

## A New Approach to Maintaining Process Control Field Devices

Written by Thomas Wallace, Asset Management Solutions, Fisher-Rosemount Systems, Inc.  
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**Adding microprocessors to field instruments has transformed them into data acquisition systems and transmission terminals. Now technicians can use well-designed software to see what is happening inside plant instrumentation.**



When asset management software is used, devices that need service can signal the operator or maintenance shop before they fail, lowering maintenance or repair costs and reducing the risk of unscheduled shutdown. Instrumentation technicians responsible for reliable operation of thousands of field devices commonly receive calls from operators who are having trouble controlling a piece of production equipment, a reactor for example. If the plant is equipped with state-of-the-art asset management software, the technician can quickly determine which devices are associated with that reactor and which ones could be causing problems.

Rather than going into the plant, the technician can evaluate each smart device from a personal computer in the instrument shop. For example, a quick computer check of the condition of each field device serving that reactor might reveal a travel deviation alert from one control valve, indicating a significant difference between the valve set point and its actual position--a situation requiring attention. The technician is spared long hours of checking out individual devices on the plant floor and knows exactly what must be done to correct the problem.

Although the poorly functioning valve in the reactor is hypothetical, the solution to this common problem is not. Up to 60 percent of instrument maintenance labor dollars are spent on devices where no problem exists or for routine checks to verify the condition of properly functioning devices. These requests often occur because an operator has no means of checking on the health and validity of field instrumentation and therefore calls the instrument shop when a problem is suspected. The most time-consuming and expensive service calls are those that conclude with no problem found.

Now, instrumentation technicians have a way to see what is happening inside plant

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instrumentation by using well-designed software in conjunction with intelligent field devices and new standard communications. These technologies allow technicians to

- Make sure field devices deliver optimum performance
- Use predictive maintenance to maximize service and repair resources
- Perform configurations and calibrations in half the normal time
- Document maintenance as required by industry regulators.

From a broader perspective, the integration and use of information acquired from intelligent field devices eliminates unexpected shutdowns, reduces downtime, and improves overall equipment performance.

### Intelligent field devices

The process control system is designed for tight control of valves, motors, heaters, etc., in real time to manage feed stocks and make quality products. However, to increase the reliability and maintainability of plant instrumentation and process equipment and to lower the mean time between failures and time to accomplish repairs, a vast amount of information is needed about the condition and status of field equipment. The increase in smart instruments throughout the process industry makes it both practical and economical to use all the information they generate. It is estimated that 30 times more information is available from smart instruments than the simple variables required for process control.

Consider a smart pressure transmitter. Beyond providing basic pressure data, it can produce information relative to an overpressure condition (which can lead to inaccurate readings), an overtemperature condition (which can cause premature failure), a loss of signal, a stuck signal, and more. In the case of a control valve, the number of times the valve has cycled is a key indicator of how much work it has done and can be used in predicting its useful life. As the reactor example mentioned previously suggests, the internal position of a valve stem versus where it is supposed to be is critically important to the reliable operation of that piece of equipment. Smart valves routinely provide this kind of information.

The accuracy of field measurements and the reliability of field instrumentation are influenced by internal conditions that can be reported only by intelligent devices, and those conditions can have a direct impact on the availability or reliability of the process itself. Demand to make use of such data is growing. The acquired information must be made available well beyond the process control system.

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### **Communicating the data**

Automation architectures are evolving to deliver information from intelligent field devices, acting as information servers, around the control system to computers where the information can be used for diagnostic and maintenance purposes, for reliability analysis, for purchasing and inventory control systems, and for the overall management of plant assets.

General-purpose field communications protocols capable of transmitting large volumes of information for these purposes are currently in use. Today, the Highway Addressable Remote Transducer (HART) protocol offers the broadest range of user benefits and is supported by a wide range of vendors. Unlike proprietary communications technologies that lock users into field devices from a single manufacturer, the HART protocol is an open communications standard that works alongside any control system without interrupting the flow of process data.

Whereas HART transmits both analog and digital signals, the emerging Foundation Fieldbus protocol will be used with all-digital systems. Profibus is another new protocol under development. These sophisticated protocols are capable of carrying complex messages. Their use enables technicians to examine an instrument's self-diagnostics and also run extensive diagnostics programs on each device.

