Chemical & Petrochemical
Perspectives in Liquid Process Analytics

25 News

INGOLD
Leading Process Analytics

Sensors That Learn
Give You the Most Reliable Diagnostics

To maximize product quality and yield, you need to know if your sensors are performing correctly. That is why we have always made diagnostics the main focus of Intelligent Sensor Management (ISM®). And with our new version of ISM we offer a world's first – sensors that actually learn from your processes to give you unequalled diagnostics performance.

Breakthrough innovation

Since its launch in 2006, ISM technology has gone on to help hundreds of companies across the world increase process reliability, reduce maintenance costs and simplify sensor handling. One of the central features of ISM is its diagnostic algorithms that predict when sensor maintenance, cleaning or replacement will be required.

With our new, advanced algorithms we provide a breakthrough innovation – sensors that actually learn from and adapt to processes. This gives you exceptionally reliable diagnostics that are specific for every single process.

No more guesswork

ISM sensor diagnostics do not give you raw data that has to be interpreted: they provide easy-to-read tools that tell operators what needs to be done and when, to keep sensors and your processes running reliably.

Sensor diagnostics mean you can confidently plan maintenance for when it is actually needed – neither late which can damage production, nor early when it is not required.

Keep your processes in the lead

There is a huge variation in processes found across manufacturing, so the latest ISM sensors actually adapt to the conditions they operate in. As a consequence, ISM diagnostics represent each and every process more accurately than ever before. This enables you to further optimize

METTLER TOLEDO

"I can transfer the knowledge of one sensor to another with just a click."

Request a free demo:
► **www.mt.com/ISM-onsite**

maintenance and calibration procedures to get the most out of your resources.

Diagnostics speed saves time

Exchanging sensors can lead to risk exposure as a measurement point is taken off-line, so a fast ramp-up and getting back to reliable operation is key. To always ensure your sensors are up and running quickly, the new algorithms provide accurate diagnostics in only 24 hours.

They not only learn – they teach

In some applications the process conditions mean that it can take some time for algorithms to stabilize and give you precise diagnostics data.

We have solved this by giving ISM sensors the ability to learn from other sensors that have already been used in an application. For example, when a pH probe is removed from a process and is connected to our iSense™ software, information on the conditions of that particular process can be stored as an application profile. This profile can then be transferred into a different pH sensor.

When this second sensor is installed in the same process, because it carries the knowledge of its predecessor, it does not need time to acclimatize. And if conditions in the process alter, the sensor diagnostics adjust themselves appropriately.

Sensor maintenance exactly when it is needed

Now diagnostics are accurate as soon as a sensor is installed and you can be sure you are conducting maintenance when it is necessary. Which means that you can be certain your sensors are always performing at their best.

Beyond Plug and Measure

With the application profile database on iSense and the ability to calibrate ISM sensors away from the process, you can build a stock of ready-to-go application specific sensors. Now you can replace a sensor at the measurement point in seconds, without having to adjust the transmitter.

For today's processes and tomorrow's

The new advanced diagnostics and other ISM developments, such as a mobile app that provides a quick sensor check on the go, mean that ISM will remain the leading technology in analytical measurement.

► **www.mt.com/sensors-that-learn**

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Resilient Conductivity Sensor
Succeeds in Harsh Acidic Process

Maintaining the correct concentration during the wet sulfuric acid process relies on constant control of sulfur trioxide hydration. Conductivity measurement is ideal for monitoring purposes, but only METTLER TOLEDO inductive conductivity sensors can tolerate the conditions. For a Brazilian company, implementation has lowered production costs.

Sulfuric acid production requires constant monitoring

A global player in the chemical industry operates a production site in Brazil where large quantities of sulfur trioxide are produced. The compound is used at the plant as a prime material in the manufacture of other products. The SO_3 is generated in a continuous process, and at times when it cannot be used elsewhere at the facility it is washed with water to produce sulfuric acid which is subsequently sold to other companies.

Control of H_2SO_4 concentration is vital as too weak a solution cannot be sold and too strong a solution means overuse of SO_3 and a reduction in profit margin. Due to the exothermic nature of the reaction it is not practical to dilute a highly concentrated solution in a later process. Likewise, it is not worth the production costs involved in making weak solutions stronger. Therefore, successful production involves continuous monitoring of the H_2SO_4 as it is generated.

