Next Generation Digital Valve Controller

Emerson's DVC7K Digital Valve Controller offers cutting edge performance, diagnostics, and integrated troubleshooting advice for both control and on/off valves, says Janelle Prusha.

Automated valves are the heart of an industrial process, enabling the control system to maintain critical flows, temperatures, and pressures; route and divert materials throughout the plant; and safely isolate processes to protect personnel and equipment. Valve positioners/controllers play a vital role in this effort, ensuring each valve reaches and maintains its commanded position, despite variable conditions.

First introduced nearly 50 years ago, the valve controller has evolved continuously to meet the changing needs of industry. Recently a new generation of digital valve controller, the Fisher™ FIELDVUE™ DVC7K, has entered the market. Utilising edge computing, advanced integrated diagnostics, and a variety of connectivity options built on decades of field proven experience, this next generation controller provides unparalleled levels of performance and data analytic capabilities.

This article will highlight the value provided by the DVC7K in six key areas:

- Real-time awareness
- Valve health at-a-glance
- Diagnose issues locally
- Reliable by design
- Install with ease, and
- Paving the way for the future.

But first, let's look at the history of valve controllers.

The evolution of the valve controller

Originally, simple single loop controllers commanded control valves directly, driving them open or closed as necessary to move the process to setpoint. As plant automation advanced in the 1970s, it became clear that control valves needed some means of local control to ensure a valve was reaching the commanded position, even as air pressure and process conditions varied. That need was met with the Fisher™ 3582i pneumatic valve positioner introduced in 1975 (Figure 1). The 3582i monitored the analog signal from the control system and the actual valve position and adjusted the actuator pressure as necessary to make the valve position match the commanded setpoint.

Improvements rapidly followed. In 1994 Fisher introduced the first digital valve controller that not only positioned the valve, but also provided a feedback signal of valve position back to the automated system. The DVC6000 was introduced six years later, incorporating a modular design to reduce maintenance costs. Further improvements in reliability were achieved when the DVC6200 eliminated the troublesome and error prone mechanical linkages in 2010.

All this advanced functionality is built on a valve positioner hardware platform that has over 10 billion hours of runtime

Figure 1: Valve positioners have evolved from the pneumatic Fisher 3582i in 1975 (top left) to the first digital model Fisher™ FIELDVUE™ DVC5000 in 1994 (top right). The Fisher™ FIELDVUE™ DVC6000 introduced modular design in 2000 (bottom left) and in 2010 the DVC6200 model (bottom right) was introduced with linkageless feedback.

Each of these models dramatically improved the performance and capabilities of automated valves by addressing pressing needs, but challenges remained. The current generation of top tier digital valve controllers integrates numerous sensors to measure a wide variety of valve related data, including valve position, actuator performance, packing performance, and supply air pressure. Unfortunately, much of this data is either lost or not utilised because the valve controller can store little or no data, and it has no analysis capabilities. Continuous data capture and analysis therefore requires an external software package to receive the data and feed it to outside entities or specialised software programs for review.

Another opportunity for digital valve controllers exists for on/off valves. Advanced controllers can provide a wealth of diagnostic capabilities and enable partial stroke testing for critical safety applications, but the cost of adding a top tier digital valve controller to these valves can be prohibitively expensive.

Next generation valve controller

Emerson addresses these shortcomings with a new generation of digital valve controller called the DVC7K. This controller builds on a thirty-year history of proven digital valve controller performance and design innovation, while also incorporating the latest in edge computing and advanced diagnostics to dramatically improve capabilities (Figure 2).

Figure 2: The Fisher FIELDVUE DVC7K incorporates next generation data collection and troubleshooting analytics into the industry's leading digital valve controller.

The biggest innovation of the DVC7K is its data driven design. The edge computing processor and analytics engine gathers and stores real time valve data locally. That information is available through the easy-to-use local user interface, or via a variety of connectivity options, including HART and Emerson Secure Bluetooth™. Unlike previous digital valve controllers, the DVC7K continuously senses and stores valve data in the device – so information before, during, and after an event is available for review.

Onboard diagnostic software runs continuously within the DVC7K, utilising patented technology and experience-based algorithms to analyse valve performance. If that analysis detects a problem, an alert is generated that can be viewed locally or remotely. Local alerts are indicated by an integrated status LED (Figures 2 and 3), prominently shown on the face of the device.

NE107 Valve Health Indicators

Solid	●	☑	Good
Blinking	●	◈	Maintenance Required
Blinking	●	⚠	Out of Specification
Blinking	●	▽	Check Function
Solid	●	⊗	Failed

Figure 3: An LED on the face of the Fisher FIELDVUE DVC7K indicates the operating status of the instrument. Developing problems are detected and indicated well in advance of outright failure so the issues can be addressed before production is impacted.

The alert not only indicates the problem, but offers Advice at the Device™, suggesting actionable steps to further troubleshoot, identify, and repair the problem. 24/7 continuous analysis helps identify and correct immediate issues, while also providing real-time awareness by detecting and flagging developing problems before they impact valve performance and plant profitability.

All this advanced functionality is built on a valve positioner hardware platform that has over 10 billion hours of runtime. A wealth of integrated sensors allows the DVC7K to monitor all aspects of valve performance, and features like linkageless valve position sensing ensures long life and minimal maintenance cost. Installation and retrofits are very easy, utilising a variety of different connection kits to allow direct mounting on Fisher™ 657/667i and GX actuators, Fisher sliding-stem and rotary actuators, or any actuator that complies with IEC 60534-6-1, IEC 60534-6-2, VDI/VDE 3845, or NAMUR mounting standards. The positioner also offers an integrated analog position output and two limit switches as options.

On/Off valve positioner options

While the DVC7K offers unparalleled performance and capabilities for control valves, it also offers a cost-effective digital controller option for critical on/off valve applications. This version of the DVC7K is specifically designed for on/off service, incorporating the same breadth of sensors, data gathering, and analytical analysis – but at a lower price point than the model designed for control valve service.

The advanced level of diagnostics and features, such as partial stroke testing within the DVC7K, allow SIL-rated safety interlock valves to achieve significantly higher levels of reliability. This can extend proof test outages, increase plant production, and allow safety analyses to take credit for unplanned trips, should they occur, as a functional test. Built-in analytics can also detect and identify developing air supply, process plugging, and other problems before they impact plant operations.

Conclusion

Digital valve controllers play a critical role in automated valve functionality, ensuring the valve meets its commanded position despite changing process conditions. The DVC7K extends this role to include the ability to not only detect and alert plant personnel to deteriorating valve performance, but to also help them quickly troubleshoot and resolve problems for both control and on/off valves. Such proactive responses can yield dramatic improvements in valve performance and plant productivity.

The future is now, and the DVC7K is leading the way from the vague promises of digital transformation to the realisation of tangible financial benefits through cutting edge performance, advanced diagnostics, and next generation analytics.

For more information on the DVC7K, visit Emerson.com/FisherDVC7K.

All figures courtesy of Emerson.

Janelle Prusha is the strategic marketing manager for Emerson's Flow Control products in Marshalltown, Iowa. Prusha graduated from Missouri University of Science and Technology in 2012 with a degree in Environmental Engineering, and from the University of Iowa in 2016 with an MBA.