Automation upgrade

With computer technology not known for standing still, it should come as no surprise that the control systems it underpins are getting cleverer and cheaper. Brian Tinham reports

Right: Siemens' Totally Integrated Automation, with its new portal facility

Interesting, isn't it? Look at almost any substantial project and the up-front spend on instrumentation and control systems will be a tiny fraction of the figure for plant equipment, the civils etc. Yet, once that shiny new plant asset has been installed, commissioned, and is up and running, the impact of that same automation system over its lifetime, in terms of productivity, maintenance costs and profitability, will be massive.

It's also the case, historically at least, that plant monitoring and control is among the last of the engineering disciplines to be considered as these projects develop. Hence, in part, the low spend (with the project budget running dry and justification running out). And hence also the early success of lower cost PLC (programmable logic controller) and PC-based SCADA (supervisory control and data acquisition) combinations – as well as the outsourced system integrator community that configures, builds and installs them.

Lower cost, that is, compared to the more highly regulated industries' (such as oil and gas, petrochemicals and refining) traditional preference for more serious DCSs – distributed control systems, now generally termed process management systems (PMS). While these projects, too, have generally kept the lid on control system costs, the complexity, scale, margins and sheer unthinkable consequences of failure put these in a different league. But that has paid dividends, in terms of uptime, efficiency, product quality and, again, profitability.

Same, but different

To an extent, that was then and this is now, but there are important lessons for us here – because, primarily, what's changed is that the technologies involved in the PLC/SCADA and PMS camps have become practically indistinguishable. So it's worth looking at the differences that remain to establish whether the current price tag differentials might deliver some useful engineering and business benefit.

Taking it from the top, Simon Ellam, Siemens business manager for process automation, suggests that the main vestigial difference between PMS/DCSs and PLC/SCADA systems is the extent of pre-engineered software in the former. "On the one hand, process control systems provide all functionality out of the box and, on the other, they are deliberately very operationally orientated," he says.

For Ellam, that's because, on process plants, the operator must be in absolute control of everything at all times, whereas on plants using PLC/SCADA systems the assumption is that maintenance engineers can be called in to keep equipment

Integrated automation

If you're looking for developments in lower cost automation kit, typically built using PLC (programmable logic controller) and PC-based HMI (human machine interface) or SCADA (supervisory control and data acquisition) systems, the word you want is 'integration'.

As Mark Daniels, field business leader for architecture and software at automation giant Rockwell, says: "Whereas these systems used to just work together, now they're properly integrated, which reduces up-front [computer] engineering work." That's good news for most of industry, given today's much smaller control system departments. The other good news is that they're generally more usable, more intuitive.

"Programmers could have achieved the same result, but it would have taken longer. Our system integrators tell us there's about a 20 to 40% reduction in the time it now takes to get an automation system built," says Daniels. And he explains that aspects, such as device communications, are now routinely handled, while system configuration environments will automatically pre-populate much of the functional code for you, as the system is built up.

In Rockwell's world, some of the improvements are the result of what it calls 'add on instructions' – building blocks that can be configured to become your standard way of handling particular plant equipment or solving defined automation problems. "So you don't start with blank pieces of paper to control that pump or manage that process. It's effectively semi-customisation, but standardised and documented for your plant."

Additionally, the links into process instrumentation, ESD (emergency shutdown), and other generally separate equipment and systems are now increasingly tight.

In Rockwell's case, these have been achieved as a result of its partnership with instrumentation firm Endress + Hauser and its purchase of ESD specialist ICS Triplex. In fact, Rockwell and E+H had been bedfellows for more than a decade before going public with a strategic relationship in 2008, involving secondment of engineers to each others' R&D labs.

going, handle the troubleshooting etc. “That just wouldn’t be acceptable on a process plant where operators in their control rooms need to be able to see, for example, why a plant is downgrading or one of the units is shutting down, right from their own runtime displays,” he explains.

What does he mean? In practice, it’s about the system providing plant schematic ‘faceplates’ on the operator screens that not only display operations, but, as standard, also automatically reveal first-out interlocks and subsequent interlocks for any event. Those are the kinds of facilities that enable plant operators quickly to see a root cause and its resulting domino effect of

HART migration for ageing plant control systems

End-of-life control solutions

Large plant operators will know that one of the major emerging issues today is control system obsolescence, and the consequent need to migrate expensive and plant-critical equipment to something else.

All control system vendors have their solutions and all talk about taking a phased approach, promising low cost, low risk and minimal downtime. On the face of it, that doesn’t sound hugely feasible, but Invensys is one that insists on the veracity of the claim. It talks about plug-in migration solutions for a range of elderly control systems, including one that is HART (highway addressable remote transducer) protocol-enabled and designed to convert legacy Fisher Provox Series 20 systems to the latest Foxboro I/A (intelligent automation).

