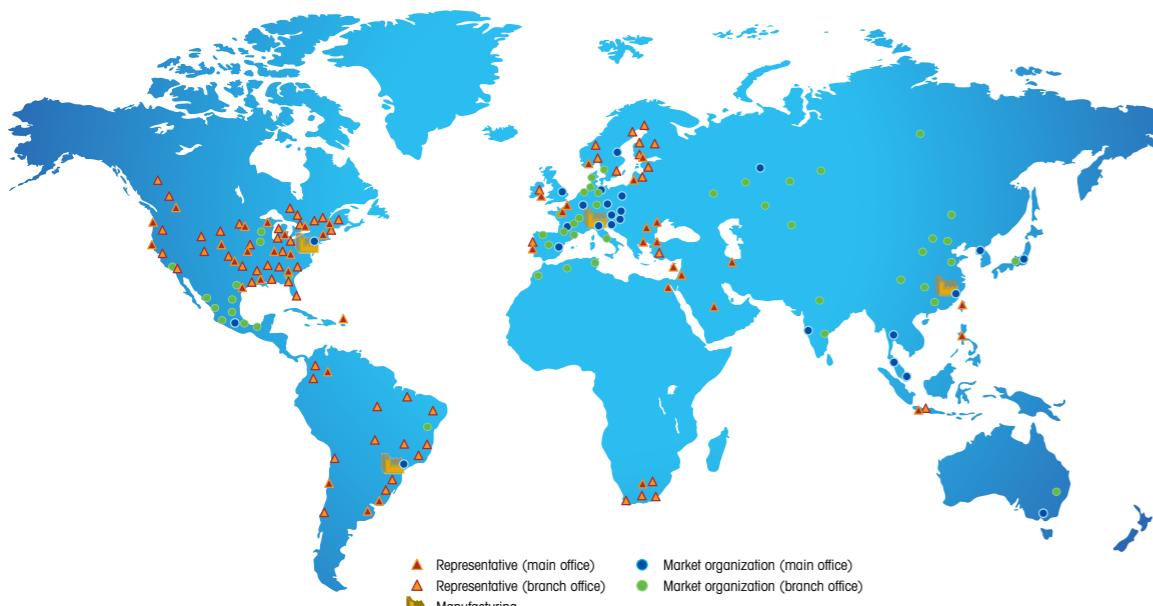
Innovation and quality

Our company enjoys an excellent reputation as an innovator demonstrated by R & D expenditures above the average for the industry. We make every effort to achieve the highest level of quality, by applying Total Quality Management at both product and process level, particu-

larly as part of the support we provide to our customers in complying with international guidelines.

Process Analytics Division

Within the METTLER TOLEDO Group, the Process Analytics Division concentrates on in-line analytical system solutions for industrial manufacturing processes. The Division consists of two business units, Ingold and Thornton, both internationally recognized leaders in their respective markets and technologies.



Ingold – Leading Process Analytics

Ingold has a long track record for innovative high-quality solutions for demanding process analytics applications.

Ingold was founded in 1948 by Dr. Werner Ingold. Today, Ingold provides the broadest range available of in-line analytical measurement solutions for industrial pro-

cesses in the biotechnology, pharmaceutical, chemical and beverage industries. Ingold offers systems for the measurement parameters pH/ORP, dissolved oxygen (DO),

dissolved CO₂, conductivity and turbidity. One of the latest developments is intelligent in-line sensor solutions for optimized maintenance management in gas O₂ applications.

Analytics for Oxygen Measurement

Controlling the level of gaseous oxygen in your process is key to ensuring the safety of the environment, people and your assets. Also, some processes require product oxidation to be minimized to improve product quality and improve plant manufacturing uptime.

Based on our long-standing field experience in analytical solutions for liquid measurement, we have developed systems for the measurement of oxygen that convince through:

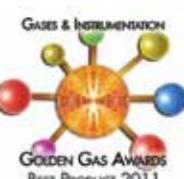
– **simplicity:** our systems are built to measure in-line, right there where you need to measure

– **low cost of ownership:** outstanding measurement performance without the drawback of heavy maintenance

– **ruggedness and long-term stability** for continuous use in the harshest environments.

With extensive know-how in process control and automation available throughout our team of application specialists worldwide, we can support you in:

- increasing process reliability,
- optimizing product yield,
- reducing maintenance costs and spare parts inventory.



Measure Oxygen In-Line

And Stop Worrying About the Weakest Link

Extractive measurement is challenging without reliable process gas conditioning. Amperometric sensors can be installed in-line – bypassing all sampling and conditioning issues.

Extractive measurements ...

