



ISM Sensors Optimize Process Development in Titanium Dioxide Production at Kronos

Titanium dioxide is the world's most widely used white pigment. For Kronos Titan, METTLER TOLEDO pH electrodes with their own diagnostic functions provide outstanding performance and a reduced maintenance requirement.

Global leader

Kronos Titan is one of the world's largest manufacturers of titanium dioxide, with gross sales of US\$ 1.1 billion in 2007. Two of six plants are located in Germany. In Nordenham, Kronos produces titanium dioxide using the sulfate process. In Leverkusen, along with the sulfate process, titanium dioxide is manufactured using the chloride process.

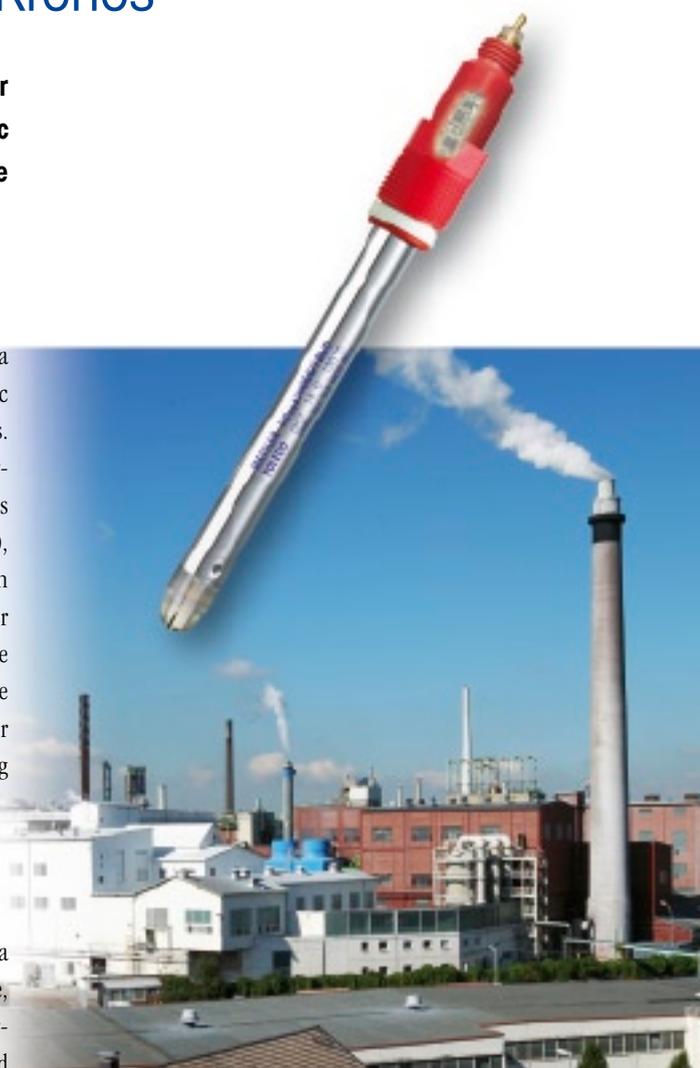
Titanium dioxide – the premier white pigment

All white commercial products that are not chlorine bleached or naturally white contain the pigment titanium dioxide, without which day-to-day life would be inconceivable. The advantages of titanium dioxide include its absolute non-toxicity and exceptional physiological compatibilities.

Kronos Titan in Leverkusen produces a variety of TiO₂ pigments with specific properties for a wide range of applications. The principal consumers are manufacturers of wall and emulsion paints, suppliers to the automobile industry (vehicle paint), the cosmetics industry (e.g. dentifrice, sun screen), food manufacturers and the paper and plastics industries. Titanium dioxide is not only the most widely used white pigment, it is also used as a brightener for colored paints because of its outstanding dispersion factor.

The technology center – production preliminaries

Kronos's R & D department operates a technology center in Leverkusen where, among other things, wet-chemical after-treatment methods are developed and





tested for production applications. Here, the actual TiO₂ pigment is provided with a treatment covering in order to specifically affect optical properties. The nature of this coating is governed by the subsequent area of application of the pigment. Kronos is continually developing the pigments and in the process takes into account specific customer requirements.

