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April 2016

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Is Industry 4.0 coming of age?

Hannover Messe will be interesting this year, as we have been promised news of some mature Industry 4.0 applications. I'm not really sure whether 'mature' is the right terminology to use, but it will certainly be interesting to see what has been achieved so far… and, hopefully, I will be able to report on this in future issues. In the meantime we have an interesting article in this issue that looks at some of the challenges of introducing mass customisation production methods, which is one of the Industry 4.0 goals (pg 38).

As industry moves towards digitized plants, I was surprised to hear that a recent study found that 90% of UK production companies do not have secure systems to protect their process control software. An article in this issue discusses the importance of protecting your hidden assets such as data and software code (pg 24).

Also in this issue is a report on the use of mobile devices on the plant floor. I was surprised at the reticence displayed by many of the vendors I spoke to on this subject – it seems like there is a good understanding of the benefits of mobile technology, but that end-users do still need some convincing. I would be interested to hear your views on the use of tablets and smart devices on the plant floor, for both maintenance and maybe even control tasks. (pg 14)

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Smoothing out system integration issues

Control Engineering Europe reports on the recent introduction of a multi-vendor solution which aims to ensure system integration in real-life situations through an extensive pre-testing program.

In common with other industrial equipment vendors, Endress + Hauser has, for some time, been testing its own instruments against the most relevant control systems and fieldbus protocols before releasing a product. It is important that instruments integrate with all PLCs, DCS and control systems that are relevant to an instruments possible use.

Open standards exist primarily to allow for the selection and combining of a variety of best-of-breed products. In order that this advantage is not reduced by potential integration problems, it is useful to test the interoperability of products in combinations that are frequently found in practice. This gives concrete and successful validated suggestions for the automation of processes along with documentation on how it should be implemented.

At sps/ipc/drives 2015 Endress + Hauser introduced its Open Integration Partner Program, in a move which it hopes will result in more complete system testing, in a systematic way, in cooperation with other automation vendors. The program aims to promote cooperation between providers of industrial automation systems as well as open fieldbus communication and open integration standards organisations.

"All of the existing integration technologies are very necessary," explained Michael Ziesemer, chief operating officer at Endress+Hauser. "However, they are based on standards and standards are never 100% perfect! There will always be room for interpretation. In addition to testing against communication protocol requirements it is also necessary today to test against DTMs, FDI and DD packages."

Ziesemer, explained the reasons behind the program: "All industrial control and field equipment needs to be tested against a variety of open integration standards – however this is often not enough to ensure

Big data analytics set to optimise the test and measurement process

Big data analytics is gaining a good deal of attention in test and measurement applications as industry starts to see analytical systems as a strategic tool to improve efficiency.

Today only around 5% of total test data is utilised. However, according to analysis from Frost & Sullivan this trend is changing as companies start to recognise the benefits that can be gained from the information that can be made available from the data, to provide actionable insights.

"Research and development, risk management and asset management are the key applications in test and measurement where big data analytics is gaining traction," said Apoorva Ravikrishnan, Frost & Sullivan Manufacturing 4.0 research analyst. "Real-time monitoring and preventive maintenance too are racing to the top of investment priorities across industries."

Automotive OEMs are looking to utilise big data analytics to optimise products in the production line and to keep track of maintenance and repair requirements. The aerospace industry is employing big data analytics for component manufacturing, preventive maintenance services and real-time structural health monitoring.

However, it is expected that high initial costs will slow down the large-scale adoption of big data analytics to a certain extent. A number of firms prefer to stick to in-house systems managed by their IT department rather than invest in advanced big data solutions for test and measurement. Several OEMs also remain skeptical on the reliability of data analytics.

"Transitioning from rigid analogue systems to digitised, smart and automated technologies will be the need of the hour for big data analytic vendors striving to strengthen test and measurement capabilities," said Ravikrishnan. "Further, acquiring industry-specific expertise will differentiate analytic providers from the competition and quicken their rise to the top of the global big data analytics market for test and measurement."

that equipment works seamlessly together. Simply testing devices against the standard is not enough. In a real life applications there will be multiple instruments that all need to connect to each other, with different software releases and with a number of instruments being interconnected, with different cables, different groundings, different termination resistors and different kinds of gateways interconnecting the bus with the control system. All of this adds complexity and the possibility of incompatibility within a system." The basic idea behind the Open Integration Partner Program, therefore, is to determine the compatibility of a variety of system and network components, as well as field devices such as instruments and valves when working together, before they are fitted in the field, to ensure compatibility resulting in a more organised and transparent solution.

The Open Integration Partner Program will see a specified reference architecture, applicable in a certain industry application, partnered with a variety of system components in a typical plant situation. The system is put together, in the same way that it would be in the plant, and tested to ensure that everything works together as expected. "This initiative takes our traditional one-on-one component tests a step further," said Ziesemer.

To date, eight companies have joined the program including AUMA Riester, HIMA Paul Hildebrandt, Honeywell Process Solutions, Mitsubishi Electric, Pepperl+Fuchs, Rockwell Automation, R. STAHL and Schneider Electric.

The move is a timely one, as many big customers are already demanding pre-installed systems integration testing. "We are already working with Honeywell on a number of projects," said Ziesemer. "Shell, for example, is pushing to ensure that the offerings of its suppliers are well integrated. We are currently in discussion with other companies and want to extend the program to include all systems and components where integration is relevant. To fill the program with life, in terms of content, specific customers will also be asked to join the program."

Reference topologies

Cooperation starts with jointly agreed reference topologies. Each reference topology is tailored to typical applications and the field communication technologies used in these applications. Depending on the industrial segment and market, the focus will be on typical requirements such as availability, redundancy or explosion protection, followed by the selection of system components and field instruments of practical relevance. This exact combination will then be tested and documented before it is published as a joint recommendation, giving customers concrete and successfully validated suggestions for automating their plant.

The Open Integration Partnership Program includes conformity and interoperability testing. Conformity tests verify products against the relevant specifications which ensures that the product is equipped with the necessary prerequisites for interoperability. Interoperability tests check whether each of two products has achieved the desired behaviour and open integration tests validate the interplay of all products in a reference topology following mutual integration tests.

This joint validation solution goes beyond the traditionally established conformity and interoperability tests and the program should offer benefits for all parties involved. "It will benefit everyone concerned, including machine builders, systems integrators and end users," said Ziesemer. "It will no longer be necessary to work on an assumption that the instruments and systems will work together so will save machine builders and system integrators time. End users will benefit from faster start ups and more reliable systems. Suppliers will also benefit as it will reduce the need for plant visits to identify and solve integration problems in the field."

Cyber Security Operation Centers for the protection of industrial facilities

Siemens has opened Cyber Security Operation Centers (CSOC) for the protection of industrial facilities – a joint location in Lisbon and Munich and one in Ohio in the USA.

The industrial security specialists based at these sites will monitor industrial facilities across the globe for cyber threats, warning companies in the event of security incidents and coordinating proactive countermeasures.

The increased networking of industrial infrastructures calls for appropriate protective action for the automation environment. The latest protective measures form part of the company's Plant Security Services, which range from security assessments and the installation of protective measures, such as firewalls and virus protection through to the continuous surveillance of plants with its Managed Security Services.

If the CSOC experts detect an increased risk, they give the customer an early warning, issue recommendations for proactive countermeasures and coordinate their implementation. The countermeasures are based on the criticality of the incident and the likely impact on the customer's business. They include modifying firewall rules or providing updates for closing gaps in security. In addition, Siemens provides forensic analyses of security incidents. Companies are then in a position to prepare reports that comply with international standards such as ISO 27002 or IEC 62443. Companies also receive a transparent view of security status of their plant.

Compact HMI can act as an automation gateway

Mitsubishi Electric has added a new model to its range of HMIs which is said to act as a gateway device to an entire automation system.

The GT2705 completes the current GT27 series line-up offering a 5.7in TFT touch screen, gesture control and high-performance graphics processing. The unit is programmed via Mitsubishi Electric's GT Works3, which includes built-in object libraries and a suite of pre-defined templates and screens to enable efficient and intuitive commissioning and updating.

Several de-bugging functions are

available as standard and whole user manuals can be stored on the HMI for direct access in the field which can help increase plant up-time by enabling more efficient on-site support.

The GT2705 has full data logging capabilities and a convenient back-up/restore function. Additionally, it can communicate directly with SQL, Oracle and Access databases, rather than needing the support of a PC. The unit can interface with control networks via Ethernet, RS-232, and RS-422/485 as standard and there are options for CC-Link, CC-Link IE and MELSECNET/H.

Control software bundle

COPA-DATA has updated its family of software products with the introduction of zenon 7.50, zenon Analyzer 3 and zenon Logic 9. Numerous new features and improvements are designed for simple project configuration and robust runtimes.

The most recent software release from COPA-DATA is not limited to the company's Operator (HMI) and Supervisor (SCADA) products. It includes new versions of its reporting software, Analyzer, as well as the integrated PLC programming environment, Logic.

"Our objective in software development was always to have a flexible, modular, but at the same time fully-integrated and networked system, the strengths of which bear fruit when interacting with one another. To achieve an even better synchronisation of our products, we have presented these bundled into one annual zenon release," said Reinhard Mayr, product manager at COPA-DATA.

The new styles in zenon were created to offer a consistent look and feel in visualisation projects. They combine graphic properties of screen elements and define parameters, such as line thickness, size or colour for the required elements. The centrally-saved styles within a project can then be applied to other elements for a consistent design within a project, as well as throughout projects and in multi-user projects. Changes can be made centrally at any time and all linked elements update automatically.

Non-contact temperature monitoring in hazardous areas

All models within the MI3 infrared sensor series from Fluke Process Instruments are now available as intrinsically safe versions for use in hazardous environments.

The miniature sensors are fully ATEX and IECEx certified for use in Zones 1 and 2 (gas) and Zones 21 and 22 (dust), to provide a complete intrinsically safe package including the sensor, a communication box, and an Ex power supply. All three components are IP65-rated, and each can be easily exchanged in the field without the need to re-calibrate the entire system.

One or two intrinsically safe MI3 sensing heads can be powered by one power supply. The sensor cables can be up to 30m long, providing high flexibility for setting up safe monitoring scenarios.

The MI3 series comprises pyrometers for various spectral ranges and applications, including the 1M and 2M short wavelength models with a 100:1 resolution and 10ms response time, which are suitable for monitoring temperatures up to +1,800°C.

Communication boxes are available with RS485, Modbus, Profibus, Ethernet, and Profinet IO interfaces and with four galvanically isolated analogue outputs.

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From vision to reality:
an innovative combination of automation and cloud technology

Overview of the Proficloud technology.

Arno Martin Fast discusses a cloud-based solution which opens up new use cases in the area of system automation.

The Internet of Things (IoT) is, for many companies, still a far-off vision that is both incomprehensive and impossible to implement at this time. While productivity is set to improve with the increasingly networked, Internet-capable smart devices and the data they provide, specific details on implementation as well as fully developed business models are generally unavailable or have not yet been fully fleshed out.

A combination of forward-looking standards gives rise to innovative solutions that cut costs and, in turn, enhance competitiveness. The Proficloud technology from Phoenix Contact, a cloud-based concept, opens up new and easy-to-implement use cases in the area of system automation (Figure 1).

Profinet and the Internet

The Profinet Industrial Ethernet standard enables a variety of solutions to be implemented – from mechanical engineering and production engineering, to process and building automation – to the entire spectrum of drive technology. The Proficloud technology now connects the Profinet networks of automation technology with the Internet.

A standard Proficloud application consists of at least one Proficloud coupler, one Proficloud device, and one Profinet controller (See figure 1). The Proficloud coupler connects the local Profinet network with the Proficloud via two Ethernet interfaces. While one of the interfaces is used for linking to the local Profinet system, connection to the Internet is established via the second Ethernet interface. Subsequently, the coupler automatically initiates a connection with the Proficloud and is ready for operation after a short period of time.