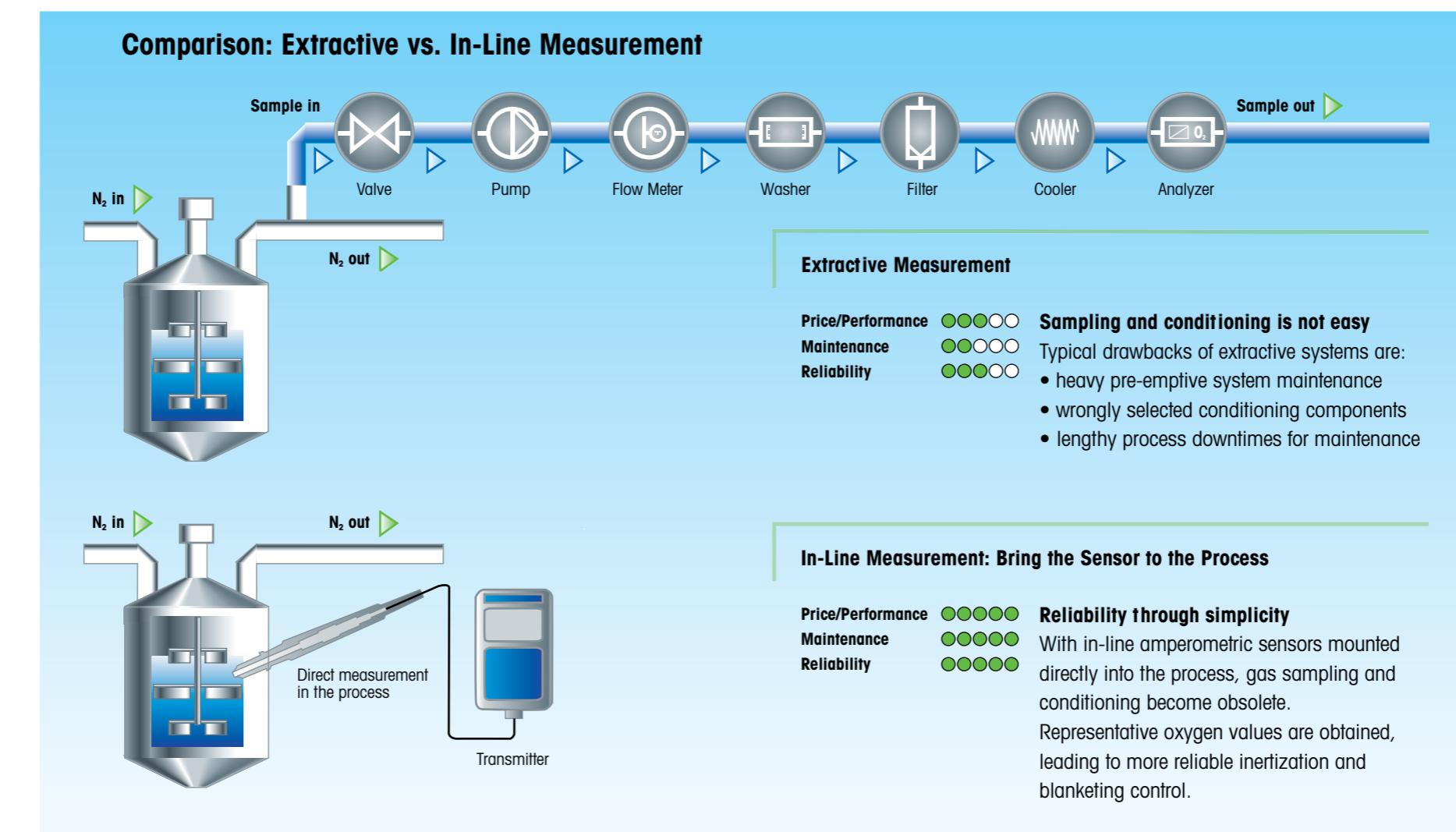
Your inertization and blanketing system can be only as good as the weakest link in the chain. In safety-critical processes, system dependability is a top priority.

For processes that require continuous monitoring, every unscheduled downtime directly impacts productivity.