Precise pH measurement despite high contamination potential

Mr Sebastian Kühnel is the PLT operations engineer at the technology center, where

he uses METTLER TOLEDO weighing and pH measurement technology. Along with a PBA 430 weighbridge, an automatic dispensing system is used which is controlled by a Panther weighing terminal. pH measurement is done using three fully automatic EasyClean measuring, cleaning and calibration systems. The EasyClean 350 e system is controlled by a pH 2100 e transmitter and the EasyClean 400 systems by an M700 transmitter. All drive an InTrac 777 retractable housing that is moved automatically in the after-treatment process and can be withdrawn for cleaning or calibration/adjustment of the pH electrode.

The digital Intelligent Sensor Management (ISM) InPro 4260 i electrode is used as the sensor. Automation of the measurement points increases accuracy and reliability of the measurements and frees personnel from time-consuming maintenance. Thanks to its special reference system, the InPro 4260 i pH electrode is particularly well suited for use in pigment suspensions.

With electrodes using conventional ceramic junctions the tiny pores clog very quickly. This can result in unreliable measurements because contamination of the junction would cause undesirable diffusion potentials that would adversely affect the electrode potential and distort

the measurement. The METTLER TOLEDO InPro 4260 i pH electrode has a solid polymer electrode that eliminates the need for a ceramic junction. Instead, the reference system is in contact with the measuring medium by way of two open connections. Very fine particles that deposit there can be rinsed away again. This predisposes the InPro 4260 i for use in applications that would quickly contaminate other types of electrode.

Digital ISM sensors optimize process development

The use of sensors with the solid XEROLYT polymer electrolyte represents a clear improvement in pH measurement. For two years now Mr Kühnel has been taking advantage of the rewards of digital sensor technology. Of particular interest to him is the fact that ISM sensors feature diagnostic functions that make possible quick and simple analysis of the cause in the event of sensor malfunction. The M700 transmitter's spider diagram shows at a glance an overview of the status of the pH electrode using its most important performance parameters. The requirement for maintenance operations such as electrode cleaning, calibration or replacement can be easily determined.

The "Plug and Measure" function reduces the expenditure for maintenance and service of pH measurement. Further, ISM

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Cleaning and calibration system
EasyClean 400



pH electrode InPro 4260 i

ISM

sensors indicate process discrepancies that previously were difficult to identify. For example, they feature a temperature indicator that registers the maximum process temperature. Computation of the remaining life of a sensor by the integrated Dynamic Lifetime Indicator also provides information on unintended process conditions if the life of the electrode decreases at a faster-than-normal rate. The electrodes are evaluated, calibrated and adjusted by Kronos employees directly at a PC on which METTLER TOLEDO iSense

Asset Management Software is installed. It makes it possible to manage sensors and to record and evaluate all important data.

Benefits of the measurement technology used

- InPro 4260 i pH electrode with polymer electrolyte – outstanding measurement performance even in media with a high contamination potential.
- EasyClean cleaning and calibration systems – reduction of maintenance

overheads thanks to automation of the measurement point.

- ISM – diagnostic tools for process optimization.

Mr Künel will report in a second article on how the life span of pH electrodes used in TiO₂ production was extended from half a day to two weeks by using ISM technology.

Discover more at:

- ▶ www.mt.com/InPro4260i
- ▶ www.mt.com/ISM

Tricky Measurement Requirements in Monitoring Microalgae Growth

When one of France's major process engineering laboratories was faced with a measurement problem they asked METTLER TOLEDO for help. Our reliable, robust and low-maintenance systems provided the solution.

Top French laboratory

The GEPEA (Process Engineering for Environment and Food) Laboratory brings together the engineering teams of the University of Nantes, the Mining College of Nantes and Nantes' School of Food Processing Engineering. The purpose of the laboratory is to develop process engineering in the fields of the environment, food and exploitation of marine bio-resources. The GEPEA team called on METTLER TOLEDO for help in culturing microalgae (micro-organisms that grow through aerobic photosynthesis).

The process

Culturing of the microalgae in photobioreactors takes between one week and

several months at a temperature in the range of 15–40 °C. To aid biomass production the temperature and neon light intensity are modified throughout the process.

