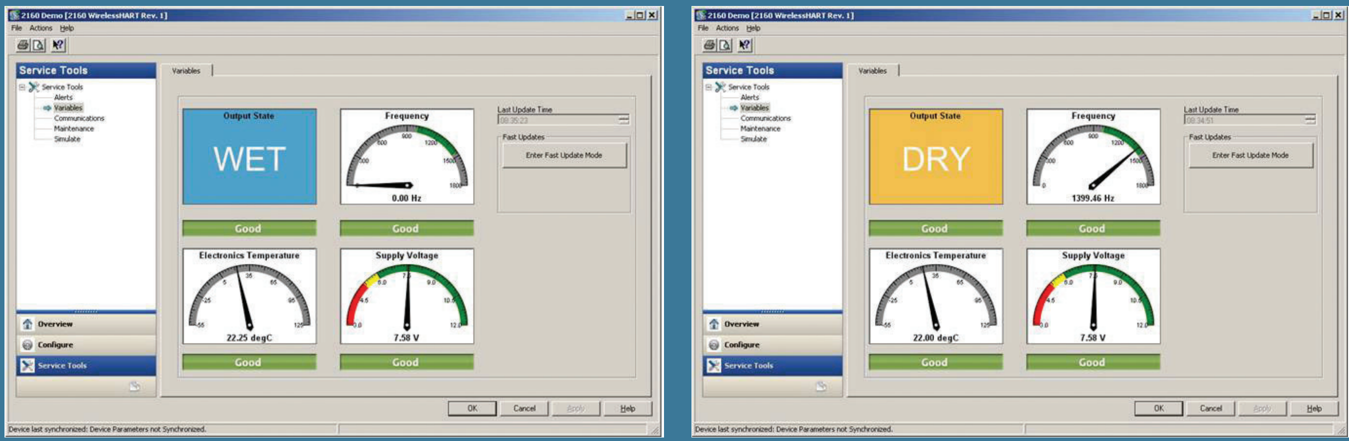


Taking control

Plant engineers wedded to particular instrument and control types might do well to widen the net. Brian Tinham examines recent developments in instrumentation and control

Instrumentation and control equipment, although high tech in its own right, isn't renowned for its lightning pace of development – at least, not at first glance. That's in part because of the potentially serious implications, if anything goes wrong, which, in turn, encourages a typically conservative engineering outlook that shies away from novelties. Additionally, most plants are not flush with either the cash or the resources to trial innovative systems.

Equally, particularly on the instrumentation side, there is the fact that equipment has already been through serious transformations in the last two decades. Consider, for example, the move from 4–20mA to the various digital fieldbuses, as well as the introduction of intelligent instruments, with built-in diagnostics, to name but two. So the technology has now entered a phase of relative maturity.

However, it's also the case that plant engineers, like everyone else, have their favourites and are generally reluctant to change once they've found something that works for them, no matter what the promised improvements. Call it scepticism, but the point is many practising engineers aren't rushing to put their heads above the parapet in a bid to find out what's out there.

Which is why it might come as quite a surprise to many engineers that there have been advances in recent years, even months, that might, if they did but know, make their lives easier and improve their plant automation, to boot. Among the most prominent are: significant improvements in wireless plant monitoring, threatening to make wireless control a reality; even smarter instrument diagnostics that can assist with everything from commissioning to process health monitoring; and advances in instrument calibration systems that may well streamline the maintenance and management game.

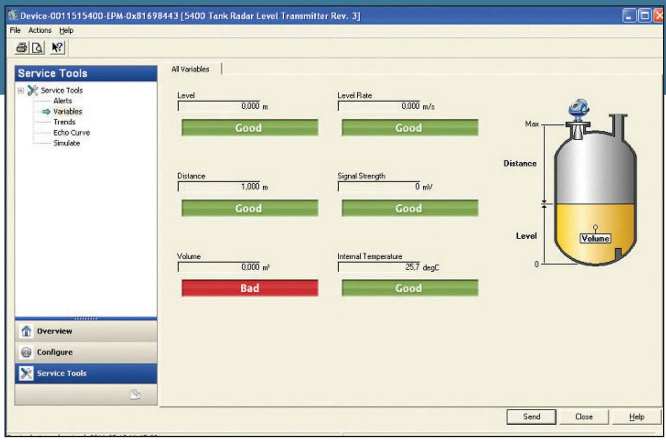
And that's not to mention the incremental sensing technology, electronics and packaging improvements that, together, are allowing instruments to monitor even more aggressive processes and, with even greater turndowns, providing ever more impressive sensitivity and repeatability. Neither does it acknowledge the continuing cost reductions, which stem largely from investments in advanced materials and also manufacturing methods, such as sputtered thin film, chemical vapour deposition and high temperature vacuum brazing.