Inductive conductivity sensors for harsh environments

Determination of acid concentration by in-line conductivity measurement is ideal for this application; however, most sensors are unable to withstand the extremely acidic, high temperature process conditions. The chemical company was looking for a precise and process-tolerant measurement system that would provide continuous concentration data. Their research identified solutions based on inductive conductivity sensors as being most suitable. Company engineers decided on a METTLER TOLEDO InPro® 7250 inductive conductivity sensor with perfluoroalkoxy (PFA) coating.

The InPro 7250 sensors have been designed specifically for measurement in such applications. As there is no electrode in direct contact with the process liquid, they are not affected by media that would foul traditional contacting probes. In addition, the sensor's PFA coating is highly resistant to aggressive chemicals.

Reliable sensor improves productivity

For our customer, the InPro 7250 sensor and subsequent control of the SO_3 feed means H_2SO_4 concentration can now be maintained within the desired range. Sulfuric acid that is either too weak or too strong is no longer produced, reducing waste of SO_3 and increasing the plant's productivity.

► **www.mt.com/InPro7250**

In Situ Sensor Convenience
with the Power of an Analyzer

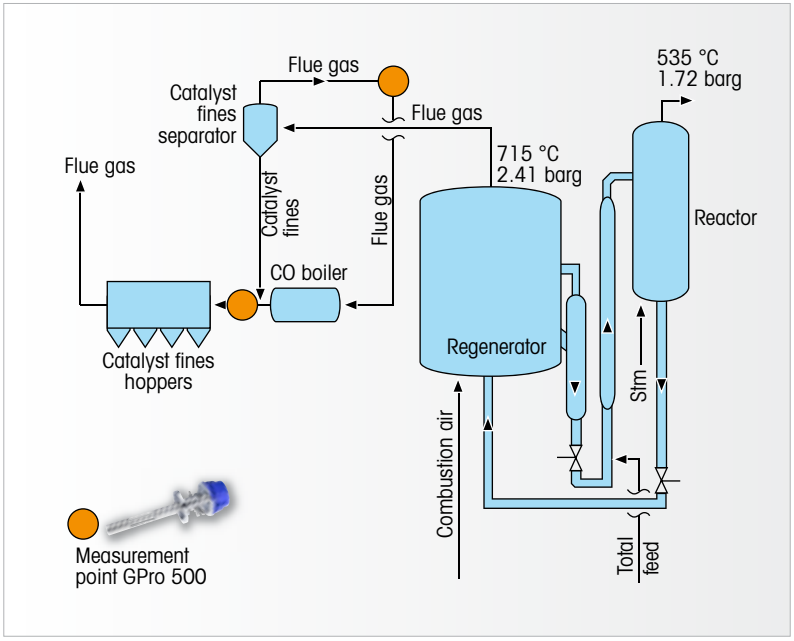
Frost & Sullivan Best Practice Award

The GPro® 500 series of in situ TDL gas analyzers is proving its reliability and flexibility in chemical and petrochemical plants worldwide. Now, four new analyzers plus an adaption for trace level measurements will further its range of applications. For simple, accurate and reliable gas measurement, get the GPro 500.

Flexible installation, fast response and minimal maintenance

Since their launch in 2012, the GPro 500 series (winner of a Frost & Sullivan Best Practice Award) of tunable diode laser analyzers have simplified gas measurement in chemical and petrochemical applications across the globe. Their ease of installation, speed of response, low maintenance and flexibility to be utilized in a wide range of processes make the GPro 500 very attractive. The addition of new analyzers to the range will widen its suitability still further.

GPro 500 has been available for O_2, CO and moisture measurement. Now, models for O_2 plus temperature, CO%, CO_2%, and a combined CO_2% plus CO% make the full GPro 500 portfolio suitable for many refinery processes where paramagnetic and extractive NDIR analyzers are normally used. Some of these process applications are outlined below.



Gas analysis measurement points in FCC unit

Greater catalyst regeneration efficiency in FCC units

Fluidized Catalytic Cracking (FCC) is an essential operation in most modern refineries. FCC units break (crack) the long chain hydrocarbons in heavy gas oils into short chain hydrocarbons to produce gasoline and fuel oils.

The catalyst used in the process must be regenerated to maintain its functionality. Conditions in the regenerator must be maintained in a narrow range or else the catalyst can be damaged or regeneration is not complete. Catalyst regeneration can be controlled by monitoring O_2, CO and CO_2.

Due to the presence of catalyst particles, narrow tubing carrying a sample can easily become blocked and extractive sample cells fouled. In addition, there is a delay in measurements due to the time required for sample transportation and conditioning.