Measurement challenges

GEPEA engineers faced various challenges when performing measurements of pH, O₂ and turbidity in this process: the problem of solution grounding on pH electrodes, formation of biofilm on sensors and oxygen bubbles adversely affecting turbidity measurement.

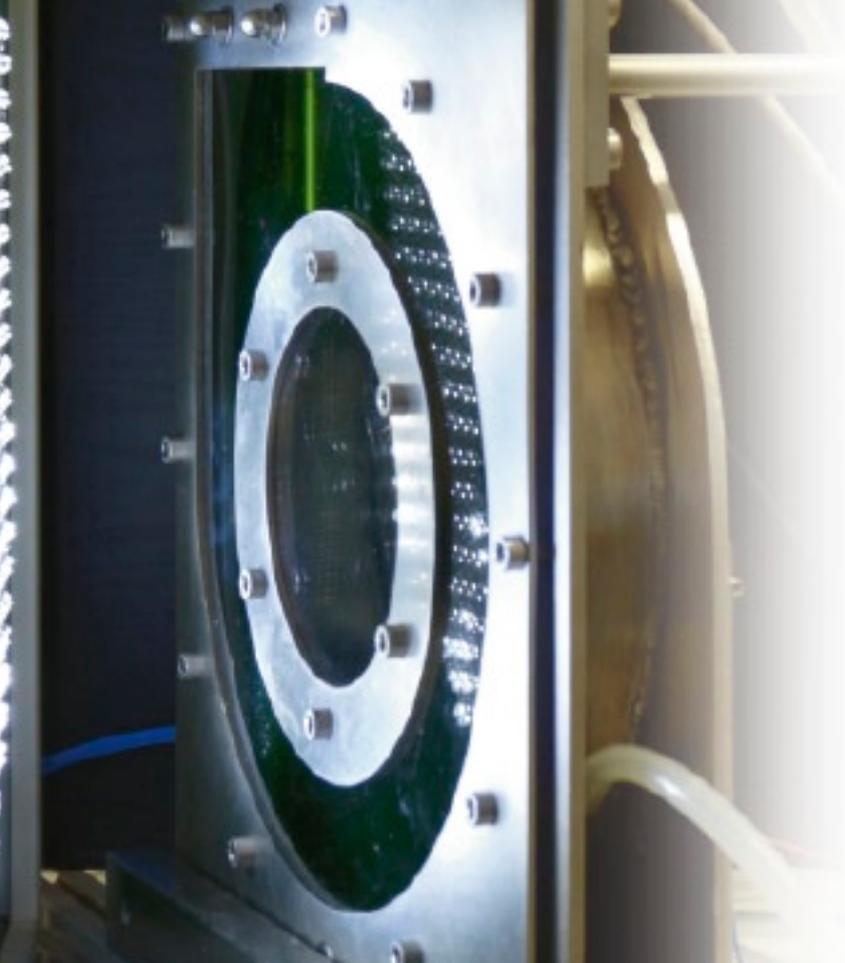
Not only were there specific measurement challenges that had to be overcome, the cultivation procedure imposed specific

necessities with respect to the nature of the medium and the process: the requirement of shallow immersion for certain applications, the need for biotechnical measurements, no-drift robustness and axenic measurement in a sterile medium. Further, GEPEA wanted low maintenance sensors that were easy to install.

METTLER TOLEDO's recommendation

We recommended the following system components:

- pH measurement
- InPro 4800 i electrode
- M300 multi-parameter transmitter



One of GEPEA's 1 L toric photobioreactors

O₂ measurement

- InPro 6850 i sensor
- M400 transmitter

Optical turbidity measurement

- InPro 8200 sensor
- Trb 8300 transmitter

Some strengths of the equipment

Rapidity: The M300, M400 and Trb 8300 transmitters feature "Plug and Measure" functionality that enables measurements within seconds of sensors being connected.



Transmitter M400



Reduced maintenance: Thanks to METTLER TOLEDO's Intelligent Sensor Management (ISM) technology, sensor status information is available in real time, making it possible to predict when a sensor requires maintenance. Such information can be used to help ensure sensors will not fail during the process. The InPro 4800 i's PTFE annular diaphragm further reduces maintenance by avoiding fouling and incrustation.

Reliability: The Trb 8300 turbidity transmitter operates with InPro 8200 fiber-optic sensors. The complete system is designed for performing accurate and reliable measurements with minimal drift over many weeks, in biotechnical applications.

