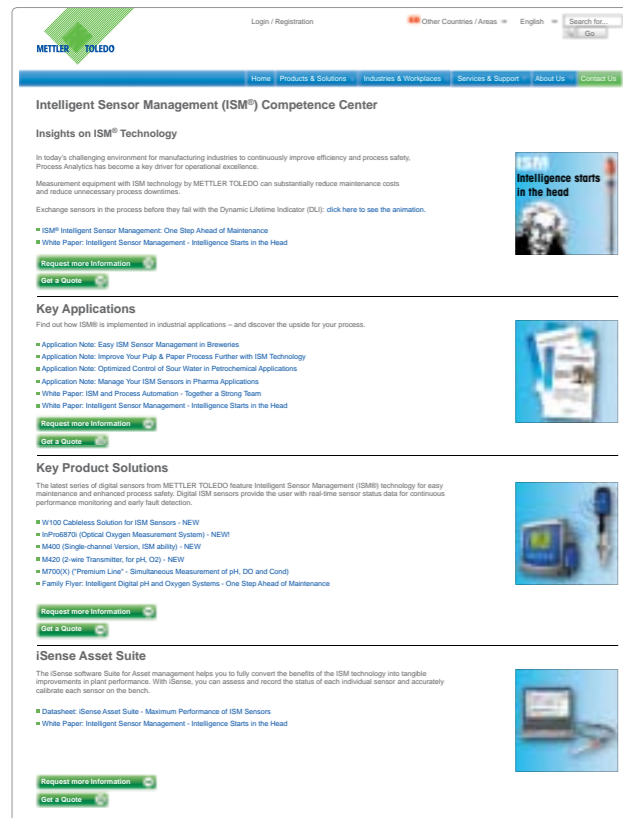


## Intelligent Sensor Management

A New Concept in Process Analytical Measurement



Explore the ISM universe of process analytical measurements at our competence center. Discover white papers, application notes, product documentation and more.

[www.mt.com/ISM](http://www.mt.com/ISM)

Intelligent Sensor Management



[www.mt.com/pro](http://www.mt.com/pro)

For more information

## Intelligent Process Analytical Solutions

### Explore the ISM Universe

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**METTLER TOLEDO**

# The Universe of Intelligent Sensor Management

## Intelligent, Predictive, Tailorable, Adaptive

**Intelligent Sensor Management (ISM) is an innovative new concept for process analytical measurement solutions that simplifies sensor handling, enhances reliability and reduces sensor lifecycle costs through a groundbreaking new maintenance concept.**



### Intelligent

- The ISM universe offers unique and comprehensive product solutions ranging from pH, DO and conductivity to ozone and TOC.
- Digital sensor technology offers easy handling with pre-calibrated sensors, enhanced sensor performance and built-in diagnostics.
- A unique set of tools allows optimized maintenance management over the whole lifecycle.

And this is just the beginning.



