Taking control

Control valves – and specifically their actuator and positioner systems – went intelligent and digital years ago. However, as further developments improve their power, much of industry seems to be missing some valuable tricks, writes Brian Tinham

Control valves mean different things to different engineers, depending on whether their equipment's duties concern high-speed pneumatics, at one end of the spectrum, or large-scale process flow management at the other. So, there's a world of difference between the form, function and indeed construction of miniature solenoid-controlled valves and manifolds for machine control, as against big globe or butterfly valves for serious process control in, say, the oil and gas industry. Equally, there are necessarily dissimilarities between the monitoring and control technologies used across such a spread of applications.

That said, while on the face of it very little changes these days in either camp, in terms of the fundamentals of valve or actuator engineering, plant engineers and managers still need to watch this space. Two reasons. On the one hand, when change does happen, although it might appear subtle, it can lead to game changers that ought to be included in any thinking around new or retrofit projects. On the other, given that installed valve systems have not always been optimally specified – and that, in any case, plant duties change over time – knowledge of some alternatives, their cost/benefits and applicability is no bad thing.

It can also be a life-saver, if you're troubleshooting – especially where downtime can cost thousands, or tens of thousands, of pounds per hour and a straight replacement might not be available. Just as important, it's invaluable when it comes to maintenance, rebuilds or upgrades. And in this context, it pays to know about more than just the valves themselves.

Valve diagnostics and wireless transmitters – both the preserve of smart positioners (today's digital incarnation of former analogue technology and even earlier I to P converters) – are where the action is, or should be. These

are the devices designed fundamentally to provide for precise valve-actuator control and hence to eliminate unstable downstream operations, while also minimising valve wear. Assuming your initial valve specifications and subsequent installation, commissioning and maintenance procedures are correct, more often than not it is digital positioners that are the keys to taking plant operations to the next level.

Invaluable diagnostics

As Tom Carnell, systems applications manager at valve manufacturer Bürkert UK, says, such devices can transform existing control valves into intelligent field devices. What does that mean? "They can provide information on status and allow [remote] actuation in an application that previously relied on pressure or manual actuation," he enthuses – adding that improving equipment in this way can pay for itself surprisingly quickly. "Older systems can be upgraded to provide faster response times … and invaluable diagnostics on valve performance."

What's more, some digital valve positioners are virtually universal and certainly easy to use. Look at ABB's Positionmaster EDP300, launched last year (Plant Engineer, January/February 2012, page 20), and Siemens' SiPart PS2 digital positioner range. Dale Snow, Siemens business manager for process instruments in the UK, says its latest release now fits everything, from Weir valves to Kent Introl, Severn Glocon and Fisher Controls, with mounting kits handling linear and rotary modulating devices in sizes from 2.8 mm to half a metre and beyond – as well as support for 4–20mA HART, Profibus and Foundation fieldbus communications.

Not only does that ease MRO stocks for plants with multiple valve types and marques, but it also minimises training requirements. All the more so since equipment set-up is now menu-driven and automatic, using three push buttons (not a laptop) for parameterisation, after which it 'learns' the process and self-configures. Snow also contends that plant users will notice a significant drop in air, and hence energy, consumption, because of Siemens' piezoelectric pneumatic valve technology. "Whereas a standard pneumatic device consumes about 560kWhr per year, ours uses 33kWhr per year. In fact, Shell Stanlow, as was, were able to knock off a compressor, with consequent CO_2 emission savings, too," he says.

Wasted power

But Snow says that, while features such as these mean uptake of the equipment is good, 30–40% of plants don't then go on to use some of the most important functionality of all – the valve and process diagnostics. "Plant engineers could, for example, see leakage rates and trends around deviation from setpoint. They could also 'life' a valve by programming stroke-hours to issue alerts for maintenance to, say, change a seat. And they could get early warning of stiction and similar issues."

But they don't. Norman Render, who leads the instrument business unit in Europe for Fisher (part of Emerson Process Management), says it's a familiar story. Almost incredibly, advanced diagnostics functionality remains very largely unused, he agrees. "It's so disappointing, because, from a plant engineering perspective, we all know that valves are dynamic machines. They're mechanical and they move, so they wear over time and need looking after, if we want to keep the plant operating efficiently and manufacturing costs as low as possible."

