Beyond basics

Asset management software pushes advanced diagnostics.

Plant control system operators and maintenance technicians have a ton of responsibilities. They must make sure the process is running optimally and make sure instruments that control the process are also performing properly.

Over the past few years, the importance of asset management has received a lot of attention. More than a quarter of maintenance dollars are spent on instruments and valves (27%, compared to 24% on mechanical equipment and 24% on process equipment), according to some industry data. Quite a few companies have implemented software applications to assist with managing smart transmitters and valves.

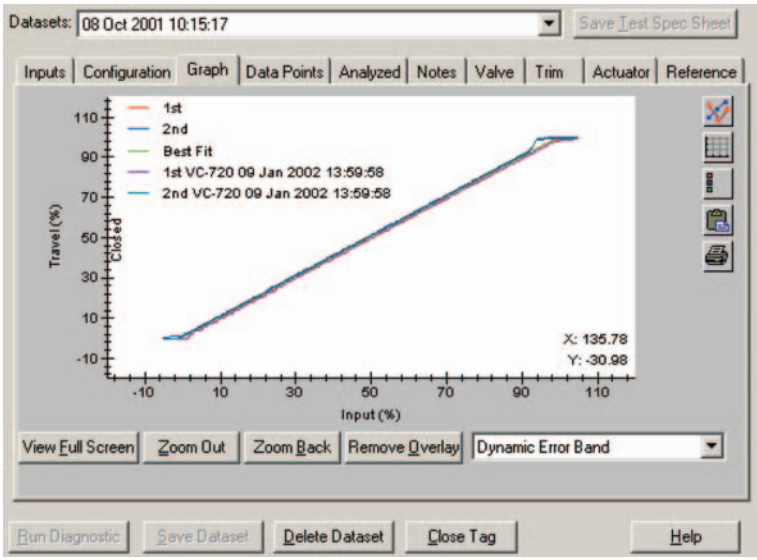
Typically, the software runs basic diagnostic functions and troubleshooting, making changes to the device's parameters and configuration and managing device calibration. These software applications also automatically document changes to the devices, for keeping historical records.

As workers have become more comfortable with using software for asset management (in place of traditional paper records), users have been looking to expand the capabilities. Specifically, the area of advanced diagnostics has been the main focus. As plants move away from reactive maintenance practices, which are costly and time consuming, users need tools to allow for predictive maintenance. They want to know which instruments need attention and the exact requirements for what type of work or repair they need to do. The scope of asset management software has expanded to include the ability for advanced diagnostics.

Smart devices

Asset management in a plant environment has come to mean managing the smart transmitters and valves, making sure they are configured and performing as specified. Smart digital protocols allow access to much more than just the device's process variable. These devices can be set up on a network to transmit live information about themselves and the process in which they are used. The information is stored in the asset management software. "Real-time" information along with the historical records in the software give users a chance to see the big picture, and make decisions based on all the data.

Proper management of smart assets is important throughout the life cycle of a plant, and the use of software tools is key. During the start-up of a new plant, or even just a few new devices, software can quickly build up a database of devices, perform loop checks and basic calibration methods, and confirm proper wiring and configuration of the devices. These can all happen faster than they can with traditional start-up practices. For ongoing maintenance tasks, the software troubleshoots devices; changes and compares device configurations;



A valve signature is overlaid on the original for comparison.

defines, schedules, and documents calibration records; and keeps the history of all devices. All of this leads to an increase in the plant's throughput and availability, improved product quality, and lower costs for maintenance and operations.

Advanced diagnostics

Maintenance engineers agree that calibrating and performing troubleshooting on valves is very time consuming. Because valves are critical in the control loop, they receive a lot of attention. The downside of this can be a user spends too much money and time working on valves that do not require maintenance. As plants strive to be proactive, it is not uncommon for them to have annual or semiannual overhauls of all valves, not knowing if they need it or not. Today, however, technicians use the advanced features in their asset management system to perform tests on HART or Foundation fieldbus digital valve controllers connected to the valves. Technicians can diagnose specific problems quickly and easily, and workers only spend time on the valves that require maintenance. Also, because the diagnostics and calibrations can run while the valve is in service, the tests can run and catch potential problems before they affect the rest of the process.