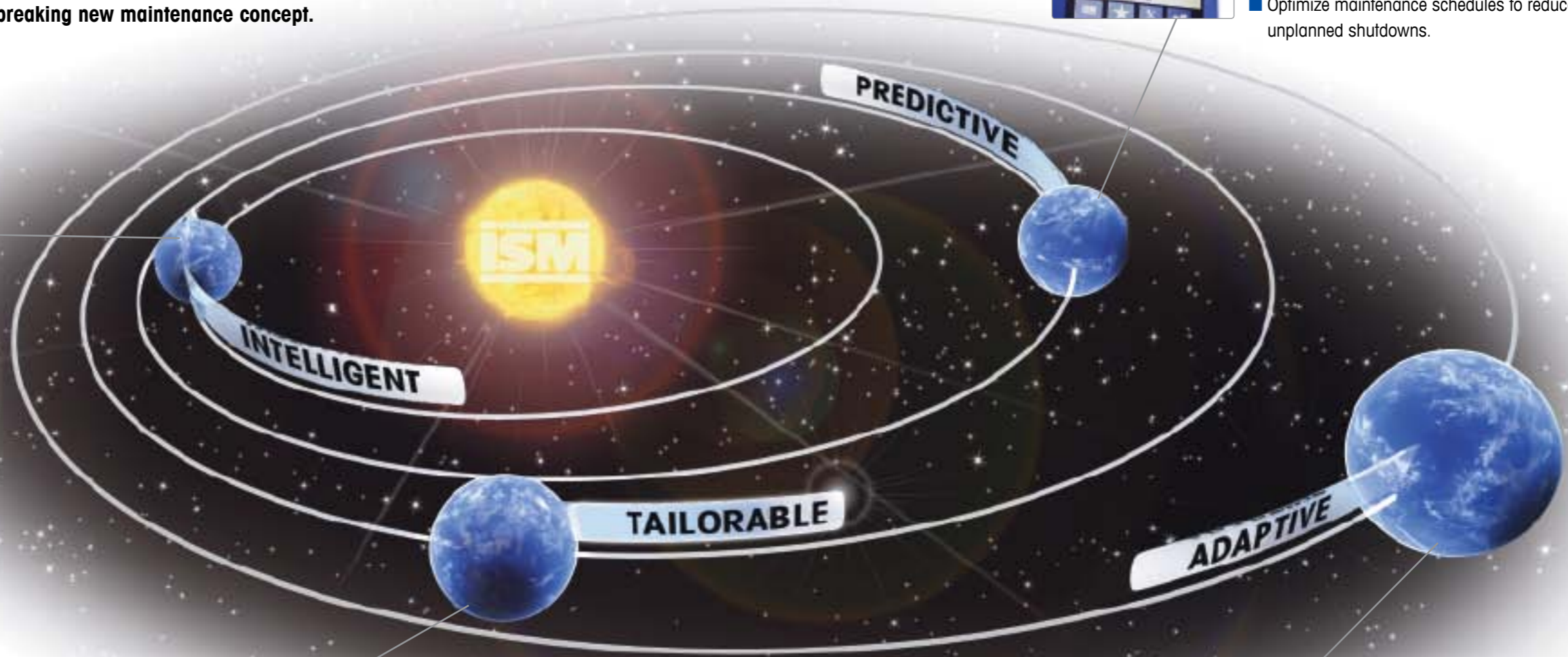
### Tailorable

- ISM offers industry specific solutions tailored to respective needs.
- **In Pharmaceutical and Biotech**, accurate calibration and comprehensive electronic documentation offer full traceability.
  - **In Chemical and Petrochemical industries**, pre-calibration in a maintenance shop and optimized maintenance management improve process reliability and reduce maintenance costs.
  - **In Breweries**, pre-calibrated optical DO sensors offer more reliable measurement and less maintenance.



### Predictive

- Avoid unscheduled maintenance with the Dynamic Lifetime Indicator, a unique predictive real-time diagnostic function.
- Manage the lifecycle of your sensors with the iSense Asset Suite, PC based sensor management software.
- Optimize maintenance schedules to reduce costs and avoid unplanned shutdowns.



### Adaptive

- ISM allows seamless integration of on-line diagnostics information into process control systems via Profibus PA and Foundation Fieldbus transmitters or Ethernet.
- Unique low-power concept also offers wireless installations and Bluetooth based temporary loggers.
- Direct integration into analog controllers via 4 ... 20 mA converter cables offer the best of both worlds, ISM based maintenance with iSense and local diagnostics with robust analog signal integration.





# Intelligent Technology Solutions For Advanced Process Analytics

The ISM universe of unique solutions is based on three pillars: intelligent measurement technology integrated into the sensor, real-time diagnostic capabilities and high flexibility of measurement point installation – truly intelligent, predictive, adaptive.

