So much more

Intelligent instruments have been with us for years, but although many more plants are installing them, they're still missing some important tricks, says Brian Tinham

Nearly half (46.5%) of the control systems on plants across the UK are up to 10 years old, but more than one third (39.5%) are aged between 11 and 20. Of the remaining 14% of plants, most are running systems in the 21–30 range, but some are struggling on with seriously ancient controls. Those are among top findings of a recent survey by ABB into the adoption of intelligent (as opposed to 'dumb') process instrumentation in the oil, gas and chemical sectors.

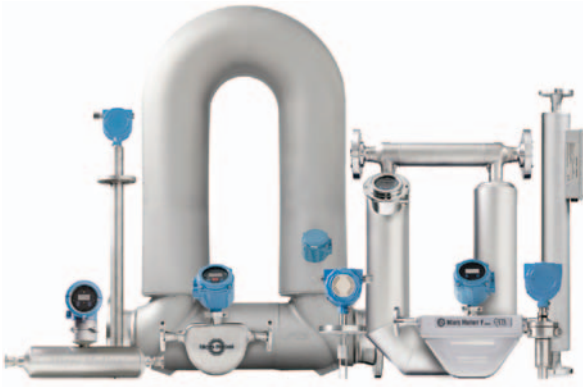
Just as interesting, ABB's study also reveals that half (51%) of these plants now have 10–20% of their instrumentation equipped for one or other of HART (Highway Addressable Remote Transducer), Foundation Fieldbus or Profibus communications (not just 4–20mA analogue signalling). Greater adoption is then evenly split, with another 16.3% running on 21–40% smart instruments, the same again having 41–60%, and the remainder with greater than 60% smarts.

Can you deliver?

Why do these statistics matter? Because they're a profound reflection of UK plants' likely ability to respond to today's mandate to cut costs, improve competitiveness and stay in line with ever more challenging environmental, and health and safety regulations. There's no direct relationship, but the implication is that the half-plus of plants running ageing systems are less likely to be able to deliver.

And the same goes for vintage instrumentation. With the transformation in technologies – both at the sensor end, but especially around smart process transmitters' increasingly powerful diagnostics – adopters of modern instrumentation have two distinct advantages over the laggards.

On the one hand, newer instruments offer



Making a practical difference

Whether you're interested in staples such as flow, level, pressure and temperature, or the more sophisticated end of real-time, in-line analytical chemistry, instrumentation is still advancing.

Take Emerson's magnetic flowmeters – which you would be forgiven for thinking had already reached their pinnacle (non-wetted sensor design and all wetted parts in stainless steel or nickel alloy, with sealing built into the casting or defended by welds). But it's not the hardware that's changed. It's all about the software.

Ian Tognarelli, business manager for Rosemount Flow at Emerson, describes developments as threefold – software helping with earthing and process noise rejection during installation and commissioning, and then meter verification throughout the instrument's life.

"One of the challenges is earth bond equalisation," he says. "That's important with mag flow, because we're measuring a microvolt level induced voltage, so it can be affected by stray voltages along the pipework and fluid." Standard stuff, yes, but selecting the best from the available approaches – earth rings, electrodes or flange to flange – depends on factors such as the pipework material, and the process fluid conductivity and its coating potential.

The problem: different engineers swear by different choices. "So our first module turns that black art into a science. We measure the difference in potential between the mag meter and process fluid. If it's a good earth bond, they get a tick; if it's not, there's a cross."

It's a similar story with process noise rejection – always a problem for mag meters in two-phase (solid and liquid) flow. Here, Emerson's diagnostics measure the signal to noise ratio at two frequencies, so that engineers can see which delivers the best signal.