The GPro 500 series works on the principle of laser absorption spectroscopy which is a non-contact measurement technique, so no tubing is involved. And because the GPro 500 measures in situ, measurements are almost instantaneous.

Prevent thermal runaways in ethylene oxide generation

Ethylene oxide is a very important raw material with a wide range of uses in agrochemicals, detergents, textiles, pharmaceuticals, etc.

Controlling O_2 during production is critical for safety as a level higher than around 25 % will result in thermal runaway. Therefore, speed of response and continuous measurement are essential. Paramagnetic analyzers not only have a long measurement time, the paramagnetic cell is delicate. If either the analyzer or the maintenance-heavy extraction equipment is off-line, the reaction is running blind.

The GPro 500 O_2 sensor has a response time of less than two seconds, and other than annual verification, requires no maintenance.

Safer purified terephthalic acid production

PTA is mainly used as a precursor in the production of multi-purpose plastics such as PET.

The level of O_2 in production off-gas is a vital measurement to prevent explosions and prevent uncontrolled oxidation. CO_2 is also usually measured to provide data on reaction progress and for safety reasons.

As mentioned above, paramagnetic O_2 analyzers are fragile, they are also expensive to replace should this become necessary. For CO_2 measurement, commonly-used NDIR analyzers typically use motors and broadband IR sources which need periodic replacement.

The GPro 500 series has no moving parts. This ensures high reliability and a long operational lifetime. In addition, as both its laser source and detectors are in the sensor head, the GPro 500 does not need alignment.

White cell for low-range applications

For processes where accurate, low-range extractive measurement is required, the new White cell adaption for the GPro 500 series provides an effective path length of 10 m and boosts measurement resolution by a factor of 10.

Simple, accurate and reliable

When it comes to process safety for protecting the environment, people, and assets, only the best equipment will do. The GPro 500 offers the convenience and ease of use of an in-line sensor, combined with the performance of a powerful gas analyzer. With the GPro 500, gas measurement across a wide range of applications is simpler and more dependable than ever before.

► **www.mt.com/TDL**

Go Green
and Stay in Control

Continuing development in global economies is placing growing pressure on the chemical industries to increase production. There is also a mounting need to do more to protect the environment. Green chemistry provides a framework for achieving this and in-line process analytics has an important role to play.

In-line analytics helps protect the environment

Across industry there is an ever increasing global push towards environmentally sound manufacturing processes and products. Alongside this, the demand for chemicals and precursors is always on the increase. This leaves the chemical and petrochemical industries with an interesting challenge as to how to meet global demands while minimizing negative impacts on the environment and adhering to a profitable bottom line.

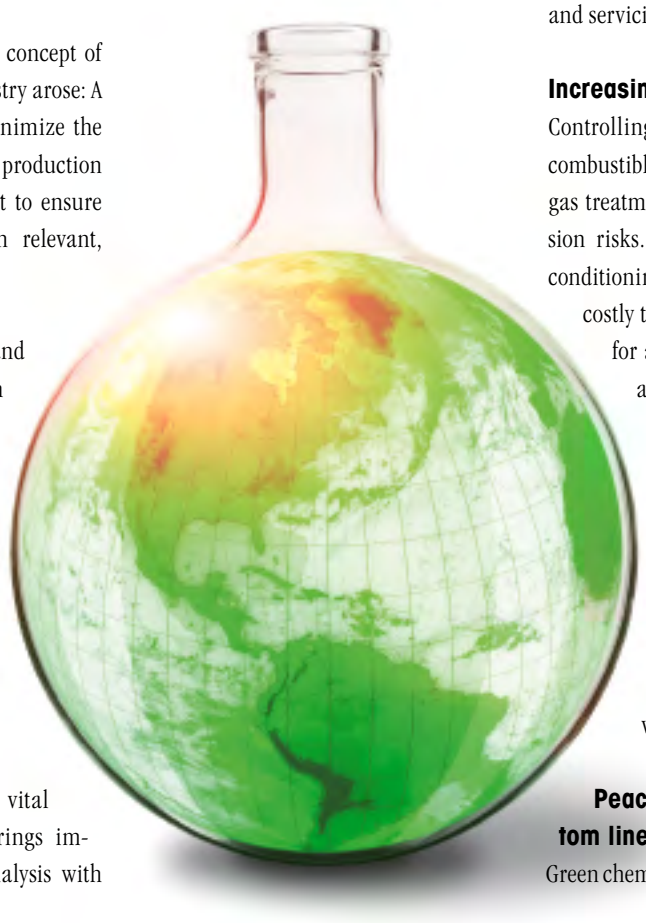
To address this concern, the concept of green (or sustainable) chemistry arose: A set of principles that can minimize the negative impact of chemicals production and steer future development to ensure industrial producers remain relevant, responsible, and profitable.