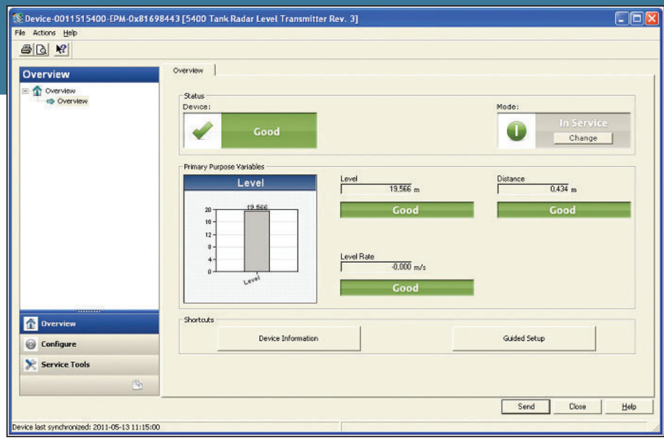
Instrumenting stars

So let's look at just a few of the emerging stars of instrumentation. Take battery-powered wireless process transmitters, classically covering pressure, flow, level and temperature. First introduced by Emerson, under its respected Rosemount brand, until a couple of years ago parameter update rates for these were approximately every 16 seconds. Last year, that rate improved to every four seconds and last month the company started rolling out a maximum update rate of one second across its transmitter range – with the potential for burst modes when the instrument sees events coming. Admittedly, it's hardly in competition with the effectively instantaneous (circa millisecond) sensing rates of conventional wired instruments, but it is more than adequate for an increasing spectrum of alarm event reporting applications and for plenty of slow-moving controls, too.

This matters particularly, because, as Treve Tagg, Emerson instrument business unit manager for

Above: Emerson's tuning fork level instruments' new diagnostic dashboard in action





Above: the latest diagnostic dashboards for sophisticated radar level measurement instrumentation

Europe, puts it: "The accepted figure for adding an I/O to a control system is close to $10,000, due to civil engineering, cable trays, marshalling, installation, commissioning etc. With wireless, adding an I/O point is a small fraction of that cost and without the disruption." And that makes all manner of projects that were hitherto rejected on grounds of price, practicality or both – aimed, for example, at improving production yield, quality, even safety – suddenly entirely feasible.

Given the proven nature of Emerson's self-organising 'mesh' network (where nodes map their neighbours and reconfigure their transmissions, in the event of a failure), developed with communications giant Cisco, this approach is only going to gain in popularity. Indeed, at time of writing, more than 1,500 mesh networks are live around the world, mostly on chemical, and oil and gas sites.

As for products, it's worth noting that 18 months have already elapsed since Emerson launched its universal Thum WirelessHART (the wireless version of the HART digital instrument communications protocol) adapters, designed to enable virtually all existing two- and four-wire HART field transmitters (the vast majority) to transmit process data and instrument diagnostics that were previously unavailable to legacy control systems. Think of the value, in terms of delivering real-time process information to a central control room, no longer just the local dial or auxiliary room, as well as providing for a new level of predictive maintenance support.

Calibration and maintenance

The big changes over the last 12 months, in terms of instrument calibration and maintenance, are all about improved ease of use and convenience, significantly expanded functionality and scope, and collapsing cost of both the equipment and its software.

Look no further than GE Measurement and Control Solutions' web-based 4Sight calibration management software. As Mike Charlton, GE's global product manager for instrument calibration products, explains: "Traditional systems were designed to provide instrument databases for field or workshop calibration. Their job was only to look at the data and produce certificates that pass or fail the instruments. But this software uses instrument data more intelligently, so that plant engineers can improve their own efficiency and that of their plants at the same time."

He gives the example of scheduling calibration and maintenance activities, and explains that the new tool takes an otherwise conventional instrument calibration data archive, but uses it to predict when devices are likely next to drift out of calibration and fail their certification.

"4Sight can assess each instrument's capabilities over time, in order to help optimise calibration periods for each device. A lot of plants calibrate their instruments every 12 months during scheduled outage, regardless of the process and its tolerance requirements. So it could be that some devices actually need to be calibrated more frequently, while others only need maintenance and recalibration every two years. 4Sight uses a statistical analysis tool to determine the right calibration periods per instrument and per process, so reducing the ongoing cost of calibration."