The same applies to Proficloud devices, which are also easily linked to the Internet and automatically connect to the Proficloud. Then, the user must only register the Proficloud devices with the UUID (Universal Unique Identifier) in the Proficloud and assign them a Proficloud coupler. The UUIDs are used as clearly identifying information in distributed systems. After registration, the Profinet system begins communicating via the Proficloud, with communication secured by Transport Layer Security (TLS).

New concepts

The Proficloud makes it easy to network I/O assemblies or connect any Internet-capable device. Such devices include smartphones and smartwatches, with an app running on the device that establishes communication with the Proficloud (See Figure 2). This expands the interaction between human and machine, as status messages and other alerts now appear directly on the machine operator's smartwatch. In the next step, he or she can respond using voice control functions without being at the respective control panel.

Aside of the integration of smart devices into the cloud, the sensors and actuators can also be linked directly via Proficloud controllers to the solution. The machine then sends the sensor data to the IT-based big data infrastructures, where it is analyzed and triggers the appropriate responses in the application.

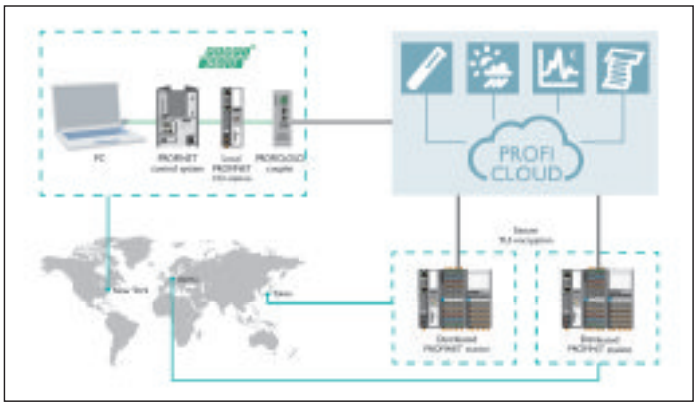


Figure 1: Example construction of a cloud solution.

Figure 2: Vendor-neutral cloud connection of machines and systems.

The operators or users require smart analytical systems that consistently deploy big data applications. Virtual Proficloud devices, created specifically for the relevant system, could conduct the analysis in such cases. The data from the system would be captured by the virtual Proficloud device via the Profinet protocol. This would then be analysed in the cloud, after which the (recommended) actions would be reported back to the system and its operator.

Any Internet service as a Proficloud device

There is then the matter of how to transfer data from the Proficloud devices to the analytical systems and protect it from unauthorized access. The Proficloud device sends its process data to the Proficloud as soon as a connection to the Internet – and thus to the cloud – has been made. The limitation to 'outbound connection' ensures that nobody from the Internet can initiate undesired communication with the Proficloud devices.

Once the devices are connected to the Proficloud via the Internet, a Profinet instance of every coupled Proficloud device is generated in the Proficloud coupler. All Proficloud devices now receive their own IP and MAC addresses, which are mapped in the local Profinet network. The user can then program any Proficloud device as though it were a local Profinet device.

Proficloud components.

Comprehensive protection

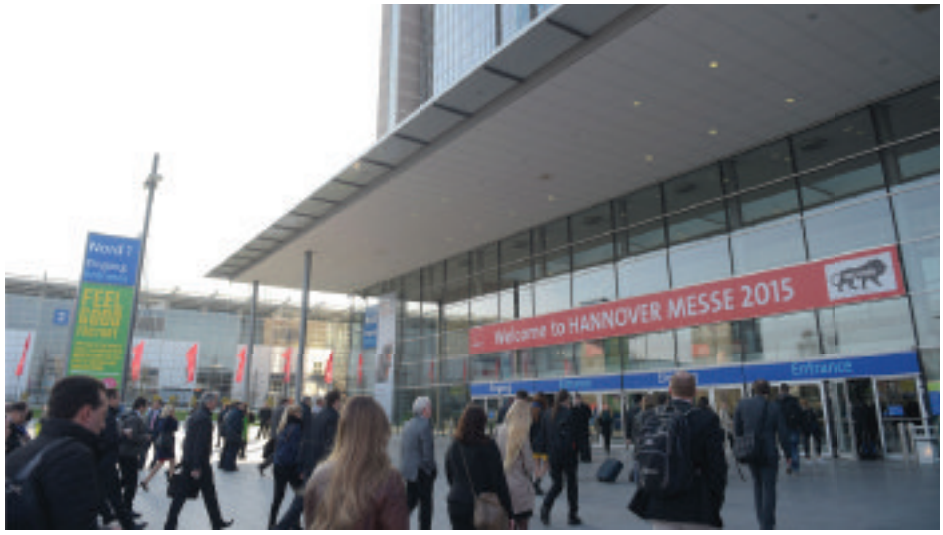
Because data transmission by the Proficloud coupler and devices is protected by TLS encoding and the connection can only be established by the Proficloud device, two fundamental aspects of Proficloud data security are observed. Even the Web application for parameterization of the Proficloud is forwarded to the user through HTTPS (HyperText Transfer Protocol Secure), making it safe against unauthorized access.

Conclusion

In summary, users can easily integrate the Proficloud into existing systems because the solution is based on the Profinet protocol established in automation technology. In this way, Phoenix Contact makes integrating automation solutions into the cloud as simple and secure as possible so that the user can take advantage of the many options provided by Internet technology.

Arno Martin Fast, B.Eng is control technology product marketing manager at Phoenix Contact Electronics GmbH, Bad Pyrmont in Germany

Discover solutions for integrated industry



Hannover Messe is back from 25 to 29th April! With Industry 4.0 and digitalisation of the factory continuing to be key themes, this year's event promises to showcase some mature Industry 4.0 projects.

Hannover Messe, which must surely be the world's largest industrial technology exhibition, is returning to Hannover this year from the 25th to the 29th April. The event organisers are expecting to welcome over 220,000 visitors and 3,600 exhibitors from across the globe who will come together to celebrate and discuss the latest industry trends and innovations.

While across Europe we are all talking about Industry 4.0 do expect to hear some slightly different terminology at the show this year. With USA as the partner country for the event in 2016 there is bound to be more references to 'advanced manufacturing' and the 'industrial Internet' which is the US take on Industry 4.0. However, whatever terminology is being used, the trends remain the same – factories are going digital and IT, the Internet and industry are converging.

Digital factories will use intelligent integration to improve processes and develop new products while conserving resources and at the event companies such as Siemens Industry, SAP, and Autodesk will be on hand to explain how. The USA is already the second largest exhibitor nation after Germany within the Digital Factory section of the event and three US industry heavyweights – Microsoft, IBM and AT&T – will be setting out their stalls there.

A focus on Industry 4.0/industrial Internet is shaping the event beyond the Digital Factory section. "For the first time we are expecting over 100 actual applications for Industry 4.0," said Dr Jochen Köckler, board member of Deutsche Messe AG. "This makes Hannover the global hotspot for all topics dealing with integrated industry."

Driving the digital enterprise

Siemens will be using the event to extend its offerings for the 'Digital Enterprise' to help achieve end-to-end digitisation.' Its slogan for 2016 is 'Ingenuity for life – Driving the Digital Enterprise.' The company will be showcasing innovations in the fields of power distribution, automation and drive technology as well as industrial software.

Although industrial enterprises will face different demands, depending on their field, the central challenges are the same for all companies – reducing the time-to-market and increasing flexibility and efficiency while achieving an ever higher standard of quality. To meet these challenges Siemens has continued to expand its portfolio of software tools, offered as part of its Digital Enterprise Software Suite, which offers a portfolio of integral software-based tools focusing on Teamcenter as a collaboration platform. In the future, this will increasingly bring about the seamless integration of PLM (Product Lifecycle Management), MES/MOM (Manufacturing Execution System/Manufacturing Operations Management) and TIA (Totally Integrated Automation). In common with industrial communication networks, security solutions and the rapid, smart evaluation of large volumes of data based on MindSphere – the Siemens Cloud for Industry – Siemens aims to help its customers achieve transformation towards the Digital Enterprise.

"Using the software tools, communication solutions, security concepts and solutions, and an open platform for data-based services, manufacturing companies will be in a position to invest in future-proof automation solutions for the step-by-step implementation of Industry 4.0 solutions," said Anton Huber, CEO of the Digital Factory Division of Siemens. "Digitalisation gives them the capability to significantly speed up their value adding processes and so engineer, produce and market products far more quickly and efficiently."

Highlights on the Siemens stand will include demonstrations of the new performance features of the TIA Portal V14 and the service concept based on MindSphere. In the field of motion control applications, Siemens will launch > p12

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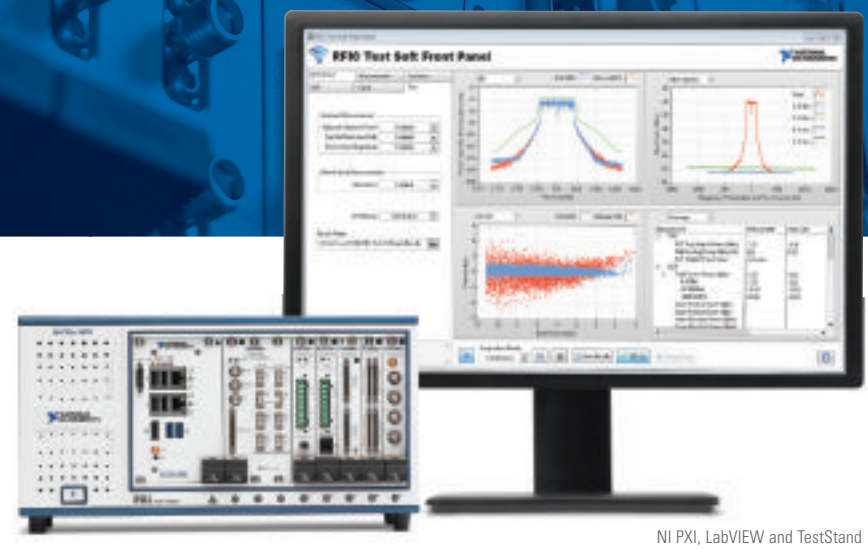

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a coordinated package comprising the Simatic Advanced Controller and Sinamics servo drive system. Also on display for the first time will be the latest release 8.2 of Simatic PCS 7 featuring additional convenience functions, the Simotics reluctance drive system with an extended output range and Simotics AMB active magnetic bearing technology.

Siemens will also be demonstrating ways that companies can benefit from the merger of the real and virtual worlds. The central exhibits on the stand will be a series of 'Highlight Cubes' on the topics of Energy for Industry, Additive Manufacturing, Automotive and Fiber Industry, which will offer a graphic illustration of selected topics for a direct hands-on experience.

The company also recently launched a new Active Field Distributor Simatic AFDiSD with extended fieldbus diagnostics for PROFIBUS PA in the process control system Simatic PCS 7. The fieldbus can be installed quickly using a commissioning wizard. The resulting commissioning report serves as proof of quality for the fieldbus installation. Users are able to access the latest information about the health status of their fieldbus installation, such as power, voltage and bus interruptions via the Simatic PCS 7 operator station in real-time.

Discover solutions

The lead theme at the event from **Beckhoff** is 'Discover Solutions' focusing on IoT and Industry 4.0. On its main stand Beckhoff will demonstrate foundational technologies and ready-to-use products for the Smart Factory. TwinCAT Analytics records industrial data synchronously with the process cycle and serves as the basis for comprehensive analytics. TwinCAT IoT facilitates straightforward IoT connections that enable cloud-based data storage and services. In addition, visitors will be able to see new innovations such as EtherCAT P and TwinCAT HMI, and witness its new generation in high-end measurement technology.

