

Control revisited

Control valves, actuators and positioners aren't renowned for rapid technological development, but advances are changing the shape of best practice. Brian Tingham reports



Above: Emerson's Fisher GX control valve and Fieldvue DVC 2000 digital valve controller – a world away from old analogue positioners
Below and right: Fisher's Control-disk brings new meaning to butterfly valves

Few of us think of process control valves, or their associated actuators and positioners, as high-tech or glamorous – and certainly not fast changing. Yet the shrinking number of developers of this equipment have a slightly different view; and one that's largely shared by some of the more enlightened process industry users. Why? The truth is that an impressive array of technologies and engineering know-how has been coming together over the years and is still challenging conventional plant thinking.

On the one hand, the big names in the control element community – like Emerson, Dresser-Masonilan (now part of GE), Neles (long since part of Metso) and Flowserve – have been responding to plant user requirements. But, on the other, some have also been pushing back the boundaries of received engineering wisdom and inviting plant engineers to reconsider not so much the art of the possible, but the science of what's viable.

Looking at the user-requested improvements, it's a sad fact that on large, complex process plants – such as those in the petrochemical, chemical and refinery sectors – experienced plant engineers and technicians are a retiring breed. The clear danger is a skills gap, leaving plants increasingly exposed either to gradually degrading controls or expensive 'rip and replace'

maintenance regimes. So control valve manufacturers have been investing heavily in developing digital valve controllers (DVCs – effectively electronic positioners) capable of the all-important automated diagnostics – providing technicians with predictive and preventive maintenance information that extends not only to the valve itself, critical though that is, but also to the control loop and even the process.

At a more mundane, but nevertheless significant, level, valve makers have also been improving their acts around packings and seals, to respond to the dictates of fugitive emissions regulations. Equally, they have been quietly beaver away at increasingly sophisticated valve trim designs, often using hardened materials, to meet the twin demands of plant noise reduction and increased valve lifespan. And similarly, some (notably Emerson, with its huge Fisher brand) have been developing valve controllers with contactless feedback, so eliminating conventional linkage mechanisms and, again, improving maintenance-free life expectancy, even in harsh plant environments.

It's worth considering all these for both new and revamp projects, not least because one additional overarching benefit is likely to be improved energy efficiency. We're also talking about new routes to quality and compliance that might pay for themselves very quickly. But more on these later.

Blue sky thinking

Meanwhile, on the blue sky side, one excellent example is Emerson, which is among front runners now offering DVCs with retrofitable wireless communications. While few are yet suggesting automatic valve control for remote locations (as they are for instrument monitoring, using wireless process transmitters), there is clear potential for something far more valuable. We're talking about very cost effective access to the above-mentioned diagnostics – but here on the tens of thousands of existing valves already equipped with DVCs but so far denied that key luxury, because they're on plants running with ageing control systems, blind to anything other than 4–20mA signals.

And it's probably no coincidence that it's also Emerson – until recently, the only remaining global process automation company sporting the complete loop of



instrumentation and control valves – that revisited the lowly butterfly valve 18 months ago, turning this on/off workhorse into a fully fledged rotary control valve. Dubbed Control-Disk, the result is significantly lower cost control for many applications, if plant engineers are but prepared to give it a go.

Ranjit Kanvinde, Emerson's European business unit manager for rotary products, explains that anticipated demand for the latter development has already encouraged the firm to extend Control-Disk's size range up to 24in from the initial 12in. "That's a big step forward for us, bringing significantly extended flow rates and allowing Control-Disk to compete strongly with segment ball valves and even some sliding stem globe control valves, in terms of cost and size [flange-to-flange dimensions] – and with good controllability over a huge amount of travel," he says.

Slashing cost?

How strongly? "How cheap depends on the kind of application and type of valve it's competing with. Basically, we're talking butterfly valve prices, so they're about 10–15% cheaper than segment ball valves, but up to 40% in the larger sizes. The only caveat is that they are pressure drop limited to about 30–35%; beyond that, you start to get noise, cavitation and vibration issues." And we should probably add that absolute pressure and temperature ranges also need to be checked.

However, Control-Disk is way more sophisticated than simply putting a positioner on a butterfly valve. That has been done for years and the problem was always their fundamentally limited control band (in the 25–50% angle opening range) – beyond which butterflies effectively revert to on/off. Hence plant engineers have mostly rejected them, in the knowledge that plant production rates change over time and no one wants the embarrassment of specifying a valve that may at some point have to be put into manual.

