

# Greater Process Reliability with Intelligent Sensors

**In the brewing industry, maintaining productivity and controlling operating costs is a constant challenge. Maintenance demands for instrumentation and unplanned production downtimes resulting from the failure of measurement technology are substantial cost factors. Cutting-edge process analytical systems with built-in intelligence solve this by predicting and indicating their own maintenance and reducing sensor lifecycle costs, and also increase process reliability.**

## Introduction

Improving production efficiency is vital to successful business operations. Part of that endeavor is ensuring brewery equipment is operating correctly and is well maintained. This is as true for analytical measurement systems as it is for any other plant asset. Failure to properly maintain measurement sensors can have a significant impact on efficiency and production costs. Reduced product quality, over- or underuse of ingredients, or unplanned downtimes can easily result from poorly calibrated or failed sensors. However, supporting an effective maintenance regime is a time-consuming burden on skilled staff. The answer is intelligent process analytical systems that not only monitor themselves for wear and advise operators when maintenance is required, but that also improve process integrity.

## On-board intelligence

Intelligent Sensor Management (ISM<sup>®</sup>) is an innovative technology for analytical process parameters that combines many features into a unique solution: one that is adaptable to specific production plant needs. ISM simplifies sensor handling and im-

ISM<sup>®</sup>

proves maintenance management, which translates into increased process reliability and reduced operating costs.

The basis of ISM is a microprocessor embedded in the sensor. Analog to digital conversion, memory storage, and sophisticated diagnostics algorithms held on the integrated circuit allow a wide range of features and provide a wealth of system possibilities.

**Digital signal – robust and reliable**

Traditional measurement systems send a sensitive analog signal to the transmitter which converts the signal into a displayed measurement. Electrical interference caused by surrounding equipment, the presence of moisture in the air, and long cable runs can degrade the sensor signal causing uncertainty as to the accuracy of the measured value.

ISM sensors operate differently. The on-board microprocessor converts the analog process value from the measurement into a digital value and conveys this to the transmitter. Being digital, the signal is immune to interference from electrical fields and moisture, and remains stable even over extended cables.

**Plug and Measure – fast and simple start up**



Fig. 1: Plug and Measure display on M800 transmitter

When replacement of an analog sensor is required, it may take a skilled operator up to one hour to configure and calibrate a new one. With ISM sensors, the calibration data is retained on the internal microprocessor allowing the sensor to be calibrated away from the

process in a convenient location such as a laboratory or maintenance shop. Once calibrated, the sensor can be stored until required. Further, when connected to an ISM transmitter, the pre-calibrated sensor is instantly recognized and the transmitter configures itself appropriately without any operator intervention (figure 1). Now when an exchange of sensor is needed, this Plug and Measure functionality means a pre-calibrated sensor can be installed and be ready to measure in under a minute, therefore substantially reducing maintenance time and allowing instrument engineers to concentrate on more skill-intensive tasks.

**Predictive diagnostics – efficient maintenance**



Fig. 2: M800 display showing DLI and ACT sensor diagnostics

It has been estimated that as much as 60 % of maintenance conducted at breweries is not required. Maintenance is often conducted on a scheduled basis, and an analytical sensor may get calibrated even though it may not actually be needed. ISM's predictive diagnostics

have solved this. ISM sensors monitor themselves for wear and stress based on past and current process conditions. This information is converted into tools such as the Dynamic Lifetime Indicator (DLI) and Adaptive Calibration Timer (ACT) (figure 2).

These tools allow a measurement point to be optimized on an ongoing basis and for all critical situations to be predicted so that maintenance staff can respond before production is affected. Because measurement point maintenance only happens when it is required, you can be certain you are not wasting maintenance resources.



Fig. 3: iMonitor display on M800 transmitter

The Dynamic Lifetime Indicator (DLI) provides technicians with an indication of how much the exposure to the process has altered the integrity of consumable sensor parts. In the case of METTLER TOLEDO carbon dioxide and optical dissolved oxygen sensors, by constantly

analyzing the process conditions and other factors, the DLI calculates the remaining reliable lifetime of the sensors' replaceable elements. The iMonitor display on the M800 transmitter shows all sensor diagnostics using easily read traffic light color coding (figure 3).

Through observing the DLI, such sensor consumables with a short remaining lifetime can be replaced preemptively before

they fail during operation, resulting in higher process reliability and fewer product quality fluctuations.

The DLI and other tools mean that a brewery's maintenance strategy can be changed from a passive, costly and unpredictable workflow, to a fully safe and controlled procedure.

**Seamless integration of diagnostics data**

Integration of ISM sensor diagnostics into control systems and asset management software allows real-time monitoring of sensor performance from the convenience of a maintenance room. This means that if production staff are away from the process and a measurement point needs attention, it will be noticed instantly.

**Asset management**

Optimizing the performance of analytical sensors enhances their reliability, improves process productivity, and reduces operating costs. iSense software for ISM sensors offers accurate sensor verification and calibration in any convenient location. The electronic user management logbook allows control and tracking of all sensor activities ensuring complete documentation of ISM sensors over their whole lifetime.

The DLI and other vital sensor data is also viewable on iSense. Now you have a single point which records the condition of your installed sensor base. Asset management ensures you always have sufficient stock of healthy sensors and allows you to enhance maintenance planning.



iSense software calibrating a dissolved oxygen sensor

**ISM Diagnostics Tools**



**Dynamic Lifetime Indicator (DLI)**  
Using a unique algorithm, the Dynamic Lifetime Indicator continuously calculates the remaining lifetime of sensor consumables.



**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.

### Conclusion

Continuous improvement in process equipment efficiency and maintenance are important business drivers. In-line analytical measurement solutions that enhance process reliability and product quality, while simultaneously reducing operating costs, are going to be of growing value.

ISM's numerous features and benefits mean that increased measurement accuracy, reliability of signal transmission, fast error-free sensor commissioning and real-time diagnostics information combine to create a powerful tool for improving process control and maximizing process equipment availability.

The flexibility offered by a wide range of solutions and further planned developments guarantees ISM will remain at the forefront of process analytical measurement technologies.

Further information on ISM can be found on our website:

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

### Features overview of ISM sensors:

- More precise measurement signal compared with analog sensors
- Advanced sensor diagnostics
- Predictive maintenance functions
- Plug and Measure functionality
- Digital IP 68 connector
- CIP / SIP counter



ISM dissolved CO<sub>2</sub> sensor

ISM dissolved O<sub>2</sub> sensor