



# FEEL THE PULSE OF AUTOMATION

By Rob Spiegel, Contributing Editor



## Industrial fieldbus networks are being used to deliver critical diagnostic information to help plants run more efficiently while improving asset management

**W**hen Cleveland-based BP Chemicals Inc. decided to build a 1, 4-butanediol (BDO) plant in Lima, Ohio, managers wanted the plant to achieve high reliability without the complexity and redundancy of a traditional process control system. “In designing the BDO plant, we wanted to avoid older analog communications,” says John Rezabek, controls specialist at the Lima complex. “An analog system would reduce our design flexibility, inflate life-cycle costs and complicate upgrades.”

Instead, the company called on Emerson Process Management, Austin, Texas, to create a distributed control system using Foundation Fieldbus, with control algorithms running in 83 of the architecture’s 85 Fisher digital valve controllers. In addition, all dual-element transmitters rely upon on-board signal-select blocks, and 71 fieldbus segments serve 350 fieldbus instruments and valves, handling 130 feedback loops. Each of the system’s 400 discrete devices in the process is wired to the automation system process controllers. Thus, the entire system—with the exception of emergency shutdown function—is covered by a single operating system.

The benefits are numerous. The open, standards-based fieldbus network provided cost savings during set-up, because the pre-engineered blocks meant there was no need to write code. All valves were calibrated in place and all instruments relied on the manufacturer’s certified calibrations, which eliminated the need for costly calibration during construction. The system also provides visibility into the workings of the device. “Operators can see valve movements on their displays, which is very helpful when balancing flows, or determining if a valve is poorly tuned or sluggish,” Rezabek observes.

Plant managers are gaining a wide range of paybacks from fieldbus networks. They are seeing gains through easy initial set-up, better preventive maintenance techniques, improved asset management, quick reconfiguration and simplified upgrades. The net result of fieldbus networking can be counted in dollars through fewer shutdowns and longer-lasting equipment.

### WARNINGS AND SAFETY

The fieldbus network can now behave as a system that tells operators the condition of the devices. “Engineers who work with fieldbuses work with a block of data that tells them when something is wrong,” says John Yingst, product manager of fieldbus systems at vendor Honeywell Process Control, in Phoenix. “That’s the low-hanging fruit because it’s built into the device. That’s the first piece of value in diagnostics—the device telling you the condition of the device.”

The smart network can send warnings of a potential device failure before the failure occurs, so preventive actions can be taken to avoid a costly shutdown. “The drives can now report back—not just a fault or warning, but the condition before a fault so you get a warning before it fails,” says Steve Boren, regional application engineer from the Low Voltage Drives group at automation vendor ABB, in Warminster, Pa. “Then the drive can be reset before something catastrophic happens.”

Another advantage of the fieldbus network is that a number of functions can be tied together into one control platform, including safety. “You can take automation capabilities that had been separate and put them into one system,” says Harry Forbes, senior analyst at ARC Advisory Group Inc., in Dedham, Mass. “In the past, the regulator, motion and safety functions were separate. You used to have to integrate them yourself. Now they’re converged in the automation controller.”

A network that combines programmable logic controllers (PLCs) and safety devices gives the operator enough information to determine whether a safety shutdown is really necessary. This can stop some costly

## MAKING THE FIELDBUS-TO-HMI/SCADA CONNECTION

In the world of fieldbus technology, there are a number of flavors. In North America, DeviceNet, Profibus and Foundation Fieldbus have become the dominant open systems for connecting industrial devices. DeviceNet tends to be the leader in automotive and semiconductor applications, while Foundation Fieldbus leads in process control. Profibus has only a foothold in North America, but it dominates in Europe. Recently, however, DeviceNet has grown in the United Kingdom.

All of the fieldbus protocols can move along Ethernet. Ethernet began as an office network protocol that was not considered robust enough for factory settings. That changed as Ethernet developed. Now Ethernet is common in plant automation systems. "The Ethernet protocol is a generic term like Kleenex," says Steve Boren, regional application engineer for the Low Voltage Drives group at automation vendor ABB, in Warminster, Pa. "There are different kinds of protocols that ride on Ethernet." Though Ethernet has grown beyond the office environment, Boren notes that some plant managers shy away from it.

shutdowns due to faulty safety devices. "When the safety devices and the input/output (I/O) devices are on the same control network, you can evaluate two pieces of information to see if the information is correct," says Helge Hornis, intelligent systems manager at vendor Pepper+Fuchs, in Twinsburg, Ohio. "When you can see the PLC data and the safety data, your diagnostic capability is enhanced and you can determine whether a shutdown is really required."

