White Paper

INGOLD
Leading Process Analytics

Remote Field Device Diagnostics
Confidence in Process Analyzers

Performance and profitability of a chemical plant rely on process consistency. Minimizing process variability depends on field devices stably measuring and controlling process parameters. Easy accessibility to intelligent instrumentation diagnostics is the key to proper field device management and greatly improving reliability and plant safety.

Field device maintenance

In a large-scale chemical facility, up to several thousand i/o are involved in running the various processes. Normal wear and tear causes field device performance to degrade over time, commonly resulting in process variability. Like all assets in a plant, automation equipment requires maintenance. Instrumentation needs verification, cleaning and calibration, valves need stroking and devices at the end of their life cycle need replacement.

This is an immense undertaking considering the thousands of devices and locations spread throughout the plant. The maintenance of field devices requires a significant cost in man-hours. Considerable time is necessary to physically check each field device, especially in plants with limited staff. Periodic routine maintenance has technicians physically checking each field device on a timely schedule. However, this strategy results in the checking of many devices that are functioning correctly, while also carrying the risk of missing devices that have developed potentially catastrophic failures in between periodic checks. It is largely accepted that routine maintenance does not prevent failures from happening and therefore a higher level of asset management is required to identify all failing devices.

METTLER TOLEDO

The principles of Industry 4.0

The 'Smart Industry' is seen as the 4th industrial revolution. The set of guidelines coined by the German government in 2011 to promote computerization in the industrial manufacturing segment, is known today as Industry 4.0. The concept was further defined in 2013 by the Working Group on Industry 4.0, which clearly defined implementation recommendations and four main principles.

These principles are:

1. Interconnection
2. Information transparency
3. Technical assistance
4. Decentralized decisions

These principals are applied to all assets in the industrial workplace to enable seamless connectivity and transparency for decision making and planning. The industrial network is the backbone in such a system. Historically, bandwidth has limited the amount of information on any network, and thus has been reserved for critical data. With the introduction of digital networks, bandwidth and connectivity have almost unlimited possibilities.

With the introduction of HART and fieldbus protocols such as FOUNDATION Fieldbus, PROFIBUS and now industrial Ethernet, a great deal of information from field devices can be fed to a platform, parallel to DCS and SCADA systems. With such a large amount of data being generated, dedicated software is required to collect, organize and present the information in a fashion that is easy to understand and to base decisions on.

Industrial Internet of Things is changing chemical plants

The Internet of Things (IOT) is already influencing our daily lives and will continue to do so in new and innovative ways. The ability to access, manipulate and allow everyday household objects to not only analyze, observe and interact with us, but also to make decisions and conclusions on their own, is a valuable tool for improving our lives and our efficiency. The workplace is no exception to this, and a key aspect of Industry 4.0 is the Industrial IOT (IIOT), the ultimate means of bringing the future of modern technology into your chemical plant.

Asset management software platforms have become a key tool in optimizing and streamlining maintenance tasks and assessing performance of key production assets. With the further implementation of Industry 4.0 and IIOT concepts, asset management platforms have become critical for receiving, organizing, analyzing and displaying the vast amount of data generated throughout a chemical production plant.

Such software is a centralized tool, using data available anywhere on the network and cloud-based systems. The software not only contains measurement values, but configuration information, commissioning, parameter assignment, calibration data and predictive diagnostics. This allows for easy access and uniform presentation of important data, as well as visuals and signals to ease decision making. Staff can easily prioritize work based on how critical a task is, as well as its urgency. Access to this data from remote locations also limits the need for technicians to enter hazardous areas for non-critical routine tasks.

Intelligent Maintenance Systems bring it all together

The combination of the network, software and plant assets make up a complete example of IIOT: the Intelligent Maintenance System (IMS). The IMS includes the use of advanced sensors, data collection and storage, and data analytical tools. Thus, the system can collect raw data from machinery and instrumentation in order to predict and prevent their potential failure. As the occurrence of failures in equipment can be costly and even catastrophic, the system analyzes the behavior of the asset and provides alarms and instructions for predictive maintenance. Such maintenance schedules based on intelligent information can save upwards of 50 % of the costs associated with repairing assets after they have failed, and can prevent (life-threatening) accidents.