According to Anastas and Warner's 12 principles of green chemistry, 2 are relevant to process analytics: real-time monitoring and control of processes to prevent the formation of hazardous substances, and taking steps to minimize the potential for accidents.

Eyes into your process

Continuous monitoring of vital process analytical values brings immediate benefits. In-line analysis with process-tolerant sensors allows real-time process control and can alert staff to non-ideal conditions which can lead to poor yields and conversion and more importantly, potentially dangerous conditions.

In contrast, lab analysis requires many man hours for sample taking, transportation, preparation and laboratory measurements. This not only affects the ability to make timely corrective actions, but can also alter the properties of a sample with respect to actual process conditions. Therefore, the results of the analysis can be misleading.



Stay in control with real-time measurements

Central to proper operating of processes is confidence in the measurement values received from sensors. This is only possible if they are well maintained. Measurement systems with Intelligent Sensor Management (ISM®) technology have the ability to monitor sensor condition and predict reliable lifetime, and calibration and servicing schedules.

Increasing plant safety

Controlling the levels of oxygen and combustible gases in processes and off-gas treatment is vital to reducing explosion risks. However, gas sampling and conditioning equipment can not only be costly to maintain; the time required for a sample to be drawn, treated and measured can result in a delay in explosive gas mixtures being identified. In situ gas measurement circumvents this issue. The GPro® 500 series of tunable diode laser gas sensors provides fast, accurate O_2 and CO measurement and are very low in maintenance.

Peace of mind and the bottom line

Green chemistry is a goal that must be met

"Green Chemistry increases safety for workers and reduces potential for accidents."
United States Environmental Protection Agency

by all producers if they wish to remain successful in the future marketplace. By adhering to its principles a chemical company can ensure that they remain competitive and responsible in meeting market demands.

Implementing modern in-line analytical equipment is a clear stepping stone to modernizing a facility and also adds value by allowing for real-time monitoring. This monitoring can rapidly detect the development of out-of-spec conditions; consequently they can be remedied quickly, ensuring on-going operations, reducing downtime, and enabling a constant flow of valuable end product. METTLER TOLEDO has the right tools to keep your facility profitable, sustainable, and safe.

▶ **www.mt.com/pro**

Success Stories

Safer Cyanide Production

One of North America's largest producers of sodium cyanide has switched to ISM pH sensors.

Previously, maintenance staff had to wear Personal Protection Equipment during sensor calibration to avoid being exposed to cyanide.

Because ISM sensors can be calibrated in any convenient location, maintenance staff now calibrate sensors in a safe environment.

▶ **www.mt.com/pro-pH**

Reduced Explosion Risk

During the production of formaldehyde, oxygen levels must be kept very low to minimize the possibility of explosion.

A US formaldehyde producer had been using extraction and conditioning equipment that delayed results and carried an increased risk of toxic process gas escaping.

They now use the "flawless" GPro 500 sensor to rapidly and accurately measure oxygen concentration directly in the gas stream.

▶ **www.mt.com/TDL**

Greater Scrubber Reliability

Gas scrubbers are tough environments for pH sensors, and failure of a probe during operation means scrubber efficiency is not being monitored.

For a specialty amine producer, switching to METTLER TOLEDO ISM pH sensors has had two main benefits: The robust probes survive for many months in the process conditions, and ISM diagnostics tell operators when sensor maintenance or replacement will be required.

Free white paper on gas scrubbers:

▶ **www.mt.com/pro-scrubber-wp**

Protecting Turbines
with a Self-Calibrating Silica Analyzer

Silica in return condensate can damage turbines and cause unplanned shutdowns. A major cogeneration operation in Russia chose the 2800 Si Analyzer to monitor silica levels in the condensate. Its accurate and reliable measurements are providing a truer picture of water quality to help keep their turbines operating.

The enemy of turbine blades

Silica in purified water can cause significant damage to turbines. Increased temperature and pressure in boilers leads to silica volatilizing with the steam. Subsequent decreases in temperature and pressure during the steam's passage through the turbine results in the formation of silica deposits on turbine blades, erosion of turbine blades, imbalance, and potential unplanned and costly shutdowns.