That's why, when users buy a Fisher control valve (apart from the initial advice and consultancy on making the right choice), the firm provides a baseline 'signature' covering its operational stroke, not only for quality »

Clockwise from main picture: Bürkert's Robolux multi-way valve eliminates extra valves and pipes; Fisher Control-Disk valve with 2052 pneumatic actuator; Fisher V150E Vee-Ball valve with expanded outlet for fibre slurries; and Bürkert solenoid valves in action

Emerson's ValveLink Mobile software introduces mobile management of control valves

assurance, but also to record the 'as new' condition. "Then, with our Fieldvue [diagnostics], they can get a window onto the valve and the process, as they change. But a lot aren't choosing to use that window."

Indeed, Render believes that "less than half" are using anything like the full potential of smart valve controllers. And that's despite 80–90% of currently available positioners having this functionality built in and ready to roll. "Most new plants and those that have been retrofitted already have the smart I/O capability they need to use the functionality. And, even if they don't, it's not hard to fit wireless adapters to control valves," he says. (See panel below.)

So the cost is low. As for the benefits, at the very least online diagnostics give you early visibility of when things are going wrong and enable you to plan ahead. As Render puts it: "Intelligence like this could make the difference between keeping a loop in auto or taking it off into manual – with the risk then of sub-optimal process operations."

Equally, when it comes to plant shutdown, you can identify the valves that don't need to be pulled for maintenance before, rather than after, doing so. Given that statistics suggest one third of valves turn out not to need attention – but, without diagnostics insight, no one knows which third – that's a major potential time and money saver.

"A properly specified, installed and tuned control valve can get you down to half a per cent [accuracy and repeatability], no problem. But that depends on everything working as-designed," says Render. "If, for example, maintenance increases the packing and torques up the nuts to reduce fugitive emissions, friction might increase. That means the valve might start overshooting and cycling, because it can't stabilise. Or someone might have turned down the air supply to improve energy efficiency – but now the pressure can't drive the valve to higher percentage openings. Either way, if you're monitoring diagnostics, such as travel deviation alerts, you can see the valve isn't falling over, but simply struggling to do its duty. That shows you straight away that the problem is elsewhere."

"Window onto the **process**"

And look at it another way: if you want to reduce manufacturing costs, control loops in manual are a great starting point. Why are they in manual? Often because of a poorly performing control valve. Diagnostics will show you why the valve (and indeed the loop) isn't cutting the mustard and hence suggest an improvement project, as well as providing the baseline data for its business justification. That could make a significant difference to process performance, particularly if it enables operations closer to plant or specification limits.

As Render says, these are really powerful tools. ■

Diagnostic developments

Emerson – primarily through its Fisher and Bettis business units – provides excellent examples of the kinds of advanced valve controls and diagnostics that can be achieved with recent upgrades in intelligent positioners. And, in many cases, improvements are as much about increasing their potential application as building out functionality.

Among its most recent introductions have been: a remote-mounting digital valve controller that harnesses Fisher's non-contact feedback technology to separate its Fieldvue DVC6205 travel-sensing and control segments from the valve mounting itself; a valve position transmitter/switch and HART 7 fieldbus comms module now provided as part of the DVC6200 valve controller; and Fisher 4320, a wireless position monitor with on/off control, specifically for quarter-turn valves.

Taking a look at the former gives some idea of what can now be done in hostile environments. Emerson states that it is intended for applications in which accessibility, extreme temperatures (up to 120°C), vibration or confined space make integral mounting of a valve controller difficult, expensive or impractical. Industries such as pulp and paper, and nuclear power have typically preferred to isolate valve-mounted instruments, but, with the DVC6205, only the valve position feedback need be mounted on the valve. The remainder of the controller can be more than 90 metres away, where the environment is more amenable or accessible.

Similarly, the DVC6200 digital valve controller with its integrated 4–20mA valve position transmitter/switch means that the expense, bracketry and maintenance of an add-on, accessory transmitter can be eliminated. Emerson also explains that the discrete switch is solid-state, opening and closing being based on a user-configurable trip point, harnessing valve travel anywhere in its calibrated range, or a device alert. Also, power for the switch comes from the control system analogue input channel, in the same way as any two-wire transmitter. And you get the unit's separate HART 7 digital communications for set-up and diagnostics.

As for the Fisher 4320, this is the first WirelessHART valve device to offer both linkage-less position feedback and on/off valve control. So its beauty lies in its ability to transform process operations that still typically rely on manually-operated discrete valves. Emerson says its user surveys suggest that 90% have had valve issues in the past 12 months, resulting in spills, lost batches and even safety incidents. That's why so many want real-time valve control with position feedback – but, until now, have been foiled by the installation costs. With this unit, however, there's no need for wires, so project costs (materials, control system I/O etc) and timescales can be slashed.

"For simplicity, quarter-turn valves and pneumatic actuators are used to automate discrete valves, [so] only air is needed," says a spokesperson.