Robustness: Based on backscatter light technology, the InPro 8200 sensor with dual optical fibers has a uniform structure and is equipped with a sapphire optical window which combined, minimize fouling and incrustation of the sensor.

Best Practice

In-line measurement means optimized production and lower operating costs

The continuous stream of data that in-line measurement provides lets you know that your processes are working as they should, and informs you the instant that they are not - helping you maximize production, and saving on lab costs.

Discover more at:



www.mt.com/PRO

Additional benefits

After two months of using the METTLER TOLEDO equipment GEPEA engineers are very satisfied with its performance. Installation at the bioreactors has been greatly simplified and they have found the ISM equipped sensors to be intuitive to use and highly reliable. The digital signal of the ISM sensors has also eliminated earthing and noise problems. GEPEA anticipates calling upon METTLER TOLEDO for dissolved CO₂ measurement sensors for CO₂ sequestration applications.

If you want to solve a measurement problem in your processes, visit:

- ▶ www.mt.com/Transmitter
- ▶ www.mt.com/ISM

Cost-effective Gaseous Oxygen Measurement

Reduce Expenditure, Reduce Risk

METTLER TOLEDO oxygen measurement solutions are not just highly flexible and accurate, they are inexpensive to implement and operate, and help ensure your processes are safe.

Common but important analysis

Gaseous oxygen is one of the most common analytical measurements undertaken in process industries. Applications for the control of gaseous oxygen are numerous: equipment headspace blanketing, prevention of product oxidation, control in hazardous areas, off-gas monitoring, etc. Failure to limit gaseous O₂ can result in reduced yield, shorter product shelf life or fire/explosion.

Costly measurement...

More than 98% of installed gaseous oxygen systems are based on expensive paramagnetic or zirconium dioxide measurement principles. Further, they have the additional expense of requiring gas conditioning equipment in the form of gas coolers, gas filters, acid filters or gas pumps. The cost of maintenance for all these parts can be substantial.

...but it doesn't have to be

Amperometric measurement systems, on the other hand, are based on inexpensive technology and additionally, installation costs are low and maintenance is quick and straightforward. On top of that, unlike the aforementioned systems where the sample must be conditioned before it can be measured – meaning that you do not receive continuous measurement results – amperometric systems do not require sample conditioning. The sensor is placed

in-line to provide you with continuous, reliable data.

METTLER TOLEDO supplies a comprehensive range of amperometric gaseous O₂ measurement systems to suit a wide variety of process applications. Our InPro 6000 series of analog and digital sensors offer a short response time and are insensitive to humidity and many chemical substances. They also provide the reassurance that your process is operating correctly, something only true in-line measurement offers.

The intelligent option

Gaseous oxygen measurement points equipped with our Intelligent Sensor Management (ISM) technology reduce the installation, maintenance and calibration effort to a minimum.

Benefits include:

- Pre-calibration – ISM technology allows sensors to be pre-calibrated in the lab, stored for future use, and installed quickly and easily.
- Digital signal – unaffected by electrical noise; measurements are reliable and robust.
- “Plug and Measure” feature – for fast start-up.
- Dynamic Lifetime Indicator – tells you when sensor maintenance is required; chance of sensor failing during the

process is almost eliminated, so process stability is greatly enhanced.

- ISM equipped systems mean simpler handling, higher process safety and increased productivity.

Complete solution

In situations where you require sensor verification before the batch or periodically during the process, METTLER TOLEDO offers a total package. InTrac retractable housings, along with EasyClean automated cleaning/calibration systems, allow sensors to be verified automatically without any interruption to the process.

The InPro series of sensors combined with our single- and multi-parameter transmitters, plus InTrac, EasyClean and unique ISM technology means that we have the right gaseous oxygen solution for you.

To save costs on gaseous oxygen measurement, go to:

- ▶ www.mt.com/O2-gas
- ▶ www.mt.com/ISM



Leading Manufacturer of Insulating Materials Discovers Benefits of Intelligent Sensors

The use of intelligent pH sensors reduces work time and maintenance costs, and increases workplace safety at Saint-Gobain Isover G+H AG.