### Intelligent – digital measurement technology integrated in the sensor

#### Plug and Measure installation

- Error-free commissioning
- Sensor recognition, quick configuration

#### Lower installation costs

- 1-wire digital bus standard
- Simple coax cable for easy wiring

#### Low-power enables wireless

- Bluetooth temporary logger
- Cableless sensor-transmitter connection with long battery lifetime up to 6 months

#### Reliable measurement

- Digital sensor-transmitter communication ensures higher signal transmission stability
- Measurement electronics in the sensor results in higher accuracy



#### Wide parameter breadth

- pH, ORP, temperature
- O<sub>2</sub> and optical O<sub>2</sub>
- Conductivity
- Turbidity
- TOC (coming soon)
- Ozone (coming soon)

### Predictive – real-time diagnostic algorithms in the sensor

#### On-line diagnostics

- True, dynamic, “GPS”-like predictive maintenance information with the Dynamic Lifetime Indicator (DLI)
- Real-time sensor “health” monitoring
- Calibration history

#### iSense Asset Suite

- USB direct integration
- ISM pH data logger

#### Service tools

- Simulators and service tools
- Benchtop calibration meter

### Adaptive – maximum flexibility through digital sensor technology

#### Advanced transmitters

- Multi-parameter
- Dual channel
- Mixed-mode analog/digital
- 2-wire loop powered option
- 4... 20 mA converter cables

#### Fieldbus

- Diagnostic data sent to control systems via Foundation fieldbus™/Profibus® transmitters
- Ethernet expandability with iConverter (coming soon)





# Intelligent Diagnostics Algorithms

## Predict Sensor Lifetime, Avoid Process Downtime

ISM products are packed with innovative features such as intelligent, predictive, real-time diagnostics algorithms – avoid unplanned process downtime or unnecessary maintenance and improve process reliability and productivity.

### ISM – a revolution in process safety and maintenance management

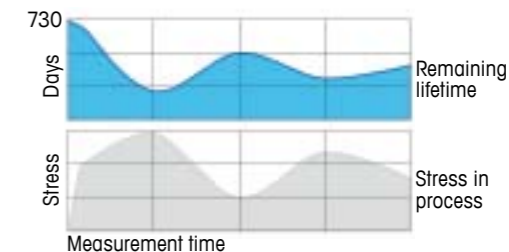
At the core of ISM is the integration of sensor and application-specific measurement and diagnostics algorithms into the sensor. Besides a more accurate measurement, this enables groundbreaking, real-time diagnostic information calculated while the sensor is measuring in the process.

All characteristic real-time measurement and sensor condition data are included in proprietary algorithms leading to on-line predictive maintenance information. This allows the user to

- avoid unexpected process downtime
- estimate measurement accuracy, predict failure and plan maintenance schedules more efficiently
- convert to a new revolutionary maintenance management which will significantly reduce maintenance costs.

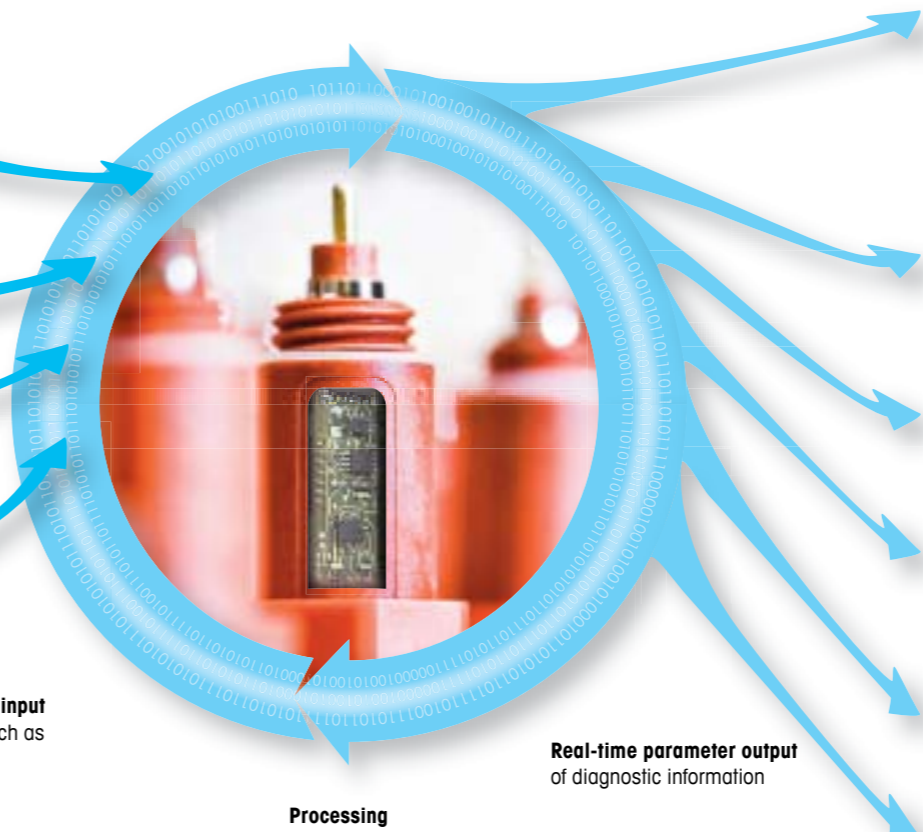
**Intelligent real-time diagnostics in the sensor head**