HMIs

A highlight on the **Turck** stand will be a new series of HMIs. The TX500 HMI PLCs with high-end touch displays and fast processors are suited to use in small to medium-size machines which have processes that have to be controlled, operated and visualised locally. Each HMI is equipped with a Profinet master and EtherNet/IP scanner, as well as a Modbus TCP and Modbus RTU master. They can also be run as slaves in both Modbus protocols.

Codesys3 enables the lean and simple programming of the PLC and visualisation functions. The latest processor technology utilised by the HMIs ensures smooth handling of computing intensive processes right through to moving image visualisations. A high resolution TFT display, with 64,000 colours, enables the high performance display of graphics and animations. The front panel is protected to IP66.

Simplified programme development

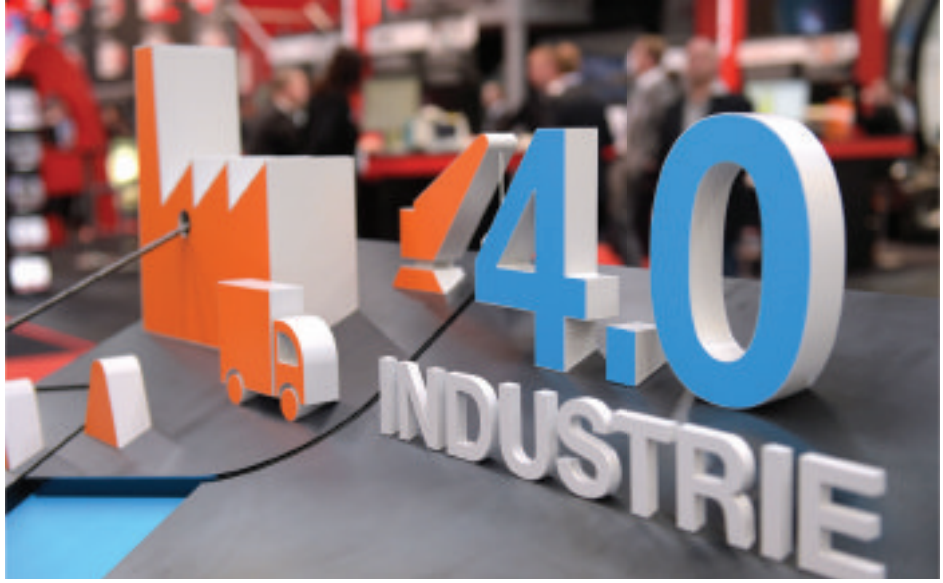
B&R will be introducing a new component to its mapp range of application software blocks which are designed to simplify the development of new programmes. They are said to result in reduced development times for new machines and systems of around 67%. The new mapp Codebox allows machine functions to be added or modified without having to reopen the original project in a development tool.

B&R will also be presenting new functions for its ACOPOS P3 servo drives and other solutions for Industry 4.0 and predictive maintenance.

Eaton will be showing a product portfolio that can help to underpin the digitalisation of the manufacturing environment. Visitors to the company's main stand will have the opportunity to experience its industrial process and machine control technologies, including electrical and hydraulic power management systems which can help engineers to build intelligent machines and systems that are more reliable, safer and more efficient while reducing time and cost across the entire manufacturing process. Smart wiring solutions that lay the foundation for Industry 4.0 will also be on show.

Flow control

Bronkhorst High-Tech offers a range of thermal and Coriolis mass flow meters and controllers. The full scale measuring range for these instruments can be selected between 0-1 mln/min and 0-10000 m3n/hr for gases and 0-100 mg/hr up to 0-600 kg/hr for liquids. The company also offers pressure transducers and controllers with a minimum range



of 0-100 mbar and a maximum range of 0-400 bar, vapour delivery systems and a series of ultra-compact, chip-sensor based instruments for gas flow and pressure measurement and control.

The company recently introduced a Profinet fieldbus interface for its mass flow meters and controllers for gases and liquids, as well as for its digital pressure controllers. The flexible Profinet architecture enables flexible, and cost-saving machine automation. Maximum performance and precision, along with flexible address assignment and modular design and fast commissioning is possible thanks to open access and defined interfaces and optimal diagnostics of devices as well as the network.

Sercos

Sercos International, supplier of the Sercos automation bus, will be demonstrating the Sercos III SoftMaster, showing how the high speeds and hard real-time can be achieved using a standard Ethernet controller. High performance and the highest determinism can be achieved due to a controller which supports queues and scheduling – for example the Intel i210. Ring topologies and redundancies are also reliably supported and functional limitations are no longer valid. Sercos cycle times up to 125µs are possible.

The Sercos SoftMaster is available as Open Source Software so is free to use. Another advantage is that special modules are not needed so the controller hardware can be designed compactly and cost-effectively because the SoftMaster runs on any platform.

Companies are already implementing projects on the basis of the Sercos III SoftMaster in cooperation with Bosch Rexroth. One packaging machine manufacturer, for example, is planning to convert its entire machine program to the technology in time for Interpack 2017.

Another highlight on the Sercos stand is the conceptual approach that simplifies the integration of machinery in manufacturing. Sercos International developed this approach in collaboration with ODVA and the OPC Foundation. A uniform network infrastructure where Sercos telegrams, CIP messages and TCP/IP telegrams run via a single cable allows mechanical engineers and users to reduce costs and complexity involved in machine integration. At the same time, they are able to keep using their preferred product suppliers and automation devices.

Powerlink

A new version of the OpenPOWERLINK industrial Ethernet stack will be presented at the event on the **EPSG** stand. Version 2.3 is said to offer improvements to the performance of operating-system-based masters and slaves. Support for coprocessor solutions that handle the real-time part of POWERLINK makes it possible to set up a deterministic network – even on conventional operating systems such as Windows – without a real-time extension. This is particularly relevant for image processing algorithms used in PC-based vision systems. Due to the new coprocessor support, stack 2.3 makes it easier to integrate such systems deterministically into high-performance POWERLINK networks while still preserving high asynchronous bandwidth.

The EPSG booth will also showcase the latest safety solutions based on the fieldbus-independent openSAFETY standard.

Taking things slowly

Suzanne Gill reports on the use of mobile devices in industrial applications. It appears to be a slow-burn technology on the plant floor and there are some hurdles that need to be overcome before mobile devices become more widely used.

The manufacturing industry sector is notoriously slow at adopting new technologies. However, as mobile device technology begins to mature, a number of opportunities are opening up for ruggedised mobile devices in this sector, although according to automation vendors, uptake does appear to remain slow. Where they are being utilised most, is in applications for monitoring SCADA systems, which enables engineers to become more mobile within the plant.

"We are finding that interest in mobile devices is growing every year and the current focus on HTML 5 and web visualisation will speed up this trend," said Michael Albrecht, product marketing IPC/HMI, Control and Industry Solutions at Phoenix Contact Electronics. The technology can offer particular benefits to users who require only infrequent access to an HMI as it could help reduce investment in fixed hardware and can help to minimise the effects of equipment failure rates due to dust and vibration, which is often present on the plant floor.

Elbert van der Bijl, manager industry marketing at Yokogawa, also believes that the industrial sector is moving towards the use of mobile devices. However, today the company is still seeing a reluctance to utilise the technology extensively due to perceived security issues. "To date the only applications we are seeing have been for second level applications – not control related – for field service and maintenance tasks. We are also seeing some interest in the use of mobile devices in start up support projects, before the plant becomes operational, and also during plant shutdowns when staff are undertaking maintenance activities. However, we feel that fixed monitoring solutions will remain dominant in the process sector for some time," said van der Bijl.

Mobile benefits

Ian Langton, mobile product manager at Captec, a supplier of specialist industrial computers, rugged tablet computers and embedded computers, expands on the benefits of mobile monitoring solutions. "Having mobile monitoring solutions on the factory floor benefits the engineers. It means that they are no longer tethered to a single workstation. However, it is not yet commonplace. We are seeing less demand for tablets to replace HMI control applications on the plant floor as it is often desirable to maintain wired connections to ensure reliability when it comes to issues relating to control."

According to Captec tablets are typically being used an as an addition to fixed plant floor monitoring solutions in the factory. The company has also identified that mobile devices are being used more frequently for trials within an existing plant framework and this is helping businesses to better understand the real world benefits and implications of such a device before they commit to wider use of the technology.

Langton believes that the use of mobile devices will increase in the future as industry has always been heavily influenced by the technology used in our everyday lives. Over the last decade, consumer use of conventional desktop computers has declined – being replaced firstly by laptops, and more recently by tablets. "This sets user expectations, and I fully expect industry to increase the level of mobile devices used for control and monitoring as the cost of this technology is becoming more attractive, and key technologies improve to increase performance and battery life to levels that better fit the needs of plant

> p16

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applications," he said. "This could result in less fixed technologies on the plant floor and more mobile devices, which could be used for multiple applications around the plant. Mobility chiefly means that users are not constrained by workstations which can enhance visibility of business information, and the ability to share and communicate critical information quickly."

Honeywell concurs that industry is showing an interest in the use of mobile devices on the shop floor, albeit in a cautious way. As the plant floor becomes further automated, more data and information is being handled electronically. "This has led to an expectation that the information should be available all the time and anywhere," said Rohit Robinson, director, portfolio innovation at Honeywell.

A typical process

"Today's shop floor needs access to a variety of information," continued Robinson. He explained that a typical process might start with the production order being sent to manufacturing. Recipes stored in ERP systems would be added and then get converted into instructions for the manufacturing line. During the manufacturing process, mobile devices could display operating procedures, data sheets, production status, etc. Quality sampling results could be amalgamated to the batch, using mobility. And finally, toward finishing, the actual bill of materials could be read and signed off from mobile devices. Warehouse and logistics are one of the areas areas where mobility has been more enthusiastically adopted. "Today a process like this involves multiple pieces of software (Manufacturing Execution Systems) and mobile devices can eliminate the need to run back and forth from the shop floor to the desktop to access these systems. Human intervention for approvals from mobile devices keeps the supply chain flowing. However, the underlying infrastructure for application integration and security does need to be fine-tuned for mobile devices," he said.

Cyber security is an important foundational structure of mobility and, according to Robinson, mobile platforms can be secured by having and enforcing policies around VPN (Virtual Private Network), MDM (Mobile Device Management) and reverse proxies.

Monitoring has always been the main building block of efficient operations and mobility can bring greater visibility to monitoring systems – again, anytime and anywhere and potentially, by anyone authorised to do so. "If a monitored alarm trips, the people in the control room know about it. But, would the safety director/production manager be sitting in the control room? Mobile solutions such as Honeywell's Pulse app can take those same critical alarms out of the control room, delivered as meaningful alerts to relevant personnel, wherever they may be."

However, Robinson believes that mobile will not completely take over from fixed plant monitoring solutions. "Mobile connectivity to monitoring systems is not as robust as hardwired connectivity. Real time control and monitoring will always remain in place, with mobility offering greater ease of access to that information," he predicts.

Information visibility

Mobility benefits for control engineers are expected to lie in the realm of information visibility and remote intervention. For example, if they can see a process variable trending toward an excursion threshold, they can take actions to mitigate the chances of a potential upset. This is available today with apps such as Pulse, which provides collaborative capabilities, in real time, with subject matter experts and gives access to monitoring and trend process variables from a smart device.

Legacy SCADA/HMI systems store their data in registers and have a somewhat limited history of their state. Integrating them with process historians allows all the history to be stored and opens

up the information highway to build smart mobile apps that convert data into actionable insights, on a mobile platform. "The value of this is not in the tag, value, confidence and timestamp that comes from sensors, but instead is in knowing what is needed to operate safely, reliably and efficiently. That intelligence comes after business logic is applied to sensor data and that logic is what MES systems provide, on desktops and now, on mobile platforms," said Robinson.

