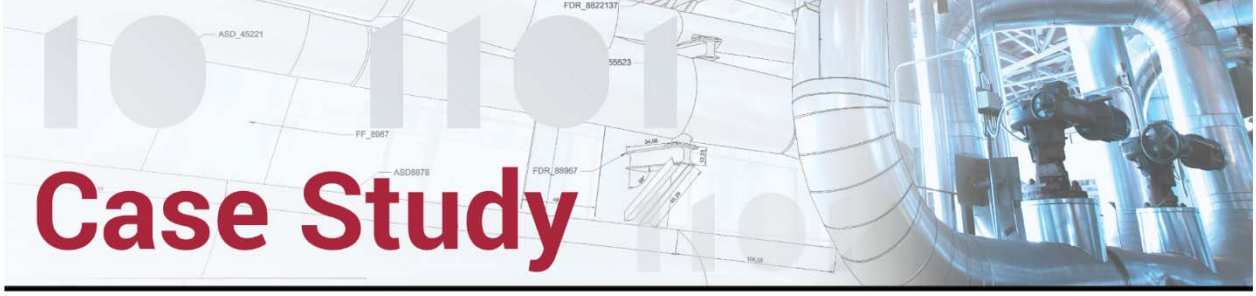

Combining Simple Devices and Fieldbus Instruments in a Common System

District heating company realizes advantages of reliable fieldbus control solution

As intelligent field devices are applied with more frequency throughout plant design, design cases occur where native bus-technology devices and simple field devices exist in the same control system. This paper shows one specific case, steam drain control, which can benefit from intelligent diagnostics on control valves, but also works quite effectively with simple level switches.

It is possible for users to combine simple devices such as level switches with more advanced FOUNDATION™ Fieldbus devices to create a more effective control solution. In fact, this practical approach is the basis of what many in the industry are calling the digital transformation of the process industry. For the Industrial Internet of Things (IIoT) and Industrie 4.0 to become reality, a digitization of the sensor network must occur. The good news is; this digitization has been occurring quietly for nearly the last three decades.

Systemic Thinking

Many Instrumentation and Controls engineers think of the field device as an instrument and the Distributed Control System (DCS) cabinet as the control system. With FOUNDATION Fieldbus technology, however, the net effect of deploying configurable field devices is to extend the boundary of what we traditionally think of as the control system into the field devices themselves. This change in philosophy is most frequently discussed as the opportunity to deploy control strategies into the field devices themselves, known as “Control in the Field.”

For plants and operators to step into the era of IIoT, we need smarter systems and devices doing smarter things and this is where FOUNDATION Fieldbus hits its stride. While there are undoubtedly control applications where using a field control strategy exclusively will limit the overall possibilities for utilizing intelligent devices in a control system, Control in the Field should be utilized as widely as possible to reduce network load and increase macrocycle time for optimal response rates.

A Case Study: Steam Drain Control

Steam lines are typically fitted with low-point drains, which are implemented using a piping device called a drain pot. This is basically a section of pipe about the same diameter as the main line, connected via a tee connection and extending downwards from the main line. Liquid is formed when heat loss through the wall of the pipe causes steam to condense. Large amounts

of liquid are formed during startup, when the bulk metal temperature of the piping components is below the saturation temperature for the steam flowing through the piping system. If this liquid is not removed from the piping system, the water can be entrained with the steam moving at high velocity down the pipe, causing mechanical damage termed “water hammer.” To alleviate this problem, liquid water is trapped in the drain pots located throughout the piping system, and drained through remotely operated valves.

One traditional control strategy for drain pot valve control involves a pair of level switches in the steam line drain pot. When the high switch detects liquid water, the control system sees the change in the switch signal and sends a command to open the valve. Depending on the line pressure, this may cause a partial open command or a full open command. When the high switch and the low switch both detect no liquid present, the control system commands the drain valve to close.

The Fieldbus Design

Typically, applying fieldbus to this control system function would involve replacing the valve with a fieldbus-enabled valve controller, and replacing the level switches with a fieldbus-enabled transmitter. This would typically be implemented with a FOUNDATION Fieldbus Analog Output block for the valve control, with position feedback derived from the BKCAL_OUT of the block, with the “Use PV for BKCAL_OUT” option selected in the IO_OPTS parameter. An analog input block for the transmitter would be added, with logic in the control system to switch the valve to either partial or full open (depending on pressure) position when level exceeds the setpoint.

What brings this approach into question is that the level switches are relatively inexpensive, and can take the system operating temperature (1,100 degrees F) and pressure (2,400 psig) without requiring additional piping components. Most continuous level technology would require additional piping components to protect the transmitter from the process conditions, which would mean added expense. It was also determined by the end user in this case that the level switches possessed sufficient reliability and would benefit only incrementally from the additional diagnostics that FOUNDATION Fieldbus would provide.

The Intelligent Field Device Solution

Today’s FOUNDATION Fieldbus enabled valves have extended capabilities, including interrogation of external switches. While these capabilities were intended for use with external limit switches for valve position, they provide an interesting solution to the drain valve control problem laid out above. The level switches can be wired to the valve controller, and switch position can be reported back to the control system using discrete input blocks. While this allows for the wiring reduction typically associated with digital device installation, it also avoids the higher device and installation cost of level transmitters.

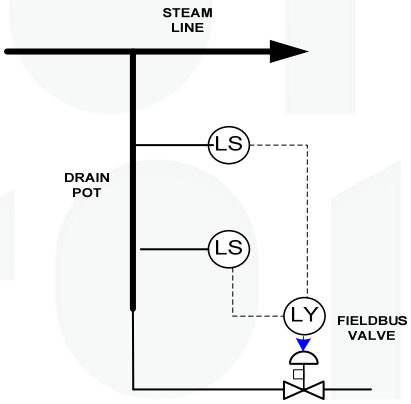

Figure 1. Local Wiring of Level Switches to Fieldbus Valve

The main drawback of the aforementioned approach is the larger number of function blocks required. Since the speed required for system response for this application is relatively slow (approx. 1 second), a sufficient number of devices can still be connected on the same segment to make the digital field device wiring cost benefit easily apparent.

Looking to the Future

Today, direct integration of simple devices like limit switches into the local FOUNDATION Fieldbus valve is a cost-effective solution, and a great example of how you can combine conventional sensors and switches with a FOUNDATION Fieldbus control solution. Some intelligent valve suppliers are utilizing the bitwise capabilities of the discrete data type described in the FOUNDATION Fieldbus standards to reduce the number of blocks required to transmit a number of valve conditions. Ultimately, when you minimize signals, you improve the overall efficiency and performance of the network. The FOUNDATION Fieldbus technical specification defines different ways for valves of all types, including actuators and positioners, to communicate more than just open/close data.

These incremental, yet important, enhancements continue to drive digital solutions to the forefront, making the IIoT inevitable. With nearly 30 years of digitizing the field sensor network already in place, the process industries need only to start listening to and utilizing what the intelligent field devices already provide in order to make a smarter more efficient plant of tomorrow.