Customer

Saint-Gobain Isover G + H AG (“Isover”) is the leading manufacturer in Germany of glass wool and stone wool fireproof insulating materials, and is a market leader in the German mineral wool market. Since 1971, the company has been a member of the French Saint-Gobain group which is one of the 100 largest industrial enterprises in the world. The product range includes insulating materials for roofs, walls, floors, ceilings and technical insulation. The German facilities are located in Bergish Gladbach, Lübz, Speyer and Ladenburg.

Stone wool manufacture

In the manufacturing process, the mineral starting materials are melted in vats at well over 1000 °C. Two different processes are used at Isover in Germany. In one process the vertically occurring melt is fiberized to form mineral fibers by centrifugal force and application of an air

current. These fibers are collected as crude felt in collection chambers or trap shafts. The second and more conventional process is the nozzle centrifuge blower process (Sillan process).

The melt flowing out of a nozzle is fiberized by means of a parallel air current. As in the centrifugal process, the mineral fibers are either suctioned off or blown off and collected. A product-specific binder is also applied to the fibers. After curing of the binder, the products are cut to measure, coated if necessary and packaged.

At the Ladenburg plant in Germany, Isover stone wool insulation materials are manufactured using the Sillan process. Stone wool insulation materials are suitable primarily for use in high-temperature applications because its melting point is over 1000 °C, or for use in situations of high mechanical stresses. These are products for building construction such as façades and flat roof insulation plates, for technical insulation such as thermal protection mats and for special market products such as inlays for fireproof doors.

Intelligent Sensor Management

Alongside production in the plant, there is one of Saint-Gobain group’s three R & D departments. Dr Christian Strassnig works here in the environmental technology department on, among other things, wash and process water. He also provides process

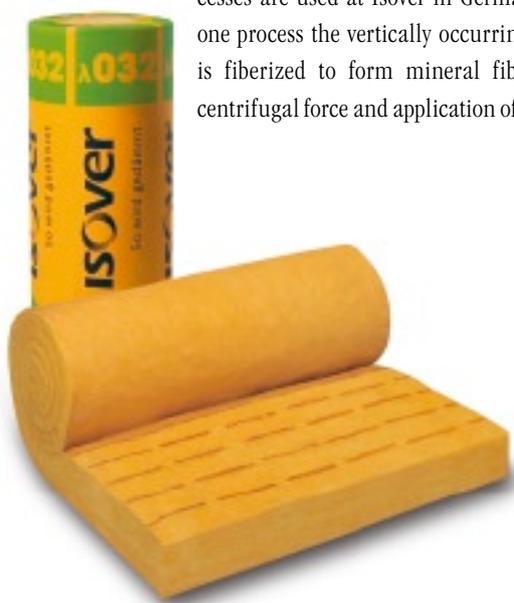
support worldwide for all Isover plants and tests new developments.

When pH measurement for monitoring cooling water quality had to be replaced at the Ladenburg plant, he decided in favor of METTLER TOLEDO’s InPro 4260 i pH electrode with Intelligent Sensor Management (ISM) technology, together with our iSense software and the M700 transmitter. Dr Strassnig considers it important that the electrode “reports” when it requires service. This is possible thanks to ISM’s sensor diagnostics. METTLER TOLEDO’s digital sensors equipped with ISM technology have a chip in the sensor head in which all relevant sensor parameters and algorithms for extended sensor diagnostics are stored.

Predictive maintenance

The purpose of ISM is to make it possible to schedule sensor maintenance in order to perform it at the time it is required. Based on years of experience in pH measurement technology, METTLER TOLEDO has developed algorithms that can be used to predict when maintenance will be needed.

The current process conditions such as pH, temperature, membrane and diaphragm resistances, and the number of CIP and SIP cycles can be continuously monitored. The resulting load matrix for the respective sensor facilitates on the one hand diagnosis in the event of measure-



ment problems, and on the other makes it possible to forecast the time to the next required calibration or adjustment, as well as remaining service life.

All essential data for the sensor is saved on the chip so that the sensor is automatically recognized when connected to the transmitter. The sensor calibration data is uploaded and typical limit values set for sensor diagnostics; the system sets its own parameters. Evaluation of the measurement signal is done directly in the sensor.