Augmented reality

The introduction of new technologies, which have already cut their teeth in the consumer sector, such as augmented reality, could make mobile devices a more interesting proposition for the industrial sector. Augmented reality shows a live view of the reality through a mobile device. This view is augmented by computer-generated content. It could benefit maintenance engineers by showing them more equipment related information. It could, for example, allow them to visualise important information related to a device.

Yokogawa is currently working with AkzoNobel on an augumented reality project.

Use cases for augmented reality, using an iMaintain android-based tablet, are being considered as part of a drive to improve plant safety, product quality and to improve cost efficiencies at a facility through the use of technology innovations. The joint project has so far identified that the use of augmented reality saves operator time, as field engineers no longer need to either involve a second person to provide them with necessary data, or to return to the control room to visualise current values on the DCS system.

Key considerations

Captec says that there are a number of key factors which need to be considered when integrating mobile devices into legacy SCADA/HMI applications. These include:

Protection – We all use mobile devices at home, or in the office, but these same devices are often not suitable for use within a plant environment due to the environmental hazards that are often present, including ingress of liquids and dust.

Rugged tablets should include a wide range of protection features that makes them suitable for a range of hazardous environments, from basic ruggedisation to prevent damage from mishandling, through to ingress protection and even ATEX certification for use in hazardous environments.

Battery life and charging practicalities – Breaking free of being a fixed device, battery life and charging methodology becomes an important consideration for tablets used on the plant floor. For mobile devices to become truly mobile all the time, real world battery life needs to match up to the length of a shift, or the time periods during which it will be used. In addition, in larger plants, rolling out larger populations of tablets can result in a problem with ensuring that devices get put back on charge easily without inconveniencing their users by having to plug devices back in with a fiddly connector, which over time may itself become damaged or unreliable.

Especially demanding usage applications can now utilise tablets with hot-swappable batteries to enable users to stay on the plant floor for extended durations.

Keeping multiple tablets charged is an issue that can be addressed through the use of a charging station that enables several users to simply drop a tablet off for a charge in a single location, rather than requiring them to be plugged in a power connector every time.

Smaller usage scenarios might have only a few users equipped with mobile devices at first, which could make use of a single tablet docking station, perhaps at a fixed workstation, where they can leave the tablet to charge when not in use, as well as providing an opportunity to connect fixed I/O such as Ethernet and USB to provide even more functionality.

Network connectivity – Because a mobile device needs to network with other systems to monitor or even control, key to its effectiveness will always be network performance and reliability. It is, therefore critical that proper consideration (such as a site survey) is given to the wireless networking provision available anywhere on the plant floor before introducing mobile devices.

Conclusion

Mobile devices have been shown to offer time saving benefits for field engineers, enabling them to stay in touch with what is happening on the plant floor, wherever they may be. However, there does appear to be some hesitation in more extensive utilisation of the technology and it seems that more work needs to be done by automation vendors to help overcome the cyber security fears and to more actively demonstrate the productivity and efficiency benefits that mobile devices are able to provide.

Ensuring secure remote access

Dave Hammond explores the security issues relating to machines which include remote access features

Following the installation of an industrial machine at an end user site, the machine builder or supplier is often contracted to support that machine during a fixed warranty period. Traditionally, a service engineer would be required to travel to the remote site to resolve any machine issues during this warranty period, even if the customer site is located thousands of miles away in a different country.

Many of the IT engineers who manage the networks at end-user sites will probably only have experience of providing remote access to machine suppliers, using 'traditional' VPN methods which requires the end-user IT department to configure and maintain a dedicated, in-bound VPN tunnel, through their corporate firewall, for each machine supplier. Once through the firewall and on the site-wide network, the machine supplier's engineer is then able to reach the machine control devices.

Immediately, it is obvious that there are inherent problems associated with these 'traditional' VPN tunnels. Firstly, the machine control devices must be connected onto the end-user site network. This will involve the machine supplier configuring network (IP) addresses for the devices, during the site installation phase. So, each machine will have to be modified to suit each installation.

Secondly, the IT department must provide the machine supplier with a copy of their preferred VPN software and help to configure it, for each PC or laptop that is to be used for remote-access. Obviously, such computers will be administered by the machine supplier and so may not meet the strict security standards that would apply for 'native' site PCs.

Since the IT department is allowing this 'foreign' user to access its production network, it must also take precautions to protect its site network from the actions of this user, over which it has limited leverage. This can range from limiting the IP addresses that the machine supplier can access, through the provision of sophisticated anti-intrusion, packet-sniffing and antivirus systems.

Taking all of the above into consideration, many IT departments understandably take the view that the operational benefits of providing remote-access to machine suppliers are outweighed by the potential security risks to their site network.

However, modern 'cloud-based' remote-access solutions are now available for which the above actions are not necessary. They work in a fundamentally different way to 'traditional' VPN tunnels.

A good example is the eWON Talk2M solution, which comprises an 'eWON' VPN Router, used with the 'Talk2M' Remote-Access Cloud service.

Network isolation

The first consideration is the issue of network isolation of the specific machine from the site network. A VPN Router can isolate the machine network from the site network, while also providing firewalled connectivity between the two. Therefore, the machine devices are not directly connected to the site network and so can be configured with IP addresses to suit the machine supplier. Indeed, every machine produced by the machine manufacturer could be identical to every other machine,

which reduces complexity, as well as costs associated with design, build and installation.

The next challenge is securing the site network from the actions of machine suppliers' engineer users.

The ideal scenario is that the machine supplier's engineer can only reach the specific machine devices for which they are responsible, while not being able to gain access to the rest of the site network. This is what the eWON Talk2M 'cloud-based' solution is able to provide. Once enabled, each eWON VPN router device initiates an outbound, point-to-point, secure VPN tunnel, all the way to a specific account in the Talk2M VPN Cloud. This authenticated, encrypted HTTPS tunnel travels across the site network, out-bound through the site firewall and across the Internet, to one of the nine clustered servers, located across the world, that comprise the Talk2M Cloud.

The machine-manufacturer's engineer then also makes a secure VPN connection to the same account in the Talk2M Cloud, to where the eWON is connecting. Therefore, he is only able to reach the eWON and the devices located 'behind' it, on the machine network. At no point can the engineer interact with any other devices on the site network.

Because each VPN tunnel is initiated from inside the site network, out to the Talk2M cloud, the only facility required of the site network is the ability to make an outbound Internet connection, through the site gateway/firewall. Consequently, the IT department does not need to provide in-bound VPN services to the external user, which yields major security advantages. No in-bound firewall ports are exposed on the Internet, no static Internet IP addresses are required and the machine supplier does not have access to the entire site-wide network.

The outbound VPN connection used by the eWON uses HTTPS port 443, which, for the majority of firewalls, will already be open. The outbound connections can be carried over any type of media that can carry IP traffic, i.e. cabled Ethernet, WiFi, 3G or even satellite.

As with any remote-access system, end user companies may be concerned that a machine manufacturer can interact with the machines that they have supplied, but which operate inside the end user factory. To overcome this fear, in order to provide additional security and control, the eWON VPN tunnel can be enabled and disabled via the 24vdc Digital Input on the eWON VPN Router, which can, in turn, be wired to a key-operated switch or a PLC output. This means that the machine builder will only have access to the machine when the end user allows them access.

Session authentication

Session authentication is widely used by major secure websites, such as on-line banking systems. Such systems typically send a unique, one-time code by SMS message to the user's mobile phone, at the point of connection. The purpose of this is to prove that the person connecting is the valid, genuine user, rather than an intruder trying to gain access using stolen username and password data.

Many IT departments take the view that the operational benefits of providing remote access to machine suppliers are outweighed by the security risks to their site network.

Such security systems are termed '2-factor authentication' systems, since they rely on more than one security measure to ensure secure access. The use of such a system should be an intrinsic part of any remote-access solution used by a machine-manufacturer because it helps to add a second level of security to overcome poor password security or malicious intent.

Dave Hammond is product manager for Ethernet & Communications at M.A.C. Solutions.

Building a calibration workshop

When designing and building a calibration workshop there are many elements that need to be taken into account.

Building a calibration workshop should be managed in the same way as any other important assignment. Be sure to appoint an accountable project manager and establish a system of organisation.

The first step is to research the functionality requirements. Find out what kind of calibration work would be carried out in the workshop. Also, what other activities could be performed in the same workshop – for example, service and repair work, electrical and electronic maintenance, and engine testing. This will help determine the equipment required.

Space requirements should also be taken into account. Often the site is already built and a suitable space in the existing premises will need to be determined. This should provide enough room and should be well located from a logistics perspective.

The level of the accuracy/ uncertainty functionality specified for the workshop, as well as possible plans for calibration laboratory accreditation, will determine the exact requirements which could, for example, include suitable HVAC system, lighting, airlock doors, electromagnetic interference protection and others.

When selecting a supplier, in addition to the equipment do consider the after-sales support and training that can be provided.

Some suppliers can help with the planning/design of a workshop, and if so, it is good to involve them early. When possible, it is preferable to select one supplier that can take sole responsibility for all the materials to be supplied.

When planning and designing the furnishings consider day-to-day usability and future adaptability. If the workshop is to be stationary and a significant amount of counter space is needed, a bench may be the best solution. If the workshop needs to be moved frequently or space is limited, a trolley workshop may be the best option.

Selecting the equipment

Equipment selection is one of the most important parts of the project so prioritise important features such as accuracy, usability and ergonomics. Again, communication and cooperation with the supplier early in the process will minimise the risk of unsuitable installations, over-specifying functionality, or missing features.

Once the selection of all the equipment has been completed, prepare for the procurement process. A proper agreement should be concluded with the supplier before processing the order.

The deliveries for a calibration workshop often include a lot of equipment and furnishings, so it is important to first agree the means of delivery. The terms of delivery should be agreed upon, as well as the responsibilities. The project may contain several delivery milestones and these should should be specified and included in the agreement.

It is recommended that assembly of all equipment is also included in the agreement so that they can take on the responsibility of ensuring that everything is properly assembled and that warranties are not jeopardised.

Acceptance testing

Once all the equipment and accessories have been delivered and assembled, acceptance testing is necessary. This will be faster and smoother if your supplier can assist with the testing. Consider also a pre-shipment inspection, where a plant representative will inspect the goods before shipment.

To make the most of your investment personnel should be professionally trained to use the equipment. Training should be the responsibility of the supplier.

When the workshop is in active use, it is important to ensure it stays in good condition. The most common need for calibration equipment maintenance is for periodical recalibration. But there can also be a need to service the equipment, so this should also form part of the supplier agreement.

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Automation is vital for productivity increases

Control Engineering UK looks at the findings of a recent report that highlights some of the critical business requirements that impact productivity.

A recent report – '*A Blueprint for the Future of UK Manufacturing*'– from Siemens UK & Ireland found that UK manufacturers and senior management want business and Government to focus on three key areas of the Government's 15-point 'productivity plan.' Education, investment and innovation.

The skills issue remains a key concern, with 73% of organisations stating that training and educating the next generation of manufacturing workforce was the most important measure they would like to see improved.

The report also identified a desire to see greater commitment for investment in infrastructure and digital technologies to improve productivity. Overwhelmingly, manufacturers said that there needs to be targetted investment at strategically important improvement projects, such as the road network and energy infrastructure.

Nearly half of those questioned for the survey asked for the permanent establishment of R&D tax credits and many called for a reform to business rates to encourage greater investment in plant and equipment.

Commenting on the findings, Brian Holliday, managing director – Digital Factory, Siemens UK & Ireland said: "We undertook this consultation to gain an insight into what industry wants the UK to focus on to aid global competitiveness and productivity. Three key areas came to the fore – education, investment and innovation – which align closely with three of the pillars of the UK's 'Productivity Plan'. Together, these form a persuasive, insightful and sustainable 'Blueprint for the Future of UK Manufacturing' and an achievable template for success.