**Predictive Maintenance**  
Intelligent diagnostics information is calculated in the sensor and displayed on the transmitter to tell you if the sensor needs maintenance or replacement – **no more downtimes due to sensor failure!**



Your process

Real-time parameter input from your process, such as pH, temperature, ...



Processing

Real-time parameter output of diagnostic information

### Dynamic Lifetime Indicator

Dynamic Lifetime Indicator (DLI) estimates in real-time the remaining lifetime of the sensor. A unique algorithm uses actual and historic measurement and calibration values to calculate a real-time lifetime indicator.



### Adaptive Calibration Timer (ACT)

Based on the above algorithm the sensor predicts the time until the next calibration will be needed.



### Time to Maintenance (TTM)

The sensor also indicates when you will have to perform the next maintenance.



### CIP/SIP Counter

CIP and SIP cycles are interpreted with a proprietary, patented algorithm.



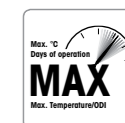
### Calibration History

Calibration history is stored in the sensor and can be used for diagnostics.



### Maximum Temperature / Operating Days Indicator

Information about the maximum temperature the sensor has ever been exposed to and the number of operating days.



Optimize your process due to predictive maintenance



# iSense Asset Suite

## A Revolution in Maintenance Management

The unique iSense PC software offers verification and calibration of digital ISM pH electrodes and oxygen sensors under laboratory conditions in a maintenance shop. It also allows management of the lifecycle of your installed base at reduced costs. No more cumbersome calibration or maintenance in the field or at remote installations.

### Easy connection to your computer

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

### View sensor performance

iSense enables you to evaluate in an instant the condition of your ISM electrodes and sensors. Broad information is provided for: last calibration date, slope, zero point, response time, date of manufacture, operating time, max. temperature and remaining lifetime.

### Intuitive calibration support

Enhance your productivity with the intuitive application for sensor calibration. Experience has shown that you can drastically reduce duration and frequency of calibration resulting in cost savings of up to 20% with a payback in less than 3 months!

### Comprehensive electronic documentation and user management

All sensor related activities such as calibration or maintenance are stored and can be documented electronically or by print-outs. A user management and electronic logbook allows control and tracking of all activities ensuring complete documentation of your sensor assets over their whole lifetime.

METTLER-TOLEDO iSense (P1-7)

iSense  
ISM Asset Suite



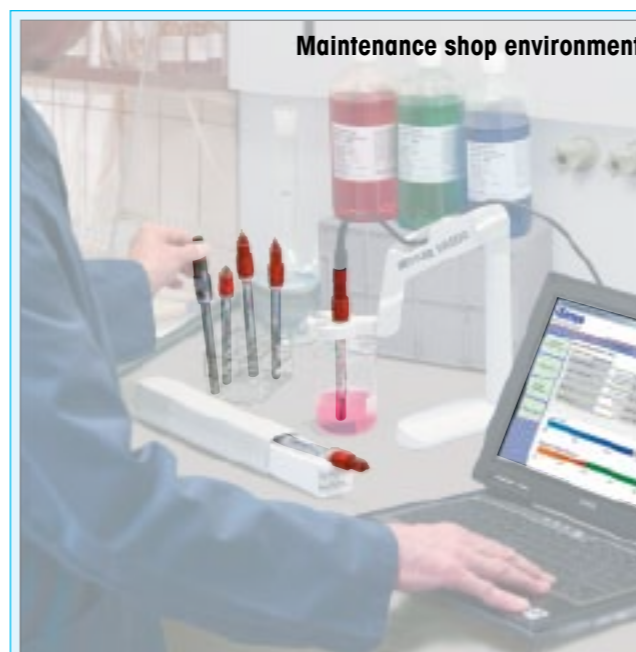
### Past: Calibrate in the field



#### Analog pH electrode example workflow:

- Calibration of electrodes under process conditions needed
- Manual documentation
- No stock of pre-calibrated electrodes possible
- Long process interruption, cumbersome and error-prone field calibration and maintenance
- Risk of possible process contamination
- No sensor lifetime management

