Avoid the Drama of Downtime

There are lots of analog devices still in the field and not many new plants are being built right now, so upgrades are taking center stage. But do you simply enhance the current infrastructure with digital devices, or adopt an entirely new control strategy?

To upgrade or not to upgrade—that is the question today's dour economy is forcing many manufacturers to ask themselves about the old analog sensors and instrumentation in their plants. They often wrestle with the question for a while, looking for evidence that installing digital technology will squeeze more from their processes to improve their competitive positions. "These end users are in the middle of a migration and modernization crunch," says Larry O'Brien, global marketing manager for the Fieldbus Foundation in Austin, Texas.

What can make these decisions particularly difficult is the strategy. Do you simply enhance the current infrastructure with digital devices, or do you adopt an entirely new control strategy?

Questions about the control strategy factor into any decisions about upgrades because, like the sensors and instrumentation, the control systems can be more than 20 years old, too. Boston-based ARC Advisory Group estimates that the installed base of process automation nearing the end of its useful life is approaching $65 billion. For this reason, O'Brien sees any move to modernize as a good opportunity to plan for migrating from the conventional 4-20mA infrastructure to a fieldbus architecture.

He believes that replacing the entire system, both instrumentation and controls, with a digital communications network is well worth the effort and expense. "You get to see your process in 'high definition," he explains.

"Foundation Fieldbus devices allow transmitting multiple values and a huge range of diagnostic information that is simply not available with any analog-based technology." Some manufacturers find that having more information can generate tremendous savings, not only in operations but especially in predictive maintenance.

"When used properly, digital technologies can provide far more functionality than their analog counterparts," adds Todd Garner, vice president of sensors and communication, for Siemens Industry Inc.'s Industry Automation Div. in Alpharetta, Ga. Besides eliminating drift and boosting the accuracy of measurements, digital instrumentation and control can perform the complex functions that are necessary for diagnostics, safety, control, supervision, and monitoring in a plant.

Garner warns users, however, to keep the differences between the digital and analog technologies in mind in the planning stage. "In most modernization projects, it is not feasible to replace all instrumentation and control system components in the plant simultaneously," he says. "Therefore, you have to pay special attention to the interaction between the existing systems and the new technology. In many cases, modernization requires more than just replacing existing systems by their digital equivalents, because the two systems are not necessarily functionally identical."

A Hart for bioplastics

To avoid this, many users prefer to forego the enhanced functionality. Instead, they add digital communications to their installed base of 4–20-mA analog devices by turning to the Hart Communications protocol, which allows an analog signal to serve as a carrier of some digital data. An example is NatureWorks LLC, a producer of biodegradable plastics in Blair, Neb. Management there had decided to perform the upgrade when the company replaced an old, proprietary control system that was no longer being supported by its manufacturer.

The process for producing plastics from sugars extracted from corn and other plants received a new distributed control system (DCS) from NovaTech LLC's Process Control Div. in Owings Mills, Md. "After choosing our D/3 DCS, the company's engineers determined that they preferred Hart field instrumentation because it is easily connected through the D/3's 8000 Series Ethernet I/O modules," says Joe Shingara, director of product marketing at NovaTech.

Besides the ability to get service from a variety of sources, a chief benefit of using these intelligent devices is the communications established by the Hart protocol and input/output (I/O) modules. Not only does FieldCare asset management software from Endress+Hauser Inc. of Greenwood, Ind. detect and populate the asset database automatically, but it also gives NatureWorks engineers access to all field devices connected to the DCS. Engineers and technicians, therefore, can configure and manage these devices remotely without having to travel to the site and climb on scaffolds. "I was actually able to do it offsite from my desk," reports Don Marek, president of Plant Services Inc., the Omaha-based consulting firm that installed and configured the instrumentation.

"The new technology also makes maintenance easier," Marek adds. Not only can operators monitor the process from the control room, but they also can monitor the health of the sensors and instruments themselves. Every time a Hart device responds to a request for information, it also sends six bits about its status and condition, thereby reporting key performance indicators about itself. Operators can dispatch technicians to recalibrate, repair or replace the device when the data indicate the need.

Another important benefit of the upgrade at NatureWorks was better accuracy. The intelligence in the new flowmeters, for example, now corrects for temperature fluctuations, which can affect the density of the material appreciably in some parts of the process. "With this information, we were able to improve the material balances and, therefore, the efficiency of the facility," reports Marek. "And we were able to do that without even being on site."

Marek attributes much of the success of the project to allowing a long-enough lead time to do the appropriate due diligence before the implementation. “We spent the better part of a year and a half in planning, testing, and performing simulations before the building phase,” he says.