A critical sector

"UK manufacturing is a critical sector, delivering 11% of national GDP and employing 2.6 million people. It is crucial that its future success is protected. Recent reports from the EEF have shown that manufacturing is key to solving the UK's productivity puzzle."

While investment remains critical, the consultation also showed that manufacturers are already committed to investing in new technologies themselves, with 91% of manufacturers deploying automation and control systems to help optimise operational efficiencies and 83% stating that they have a desire to continue to invest in these areas. Many manufacturers are also planning investment to help address obsolescence and improve productivity.

While many acknowledge the potential promised by Industry 4.0, digitisation is already having an influence in the industrial environment, and automation technology is making real inroads in this sector. For example, product lifecycle management tools in a virtual digitalised world are now able to design, prototype and simulate products to optimise development timescales. Other automation tools are able to design and simulate an assembly line to support the optimisation of logistics processes and production throughput – without the need to invest significant sums up front. Unified digital connections between the critical phases of product design, production planning, engineering and execution, using relatively inexpensive automation technology solutions, are shortening product development timeframes, reducing costs and providing insight to inform future investment decisions.

Such digital capability is scalable, affordable and available today across the manufacturing spectrum to the smallest SME, as well as to a large-scale production facility.

Using automation technology, a number of manufacturers are benefitting from reduced capital expenditure investment risk, improved operational efficiencies, enhanced levels of production flexibility and productivity and shortened time to market. However, more manufacturers need to follow suit. Although the report clearly shows that manufacturers see the benefits of automaton technology they still need encouragement, support and the practical means to continue with their proposed investment plans.

Positive action and support is, therefore, needed from all stakeholders – including Government – in a number of key areas over the short, medium and long-term to drive home the benefits of automation for UK manufacturers to help facilitate growth and to enhance future global competitiveness.

A copy of the full report can be downloaded from www.siemens.co.uk

UK maintenance practices are a cause for concern

A recent report, published by Bosch Rexroth and the Institute of Engineering and Technology, surveyed nearly 300 engineers in UK industry. It identified that maintenance practices continue to be a cause for concern.

A total of 32% of manufacturers who took part in the survey described their maintenance as being reactive with less than 30% implementing either predictive or preventive maintenance regimes.

"The fact that nearly 30% of manufacturers in poll would class their maintenance strategy as predictive or preventive is something to be celebrated," says Richard Chamberlain, UK Service Manager at Bosch Rexroth. "However, there is still some way to go both to help bridge the gap for those that continue to take a reactive approach and helping forward looking manufacturers take that extra step towards a more planned maintenance programme."

According to the report, one of the key barriers to adopting a more forward thinking approach by maintenance teams is resource, with 53% of respondents saying that maintenance budgets have stagnated or decreased in recent years, and 64% saying that maintenance personnel numbers have similarly stayed the same or reduced.

"Maintenance resource is the major issue for manufacturers," said Chamberlain. "All-too-often, maintenance teams are stretched too thinly to be able to be more planned and predictive, instead resorting to firefighting to keep machines running."

'What you don't repair you destroy – A report into maintenance practices in UK Industry' by Bosch Rexroth can be downloaded from **http://bit.ly/RexrothMaintenance**.

Artificial intelligence solution seeks application partners

BigRing Solutions, a research and development company in the field of knowledge transfer and artificial intelligence based in Slovakia has finalised the creation of an artificial intelligence (AI) technology called bigRing. The solution is said to be capable of causal inference and so is able to comprehend, act, learn and predict.

Having completed the development and testing phase, BigRing Solutions is now looking for partners willing to implement this intelligent solution to improve their operations and create new growth opportunities.

For the last five years, the key players in the field of AI have been aiming to teach computers to think more like humans and to develop a new generation of tools and capacities that promise to provide consumers and knowledge workers around the world with intelligent assistance. BigRing Solutions believes it has a solution for these challenges with its new Knowledge Transfer Platform. "Unlike other research labs that deal with transferring the functions of the human senses to digital form, we discovered the first principle of knowledge representation and created a cognitive system that is capable of detecting causal bonds phenomena," said Karol Mozsi, CEO of BigRing Solutions and inventor of the bigRing technology. Our Knowledge Transfer Platform can therefore be perceived as an interface between humans and machines, which uses cognitive analysis to facilitate collaboration, interaction and knowledge sharing between them."

BigBrain merges all the information systems into a single complex and continuous self-development information system for interdisciplinary problem solving, allowing knowledge workers and managers to create a KnowledgeApp – an application that automates and shares their specific expertise. These KnowledgeApps – which are managed by the AI personal assistant to maintain an optimum balance – are automatically suggested to customers according to their knowledge deficit and current needs in a wide variety of fields.

The solution has come to fruition following 12 years of intense research and testing. The company is now seeking partners who are prepared to accelerate the integration of intelligence and automation within their business. "Our development strategy is twofold," said Mozsi. "Firstly, to approach investors with the aim of optimising the architecture of neural networks to achieve an artificial consciousness that is able to control its technological infrastructure, and secondly to finalise the product with a pilot customer with the aim of implementing our innovative solution."

For more information, please visit www.bigring.eu

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Demonstrating the benefits of variable speed drives

Control Engineering UK looks at some recent variable speed drive applications – one for which has offered energy efficiency benefits and another which has solved an OEM product reliability issue.

A sewage treatment works operated by Anglian Water has halved its aerator energy costs for a 4kW aerator at the unmanned treatment works since installing a variable speed drive (VSD). In addition it has succeeded in reducing maintenance costs and has cut ammonia to almost zero levels following the installation of an ABB variable-speed drive.

Wayne Barley, northern energy and efficiency engineer for Anglian Water, explains: "The vertical rotor of the aerator was set on a duty cycle of 20 minutes off, 20 minutes on. Working in this way, there were frequent sudden stops and starts that caused shock loads on the motor and gearbox, as well as needing frequent operation of the contactor to switch the motor on and off.

"This sometimes led to electrical and mechanical failure of the aerator, causing interruptions to sewage treatment and a possible subsequent failure to consent." This sewage treatment works has descriptive consent which specifies that all plant must be working but does not specify an ammonia limit.

The middle of the aerator has a tube to pull effluent from the bottom to the top of the tank, similar to an aquarium air lift. This ensures all the content is treated. However, the 20-minute duty cycle allowed detritus to settle at the bottom of the tank during the off phase, causing the tube to block over time. "We needed a solution that would solve these problems and hopefully also produce energy savings by matching sewage treatment more closely to demand," continued Barley.

Following a site survey by Inverter Drive Systems, an ABB Authorised Value Provider, an ACS355 machinery drive was recommended. The internal timer of the drive outputs signals to switch the motor on and off and to alter the frequency to achieve different speeds at different times.

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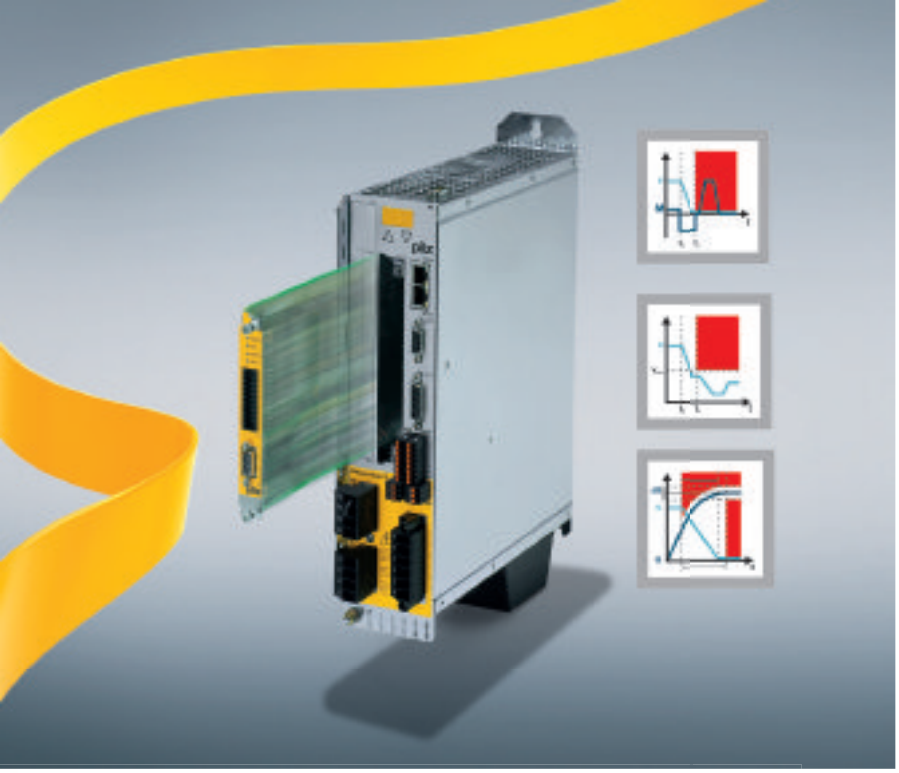

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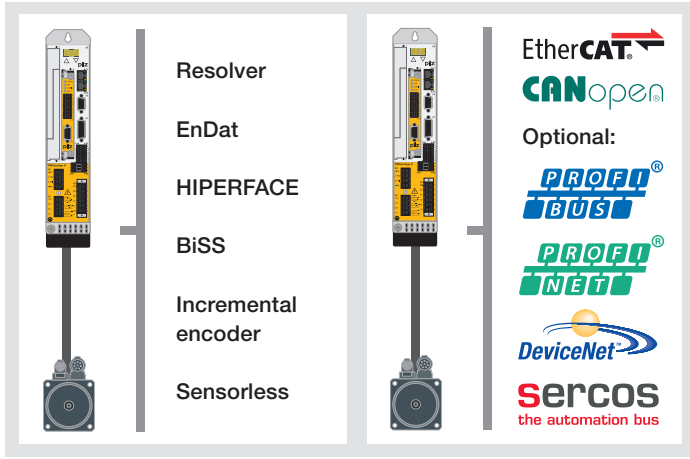

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"We experimented with the timings and speeds so we could find the minimum that would still draw the effluent and aerate the sewage," explained Barley. "We settled on four different time periods, during which the motor would be constantly on but working at different speeds to match the demand at those times.

"Midnight to seven am, we operate at 40 Hz, seven to 10 am at 45 Hz, 10am to five pm at 43 Hz and five pm to midnight 45 Hz. Any lower than 40 Hz and we found that we got no updraw into aeration or enough surface oxygenation.

The changes that were made mean that the aerator motor has achieved a minimum of 10% reduction in speed even at peak times, while the ramping and soft start capability avoids shock loading to the motor and gearbox. A ramped start feature has reduced the high load and torque placed on the motor gearbox and power train during start up, and also prevents constant switching of the contactor and motor which can lead to failure of equipment over time.

A ramped start feature has reduced the high load and torque placed on the motor gearbox and power train during start up, and also prevents constant switching of the contactor and motor.

The original energy cost of the application was £762 per annum, but this fell to only £374 following the introduction of the new drive, a reduction of nearly 50%.

Because there is now no 20 minute off period, there is no settling of the effluent, removing the threat of blockages and settlement.

"Since the introduction of the drive, we have found the application to be very reliable and there have been no maintenance issues with the assets on the aeration system," said Barley. "Although there is no consent governing ammonia levels, we have also reduced the ammonia discharge to almost zero – an indication that we have the right amount of oxygen getting into the effluent."

Anglian Water is now planning to introduce similar drive solutions for three other small sewage treatment works.

OEM application

A specialist supplier of concrete surface preparation equipment was

Compact VSDs for low-power motors

WEG recently introduced a compact range of variable speed drives (VSDs) to enhance energy efficiency for low motor power applications.