### Today: Calibrate in the lab – Swap in the field



#### Digital ISM pH electrode example workflow:

- Pre-calibration of electrodes with iSense in maintenance shop environment
- Complete electronic documentation
- Hold pre-calibrated electrodes in stock
- Sensor maintenance simply by taking electrodes from stock and swapping in the field
- Complete sensor lifetime management includes sensor diagnostics before use and final de-activation

### Optimized maintenance with iSense

iSense Asset Suite for Process Analytics represents a revolution into a more controllable future of your sensors' life – starting at the first implementation into your process until the decision to dispose of the sensor.

### Manage your ISM sensors over the entire lifecycle

A complete view of all sensor data is provided by an SQL database allowing you to access all previously stored data of any equipment that has ever been used in the process. Unlimited data export opens abundant possibilities to optimize your measuring system and process.

### Key benefits at a glance

- Verification and calibration of ISM electrodes and sensors in a maintenance shop
- Electronic sensor lifetime documentation
- Data can be exported to .csv file
- Protocols can be printed
- Sensor lifetime management
- Available for pH/ORP, amperometric DO, O<sub>2</sub> gas, optical DO
- Windows 7 compatible, 32 bit and 64 bit
- User management and electronic logbook



# Tailored Solutions To Meet Specific Industry Needs

ISM offers a wide range of application specific solutions and advanced diagnostic features addressing every industry's needs. The iSense asset management tool provides all the maintenance support you need, from calibration, predictive diagnostics and documentation to complete management of the installed base. Just tailorable ...

| Industry            | Advanced Real-Time Diagnostics   | CIP / SIP Counter                | Pre-calibration/ Plug & Measure  | eDocumentation & User Management | Asset Management                 | Seamless PLC Integration         |
|---------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Biopharma           | <input type="radio"/>            | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Chemical            | <input checked="" type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Food & Beverage     | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Refining, Petrochem | <input checked="" type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Microelectronics    | <input checked="" type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input type="radio"/>            | <input type="radio"/>            | <input type="radio"/>            |
| Mining/Pulp & Paper | <input checked="" type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input checked="" type="radio"/> |
| Power Generation    | <input checked="" type="radio"/> | <input type="radio"/>            | <input checked="" type="radio"/> | <input type="radio"/>            | <input type="radio"/>            | <input type="radio"/>            |

Available     Industry relevant

### Pharmaceutical Industry

Process reliability and compliance with regulations are critical performance parameters in a pharmaceutical plant. Accuracy of sensor after sterilization and pre-installation diagnostics are important to avoid loss of valuable product and ensure high yield. Sensors can be pre-calibrated and diagnosed with iSense to check if they will work for the next fermentation batch. In addition, full documentation of the sensor lifecycle is ensured which supports compliance with regulations.



### Chemical Industry

Today, plant performance and reliability has become a key success factor. More than 45 bn USD a year are lost on unscheduled downtimes and over 60% of maintenance work is unnecessary. Pre-calibrated sensors can be swapped out in the field quickly and safely and digital technology ensures reliable performance of sensitive sensors. With intelligent sensors, maintenance costs are significantly reduced and unscheduled downtimes can be avoided by predictive maintenance.



### Food & Beverage Industry

In hygienic processes in the F&B industry, ease-of-use and safe handling as well as process reliability are becoming ever more important to control costs. Pre-calibrated sensors make commissioning of a measurement point easy. Real-time diagnostics increases process reliability, facilitates fast and easy maintenance and helps to avoid unscheduled downtimes.