Improved procedures

With the dynamic display of service life which provides information on when the sensor should be replaced, the determination of the next calibration date using the Adaptive Calibration Timer and the electronic recording of calibration history, ISM sensors, together with METTLER TOLEDO's iSense software, provide a decisive advantage.

With iSense software ISM sensors can be calibrated, managed and evaluated directly on a PC via a USB cable, without the use of a transmitter. It is therefore possible to calibrate sensors under controlled laboratory conditions for the next deployment. Whether and for how long a sensor can continue to be used after cleaning, condi-

tioning and recalibration can thus be determined by personnel in the laboratory, before sensor redeployment. The calibration data is stored in the sensor so that it can be easily replaced at the measurement site. This can be done by the user, who may be almost untrained in handling the sensor.

In the near future, Dr Strassnig will deploy ISM technology at the Speyer plant as well. At the Speyer plant there are several measuring points which are difficult to calibrate because of spatial conditions. The calibration process using sensors and buffer solutions is frequently made impractical due to confined space or poor weather. Such procedures are eliminated via the use of pre-calibrated ISM sensors by untrained personnel right at the measurement point.

In this way, according to Dr Strassnig, Isover can not only save work time but has found that ISM also supports operational safety. In addition, maintenance costs can be reduced. And when calibration in difficult to access measurement points is eliminated, work will also be safer.

Discover more at:

- ▶ www.mt.com/InPro4260i
- ▶ www.mt.com/M700



Transmitter M700



pH Sensor InPro 4260i

Best Practice

Stay one step ahead of maintenance with ISM

Intelligent Sensor Management reduces the installation, maintenance and calibration effort for METTLER TOLEDO's digital sensors to a minimum. This considerably improves process reliability, productivity and system availability.

Find out how ISM can help you, at:



▶ www.mt.com/ISM

ISM

Wastewater Drain pH Measurement under Explosion Risk Conditions

ISM sensors complement the ORI MODULE self-sustaining measurement system with wireless data transfer using Bluetooth or GSM/GPRS, providing simple, continuous monitoring of drain conditions.

Introduction

There are very specific requirements for portable pH measurement in wastewater drains. The measurement locations are generally decentralized and it may not be possible to connect them directly to the conduction system using standard connectors. A local solution using a memory buffer and a battery-operated power source is required. If in addition, the measurement locations are situated in a hazardous area, within a drain for example, a more clever solution is in order.

If the user wants to collect data over a period of time and subject it to detailed examination at a later date, the analysis can be done off-line in the laboratory. However, if an excessive overrun occurs, the benefits of the system immediately informing the user are obvious. An innovative solution from ORI GmbH & Co. demonstrates how such a system can be achieved using intelligent sensors.

The solution in the field

Using their MODULE device, ORI GmbH & Co. of Hille, Germany has developed a measurement system that eliminates conventional transmitters and operating components. The MODULE system works self-sufficiently with its own battery power supply or by using a hard connection. With integrated data storage and the possibility of wireless data transfer, the system offers a multitude of novel possibilities for a wide range of applications.

The portable module system, utilizing up to two sensors and with its own battery power supply, can simultaneously determine and log measurements for more than two months and, depending on the variant, transfer the data using Bluetooth to a PDA or PC and up to a PLC, using an integrated GSM/GPRS modem to transmit the data by e-mail or FTP process as well.

Maintenance and documentation of the sensor technology in the laboratory

METTLER TOLEDO iSense software is also part of the package and makes it possible to perform complete maintenance management around the measurement technology. Each sensor being deployed is calibrated on a laptop or workstation using a direct link via cable and USB interface, and the software monitors and archives the status of all sensors. When a pH electrode comes back to the lab from



ORI MODULE with METTLER TOLEDO InPro3250i SG pH electrode



iSense Asset Suite



the process, iSense can read its current status and decide how to proceed. Using METTLER TOLEDO's Intelligent Sensor Management (ISM) technology, the electrode monitors itself during deployment. In-built diagnostic functions are the basis for further evaluation in the iSense software.

Here too, no expensive calibration set up with a transmitter and transfer to the computer is required. The information is transferred via a USB cable directly to iSense.

Deployment under the toughest conditions

A typical application for the MODULE measurement system in the portable self-sufficient version is the monitoring of wastewater drains and discharge points.