Designed to drive motors with power from 180 W to 4 kW, the series is suited to use in relatively small machinery such as centrifugal and metering pumps, fans and ventilators, stirrers and mixers, extruders, roller conveyors, cutting machines and rotary filters.

The drives feature an integrated micro PLC and a control panel with LCD display. Plug-and-play extension modules have been added to simplify installation and the drive unit's fan can be removed for maintenance.

Two slots have been included for extension modules – one for communication and the other for a variety of I/O modules which allows users to integrate RS485 or RS232 interfaces and use Modbus RTU, Bluetooth or USB communication protocols. The VSD can also be connected to fieldbus systems such as Profibus DP, CANopen or DeviceNet, or configured for operation under remote control. An Ethernet IP interface is also available.

Initially the drive will be available in frame size A for rated power from 180 W to 1.5 kW and frame size B for rated power from 2.2 to 4 kW. It will provide supply voltage flexibility with versions for single-phase and three-phase power.

The single-phase version can also be powered directly from a DC supply connected to the DC link, in order to drive three-phase induction motors from a DC power source.

encountering reliability issues with a floor grinding machine that is used for creating low maintenance polished concrete floors.

The grinder was utilising a single-phase drive, which was found to cause problems and needed to be enclosed and ventilated, at an additional cost to the OEM. Despite this, dust was still able to get through the unit, causing damage to the machine's fans and components.

To try and solve the problem, the company swopped the exisiting drive for a variable frequency drive using 230 VAC configured for one phase support. Although it had an impressive shock rating it also had to use dry type capacitors which meant derating had to be massive and this caused issues with keeping the DC link stable, leading to unpredictable operation of the grinding machine and poor torque.

Invertek was contacted for a solution and it suggested the Optidrive E3 with 240 VAC because it offered good stability, even when overloaded. It is also IP66 rated, meaning it is dust-tight, helping prevent the on-going problem of damage being caused to the machine's fans and components.

Commenting on the project, Brett Masters, an Invertek sales partner, said: "After installing the Optidrive E3, the machine was transformed in terms of stability while torque performance could be raised from 50Hz to 60Hz without causing any issues.

"Both the motor and Optidrive E3 were tested under continuous, very demanding loading. Despite this onerous testing regime, motor and load temperatures were kept low and there were no problems with tripping.

"Even when there was poor power available, the grinding machine remained acceptably powerful and could carry out its function without any problems," he said.

General purpose motor control solution

Parker Hannifin has extended the AC10 series of compact drives to offer power ratings in 230V three-phase drives category up to 15 kW.

The AC10 series is said to provide a no-fuss approach to general purpose industrial motor control applications offering users the energy-saving benefits associated with variable speed drives, as well as the improved reliability and extended service life advantages that come with smoother starting and stopping of regularly cycling loads.

The range provides sensor-less vector mode and a full 150% overload for one minute. In addition, an integrated keypad and user-friendly software is said to help reduce installation, set up and commissioning.

High-performance HMIs

Using high-performance HMIs offers a way to streamline how operators manage processes and allows them to react efficiently to process upsets.

Before computers were widely available in manufacturing, operator interfaces consisted of lights, rotary readouts, and control charts. These components were mounted on a wall in the control room and required operators to physically interact with them to run the process. Early computer graphics were used to shrink the operator interface to fit on a monitor but were rudimentary and made it easy for the operators to be overwhelmed with data.

As computer graphics progressed 3D rendered process environments common in most HMIs. While these graphics look great in a brochure, they can lead to confusion and additional productivity losses during process upsets.

On a parallel path to the advancements in computer graphics, process control systems have become more complex over the past few decades.

High-performance HMIs are a relatively new design methodology designed to combat the confusion present in HMI applications with enhanced graphics by focusing on situational awareness as a primary motivator behind design decisions. Situational awareness is an operator's ability to understand the information critical to his job at any given time, derive the correct actions, and reduce information overload through the use of simplified graphics by using color and animation only to convey process upsets.

The major hurdle in designing high-performance HMI systems is that high-performance graphics are not conventionally attractive for use as marketing collateral and are not as easy to advertise.

Sound the alarms

In non-high-performance applications, normal process conditions are usually some combination of green and red for running or stopped motors, open and closed valves, and so on. Coloured lines are used to show the different process connections, usually based on the process's P&ID drawing. When something goes wrong, there might even be a flood of alarms.

Even for someone who is familiar with the process, finding out the root cause of an upset can be a time consuming task. High-performance HMI applications are designed to reduce the amount of time spent looking for the root cause. This is accomplished by simplifying the graphics, removing animation, flashing, and colour under normal operating conditions. This even extends to accessibility concerns by not relying on color as the sole source of information. In the case of an alarm, different shapes and symbols can be used to indicate the equipment that is not running normally.

When a process upset occurs, the offending portion of the process can be highlighted, drawing the operator's attention to it, and increasing his or her situational awareness.

High-performance HMIs can also be helpful under normal operating conditions by using trends embedded into process object graphics to show conditions over time.

One benefit to more complex HMI architectures is the introduction of object-oriented programming techniques. This approach allows developers to create templates for graphics, scripting, alarms, and communication structures.

Using a template approach to developing high-performance HMI applications can reduce overall conversion time by building templates for the graphics and scripting that can then be placed in the application along with parameters for each instance of the graphics. If changes need to be made to any of the objects after the application has been developed, they will automatically be applied to all of the objects, saving time and hassle during commissioning and operation.

Many companies are now implementing high-performance HMI applications in their facilities. As they see gains in their process efficiency, other companies are taking note. In the past 18 to 24 months, the tide has started to turn, with high-performance HMIs making their way back to the system vendors and in marketing materials; the major vendors also are offering graphics, scripting, and even control logic as out-of-the-box templates to further reduce the complexity and learning curve required to implement high-performance HMI applications at any facility.

High-performance HMIs are a powerful tool that can make operators more effective, reduce overall downtime and lost-time spent on troubleshooting, and reduce the stress involved in handling process upsets.

By reducing the graphic interface's complexity, high-performance HMIs have the added benefit of being able to convey more information than a typical HMI application because it takes less work for the operators to get their bearings with the increased focus on situational awareness.

Alex Marcy, P.E., is the owner and president of Corso Systems, a US-based system integrator.

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Panel downsizing: help is at hand

Jodie Commercial discusses how a new breed of compact panel components can help to address panel builders downsizing challenges.

There are many challenges facing panel builders and machine designers today. They need to reduce costs, increase flexibility, and meet user requirements to optimise plant floor space. All of these have led to a trend towards reducing panel size. At the same time, however, end users want increased functionality, often built around new control architectures, which tend to require increased panel space.

Panel space has always carried a cost premium, but as the prices of steel and copper rise the requirement to minimise panel sizes has become more acute. Panel builders – and indeed machine designers – will frequently also have to take into account export costs, and the bigger and heavier the panel, the higher the cost of transportation.

However, it is not just the panel builders who have an interest in downsizing panels. For end users available space on the plant floor is inevitably limited as they strive for ever greater levels of productivity within the same production real estate, there are requirements for smaller panels to help optimise available floor space.

Complications

Complicating matters further, end users also frequently ask for panels which allow for ongoing system upgrades or for customisation. A given line may have an operational lifespan of 15 years or more, and will be modified on numerous occasions to increase performance or to handle a wider array of products. For the panels themselves, this inevitably means the addition of more control and I/O components.

This makes panel downsizing even more of a challenge at the design stage, with panel builders being required to implement an initial control solution in the tightest possible space, and yet still leave room in the panel for upgrades. Alternatively, at the midpoint in a machine's operational lifetime, panel builders may be asked to upgrade existing panels where there is no more space, facing the challenge of adding increased functionality into panels which already seem unfeasibly small.

To help meet these challenges, Omron has developed a range of compact components to enable panel streamlining. The slim in-panel component designs offer widths of as little as 6.2mm, as well as on-panel components with reduced depth. This can help to reduce overall panel dimensions by as much as 20%.

The complete range of compact in-panel components includes electromechanical and solid state relays, micro connectors, safety relays, temperature controllers, timers, measuring and monitoring relays, PLCs and power supplies. On-panel components with reduced depth include pushbutton switches, temperature controllers, timers and counters.

The slim industrial relays allow modules to be downsized or the number of I/O points to be increased without increasing panel space. Safety relays save mounting space and measuring and monitoring relays offer a compact footprint for narrow panel spaces with widths of only 17.5mm and 22.5mm. These products also offer features such as screw-less terminals, LED status indicators, simple front wiring and push in terminals, all helping panel designers to optimise panel layouts without impacting on issues such as usability or maintenance.

Panel builders are being challenged to reduce the size of control panels.

A compact uninterruptible power supply (UPS) is also available. It uses lithium-ion batteries to minimise component size and weight, as well as increasing product life. Further, standard switch mode industrial power supplies have been redesigned to be up to 13% smaller than comparable power supplies, offering the smallest footprint on the market.

As a further aid to panel downsizing, Omron has made parts data for all control products available via an online data portal. The information from this portal can be directly imported into panel design software packages such as EPLAN and Zuken E3.

Jodie Commercial is product marketing manager for components at Omron.

Electrical power conversion: addressing rail application needs

Bendi Oueini and *Guy Gallet* discuss modern rail power conversion requirements and demonstrate how they are being met with a combination of standard products and innovative design solutions.

Rail industry applications often places harsh mechanical, electrical and environmental demands on electrical and electronic equipment. Today, for systems integrators supplying this industry sector, simply having correctly-certified products is often not enough. Increasingly it is necessary to have the ability to customise or even re-design products to meet individual rail project requirements.

Railway systems need an ever higher density of electrical equipment – both on board trains and in trackside installations – to ensure passenger comfort and safety and improve performance.

For some rail projects, achieving the required functionality using standard products may be impossible simply due to space limitations in the target installation area. In other cases, the ability to provide a compact, cost-effective solution may be compromised by all the variants essential to ensure international acceptability and standards compliance.

The issue of availability is also important in this sector – this is the percentage of installation life for which a component is 'healthy' and able to perform its required functions. Availability relies on reliability and therefore mean time between failures (MTBF) as well as the time taken to effect a repair – mean time to repair or MTTR – if a fault does occur. MTTR refers to the entire period between when an item fails and when it is back on line. If ways can be found to reduce diagnostics times and MTTR, the equipment's availability and value will improve.

Although having access to good quality and certified products is essential, it is not always sufficient. Often customisation is needed to meet the form, fit and function required by individual projects.

Reducing EMC disturbance

EMC is an important issue for rail equipment and specific EMC standards are imposed. In Europe, the reference standards are EN 50121-1, 2 and 3 (and -4 and -5), which are part of EN 50121 (Railway applications - Electromagnetic compatibility).

In a recent project for a major railway equipment OEM, undertaken by Eaton, there was a requirement for a large number of DC-DC converters. Although the requirement was nominally for a single power supply, paralleling was

used to reach the required power output, and to build in redundancy for safety reasons. This meant that 12 DC-DC converters were required. The system configuration comprised four racks, each 6U high and containing three converters together supplying 140 W. In the original customer configuration, the racks also contained a large number of EMC input filters to ensure EMC standards compliance. The total cost became extremely high and the solution was difficult to integrate.

Nevertheless the initial implementation was acceptable to the French market because only the OEM used the 24 V input. The requirement was limited to ensuring that the system itself was functional. However, once the OEM addressed a wider export market in Northern Europe, other equipment needed connection to the 24 V supply, with protection from EMC disturbance.

Achieving this level of compliance for 12 converters in parallel was a challenge. It was not possible to free up extra rack space, change the cabling or increase converter size. Eaton worked on the converter printed circuit board CAD layout and component placement, while also making strategic frequency adjustments. This has allowed a solution to be finalised in which the complete cabinet has successfully passed the required level of EMC compliance.