And the big one: meter verification, which relies on a technique similar to one already implemented on Emerson's Coriolis mass flow meters – where the instrument stores a record of its as-shipped 'digital fingerprint'. "If, at any time, plant operators suspect that process problems might be due to a meter fault, it can perform a self test against the fingerprint. That's on-line, without removing it for testing, and whatever the flow. In fact, with the latest software, the diagnostics can run in the background 24/7, so that when, 10 or 15 years later, it starts drifting, the meter can provide an early alert."

superior accuracy, repeatability and resilience than their forebears. Those translate to a very real potential for increased yield, reduced waste, energy savings and also better product qualities. But, on the other hand, they deal very well with the instrument engineering skills shortage – an issue that plants have been wrestling with for decades.

They do so by enabling everything from easier installation and commissioning – using auto set-up routines – to simplified maintenance and instrument validation. And that latter point also impacts on plant uptime: instruments able to declare themselves healthy don't have to be pulled to find out – with all the risks of technician-induced error on reinstallation. Conversely, those that are tending towards problems tell you, so plant engineers don't waste time, effort, money and probably plant productivity barking up the wrong tree.

Use it or lose it

However, to achieve these benefits, plant engineers need to use the new instrumentation facilities, not merely install the kit. And, back to ABB's research, while a little over half (56.8%) of the plants investigated say they do, a staggering 43.2% do not. Maybe that high figure for the non-users is not so surprising, given the age of many control systems, which makes it difficult to get the remote monitoring. But Emerson, for one, introduced its Thumb adapter (for HART-based smart instruments) three or four years ago to address this very problem – by making the diagnostics available over a wireless network.

The point is that the prize for getting connected is great. Of those that do use their intelligent instruments, ABB finds 77% employ them to assist with instrument maintenance. A little over half (54.5%) also use them to improve plant optimisation and the same proportion for early event warning. What's more, nearly two thirds (63.6%) have implemented their smart instruments to drive preventive maintenance and/or environmental compliance, too. Couldn't be a lot more convincing, could it?

So what should you do? If you're not already looking at change, then perhaps it's time to do so. Easy to say, I know, but, if the plant is up against it, there's even more reason. And, if you're after guidance around which way to jump, those in the oil, gas and chemical sectors are voting for HART first (38.7%), running over existing 4—20mA cables, followed by Profibus and wireless (both 22.6%), Foundation Fieldbus (9.7%) and Ethernet IP (6.5%). But, given the industry (experience), geographical (support) and technology (system age and type) dependence of these options, unless you're on a green field site, you're choice is likely to be made for you.

And note this: ABB finds that more than three quarters of its plant respondents envisage significant further investment in intelligent instrumentation to meet health and safety legislation. Also, more than 60% see new instrumentation as key to cutting energy consumption. That's a powerful vote of confidence in intelligent instruments. PE

Simple and sophisticated

Sophisticated:

Knowledge is power, goes the saying – and hence the value of 'information rich' digital equipment, whether intelligent instrumentation or final elements, such as process control valves. But it's not just that they reveal instrument health. Increasingly, they can also deliver insights into the bigger picture plant and process health, too.

Siemens PCS7 process management system is one among several that now takes advantage of that potential. Not only does it provide top-level automation and control, with the human interface for plant operators, but it also delivers asset management.

Put crudely, feeding off the same digital equipment electrical and mechanical data, and associating that with software models of plant units, it can deduce, for example, early stage heat exchanger fouling. With red, amber and green indicators, maintenance can then be targeted on areas where the digital systems suggest problems are brewing.

Simple:

But some instrument improvements are, on the face of it, very simple – albeit enabled by sophisticated electronics. Emerson's Rosemount 3051S ERS (electronic remote sensor) system is one such.

For plant, such as distillation columns and outdoor vessels that have to date required long impulse lines or capillaries for DP (differential pressure) measurement, this unit provides a much improved digital replacement.

Essentially, it relies on two Rosemount 3051S differential pressure transmitters synchronised electronically, with just one providing a standard two-wire 4–20mA HART signal. And the result? No impulse lines; none of the maintenance issues; reduced spares holding; and multi-variable technology that eliminates the effects of varying temperature. Oh, and a claimed 90% improvement in response time.