Interestingly, plant engineers can even log on to the system via a standard PC and their Internet browser, and get all functionality. Not only does that mean remote access, but also minimal overhead, in terms of the IT department. In short, since the software is hosted, it doesn't run on the plant's own servers.

Wireless at Chevron

At the Chevron Phillips chemical plant in Sweeny, Texas, USA, for example, Thum adapters are enabling its installed Micro Motion Coriolis flowmeters – used for fiscal monitoring of product transfers between the site and an adjacent refinery – to deliver just such extra functionality. "The required proving for fiscal transfer flowmeters is time consuming and a big expense for the plant," explains Stephen Fair, instrument measurement planner at Chevron Phillips.

"To ease this issue, we plan to confirm our ability to extend the time intervals between meter provings by trending data from the Micro Motion meter verification tool against data from proving reports," he continues. "[Also], the Thum adapter on the remote flowmeters is making it possible for us to launch meter verification from the plant control room, rather than making trips to the field. Additionally, the adapters will act as repeaters for other devices being added to the wireless network."

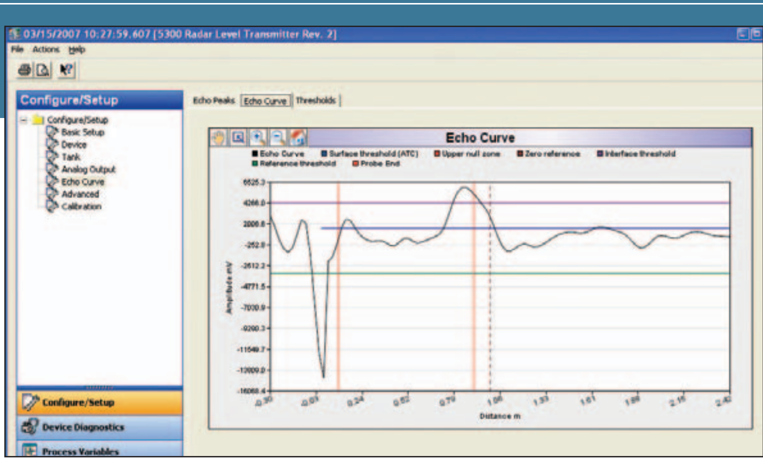
Pretty impressive. But we're not just talking about wireless on fancy instruments: Emerson recently launched two additions to its very mature vibrating tuning fork liquid level switches – the Rosemount 2130 to handle higher temperature process media (form 150 to 260ºC), but also the 2160 wireless version, again using WirelessHART, and again for use in locations previously inaccessible or too costly for wired devices.

There are thousands of applications for such instruments, including in certified hazardous areas, where their intrinsically safe power modules confer on them ATEX (Europe), IECEx (Asia), FM (US) and CSA (Canada) certification. You get all the basic features of the standard wired level switches – virtually unaffected by flow, bubbles, turbulence, foam, vibration, solids content, coatings, liquid properties and product variations, as well as 3m range – and no wiring costs. And bear in mind that wireless in no way compromises the device's ability to perform in extreme temperatures and harsh process conditions that can be a problem for other switch technologies. So overfill protection, high and low level alarms, pump control (limit detection), pump protection and empty pipe detection are all within bounds.

What's more, given that these are HART-based switches, you get the full complement of diagnostics. Kevin Cullen, product manager at Emerson's Mobrey Measurement division, explains that the instruments constantly self-monitor fork vibration frequency for system health, and that, if they detect a problem, can switch external equipment to a safe condition. "For the first time, maintenance engineers can monitor instrument health remotely, using the instrument's own vibration frequency, beyond the normal envelope, to detect problems, such as corrosion, bridged forks, over-temperature or even damage caused during installation."

And there's more. On sophisticated instruments, such as guided wave and non-contact radar level transmitters – typically used where density, vapour and temperature excursions rule out most other alternatives – diagnostics also provide plant engineers with an accurate picture of what the transmitter sees, in terms of obstacles, such as tank baffles etc, by displaying radar echoes in real time.

It's hard to exaggerate the value of that visualisation to plant engineers tasked with installation and commissioning. Add in the potential, on some processes, to use instrument diagnostics to infer aspects of process health, hitherto difficult to detect (such as excessive product build-up or sedimentation caused by process variances), and you start to see the scale of new potential. PE



Emerson's non-contact radar probe display, showing its real-time echo curve in operation