New life for legacy systems

For most companies that still rely on a legacy infrastructure of analog devices, using the Hart protocol to carry digital data on the analog signal could be the simplest way to exploit the benefits of digital technology. “At least 70 percent of devices sold in the past five years are Hart-enabled,” notes Chuck Micallef, a marketing consultant for the Hart Communication Foundation headquartered in Austin, Texas. “The chances are pretty good that users already have Hart devices scattered throughout their plants.”

If they are tied to an analog-only system, then the control system is reading the primary variable, pressure on a pressure transmitter, for example. “But that doesn’t mean that’s all the device can tell them,” says Micallef. “It can also possibly report the local temperature.” To extract and make use of that information, one can install tools—such as multiplexes, remote I/O, and loop converters—that will send the data to a control or asset management system.

Shingara at NovaTech advises standardizing on a set of technologies to avoid installing a hodgepodge that is difficult to understand and maintain. “We advise our customers to work in an orderly way establishing standards for families of field devices, how they will be programmed, sequenced, interlocked, visualized, documented and managed.”

Open a door to innovation

No matter whether a plant goes with Hart or an all-digital system like Foundation Fieldbus, going digital will do more than just enhance instruments like the flowmeters at NatureWorks. It will also open the door to a whole new set of technologies, as United Canadian Malt Ltd. has discovered through continuous improvements to its processes for producing extracts of malted barley, wheat, oats, and rice. Working with Siemens Industry’s Industrial Automation Div., the Canadian extract producer has been able to upgrade many of its level sensors with radar-based transmitters.

Recently, for example, the company fitted the second of two 15-meter outdoor silos on its site in Peterborough, Ontario with a Siemens Sitrans LR560 microwave-radar level transmitter. As the silo receives malted barley, the main ingredient for its products, by rail car or truck every few days, the transfer generates a significant amount of dust. The previous mechanical rotary-paddle switches and plump-bob systems were just too unreliable. “Both of these devices were prone to costly maintenance and failures,” explains Monte Smith, general manager. Once, a failure even permitted overfilling, which demanded a labor-intensive cleanup of both the silo and its surroundings.

The high cost of maintaining these mechanical systems and the lack of trust in their reported readings drove management to seek new technology. It was obvious that the operators needed a local display inside the building where they could see reliable level readings at a glance. They needed to be able to check the screen periodically and stop the transfer well before the silo was completely full.

To get this ability, Smith and his team turned to the Siemens radar technology because various versions of it had already solved some level-measurement problems elsewhere in the plant. “It is often challenging to obtain accurate measurements of some of our products,” says Smith. An example is wort, a liquid extract. Steam and foam generated during its transfer, a sticky residue caused by the foam, and a weekly chemical sanitation bath and high-pressure washdown create a harsh environment for sensors that have to come into contact with it.

Because the noncontact radar technology worked in wort production, it was not much of a surprise that the LR560 has required no maintenance since its installation on the second silo.

“The yearly maintenance cost associated with the previous mechanical level system has been eliminated,” reports Smith. **“The new equipment was paid back well within the first year of operation.”**

Consistently accurate measurements contributed to this rapid payback. Besides being able to see through the dust and measure the contents of the main section of the silo, the microwave radar also accurately measures the level in the cone crowning the structure. United Canadian Malt knows that the measurements are accurate because it validates them against a mathematical interpolation of its production data.

Having access to accurate data in real time permits the company to maintain its inventory much more precisely. “The information provided by the silo level radar unit has provided us with the ability to improve the scheduling of different incoming grain lots,” says Smith. Not only does this translate into lower demurrage costs for holding railcars, but it also assists in the recordkeeping required by the government.

Don’t tolerate marginal performance

Except for special cases involving harsh environments, such as those at United Canadian Malt, the reliability of sensors and instrumentation seems not to be quite as problematic as it once was. In fact, Marek at Plant Services goes so far as to assert that reliability has been the most important technical advancement in sensor technology and instrumentation over the last decade.

The Hart Communication Foundation has heard similar reports from its members. Anecdotal evidence suggests that devices that might have lasted only three to five years in the past now might have a lifespan of ten years. “Reliability is now to the point where some companies have adopted a maintenance strategy of run to failure,” says Micallef, rather than having a proactive preventive maintenance program that replaces them periodically.

For this reason and because of the technology available today, there is no reason to tolerate marginal performance and unexpected shutdowns caused by inaccuracy and failures of your sensors and instrumentation. “If the plant is not running, it’s not producing product to make money and pay the bills,” says Marek. And that fact gives you a definitive answer to the question of whether to upgrade or not to upgrade.

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