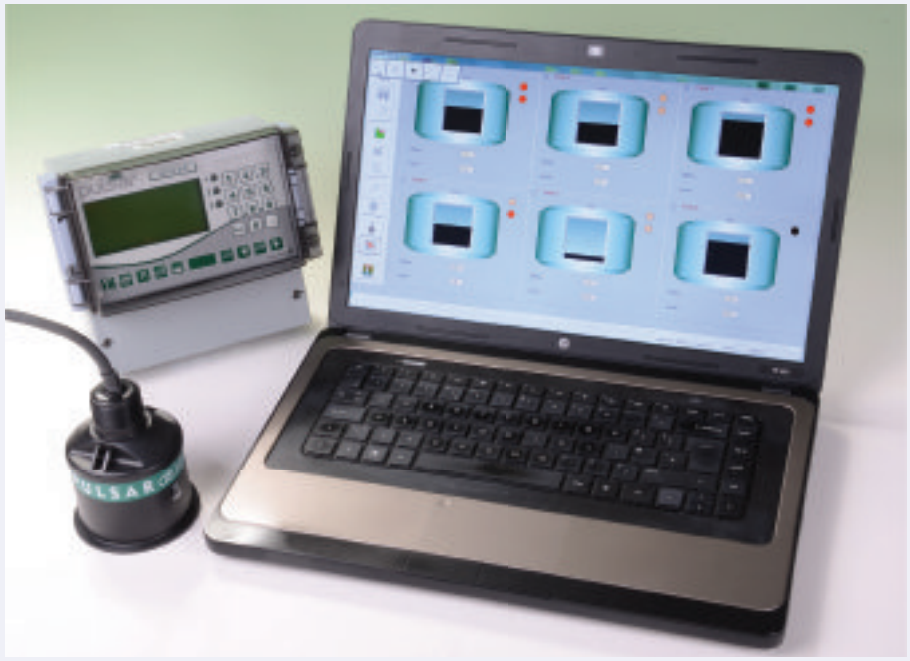
After completing many steps to validate the solution, EMC noise has been reduced by a factor of 2 or 3; no disturbance is experienced by systems sharing the 24 V supply. The original converter and cabinet dimensions have been preserved, and the solution is also very cost-effective.

A single wide input voltage solution

Many different battery voltages are in use within the rail industry.

Standard EN 50155 defines the set of allowable battery voltages; 24 V, 36 V, 48 V, 72 V, 96 V and 110 V. The minimum and maximum cell tensions are between 0.6 V Un and 1.4 V Un. For applications, the voltages > pUK14

Maintenance-free non-contacting bulk fuel tank monitoring



Non-contacting ultrasonic volume measurement equipment has been supplied by Pulsar Process Measurement along with associated remote plant mimic software, to help solve an issue for Northern Rail at three different sites. The solution allows for better control of ordering, delivery of fuel as well as enabling it to use fuel more efficiently.

As part of a larger project, Northern Rail's contractor, Austin-Lenika, had identified that the original level indicators were not designed for the application and were, not correctly reading levels. It approached Pulsar for a solution specifying that new equipment should provide a measurement of the volume of fuel in the bulk tanks with a target of ±1% accuracy, allowing staff on site to monitor fuel usage and transfer and pinpoint the optimum time to re-order fuel. It also wanted to have a local display of level on the storage tanks as well as being able to remotely monitor levels across the tank farm of eight fuel vessels, plus three additional bulk tanks.

Pulsar was able to meet all these demands with its Ultra 3 non-contacting ultrasonic level measurement controllers with associated dB series transducers. The transducers were mounted into flanges at the top of the fuel tanks, and operate on a 'time of flight' principle, with an ultrasonic signal reflecting back to the transducer from the surface of the fuel. The measurement also utilises signal processing via Pulsar's dedicated DATEM software system. In addition, the Pulsar Ultra Controller is able to calculate volume based on almost any standard tank shape, taking the tank dimensions and making the calculations necessary to convert them into the volume of fuel in the tank.

Pulsar also supplied UltraScan software, which uses a Modbus output to provide a screen display of both levels and alarms. UltraScan can operate either on a site basis or can bring together measurements from a variety of sites.

Staff at Northern Rail are using the system effectively today. The system was tested by comparing delivered fuel from a tanker to measured levels from the Pulsar system. This found a variance of from a 6,000l delivery of 'within 60l, achieving the desired ±1% target.

are usually grouped into three ranges; 24 – 36 V, 48 V and 72 – 110 V.

This leads to a proliferation in equipment variants, as three different equipment versions are needed for the three voltage ranges as defined. Development costs are therefore multiplied by three, as are the costs for thermal, EMC and vibration qualification testing. Stockholding requirements are also multiplied by the same factor.

When a large systems customer came to Eaton with a requirement for four or five DC-DC converter variants with different input voltage ranges, an improved, cost-effective solution was suggested – a universal wide-input unit with a voltage input range of 16.8 V to 137.5 V to eliminate unnecessary equipment proliferation. This offered a number of advantages. The increase in material cost was less than 10%, which was more than offset by savings in testing requirements. Avoiding a change in input voltage range eliminates the related possibility that a product's EMC performance may change, so no new EMC test is needed. Triplicate thermal and vibration qualifications are also avoided.

The reduction in testing saved time as well as cost, so the systems integrator received their products more quickly as a result of the single solution. The customer's own qualification testing burden was also reduced.

Diagnostic capability

Built-in diagnostics and communications capability is a useful feature today, to help improve productivity and reliability of equipment. Without such capability, fault diagnosis in a complex application such as a train is difficult and time-consuming – especially if the fault is transient. A fault incident and its diagnosis can take a train out of service for several hours or even days.

Adding diagnostics capability and the ability to communicate status and fault information over, say, a CAN bus, reduces diagnostics time to a couple of minutes rather than hours or days. After that, repair of a DC-DC converter is usually simple, as it can typically be effected just by exchanging the faulty plug-in converter rack module.

The information available across the CAN bus is also valuable for longer term preventative maintenance. Parameters including output voltage, internal temperature, power consumption and output power can be analysed by a failure mode and effect analysis (FMEA) tool to identify and reveal potential problems.

This capability allows systems providers to the rail industry to identify and prove when the root cause of a fault lies outside their system. The ambient temperature, for example, may have climbed to an excessive level, subjecting their equipment to out-of-specification operating conditions.

Status and potential fault data is continuously being generated by DC-DC converters as a natural part of their operation. Eaton has already implemented CAN bus-based systems for trucks, and is now using this expertise on further rail system developments.

Conclusion

Problems can be solved and solutions made more efficient and cost-effective by customising or re-designing products to overcome the challenges of a particular application. Eaton has built up strong expertise in EN 50155 and EN 50121-2-3 requirements, together with a good knowledge base in environmental conditions. MTBF calculations and FMEA analysis tools are backed up by extensive in-house testing equipment deployed across development and production facilities in France, the UK and Tunisia.

Eaton now has power conversion products that comply with all applicable rail standards installed in trains and trackside applications across the world ranging in power from 15 W to over 30 kW. With proven reliability, they comply with all applicable rail standards. They are ruggedised to withstand a range of environmental conditions appropriate to their applications, including vibration, EMC requirements, wide temperature ranges and wide input voltage ranges, as well as extended hold up times, salted fog and humidity.

Guy Gallet and Bendi Oueini are from Eaton Power Electronics

Simplified configuration of complex industrial networks

Westermo has introduced a range of new Ethernet switches and supporting software to help simplify configuration of complex resilient Ethernet networks.

Four new layer-2 high-performance managed Ethernet switches have been added to the Westermo RedFox range. Designed for use in harsh environments and demanding Edge Network applications, the switches are supported by MTBF, a wide operating temperature range and type testing for both industrial and rail trackside use.

The devices offer a range of port options including 11 gigabit ports. The two industrial switches, suitable for installation in extreme environments, feature 11 and 19 port options. Two new rack mountable versions of the switch, suitable for control room or cabinet installation, feature 27 ports and are available in AC and DC power variants.

Version 1.3 of its network configuration management tool, WeConfig, is said to simplify the configuration of complex resilient networks that can typically feature multiple rings, gigabit links and numerous devices. The software includes a variety of new wizards for quick and easy configuration with global parameter settings. It analyses port and path for best implementation of single or multiple rings, simple fast ring recovery and ring coupling.

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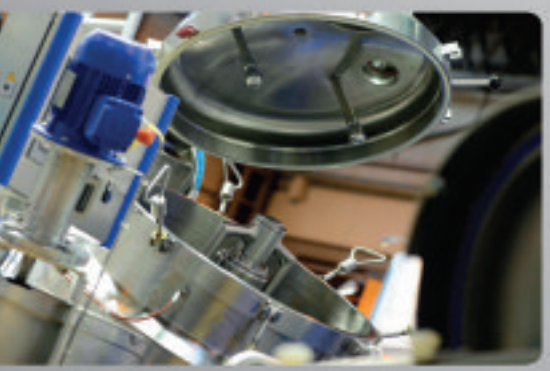

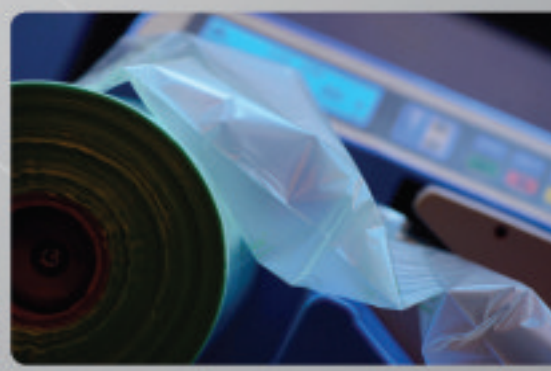

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Entry-level 19in rack mount PC

Suitable for production applications requiring a PC with greater ruggedness and a higher availability than office-grade PCs, the Siemens SIMATIC IPC347 can be used for visualisation and SCADA tasks, data collection and management, testing and measuring tasks in discrete production and process automation, as well as logistics and laboratory automation applications.

In common with other rack PCs in the SIMATIC family, the new entry level model is designed for 24-hour use in industrial settings which may have an ambient temperature of up to 40°C, vibration, shock and EMC requirements. The dust protection filter and overpressure ventilation system also protects the PC against damage when used in harsh or dusty environments.

SIMATIC IPC347E is available in five configurations. Users can select the appropriate processor performance with either an Intel Pentium or 4th generation Core i5 processor; optional ± R/RW DVD drive and optional pre-installed 64 bit Windows 7 Ultimate operating system. The PCs each have 7x PCI(e) expansion slots, a 500GB hard disk, and 2 or 4GB RAM, which can be increased up to 16GB.

IS connector family: additional poles add flexibility

HARTING has extended the Han Ex intrinsically safe (IS) connector family with new standard inserts and housings designed to offer greater flexibility by providing additional contact numbers.

The Han Ex range is designed to conform with the preconditions for the ignition protection intrinsic safety category, and can also be applied in the explosion endangered zones 1 and 2.

Up to 64 connections are possible in combination with a 24B housing. Crimp, screw and cage clamp connection technologies are all available. The housings offer cable outlets of M20 to M40, while a robust and reliable metal bracket serves as a locking system.

The housing alloy has been selected to enable applications in methane/coal-dust atmospheres. In addition, the connectors comply with the IP protection class 65 in the plugged state.

Condition monitoring and solution with display

The Datawatch IX monitor/recorder from Metrix Instrument, is now available in the UK from Ixthus Instrumentation.

The 3.5in colour TFT display is said to offer clear visualisation of vibration, acceleration and other process parameters through four or eight universal inputs with fully configurable views plus alarm, shutdown and data recording/storage capability.

The panel-mountable device offers communication with PLC, SCADA, DCS or remote terminals over an integral Modbus TCP/IP port and is also capable of handling up to 30 virtual channels that can be used to view Modbus inputs, maths, counter and other values within the instrument.