Intelligent devices fit into these principles by offering the smart diagnostics interconnected into the overall plant network. This diagnostic information is available throughout the network and is used directly for technical assistance. Maintenance tasks can be scheduled for when they will be required. Sudden failure or abnormal functioning of a device can also trigger alarms for an immediate action. Further, such information can be used to optimize inventory planning for the entire plant.

Process analyzers need frequent servicing

Within the collection of field devices, analytical instrumentation typically has a higher maintenance need and requires more attention compared to instruments for measuring physical parameters. pH, ORP and (dissolved) oxygen analyzers are typical examples of essential tools that require "regular" maintenance.

Over time in the process such sensors will not only require cleaning, but also frequent calibrations as the measurement values drift due to process effects. Eventually, sensors need replaced when no longer measuring reliably. Standardizing procedures for sensor maintenance is difficult as different processes require different probes and their aging is highly dependent on process conditions at the measurement location.

Not all digital sensors are smart

Digital analytical sensors are rapidly gaining ground over their analog counterparts, but the mere fact of being digital does not automatically mean the sensor is intelligent. Some sensors may store calibration settings or manufacturing date. Others may simply count the number of days they have been used for. But none of this information will contribute to any intelligent maintenance system if the sensors lack predictive diagnostics. In fact, such data does not bring reliability to a level higher than that achieved through routine maintenance.

Sensors that simply count down days until a maintenance task should be performed generate a false idea of process safety. If a counter has not reached zero, a maintenance engineer may wrongly assume that a heavily compromised sensor is still fit for use.

When process analyzers are directly responsible for process quality, unnoticed sensor performance issues reflect themselves immediately in process variability. In safety applications, such as oxygen monitoring in inerting and blanketing operations, sensor drift may not be discovered, leading to false trips or dangerous incidents. The METTLER TOLEDO Intelligent Sensor Management (ISM®) platform is the solution to these issues.

Figure 1: Portable handheld Field Communicator displaying ISM information

Intelligent analyzers

METTLER TOLEDO digital analytical sensors embrace the concepts of Industry 4.0 with their ISM technology. While measuring the process parameters, the intelligent sensors are using the information to constantly calculate important diagnostic values.

ISM's Adaptive Calibration Timer (ACT) calculates the number of days until a sensor will require calibration. This optimizes the precise date when calibration will likely be required based on current and past process conditions.. The means the costs of calibrating earlier than necessary are saved, and calibration can be done before drift adversely affects process consistency.

Further diagnostics include the Dynamic Lifetime Indicator (DLI). This is the number of days remaining for which a sensor can confidently be used. Since the sensor's onboard microprocessor calculates these values in real time, the diagnostics not only represent the lifetime based on present measuring conditions, but also the historical conditions the sensor has endured. These diagnostics provide clear and precise values that technicians can easily understand, and tell them exactly when sensor calibration and replacement will be required. In addition, ISM pH sensors output glass integrity and reference impedance, instantly alerting the user in cases of breakage and fouling. Figure 1. shows ISM diagnostic information displayed on a hand held field communicator for instant analysis.