For cogeneration applications, where the plant produces steam for production processes, the returning condensate may contain contaminants such as silica, that originate outside the water-steam cycle. Timely detection of excess concentration of these contaminants is key to taking corrective action and ensuring reliable operation of the equipment.

Return condensate must be closely monitored

In May 2014, a major cogeneration power plant in Russia initiated a project to monitor the return condensate collected from the adjacent fertilizer plant it supplies power to. Based on the process requirements, pH, total dissolved solids, and silica were monitored. For silica monitoring a 2800 Si Analyzer was used.

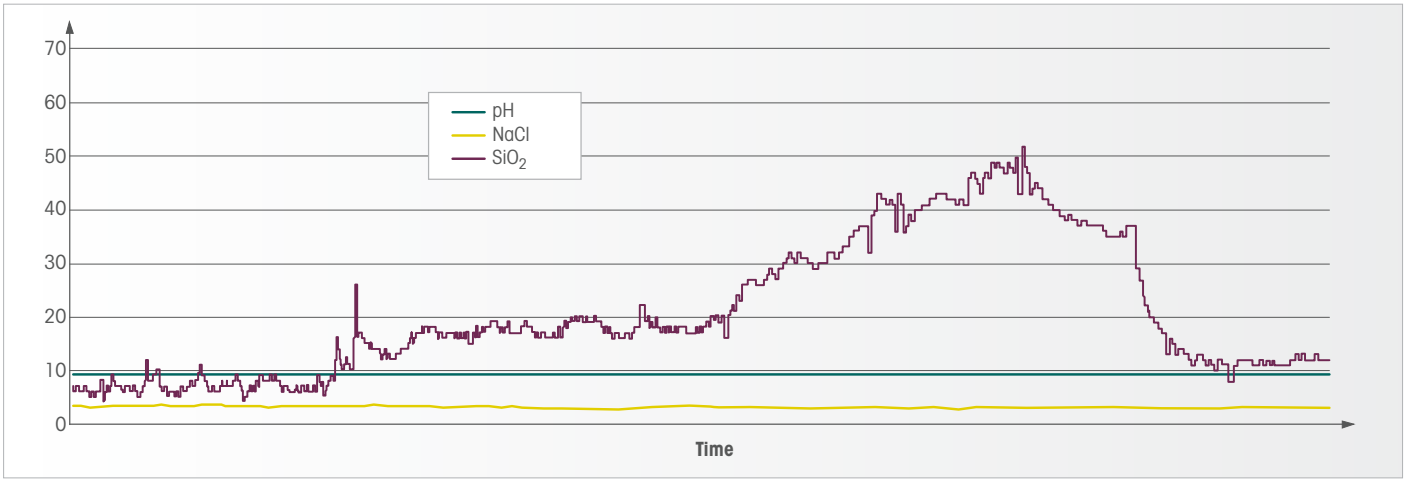
The data collected over two weeks is shown in the graph below.

As can be seen, even though the values of pH and TDS content (as ppb NaCl) did not change, the concentration of silica varied significantly. This shows that:

- Partial monitoring (pH and TDS) and laboratory testing do not give a complete and timely picture of fluctuations in key indicators of water quality.
- The use of on-line analyzers allows dynamic monitoring of changes in a timely manner, leading to quick response to any deviation in key parameters.

Reliable and accurate silica analyzer

The 2800 Si Analyzer offers easy installation, exceptional reliability and has minimal maintenance requirements. With automated calibration and operation, the analyzer ensures consistently



Changes in return condensate pH, TDS, and silica levels over two week period. Only monitoring pH and TDS would not have shown the variation in water quality.

accurate measurements to help detect any deviations in silica levels. Large reagent bottles enable long-term operation before refilling becomes necessary.

Continuous and dependable measurements

Chemists at the power plant noted that the analyzer provided stable and accurate measurements continuously, even when the water sample temperature and pressure changed. The precision of the on-line measurements was much higher than the laboratory analyses they previously relied on, leading to far greater confidence in their water treatment decisions.

2800Si Silica Analyzer

Reduced chance of operator error

The analyzer's design and safety features, such as a lockable enclosure, help prevent accidental damage to the unit. The supervisory staff appreciated the automatic unattended calibration and operation of the analyzer, which reduce operator error and ensure reliability of measurements at all times. Moreover, specialists from METTLER TOLEDO were available to train plant personnel and assist in start-up and maintenance of the analyzer, thus providing local support whenever needed.

▶ **www.mt.com/Thornton-silica**

Speed and Safety
Faster Filling in Hazardous Areas

As plants modernize, safety requirements must be fulfilled while improving efficiency. Those two goals are difficult to meet in explosive environments. However, a new weighing terminal enables fast, error-free filling in hazardous areas.