### **Using the information**

For field data to be turned into useful knowledge, a reliable method of receiving, processing, and presenting it is required. Maintenance personnel require information on the condition of equipment, while operations personnel want other information and purchasing or inventory control requires something different. Each group needs information tailored to specific requirements. For example, the enhancement most desired by maintenance supervisors is seamless access to maintenance-related data. Advanced software applications are performing that function now.

Monitoring the intelligent devices installed in a plant and viewing their self-diagnostics probably are the most common functions of the instrumentation technician. Most smart instruments provide extensive information about their own health. Access to on-line device status provides a way to monitor and ensure proper device performance. The technician calls up the information device by device to see if any faults are flagged.

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Automatic alert monitoring also is available to automatically scan devices on a user-determined schedule. If device problems exist, the information is posted to an alert monitor list. If no specific problems are found but something is suspected, it may be possible, depending on the software package, to use on-demand diagnostics. Certain operating parameters may be changed slightly to see if the device responds. For example, safety valves might be moved slightly to determine that the valve is not stuck and actuator pressures are sufficient to move the valve.

Automatic scanning of devices requires a higher level of sophistication. Such scans may uncover devices that need immediate attention, or they might generate lists of devices due for calibration. Some software is designed to interface with computerized maintenance management systems that track maintenance schedules and alert technicians when maintenance is due. Sophisticated software that identifies a need for instrument calibration combined with intelligent calibrators may also be able to automatically perform configurations and calibrations in a fraction of the time required for conventional calibrations.

Advanced, maintenance-oriented software permits maximum use of the information transmitted through a general-purpose protocol. The more advanced software receives the data, organizes it into open databases, and makes it available to other applications within the organization. Predictive maintenance is one of the key attributes of such systems. When the software makes a prediction about the expected service life of any piece of equipment, knowledgeable decisions can be made as to when repair or replacement will cause the least disruption to production.

Decisions such as run until failure, continue to run at reduced load, run until a scheduled shutdown, or repair immediately are based on highly reliable information, including the importance of the piece of equipment to the process. This approach helps focus limited resources on problems that warrant attention rather than wasting time on devices expected to continue working properly. In this way, instruments and control systems can be maintained in a high state of continued reliability.

### What to look for

It is not difficult to obtain a communications and software package capable of accessing information generated by smart instruments, but not all software is created equal. First, potential buyers should be sure that nothing done with this ancillary information degrades the performance of the control system. Users of heavily loaded control systems may want to reserve all remaining control system capacity for future process control needs. Solutions available from various vendors of HART-compatible devices will carry the information through

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multiplexing, through intrinsic safety barrier panels, and through intelligent termination panels where information can be accessed by computers without using control system communications and computation resources.

However, data acquisition by itself does not provide the cost and time-saving benefits most maintenance managers are seeking. A flexible, maintenance-oriented, modular software platform that is both expandable and scalable must be found. Such software can provide access to a single device or to highly integrated client/server solutions for large multi-instrument plants.

In addition, the software should use device descriptions (DD), which are essentially files of field device attributes residing in the host application. The DD is essential to the interoperability of devices, allowing users to choose those that best meet their needs, regardless of manufacturer. As each new device is introduced, the description of attributes and capabilities is loaded into the host, providing complete data about each device in the plant. The DD technology is fundamental to the HART and Fieldbus protocols.

To be most useful, the software must accommodate the broadest range of field devices. It should support virtually all current HART and future Fieldbus devices, not just those manufactured by one company. In other words, the company should choose a technology to accommodate the widest range of applications needed to meet current and future plant and business needs. A number of good solutions are available. However, many tend to focus on a specific vendor's field instrumentation, which does not generally solve the problem of the large multi-instrument user.

Finally, it must be possible to integrate data from the field management software with any computerized maintenance management system the plant is running. An integrated solution is essential to realize the greatest value from information derived from intelligent field devices, transported through a state-of-the-art data highway, and processed in sophisticated, maintenance-oriented software.

Estimates show that one-third of all dollars spent on maintenance are wasted because of unnecessary work or ineffective practices. This trend can be reversed through the application of information generated by intelligent field devices and acceptance of the concept of predictive maintenance. The result can be a significant contribution to a plant's profitability.

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It is not necessary to totally restructure maintenance practices. A plant can start small and expand the use of process floor information as needs dictate and budgets allow. The key is to begin building a database from the smart devices now in operation and expand the use of the available information as the number of such devices grows. A scalable and expandable platform can grow into a plantwide system that supports the reliability and maintainability of all field instrumentation. **MT**

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