Betty Naylor-McDevitt, director of control and safety solutions at Invensys Operations Management, explains that upgrading is achieved via HART field communications functionality. She also says that plant users can harness Invensys’ InFusion ‘enterprise control system’ technology, aimed at synchronising business requirements with plant floor control – all without any need to replace field wiring, termination assemblies, system enclosures or power supplies.

In this case, Invensys replaces the Fisher Provox I/O modules with new Foxboro I/A units designed to plug directly into the existing system nests. “Invensys brings new meaning and value to the term ‘migration’,” states Naylor-McDevitt. “We make migrating from legacy to a modern control system easy, low risk and cost effective. In addition, the resulting new DCS provides the foundation for expanding into an InFusion ECS [which] helps users leverage Invensys and third-party systems to achieve operational excellence.”

And, if you’re more interested in the ECS aspect, one plant reporting recent success is ExxonMobil Lubricants & Specialties in Beaumont, Texas. Its system has been installed to help manage the plant, controlling major processes, but also integrating with the existing SAP business system, as well as the batch processing, packaging and shipping systems. According to a plant spokesperson, ECS applies the principles of real-time process automation across the plant to improve production flexibility and workflow.

events – and thus to take appropriate action.

It's the same with alarm management, where the PMS vendors' control software will be to EEMUA (Engineering Equipment and Materials Users' Association) standards, meaning that alarm events display at the top of the screen with the avalanche of second tier alarms temporarily hidden, so that operators are immediately guided straight to the primary cause.

No one argues that this kind of functionality is essential for machine automation where the complexity might not be there; the world isn't going to stop turning, if it goes down for a while and maintenance is on hand to sort it out, using its own diagnostic tools – but you get the point.

On-time, to budget

Sounds useful? Backtrack a moment and, if we generalise PLC/SCADA projects, the pressure is on system integrators to deliver a running plant on-time and to (diminishing) budget. There is usually little or no incentive for bells and whistles, or 'nice to have' pre-engineered features. As Ellam puts it: "Ultimately, PLC/SCADA is a blank canvas and that might be a good thing – but the limit almost always comes down to how much time and effort plant operators typically are prepared to pay for. If you have a sophisticated end user with its own standards and a high end system integrator, then you can achieve these things, but most just don't have the capability, resource or financial incentive."

However, Siemens, Rockwell and others believe the game is changing, and we don't have to look much farther than the burgeoning energy-from-waste industry to see what they mean. As companies in this sector design, build and operate their own plants, there is the incentive to get the choice of control system type and the scale of pre-engineered software right – and to take a more holistic view of the price.

"They can quantify the cost against ROI, because they have a vested interest in knowing exactly how the plant will run in the long-term," asserts Ellam. And talking of time, when you step up to systems that come from the process world, you also gain certainty of cost, irrespective of future technology migrations, as operating systems and hardware become obsolete. So, no more legacy systems.

That's one of the other deliverables to come from standards-based monitoring and control software, and the engineering systems designed to program, configure and troubleshoot them. PE

Quick reverse prevents jams

For some time, it has been possible to monitor the component of motor current that affects torque, to detect when plant equipment is in danger of jamming. Then, if it doesn't clear, a quick reverse often eliminates the problem – for example, dealing with ragging problems on transfer pumps (in which fibrous lengths of rag get lodged around the leading edges of impellers) in water treatment works.

The technique has, however, been given a new twist by Control Techniques (part of Emerson), which has embedded control algorithms directly into its intelligent variable speed drives. For plant users, that means an end to the cost and inconvenience of stoppages and unplanned weekly or even daily maintenance, as well as energy savings as great as 15%. For control engineers, it also means no requirement for additional PLCs or engineering work in developing the automation side.

Paul Cosing, Control Techniques' engineering and production manager, explains that the achievement is a result of the scale of intelligence in its drives. "Users get configurable functions and programmable memory, which they can add to with plug-in modules that increase the control performance of the drive to match that of a mid-size PLC," he says. And not just control: also connectivity to other drives, plant or control equipment, via high speed RS485 ports (optionally full duplex, four-wire).

Called 'intelligent pump control', embedded anti-ragging was first applied in 2007 at the Seaton Sluice Sewage Pumping station for Northumbrian Water. Subsequently, a more detailed study was undertaken by Scottish Water at its Levenhall Sewage Pumping station, starting on 10 June last year, with a single controller on its number one pump – one of four driven by 45kW motors.

Graeme Moore, Scottish Water's senior project manager, says the site was particularly prone to pump blockages, costing the company an estimated £15,000 per annum. Replacement pumps were claimed to solve the problem, but, with no guarantee and costing £120,000–140,000, were discounted in favour of the drives, at £7,000 each.

On 12 June, two days after the trial started, all pumps, with the exception of No 1, blocked and had to be lifted and cleared. On 16 June, Numbers 2 and 3 blocked again. Matters continued in a similar vein until the variable speed drives were installed on the remaining pumps – since which time they have been recommended for all Scottish Water's sewage pumps where there is a blockage problem.