... that come at a cost

Extractive analyzers are complex systems that operate satisfactorily only if each component performs well. Issues to be dealt with on a regular basis are:

- component servicing and repair
- line clogging caused by condensation or dust
- slow response time due to long sampling lines



10 Top 10 Reasons for going In-Line

1 No gas sampling or conditioning: less parts, less breakdowns

2 Measure directly in the gas stream: more representative measurements

3 No more cumbersome maintenance: simply use air for calibration

4 Fast payback: ROI typically less than 6 months

5 Humidity-insensitive sensor: wet gas streams welcome

6 Rugged system design: for harshest applications

7 Predictive maintenance: with the built-in ISM® technology

8 On-the-fly sensor exchange: with safe retractable housings

9 Simple system setup: approved for hazardous areas

10 Easy maintenance: no specialist know-how needed



Pay back in no time

Figures that speak volumes

There is no project funding without a profitability analysis. Get the facts and figures for replacing your extractive system and win your case.

Visit the METTLER TOLEDO competence center (www.mt.com/o2-gas) to download the Return On Investment (ROI) calculator.

In-line Inertization Control

No Sampling, Just Measuring

Containing the risk of explosion in processes with flammable solvents and potentially explosive products is a top priority in all industries. Amperometric oxygen sensors offer superior insight into process oxygen levels, and at low cost of ownership.

Unwanted oxygen

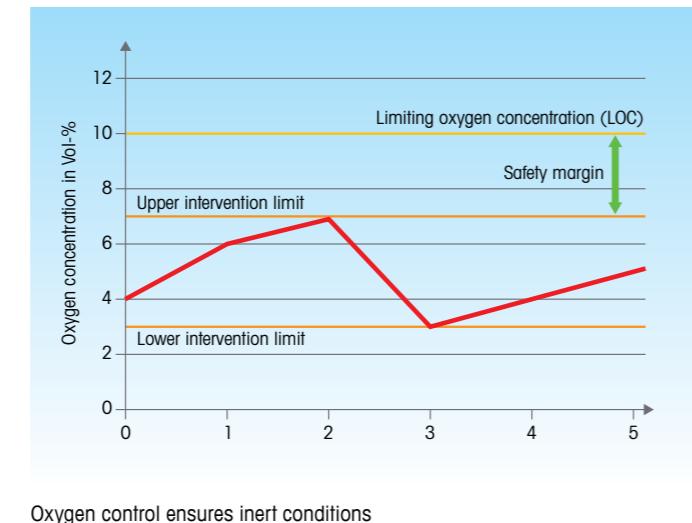
Inertization is all about avoiding potentially hazardous situations at any given time by keeping the oxygen level below the LOC (Limiting Oxygen Content), after deduction of a safety factor.

Typically, inert conditions are obtained by controlling flow and/or applying low overpressure to a tank. However, this method provides no information on oxygen concentration, knowledge of which is particularly important during tank filling and emptying. Further, a drop in ambient temperature can lead to tank "in-breathing" of air in order to avoid tank collapse.

Know what's inside

Therefore, oxygen measurement is added to the inertization system. In practical terms, the measurement location for representative oxygen values is highly critical, because homogenous gas conditions within the volume to be inerted may not be present, and oxygen "hot spots" may exist.

With extractive measurement, such "hot spots" may not be identifiable. Additionally, long sampling lines cause unnecessary measurement delay.



Examples of successful applications:

- Monitoring of centrifuges and separators
- Milling systems
- Crystallizers
- Glove box inerting
- Spray tower atmosphere control



The truth about oxygen in your process

In-line amperometric sensors are preferred to extractive systems because they allow the collection of oxygen readings from where explosion risk is present, without the problems of long sampling lines and unnecessarily long response times.

New approach to inertization

The availability of reliable amperometric solutions opens new ways for improved, fast inertization control. Closed-loop systems with in-line sensor, analyzer with integrated PID controller and upper/lower limit open the way for field-level autonomous inertization systems.

Benefits at a glance

- Measure oxygen where it matters: in the process
- 2-minute maintenance without process downtime
- No interference from many solvents
- Better process control through closed-loop oxygen control
- Digital technology for accurate signals and diagnostics

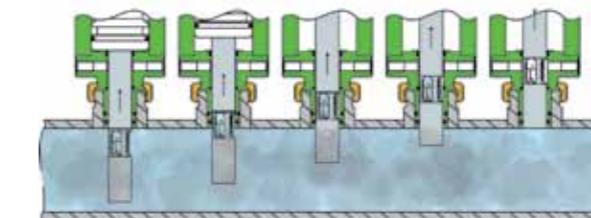
Moreover, oxygen measurement enables efficient management of inerting gas consumption.

When coupled with overpressure measurement, oxygen control delivers maximum safety of critical equipment.

ISM



FDA **IECEx**



With the patented Tri-Lock® system for InTrac® housings, the sensor can be safely removed from the process gas stream at any given time, without process interruption.