# ISM Success Stories

## From Customers Across all Industries

**ISM is rapidly gaining acceptance in all industries around the globe. Key benefits driving customer satisfaction are reliable digital measurement, pre-calibrated sensors and predictive maintenance information.**

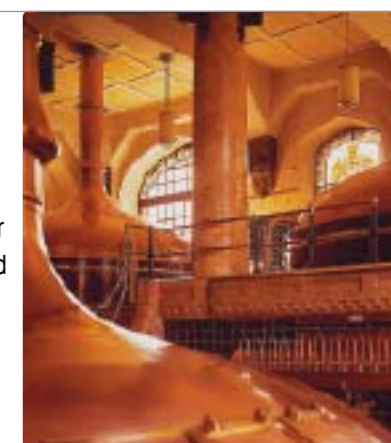
### Reliable measurement and predictive maintenance helps ethanol production

The more critical a pH measurement is, the more accurate and reliable the pH measurement system has to be. METTLER TOLEDO offers intelligent, high performance sensors with advanced diagnostic capabilities, that predict their own maintenance requirement – that is why a Brazilian group chose ISM sensors for reducing their maintenance costs. Original extract from customer letter: "The combination of reliable signal, predictive maintenance and dependable, accurate pH measurement is exactly what we have been looking for. Our satisfaction is such that we are now considering upgrading our other installations with ISM equipment."  
Ethanol plant, Brazil



### Optical DO with ISM optimizes maintenance in brewery

Rapid, accurate measurement of the dissolved oxygen content in beer is important during keg filling. The InPro 6970 i optical oxygen measurement system offers a short response time, high accuracy and low maintenance effort – meaning lower production costs. The compatible M400 transmitter enables real-time retrieval of sensor status data for transfer to the process control system. Continuous sensor monitoring is supported by the integrated Dynamic Lifetime Indicator and Adaptive Calibration Timer, which facilitate the planning of sensor maintenance.  
Brewery, Germany



### No more sensor documentation problems in drug fermentation

Inadequate measurement system documentation was a significant headache for an API producer in China. During fermentation stages of pilot testing and production, technicians pay particular attention to pH and DO levels due to their considerable influence on yield. However, human factors involved during the process made it impossible to understand in detail the use of each sensor. Switching to ISM solved the issue. With iSense Asset Suite, a record of every sensor calibration as well as the history of all ISM sensors used at the facility is stored in the software's database. With complete and reliable documentation for each sensor now easily accessible, regulatory requirements are easily met.  
Pharmaceutical plant, China



### Reduced downtime in catalyst production

The Process Technologies Catalyst business of Johnson Matthey, UK was looking to monitor pH in the production of one of its catalysts. At one point in the process the media is a thick slurry that can block the electrode reference junction and result in an electrode failure. Changing to the InPro 4250 SG pH electrode reduced the blockages. By using the advanced diagnostics functionality of the M700 transmitter, combined with the ISM features of the sensors, the operators were able to get real-time information on the condition of their pH electrodes. This allowed maintenance operations to be performed pro-actively, thereby reducing the number of unexpected failures and hence helping to maximize process efficiency.  
Chemical plant, UK





## Seamless Integration of ISM Diagnostics Into Control Systems

**Flexible system integration solutions for ISM sensors via fieldbus transmitters, converters to analog outputs or Ethernet allow a unique real-time integration of diagnostics information into control systems – truly adaptive.**

Contrary to conventional analog sensors, digital ISM sensors offer flexible integration of key diagnostic data into PLCs. Fully digital sensor technology also allows temporary and remote installations, as well as future oriented direct sensor integration solutions for specific industries.