Asset management software

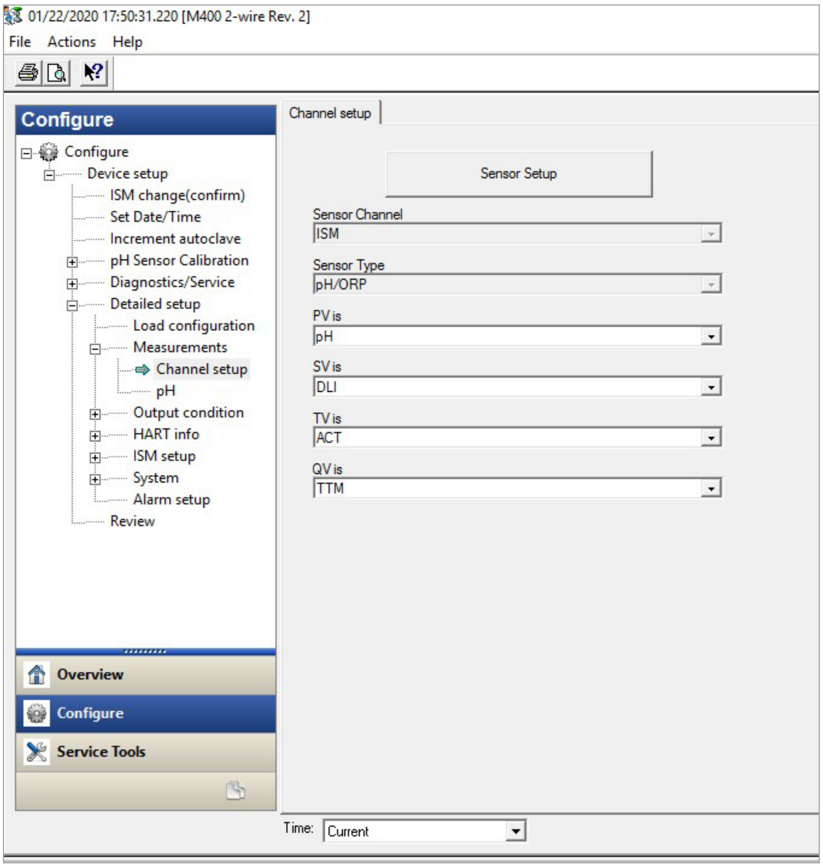

Figure 2: AMS software showing information from an ISM pH sensor.

Following the concepts of Industry 4.0, all ISM predictive diagnostics are available throughout the plant network for planning and decision making purposes. The central tool to organize this information is asset management software. Solutions such as AMS, SIMATIC PDM, and PACTware accept and organize all the information from field devices (Figure 2.).

Besides process variables, the software contains configuration information, parameter assignment, calibration data and predictive diagnostics. This allows for easy access and uniform presentation of important data, as well as visuals and signals to facilitate decisions and action taking.

Indeed, using ISM and asset management software, maintenance technicians can easily see how many days remain until sensor calibration or replacement is needed (Figure 3–4). METTLER TOLEDO's ISM-compatible transmitters allow seamless connection of intelligent diagnostics information to AMS systems through HART, PROFIBUS, FOUNDATION Fieldbus and Profinet communication protocols.

Accessibility

Continuing on the application of Industry 4.0, the diagnostics information can be further interconnected to the IIoT. The asset management software, when connected to the internet, is accessible from any external internet terminal. This allows workers to quickly access the diagnostics of their field devices away from the plant environment, on their mobile phones, and even from home if technicians are working remotely.

Conclusion

Industry 4.0 is and will continue to be the driving force for the modern chemical plant. An inherent part of the strategy is an Intelligent Maintenance System that strongly improves reliability, plant safety and with that, plant profitability. Continuous real-time availability of instrument and machine diagnostics form the core of the Intelligent Maintenance System. Asset management software platforms enable instant access to remote field devices and help define maintenance task in order to optimize workers' time.

As with any system, it is only as strong as its weakest link. Only device diagnostics based on real process data and continuous instrument self-assessment can predict maintenance needs and protect safe operation.

METTLER TOLEDO ISM sensors have the unique ability to evaluate their performance and calculate the days remain-