Safety measures must be incorporated in every aspect of your operation. Asiatic Agricultural Industries Pte Ltd. considered that when recently upgrading its scales. The Singapore-based company manufactures and distributes products and solutions that serve to optimize crop yields and safeguard the well-being of humans as well as livestock.

Since 1972, it has worked with an extensive network of businesses in more than 25 countries throughout Asia, Africa, the Middle East and Indian regions.

Safe, sturdy and error-free

For manufacturing its crop-protection products and pesticides, the management at Asiatic Agricultural Industries decided to convert its mix of hazardous-area (EX) approved and non-approved equipment in its plants to all EX equipment. Its old scales were worn and weighed inaccurately, even after calibration. It was time for an upgrade.

Asiatic Agricultural Industries' semi-automatic processes required operators to fill bags and record weighing transactions by hand, a process with an inherent risk of human errors.

Asiatic Agricultural Industries employees fill buckets on an ICS466x scale.

ICS466x with colorWeight®

METTLER TOLEDO recommended the ICS466x for this application because it is suitable for hazardous-area Zone 1 / Division 1. In addition, the terminal features colorWeight® functionality, which helps operators easily detect under- and overfilling with colored lights. The company was looking into connecting a tower light or buzzer to the indicator, but found them to be too complex and expensive. The colorWeight® indicator proved to be a simple alternative to nearly eliminate human errors.

Faster Filling with Fewer Errors

"The color display helps the operator to fill faster and it is easier to read the output," says the chairman of Asiatic Agricultural Industries. "It has 100 percent eliminated human error."

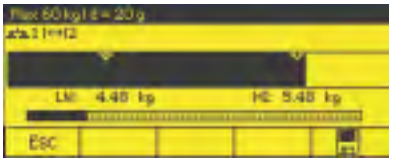
In addition, the scale and terminal are capable of creating an automatic printout when a stable weight value within tolerances is reached. This saves the operators time. Material batch details can be saved and data transactions are stored in the alibi memory.

www.asiaticind.com.sg

▶ **www.mt.com/ind-chem14**

The changing display color quickly indicates if the weighment is within tolerance.

colorWeight®



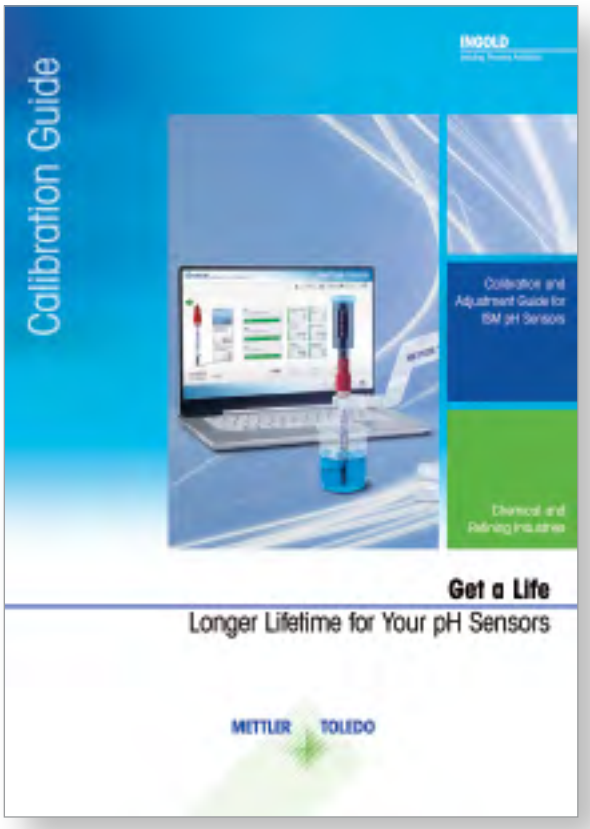
Above tolerance

Within tolerance

Below tolerance

With colorWeight®, the colored weight control system, you can increase productivity during manual processes. The three-color display prevents losses, overfilling and operating errors.

Get in-line with METTLER TOLEDO



FREE Guide: pH Sensor Calibration

Quick, easy and error-free

pH systems with Intelligent Sensor Management (ISM®) drastically minimize the maintenance workload, meaning far less time spent at measurement points.

Find out everything you need to know about getting the most from your pH sensors in our new guide.

► **www.mt.com/ISM-calibration-guide**

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