"With Control-Disk, we've changed the game. This is now a true control valve, with a classic equal percentage control characteristic across 15–70% of its range," claims Kanvinde. And if you're not convinced by him, how about Neil Price, improvement and performance coordinator at E.On, who reckons the valve was responsible for improving backwash flow controls on a water-treatment system at its CHP (combined heat and power) plant in Northwich. He says Control-Disk has eliminated media losses and downtime, enabling the plant to cut costs and improve availability.

This is one of the largest CHP plants of its type in the UK, generating 130MW of electricity and capable of supplying 500 tonnes of steam every hour to soda-ash plants in Winnington and Lostock – so availability is important. Price explains that



make-up boiler feed water comes from the River Dane, is cooled and pre-treated to remove algae and silt, then passed through one of six filters before being sent to a holding tank. The filters are cleaned by air scouring and backwashing.

Before installing a Control-Disk, the latter was difficult, because the original butterfly valve could not maintain steady flow rate, leading to media being lost through the filters. As a result, he says, the filter media had to be replaced or refilled at an





Above and right: Connecting up for the all-important valve diagnostics just got much easier, thanks to wireless links
Below right: A Fisher Control-Disk butterfly valve installed in a newsprint mill

average cost of £3,500 a year – and there were substantial downtime costs. Since installing an eight-inch Control-Disk, however, Price reports dramatically improved control. “The Control-Disk valve not only controls the backwash flow rate more accurately, but it also delivers a flow rate adequate to meet the [maximum] water plant demands, without restrictions,” he says.

Moving on to positioners, the game changer is what Treve Tagg, Emerson’s European instrument business unit manager, refers to as “the liberation of diagnostics”. He’s talking about the power of wireless transmitters on Emerson’s DVCs finally to enable easy and low-cost access to all valve diagnostics, no matter how old the plant control system. For plant managers, that’s invaluable. Why? Because, to date, the price of breaking into existing control systems to retrieve diagnostics data has been up to \$10,000 per I/O point, so the vast majority of plant managers haven’t done it. Yet, from a maintenance perspective, control valves are the weakest and most expensive link, due to the

sheer cost of unplanned plant shutdowns for emergency repairs when impending failures go undetected. So a solution that delivers diagnostics without breaking into the wiring is gold dust.

“Previously, for plants running on 4–20mA controls without HART access, if technicians wanted to access the diagnostics, they would have to install a HART-to-analogue converter, such as a tri-loop, or they would need to open up the marshalling cabinets, add a power supply, multiplexer and so on,” explains Tagg. “Now, they can just install the wireless unit directly on the DVC and get all the information they want on valve performance, positioning and control, back to their asset management system, without disrupting the legacy DCS [distributed control system] at all.”

Fieldbus connections

Incidentally, if HART and Foundation Fieldbus – the currently supported DVC digital communications protocols – aren’t what you need, don’t worry. Tagg says Profibus is coming this spring. “That will open up usage way beyond the oil and gas, and heavy industry sectors,” he explains, “to include,

for example, food and drink plants, fine chemicals and many more. Much of that development work has been done with Interbrew in North America, so plant managers will like what they see.”

What about other positioner developments? “Apart from the move from analogue to digital control, the other real change has been non-contact feedback – in our case, with Hall effect sensors inferring valve position. We introduced this on our Fieldvue DVC 2000 six years ago and, more recently, on our GX globe valve and actuator system. But that was for IS [intrinsically safe] applications only, so now we’ve launched DVC 6200 as an explosion-proof version.”

For plant engineers, the big deal here is: first, the mechanical linkages to the actuator are gone, which deletes most maintenance, generally caused by plant vibration and/or corrosion; secondly, as a result, reliability and repeatability are improved (and probably also hysteresis and stability); and thirdly,



the system works on rotary and sliding stem valves, so there's less parts stocking. "This is available for all Emerson valves and there are also mountings for all competitors' products, too," confirms Tagg. "In fact, we're withdrawing our old linkage-based offerings, because these are so much better and, in the end, cheaper."