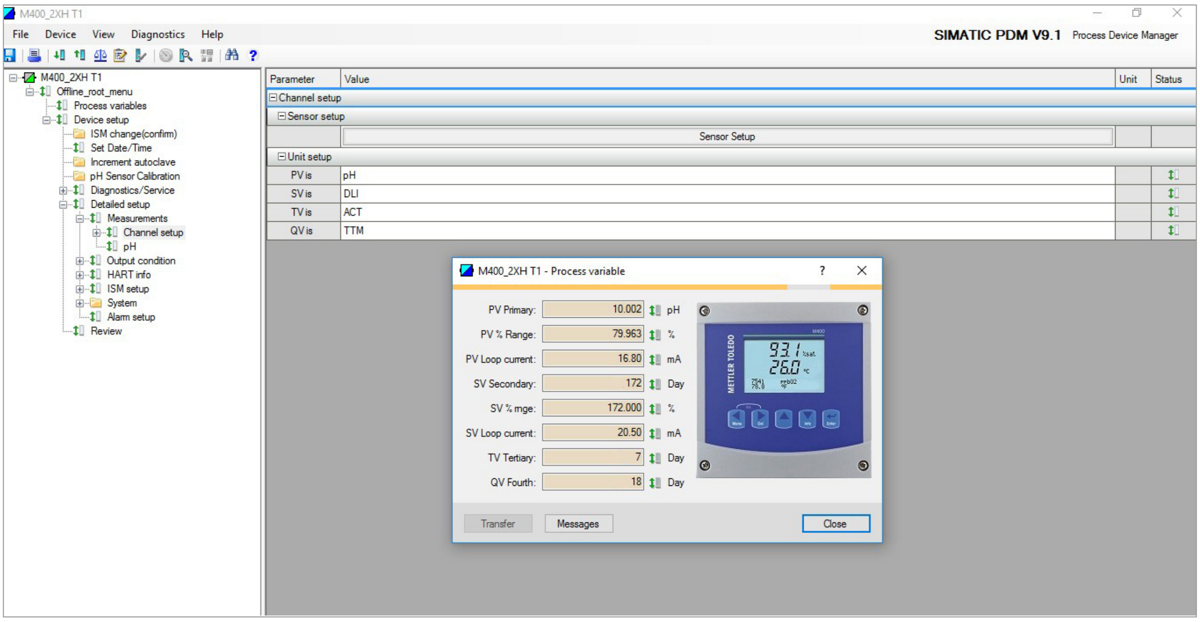

Figure 3: SIMATIC PDM software displaying real-time values from an ISM pH sensor.

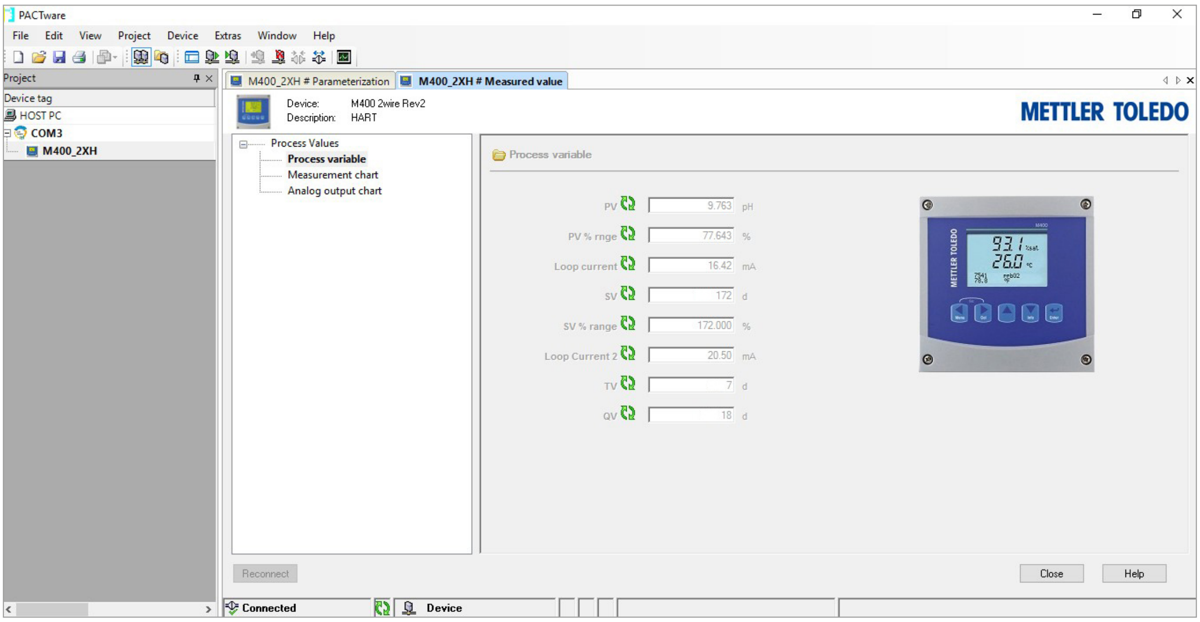

Figure 4: PACTware software displaying ISM predictive diagnostic values.

ing until calibration and replacement will be required. These highly advanced, predictive diagnostics can be easily presented in asset management software and can be accessed via the internet on any suitably equipped PC or laptop, ensuring workers are confident in the performance state of their devices at any time and place.

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