One such diagnostic is the valve signature. This test is usually run when a valve is new to benchmark its performance, trending the travel distance when opening and closing versus the pressure applied. As users perform the test over the years, they can overlay the results on the original, determine actuator spring rate and valve friction, and see if any degradation has occurred, such as problems with the packing. Other features may include the following:

- step response test, to minimize overshoot, dead band, and dead time
- dynamic error band test, to determine how the valve will perform under dynamic conditions
- calculation of friction, spring rate, and other parameters, to give the user the best possible view into the health of the valve
- tuning and calibration, to set up the valve properly and quickly during commissioning

All of this information helps users pinpoint exactly what needs repair, instead of replacing parts that are still good. Weyerhaeuser in Grande Prairie, Alberta, Canada, used the advanced valve diagnostics in its asset management software and realized savings of more than $19,000 (CAN$26,000) during one scheduled shutdown.

Normally, the company would remove valves during its annual shutdown and send them out for repair or replacement. Instead, the company ran diagnostics and tests on the valves and repaired only what was necessary.

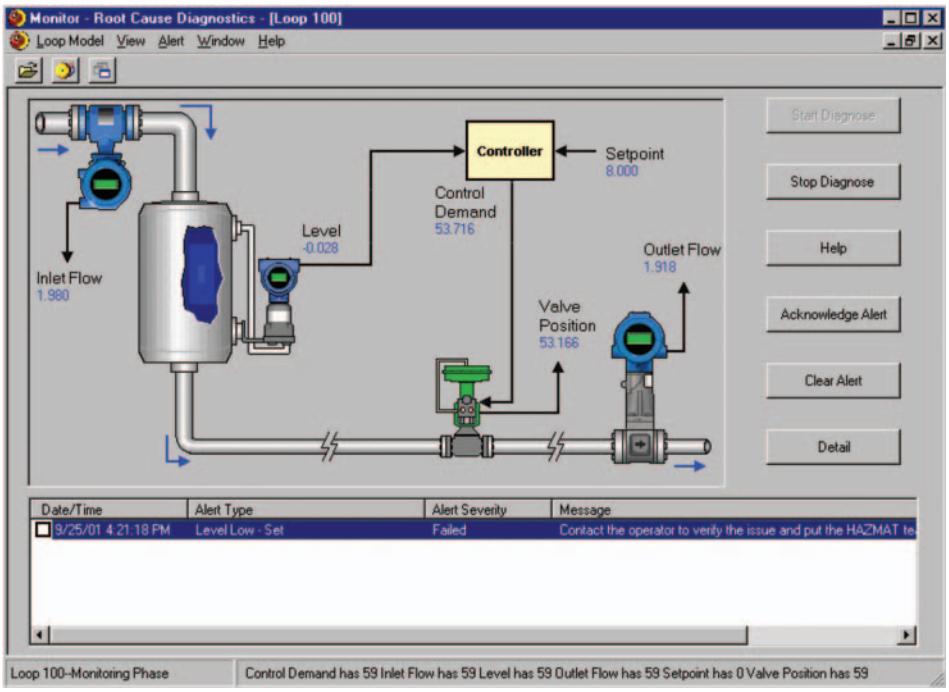
A step higher

Process upsets can occur by factors other than device failures. Basic asset management software can usually detect device-level alerts, but plant operators also need to be aware of problems in the process. Failures that had been difficult to detect in the past are now getting proper attention by using advanced software options.

Plugged impulse lines are a common problem in some industries, in the lines between the main flow piping and the flow or pressure transmitter (usually a multivariable or differential pressure transmitter). Various conditions, such as debris in the process fluid, can cause a buildup or plugging in the thin impulse lines. The main process is still flowing, and, because the plug "traps" some fluid up against the transmitter, the transmitter is still reading a pressure. However, the control room is unknowingly running on false data. After several hours or days, the trapped pressure may bleed out, causing the operator to take notice. Although the operator ultimately figures out the problem, the fact that the process was "running blind" often means the company must toss out the throughput.

Worse yet, the false readings from the transmitter do not allow detection of real process problems, and a larger plant failure can occur.