### Fieldbus integration via transmitters

- M700 transmitter offer Profibus® PA and Foundation fieldbus™ solutions
- On-line integration of diagnostics and characteristic sensor information into PLC

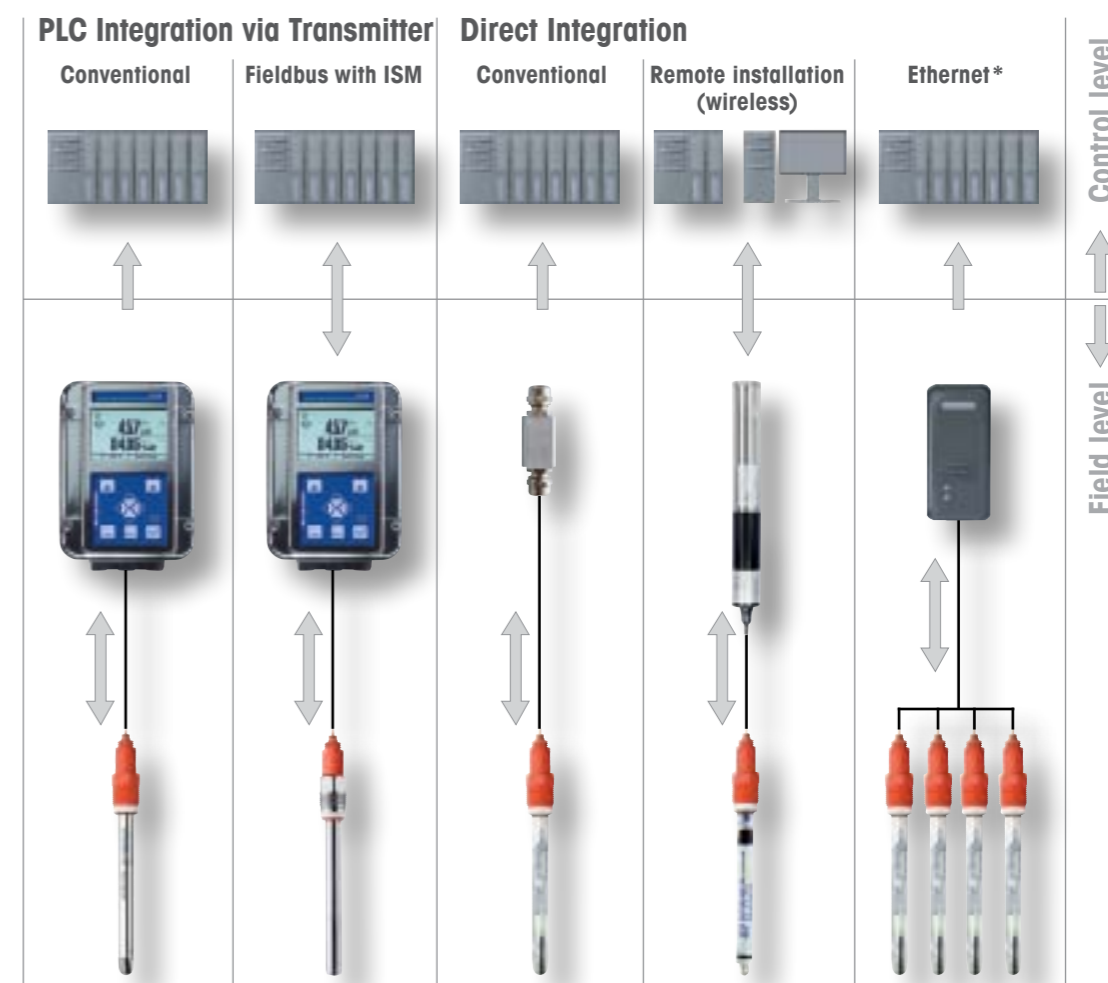


### Direct integration converters

- Converter cables from ISM to analog 4 ... 20 mA
- Converter cables for ISM sensors to conventional analog bioreactor control system inputs
- iConverter solution for ISM sensor integration via TCP/IP protocol offer full data access (coming soon)

### Wireless solutions

- iRO temporary logger solution via Bluetooth
- Cableless sensor-transmitter solution for remote installations
- Bluetooth based integration into Wago PLC



\* coming soon

The ISM universe offers a complete range of integration solutions into analog legacy systems as well as future oriented fieldbus systems.

- Fieldbus offers integration of sensor data and diagnostics information into control systems
- Converter cables for analog outputs allow consistent use of the same sensor throughout a pharmaceutical process
- Wireless and Ethernet based integration solutions are leading the way to a future of direct integration of sensor information into industry specific control systems such as in biotechnology or in integrated skids