This information coming from the devices lets operators improve the efficiency of the plant. "The fieldbus allows for minor changes, to improve how the machine is working," says Tim Black, device integration manager at Wonderware, another automation vendor based in Lake Forest, Calif.

Maintenance is another area in which plants are taking savings due to the diagnostic capabilities of fieldbus networks. Devices have become more intelligent and can actually report back on their true condition through the network. The savings come from not shutting down for routine maintenance if that maintenance is not required. Savings also come when you can replace a device that is on its way to failure.

Real-time data coming through the fieldbus network helps operators fix only what truly needs fixing. "Instead of doing routine maintenance, operators are getting told by the devices when they need maintenance," says Honeywell's Yingst. "The device can also tell you when it has lost air pressure or when its packing is too tight and it's starting to see some friction."

Valves can be a problem when they get clogged. Many plants schedule routine

maintenance to clean or replace valves in anticipation of clogging. "When you use smart valves, you can determine which valves have to be cleaned and which ones can wait until the next shutdown," says Martin Zielinski, Hart and fieldbus technology director at Emerson Process Management. "Say you have a valve that moves up and down. You keep track of the valve movement and figure out how many miles it has gone so you can determine whether it needs to be replaced."

### COST SAVINGS, LIMITATIONS

The advantages of fieldbus networks can be translated into direct cost savings. Much of the savings are taken at the time of installation and configuration. "The first piece of value is in setting it up, the calibration and the configuration," says Honeywell's Yingst. "When we started using fieldbuses, we were able to commission in 30 percent to 40 percent of the time. It's all digital, which makes it easier and faster, so plants are saving a lot of money."

During installation there is always plenty of tinkering around to get the system working correctly. In the past, this meant plenty of trips to the device. Fieldbus networks save time and money by eliminating most of those trips.

"Take the situation where you have field devices that are installed and the parameters are not quite right. You used to have to send the technician into the field with a handheld, and he would have to change the equipment," says Emerson's Zielinski. "Now, with the asset management online, you don't have to send anyone out in the field."

"Whether Ethernet is used or not depends on whose programmable logic controllers (PLCs) are being used."

The Ethernet then connects out to human-machine interface/supervisory control and data acquisition (HMI/SCADA) and advanced SCADA systems. This level of networking brings the device data to the operators or to manufacturing execution systems, supply chain execution and enterprise resource planning (ERP) systems, and even Web applications.

The advantage of the HMI interface is that it allows operators to control devices digitally and take diagnostic information off the devices in real time. "I visited a brewery where they were replacing their bottling and palletizing equipment with fieldbus," says Tim Black, device integration manager at automation provider Wonderware, an Invensys company based in Lake Forest, Calif. "They used HMI as the front end of the fieldbus. The HMI is the perfect front end for fieldbus because it can represent the diagnostics. You get the information and display it to the end-user."

There has been some resistance to widespread information systems among plant operators, yet the principle of "more-data more-better" increasingly wins out over the desire to do things the old way. "Communications is always cheaper. You get more data and more diagnostics and less cost," says ABB's Boren. "People used to avoid communications, but now they are starting to see the benefits."

With all of the measurable benefits of fieldbus networks, there are some built-in limitations that can't be completely overcome. For one, devices can carry only so much power. "I see vendors wanting to make their devices smarter and smarter, but there is only so much a device can do. All of the devices are power-limited," says Honeywell's Yingst.

Yet the pluses of fieldbus far outweigh any limitations, many industry watchers agree. "The fieldbus network pays benefits throughout its lifecycle," says ARC's Forbes. "You get more flexibility, it's easier to reconfigure, and it takes less time for an OEM (original equipment manufacturer) to design a piece of equipment. It also supports continuous improvement."

With devices getting smarter, the information taken from the devices can shorten set-up and reconfiguration time, and it also acts as a real-time reality check on the condition of the devices and equipment. That means parts don't have to be replaced unless they are experiencing actual wear, and safety shutdowns don't have to occur unless there is truly something wrong. 

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