Important front-end information relating to a treatment plant can be collected using ISM pH and conductivity sensors suspended under the manhole cover, and any overruns of maximum permissible values can be promptly identified and immediately forwarded using e-mail, SMS, etc. The operator concerned thus receives notification when maximum permissible values are exceeded and can then promptly conduct appropriate measures and investigate the cause. Wireless coupling with automatic sampling devices for further qualitative analysis is also an option with this device.

The MODULE system is also appropriately Zone 1 & 2 ATEX-certified for operation in hazardous area environments for use, for example, in drains.

More information is available at www.origmbh.de. You can also view a video on deployment and operation of the module at the following links:

- ▶ www.youtube.com/watch?v=PDI Bc_vgk3c (English Version)
- ▶ www.de.youtube.com/watch?v=6Is4WvZ9GKA (German Version)
- ▶ www.youtube.com/watch?v=RC1Qxo2DY9A (Chinese Version)

For more information on ISM, go to:

- ▶ www.mt.com/ISM



Engineer accesses an ORI MODULE via a wireless connection

ISM



pH electrode InPro 4260i

Intelligent Sensor Management

Reduces Life Cycle Costs and Improves Process Safety

Intelligent Sensor Management (ISM)

ISM reduces the installation, maintenance and calibration effort for METTLER TOLEDO's digital sensors to a minimum. This considerably improves process reliability, productivity and system availability.

Reliable installation

Digital communication between sensor and transmitter means signal is always reliable and unaffected by moisture.

Intelligence – starts in the head

ISM sensors are equipped with integrated electronics in the sensor head that store all relevant sensor parameters and includes algorithms for enhanced sensor diagnostics.

Predictive maintenance

Intelligent diagnostics information is calculated and displayed on the sensor's transmitter and tells you if the sensor needs maintenance or replacement – no more downtimes due to sensor failure!

System integration

Key ISM parameters can be fully integrated in a process control system via PROFIBUS® PA or FOUNDATION Fieldbus™.

Plug and Measure

- Sensors are immediately recognized when connected to the transmitter – eliminating difficult configuration procedures.
- Operational availability of measurement point within seconds.
- Wireless module available for transmission from sensor to transmitter – no need for costly cable installation.
- Sensors can be pre-calibrated in the lab and stored for later use, saving time and increasing operational availability.

METTLER TOLEDO's ISM product range includes...

... a wide range of sensors for

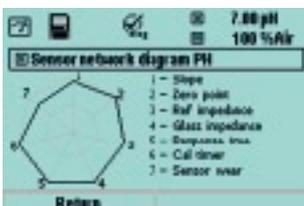
- pH
- dissolved and gaseous O₂
- conductivity
- turbidity





Diagnostics

- Any sensor maintenance requirement is recognized at an early stage, reducing downtimes and minimizing plant operation costs.
- Dynamic Lifetime Indicator estimates in real time the remaining lifetime of the sensor.
- CIP/SIP cycles counted automatically.
- Sensor spider diagram for fast troubleshooting.



Maximum Performance

- iSense Asset Suite software offers you a unique means of optimizing the performance of ISM sensors for enhanced reliability and process safety.
- Key Performance Table enables you to evaluate the condition of an ISM sensor at a glance, without the need of a transmitter.
- Documentation of every calibration as well as the entire sensor history – documentation requirements to regulatory standards are easily met.

... advanced single- and multi-channel transmitters

- 4-wire
- 2-wire
- wireless module

... software applications

- iSense Asset Suite
- pH data logger



Get in-line with METTLER TOLEDO



Reduce Costs for pH and O₂ Measurement

How do you significantly reduce measurement installation and maintenance costs without compromising process reliability? Sensors with Intelligent Sensor Management (ISM) technology allow the performing of true predictive maintenance. ISM sensors can monitor themselves and provide real-time information such as sensor diagnostics and dynamic calculation of the remaining sensor lifetime, to the process control system. Conducting calibration and maintenance procedures at the measuring point are no longer needed. Sensors can be accurately pre-calibrated using METTLER TOLEDO's iSense software and quickly exchanged at the measuring point. The easy to install ISM sensors provide a stable digital signal free from interference, even in very harsh environments.

www.mt.com/ISM

ISM

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