Blanketing and Storage Solutions

to Efficiently Protect Your Product

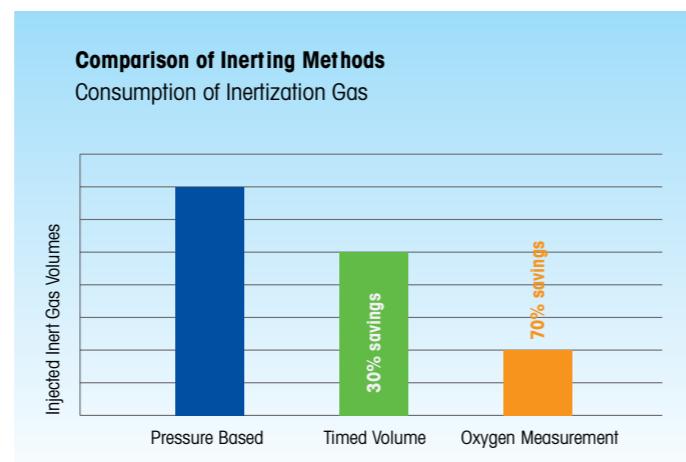
Controlling the inert gas blanket in a vessel by pressure and flow only, can lead to a "blackbox" situation: the effective oxygen concentration is assumed, but never known. Extra nitrogen is injected to ensure sufficient blanketing. Oxygen measurement inside the vessel can change that.

Less oxygen, more yield

If oxidation is detrimental to the product, blanketing of tanks during intermediate process steps and final storage is necessary.

The conventional approach to solving this task involves the measurement of headspace overpressure and/or the measurement of the inert gas flow. Relying only on these indirect parameters for blanketing control, however, has significant drawbacks:

- The presence of oxygen in the tank is not quantified. This can lead to inconsistent product output.
- To be on the safe side, extra inert gas is pumped in to ensure correct blanketing. This leads to higher inert gas consumption.
- If you are not measuring the oxygen concentration in inert gases acquired from different sources, it is not safe to mix them (don't assume "pure nitrogen" is pure).



On a typical inerting application, using in-line oxygen measurement can help you save up to 70% of inerting costs.

What Customers Say
In-Line Measurement Solutions • In-Line Measurement Solutions • In-Line Measurement Solutions

Savings that we did not expect
"Identifying potentials for cost improvements is part of our daily activities. With amperometric oxygen measurement systems we not only uncovered substantial savings opportunities on our inerting bill, we also improved our process by taking control of blanketing. That turned out to be a key quality driver for us."

Extract from an original customer testimonial.



Blanketing made efficient

With oxygen measurement in-line, inert gas costs are minimized. Because amperometric sensors are insensitive to dust, moisture and many interfering gases, they can be inserted in-line to deliver reliable, accurate values.

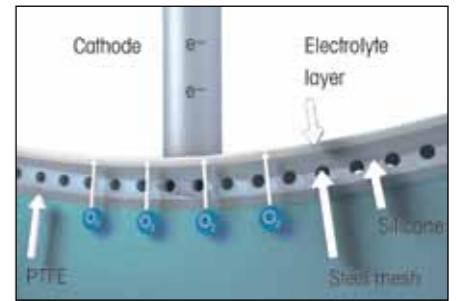
Benefits at a glance

- Direct in-line installation
- High operational availability thanks to the 2-minute maintenance concept
- Calibration in air only, for low cost of ownership
- Wide application coverage thanks to broad configuration options
- High dynamic range from 50 ppm to air

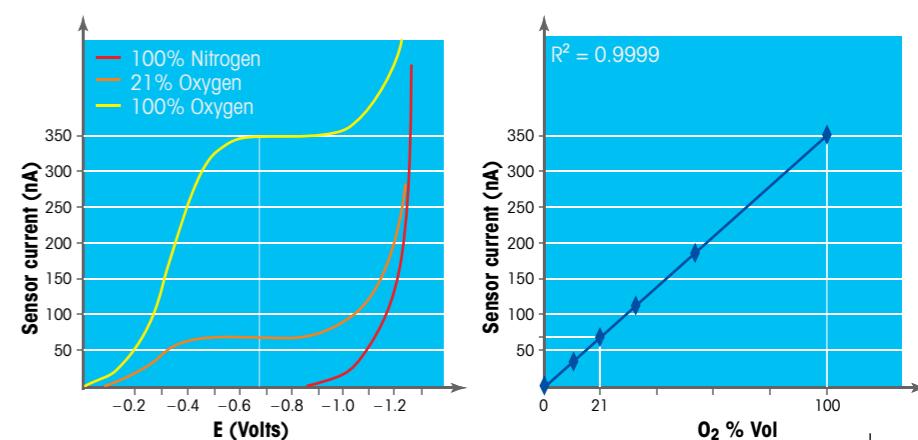


How it works

The oxygen sensor is separated from the sample gas by a membrane. This membrane is permeable to oxygen, but prevents detrimental components influencing the measurement. At the cathode, oxygen is electrochemically measured as a current to calculate the oxygen partial pressure.



