

Greater Process Integrity with Intelligent Sensors

In the chemical industry, maintaining product quality while improving process safety 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 increase process integrity and reduce downtime by predicting their own maintenance. They also reduce instrument lifecycle costs.

Introduction

Improving manufacturing plant efficiency is vital to successful business operations. Part of that endeavor is ensuring production 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 analytical sensors can have a significant impact on efficiency and production costs. Reduced product quality, over- or underuse of reagents, and unplanned downtimes can easily result from poorly calibrated, dirty, 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 also improve process integrity.

On-board intelligence

Intelligent Sensor Management (ISM[®]) is an innovative technology for analytical process parameters that combines many fea-



tures into a unique solution: one that is adaptable to specific chemical plant needs. ISM simplifies sensor handling and improves maintenance management, which translates into increased process reliability and reduced operating costs.

The foundation of ISM is built from a microprocessor embedded in the sensor. Analog to digital conversion, memory storage, and sensor specific diagnostic 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. Users can therefore be assured that the measurement value received by the process control system is the same as the one registered in the process.

Plug and Measure – fast and simple start up

When replacement of an analog probe 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 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. 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. This substan-

tially reduces maintenance time and allows instrument engineers to concentrate on more skill-intensive tasks.

Predictive diagnostics – efficient maintenance

It has been estimated that as much as 60% of maintenance carried out at chemical plants is not required. Maintenance is often conducted on a scheduled basis, and an analytical sensor might be calibrated even though it may not actually be needed. ISM's predictive diagnostics tools have solved this. ISM sensors monitor themselves for wear and stress based on past and current process conditions. This information is converted into easily read tools such as the Dynamic Lifetime Indicator and Adaptive Calibration Timer.

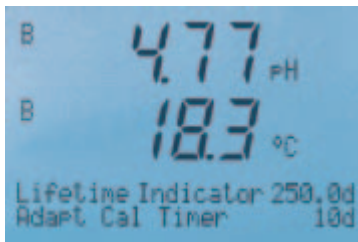
These tools allow a measurement point to be optimized on an ongoing basis and for all critical situations to be predicted so that maintenance staff can respond before production is affected. Because measurement point maintenance only happens when it is required, you can be certain you are not wasting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

Use the sensor or discard it?

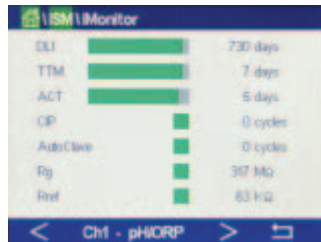
The Dynamic Lifetime Indicator (DLI) provides technicians with an indication of how much the exposure to the process has altered a sensor's condition. In the case of pH sensors, by constantly analyzing a probe's slope, impedance, the process conditions themselves, and other factors, the DLI calculates the remaining reliable lifetime of the sensor. The DLI is truly dynamic and can be set to take into account the severity of individual processes.

Through observing the DLI, sensors with a short remaining lifetime can be replaced preemptively before they fail during operation, resulting in higher process integrity and fewer product quality fluctuations.





Spider diagram provides clear sensor diagnostics on the M700 transmitter



Detailed sensor diagnostics shown on the M800 transmitter's iMonitor

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

Convenient calibration, easy traceability

Optimizing the performance of analytical sensors enhances their reliability, improves process safety, and reduces operating costs. iSense software for ISM sensors offers accurate sensor verification and calibration in a maintenance shop. 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 helps you ensure you always have sufficient stock of healthy sensors and allows you to enhance maintenance planning.

Tailorable to your requirements

Requirements across different chemical plants and individual processes can vary significantly, and one of the major benefits of ISM is that system functionality can be modified to meet specific needs. As mentioned above, diagnostic tools such as the DLI can be altered to accommodate the requirements of individual measurements. The DLI can be set differently depending on whether the sensor is being used for critical control or is simply monitoring an application.

ISM Diagnostic Tools



Dynamic Lifetime Indicator (DLI)

A unique algorithm uses actual and historic measurement and calibration values to calculate the remaining reliable lifetime of a sensor.



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.



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.



Seamless integration of diagnostics data

The invaluable sensor diagnostics data that ISM provides do not stop at the transmitter. Integration through HART® or FOUNDATION fieldbus™ 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.

Fieldbus integration via transmitters, direct integration using digital to analog converters, and a variety of wireless solutions are all available for ISM. ISM solutions are therefore compatible with legacy installations as well as the latest Ethernet-based technologies.

A range of advanced multi-parameter, dual-channel, and mixed-mode (accepts ISM and conventional analog sensors) transmitters further ensure the adaptability of ISM solutions to your needs.

Conclusion

Continuous improvement in process equipment efficiency and maintenance are important business drivers. Analytical measurement solutions that enhance product quality and yield, while

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
- ATEX, FM compatible

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