So much for valves and positioners; what about the actuators? Most in the business agree that the overarching trend is firmly towards electric actuators, and away from pneumatics – for several reasons, including reducing reliance on compressed air, with its associated energy and maintenance issues. So Auma Actuators is good value here, and Ian Sully, managing director of Auma UK, suggests that the main change with electric devices, following on from the move to modular, has had little to do with the mechanics of the actuator and everything to do with the increasing addition of intelligence in its integral positioners.

Asset management

"For example, we've just released the second generation of our current range, which now provides for asset management facilities." Again, it's all about diagnostics, with the devices designed to monitor everything from how often they're being required to work, to how hard they are working (torque output) – and hence whether they need maintenance. Beyond that, though, just as with instrument controllers, the intelligence has been turned to enable, first, auto set-up and, secondly, digital control, primarily via Profibus DP, so eliminating traditional multi-core hard wiring.

"Nearly 50% of our actuator sales are now on Profibus, although we also support Modbus, Foundation Fieldbus and DeviceNet, as well as 4–20mA" confirms Sully. "But we've also just launched a wireless version, based on Wireless HART, at the Valve World show in Dusseldorf. For remote sites, this means that plant engineers will no longer need to run twisted pair cable over the site. They'll just need a local three phase power supply, and then control and monitoring will both be over the wireless network."

Sully concedes that control won't be as fast or responsive as with the existing technologies and agrees that take-up will be the exception, rather than the rule. However, he also suggests that developments are continuing and that within 12–24 months, things could be different again. And he raises another point: whereas Auma's (and almost all other) electric actuators harness fixed speed motors to effect valve movement, Sipos Aktorik actuators – formerly under Siemens, but now an

What's in a name?

At a commercial level, the biggest recent change in the valves sector was GE's purchase of Dresser for \$3 billion, and with it the iconic Masoneilan valves brand, which fell under Dresser's wing in 1985. The acquisition is significant, in that there are now two global automation players with world-class process control valve technologies to their names – the other being Emerson, which bought Fisher from Monsanto back in 1992 (and several others in the valves community since).

Just as significant, however, is the doubt in the valves community over whether GE fully realises the potential of its purchase, when it describes Dresser as "a global energy infrastructure technology and service provider" and adds simply that it will expand GE's offerings "for its energy and industrial customers around the world".

No mention of valves or valve systems there. And no sign that GE understands the value of Masoneilan's addition to its existing control systems business, in terms of closing the loop for large automation projects. Interestingly, there's also no mention of Dresser Masoneilan's former deal with ABB, signed only last September, initially to develop monitoring and diagnostics systems for emergency shutdown valves. Competitors being what they are, it's hard to see that partnership continuing so the question is: who will ABB turn to next for valve technology?

GE's only real nod to valves comes in a statement from John Krenicki, vice chairman of the company and president and CEO of GE Energy. Long after dwelling on Dresser's prowess in gas engines and the rest, he says: "Dresser's technology ... adds offerings complementary to those of GE in the \$45 billion flow technology industry, including product offerings in the highly engineered valve segment."

Joseph Hogan, formerly with GE and now CEO of ABB, must be looking at the acquisition and considering how much he might have made of it, had Masoneilan fallen under ABB's control. As Andrew Bond, outgoing editor of Industrial Automation Insider and renowned automation systems pundit, puts it: "Look at the published performance data for all the global automation companies and the only organisation that grew outside North America last year was Emerson. That's at least in part because John Berra [now retired Emerson CEO] realised the value of Fisher when he had the opportunity to buy it. He didn't care about Provox [its high profile process automation system]. He knew that adding Fisher valves to the Rosemount instrument business and its existing control systems was like being given the crown jewels."

Auma brand – offer variable speed motor action.

"These actuators have an integral frequency converter in the field controller, so, if your process requires, say, different opening and closing speeds, or if you have a butterfly valve with non-linear

characteristics, the actuator can linearise that control," states Sully. "They also work well, if you need to close a valve to a certain percentage at high speed, but then reduce the final closure speed to avoid water hammer."

As is very often the case, the devil is in the detail: what looks, at first sight, unchanged may be very different indeed. Clearly, that is particularly the case in the control industry, which, although necessarily conservative, is alive with engineering innovation, particularly in the petrochemicals, and oil and gas sectors, where big consolidated R&D budgets, global competition and increasing cost- and energy-consciousness are the drivers. **PE**



Left: Emerson's compact GX control valve and actuator combination is as state-of-the-art as you will find