The current output is proportional to the oxygen concentration (right). To obtain this fully linear relationship over the whole measurement range of 0 to 100 % oxygen, a polarization voltage of -675 mV is applied between anode and cathode (left).



Predictive Diagnostics and Maintenance Tools for Lifecycle Management

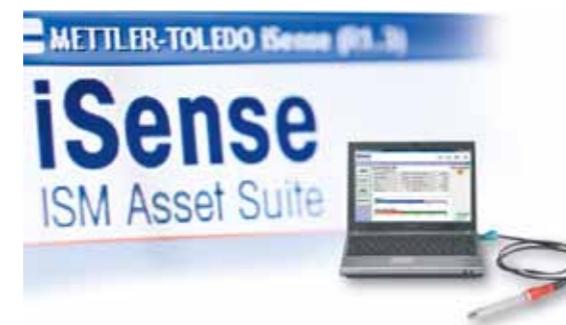
The unique iSense software allows verification and calibration of digital ISM oxygen sensors under laboratory conditions and management of the lifecycle of your installed base at reduced cost.

Easy connection to your computer

Simply connect an ISM sensor via a USB port to your computer and follow the instructions of the iSense software. No transmitter is necessary as an interface.

View the sensor performance in an instant

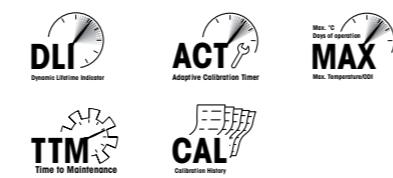
iSense enables you to evaluate in an instant the conditions of your ISM O₂ sensors. Information is provided for: last calibration date, date of adjustment, slope, zero point, date of manufacture, time of operation, max. temperature and condition of sensor wear.



iSense software enables verification and calibration of digital ISM oxygen sensors under laboratory conditions.

Intuitive calibration support

Enhance your productivity with the advanced iSense application for sensor calibration management. Analysis has shown that you may reduce drastically the duration and frequency of calibration resulting in cost savings of about 25 % with an ROI as short as 3 months!



Calibrate accurately and safely in a maintenance shop and just swap sensors at the installation point.

Service XXL

Service Offerings Covering our Products for End Users and Project Engineers

ServiceXXL embraces the complete range of service offerings provided by Ingold. We offer an attractive range of services to customers, from product guidance, over installation through to service contracts.

ServiceXXL – the high-level METTLER TOLEDO service concept

Our comprehensive sales consulting and technical services have established us as a competent partner for our customers everywhere around the world. Many global manufacturing companies rely on our competence and our long-standing experience.

Services offering

We offer attractive services to customers, ranging from product guidance, over installation through to service contracts.



We provide, amongst others, the following services:

• Distribution network

Based on several global production sites, with more than 40 market organizations and numerous international sales offices, METTLER TOLEDO maintains a worldwide distribution network and is always close to its customers.

• Plant engineering and system integration

Time is money. Our detailed technical product documentation together with local support during specification, installation and commissioning contribute to on-schedule project realization.



Oxygen Competence Center

The Latest News on Applications and Products



The screenshot shows the homepage of the 'Oxygen Measurement Competence Center'. The top navigation bar includes links for 'Log in / Registration', 'Other Countries / Areas', 'English', 'Deutsch', and a search bar. The main content area features a section titled 'Oxygen Measurement Competence Center' with a sub-section 'Oxygen gas measurement: Why should you measure it?'. It includes a brief description, a 'Download' link for a white paper, and a 'Watch' link for a video. Below this is a 'Warning: oxygen toxicity summary - & how-to video' section with a video thumbnail. Further down are sections for 'Short instructions to do your oxygen measurement', 'Why do you need a measurement of your oxygen gas analyzer?', 'Why do you need a measurement of your oxygen gas analyzer?', 'Typical, automatic gas-phase measurement systems: basic safety and maintenance: various sampling systems, oxygen sensors, etc.', 'Top 10 Reasons for Anoxia/Oxygen Deficiency: why should I gas measurement?', and 'Subscribe to our e-mail newsletter'. Each section contains a brief description and a 'Download' or 'Subscribe' link.

Visit us online to discover white papers, application notes, how-to videos and our list of upcoming webinars.

► www.mt.com/o2-gas

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Subject to technical changes
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