Foundation fieldbus pressure transmitters are available with built-in ability to detect plugged impulse lines. Software options are also now available to detect plugged impulse lines when HART transmitters are measuring the process. Operators can select which transmitters they want to monitor. The software first learns the normal steady-state data from the transmitter while the process is flowing. Then, it goes into a monitoring mode. Using built-in specific diagnostic algorithms, the software "watches" for a change in the conditions and detects when the impulse lines plug



Monitoring of the liquid level loop.

up. Operator notification comes via PC display. As with all good asset management procedures, the incident undergoes documentation in the software's audit trail. Early detection of plugged impulse lines can save thousands of dollars in lost production time and material.

At a higher level still is the need for diagnostics of entire flow or level control loops. Control loops usually have several types of instruments, including pressure, temperature, and flow transmitters, as well as valves. Because devices in a loop may have different smart protocols (or no protocol at all, in the case of conventional devices), new software has been developed to be independent of protocol. Using device variables coming through a control system with an OPC server, the software can monitor the process loop and look for the root cause of process problems. A single device may not display an alert, but a problem could be occurring in the process. Setting up this type of software option is similar to that described for detecting plugged impulse lines. First, the operator selects which devices and variables in the process loop he or she will monitor.

Predefined templates in the software make the configuration fast and easy for the user. With the process running, the software learns the normal steady state, followed by the monitoring of the process. When the system detects a problem, the user gets notification via an onscreen display, and, of course, the incident undergoes documentation in the asset management software. Examples of detectable conditions are as follows:

- measurement sensor drift
- liquid leak
- valve problem
- head loss
- unsteady process

The benefits of detecting problems early are most often tied back to the time and money saved by not having a major shutdown due to undetected issues. Users find out about problems that may otherwise go unnoticed, and avoid costly, potentially dangerous, unplanned shutdowns.

Need for speed

Newer options for asset management software can also deliver benefits during the start-up of a new plant. Software can greatly reduce the time required for interlock checking. It can also streamline the periodic checks throughout the operation of the process plant. Interlock checkouts test the response of the control system during normal and emergency situations. By setting devices to simulate process variables, operators can determine if the system will perform properly during actual production. In the past, interlock checking was a tedious and time-consuming process. It often required several technicians around the plant to "set" the various transmitters in a fixed-output mode, wait for a technician in the control room to confirm if the test was successful, and then set each transmitter back into normal mode.

Interlock checkout software makes the process much easier and virtually mistake-free. A single technician can be at the PC, using the software to set the transmitters at the desired output. The control system still confirms the performance. Once the tests are complete, the software lets the technician quickly and easily set the transmitters back to their normal mode. Devices in a fixed mode highlight on the PC screen, so users will always know if a device has not released.

Using this type of option can reduce a typical ten-hour interlock checkout into a simple thirty-minute procedure. Not only can this software option speed the time of interlock checking, it contributes to starting up a new process faster. This means the plant is producing products and profits sooner.

Remote access means that an on-call technician can view the asset information from a Web site at home prior to making a midnight drive to the plant. Web-based tools can tie together more than just transmitter information.

Net moves

Perhaps the most highly anticipated functionality in the world of asset management software is access to data on the Internet. As the need for remote access and the sharing of information becomes more important, new Web-based tools have arrived.

The tools make it easier to view asset data, for anyone from maintenance technicians and control system operators to plant managers. Users can view the status and configuration of smart devices, refer to historical information in the audit trail, and access calibration schedules and history.

Remote access means that an on-call technician can view the asset information from a Web site at home prior to making a midnight drive to the plant. Web-based tools can tie together more than just transmitter information. Software monitoring pumps, motors, boilers, and larger equipment can feed the data up to a single Web page. Users can view instruments and equipment from around a single plant, or even multiple plants. Overall maintenance practices improve because access to the information makes decision making easier. If the user identifies a need for maintenance, scheduling the work can happen faster and more efficiently.

Asset management software can now go beyond the basic functions of configuration, simple diagnostics, and documentation of smart devices. By integrating the advanced options into maintenance and operations practices, tasks occur more efficiently and effectively. The purpose of asset management is twofold: to ensure that instruments are healthy and configured properly and to allow access to current and historic information. In doing so, users make informed decisions, and process plants realize the benefits of running production closer to specified levels, with greater uptime and less unscheduled downtime. Whether the tools perform advanced diagnostics to determine if a valve requires maintenance, or if they monitor critical process loops to detect process upsets earlier, the cost of maintenance goes down while production increases.

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