The device is said to offer particular benefits where there is a need to add permanent condition monitoring to existing plant. It is able to display horizontal and vertical trends or bar graphs, numeric information and alarm panel and status. Configuration can be via USB or Ethernet, or from the front panel.

Field rangeable pressure sensor

As part of its GP:50 range of pressure sensors and transmitters for hazardous and harsh environments, Interface Force has introduced the Model 1171 field rangeable pressure sensor.

The rugged, compact transmitter is designed for use in severe weather conditions, for example in the offshore, energy and maritime sectors.

Pressure ranges from 50 through 100,000 PSIS, PSIA and PSIV and is 4-20mA loop powered. The external zero, span and calibration controls are hermetically sealed and can be adjusted via a magnetically coupled drive system. The sensor allows for 5:1 ranging of the transmitter's standard pressure range, so there is no need for a calibrated pressure source.

Six key findings on integrating operations

2015 IIoT, INDUSTRIE 4.0, INFORMATION INTEGRATION STUDY:

Respondents to the Control Engineering 2015 Industrial Internet of Things (IIoT), Industrie 4.0, Information Integration Study identified six high-level findings impacting control systems today:

1. **Integrated levels:** Seventeen percent of organisations' manufacturing floors (Level 1) and advanced manufacturing control (Level 2) are highly integrated. Another 9% report Level 2 and enterprise (Level 3) to be highly integrated, and 8% cite the same level of integration between Levels 1 and 3.

2. **Lack of integration:** The most popular reasons for low levels of integration at respondents' facilities are an unwillingness to assign resources/ benefits are not recognised and the difficulty and cost of implementation.

3. **Benefits:** Some benefits from recent integration projects include better support for decision making (47%), faster decision making (39%), and better control of resources (39%).

4. **Challenges:** One in four respondents have found a lack of budget to be the top challenge when integrating operations, followed closely by confusion over project scope and/or benefits.

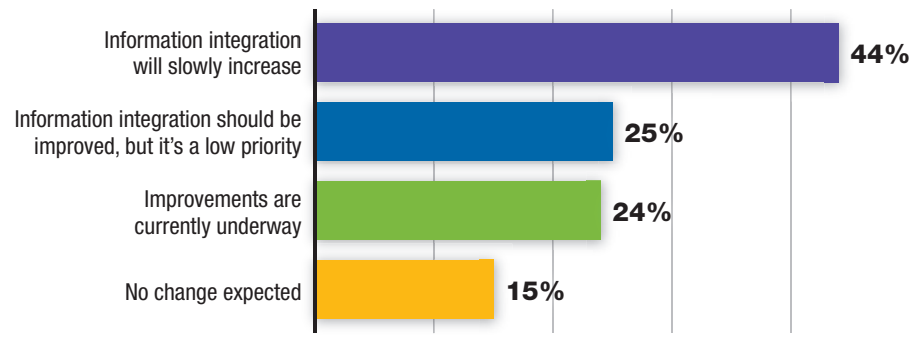
5. **Information sharing:** Internal networks and weekly reports are popular methods for which corporate management receives information from the manufacturing and enterprise levels of organisations.

6. **Integration tools:** To establish and sustain integration, respondents take advantage of system integrators (42%), customised software (42%), and browser-based interfaces (34%), among other methods.

View more information at www.controleng.com/2015InfoStudy.

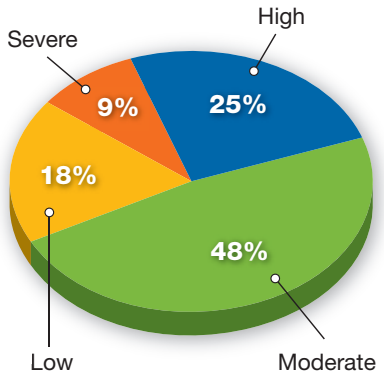
Amanda Pelliccione is research director at CFE Media, apelliccione@cfemedia.com.

Status of information integration over the next few years



Forty-four percent of survey respondents believe that information integration within their facilities will increase at a slow pace, while 24% are currently undergoing improvements. Courtesy: Control Engineering

Control system cyber security threat levels



Nearly half of control systems are considered moderately at risk to a cyber security breach. Source: Control Engineering 2015 Cyber Security Study

49% of engineers admit that they or their peers lack the communication/presentation skills necessary for advancing in their career. Source: Control Engineering 2015 Career Study

15: Average number of system integration projects worked on or outsourced per year; 57% work on/outsource 10 projects or fewer annually. Source: Control Engineering 2015 System Integration Study

3in10 engineers report a lack of integration between the manufacturing floor and enterprise due to an executive decision to restrict information access. Source: Control Engineering 2015 IIoT, Industrie 4.0, Information Integration Study

More research

Control Engineering surveys its audience on several topics each year, including cyber security; career survey; system integration, and IIoT, Industrie 4.0, information integration. All reports are available at www.controleng.com/ce-research.

Increasing plant level awareness

The challenges of deploying a plant Ethernet network are very real. A recent webinar proposed a solution that helps increase plant-level awareness of industrial networks.

Ethernet networks provide a critical link between manufacturing and automation systems and business systems. However, as networks have to cope with ever more connected devices detection, diagnosis and problem resolution is now a costly and time-consuming task.

A recent *Control Engineering Europe* hosted webinar looked at these challenges and suggested a solution. Michael Vermeer, senior business development manager at Panduit, explained that as automation systems move from proprietary bus networks to industrial Ethernet, control engineers have moved from having a robust toolset with which to manage their plant systems, to virtually nothing. "Tools that do exist focus more on managing the switch and router architecture in the plant and enterprise networks, rather than the industrial devices. Often they are not control engineering friendly either," he said.

The result is that if there is a critical production issue it is often difficult to identify whether network and infrastructure could be the problem.

During the webinar Vermeer discussed some of the most common requirements of the operations team and proposed a tool that is built to help proactively support the industrial Internet in a way that complements the needs and critical support of the IT department on the enterprise network.

Network visibility

The IntraVUE software toolset can provide network visibility to control and maintenance teams responsible for plant uptime. It is able to continuously monitor devices connected by Industrial Ethernet and provide KPIs and analytics for plant floor devices.

"The base unit of network reliability can be considered as the individual connection," said Vermeer. "It is important that these individual connections are reliable and connected seamlessly. However, they are often buried in hard to reach places on the plant floor. It's not enough to simply have high quality connections. We also need to select the right product and devices for the environment to ensure issues such as mechanical strain, ingress, climatics, chemical and electromagnetic issues are addressed as they arise on the plant floor. Even then issues relating to EMI can arise." Often overcoming EMI issues requires a change in the design of control equipment to separate noisy and sensitive cabling. There are also ways to select appropriate connectivity or design the pathway to avoid EMI. However, EMI problems are often identified too late. "Panduit customers are requesting a solution to identify the latent risks that exist in their plants to allow them to proactively addresses these issues," said Vermeer.

"Other issues arise as a result of the growing industrial Ethernet network. As the number of Ethernet devices scale there is no common consistent architecture or physical layer to scale it in a manageable way and this can make it difficult to maintain and trace problems when they arise."

Control professionals want to be able to do more than just design best practices to mitigate risks as their networks take on new deployments and they want to understand the risk within their systems, but rarely is there capability to have a view of the entire plant network.

IntraVUE provides visibility into all levels of devices. The provision of advanced analytics helps engineers optimise ongoing performance and empowers control professionals to shift from a reactive response to a proactive approach, which will improve the uptime and performance of critical, real-time networks.

Designed for easy installation and minimal training requirements, the software automatically detects all Ethernet-connected devices and assembles them into a connection tree diagram of the physical layer network infrastructure which details device, associated IP addresses and how devices connect to each other. Once devices are detected the software can provide 24/7 monitoring and data capture from intermittent disturbances to the overall health of devices and connections.

Available as an Internet download to a laptop or desktop PC the software can be deployed quickly and is easy to maintain. The solution can be seamlessly scaled as the number of connected devices increases. Once installed IntraVUE is said to be able to realise a ROI in only six months in most applications through cost savings around improved documentation, reduced failures, fewer errors, less reliance on high-skilled IT to resolve network problems and reduced time and costs associated with network expansions.

Key in Linkcode 110133 on www.controlengeurope.com to see a recording of the webinar.

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The June issue of *Control Engineering Europe* will cover some of the hot topics in industry today:

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To tell your story contact Suzanne Gill now on

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Safeguarding your hidden assets

Control Engineering Europe looks at the need to safeguard hidden assets, such as the software code and data that controls a production plant's processes.

Oil and gas operator Total E&P UK selected Asset Guardian to improve management and integrity of the process control software used to operate its offshore North Sea developments. The first asset to have access to Asset Guardian is in the Elgin Franklin fields.

Failure to protect hidden assets could result in disruption to a plant's operations, potentially leading to costly downtime and financial loss. It is as important as ensuring that physical assets are well maintained and operate safely and effectively.

A recent study – the Global State of Information Security Survey 2016 by PriceWaterhouseCoopers – found that 90% of UK production companies do not have secure systems to protect all of their process control software.

However, appreciation of software asset security is starting to improve, spurring companies into action. According to the survey, organisations increased their information security budgets by 24% in 2015, which is reflected in a 5% decrease in financial loss and a 38% rise in security incident detection since 2014.

Protecting hidden assets

Every process plant is different, so it is difficult to find a single solution. There are, however, several areas that companies should be considering. These include compliance with industry standards, software security, disaster recovery, change management and obsolescence management.

Asset Guardian Solutions specialises in protecting companies process control software assets. It developed a multifaceted, customisable software-based management tool – Asset Guardian – to help address these and other critical issues associated with managing process control systems (see Figure 1).

Compliance – Regardless of sector, the regulations, standards and guidelines that govern the process industry call for the effective management of control system software. Broadly speaking, this means providing secure backups of code and documents, configuration management (including change control and fault logging), user password management, security of information and audit trails.

With no effective system in place to manage these responsibilities, there is a significant risk that operators will fail to comply with these requirements.

Security and disaster recovery – Process control software is a key component in the safety and operational integrity of any production plant. Ensuring that the right person has access to the right information at the right time is critical to controlling the effective management and security of a company's data and software.

With the increase in cyber attacks targeted at process control software, preventing unauthorised access to software is becoming an increasingly important consideration. While unintentional breaches can occur, a user, employee or contractor could also deliberately infiltrate and disrupt a system. Asset Guardian limits unauthorised access to all data and software files by providing a secure central repository. Users of the system need to log in with a username and password

Using storage media such as CDs, USBs and others – can increase the risk of data corruption and provides no validation as to the integrity of stored files.

Asset Guardian uses Checksums, which checks software for any corruption during uploading, storage and downloading of files, securely protecting a company's software assets. It simultaneously ensures that the right version of the software can be accessed quickly, allowing the plant to be safely returned to its pre-failure operational state.

Change management

A key element in 'Managing Change' is having an effective process in place to manage the workflow and to ensure the correct level of approval and authorisation to initiate and close off the process upon completion. It can also provide a comprehensive audit trail of all actions completed.

Process control engineers are all too

familiar with the challenges that making changes to control systems on operational processes will pose. They are also aware that many Management of Change systems adopted at the corporate level are not well suited to managing changes to process software configurations. Asset Guardian's Management of Change system, however, offers a structured workflow that can be modified to suit the specific requirements of individual companies.

Obsolescence management

Today's increasing population of ageing assets, combined with commercial pressure to extend the operational life of plant, means that greater emphasis is now being placed on collecting, managing and analysing data to determine whether an item should be replaced or retained and used to extend the life of another part of the process.

Figure 1: Asset Guardian can help protect process control software assets as well as other critical issues associated with managing process control systems.

Asset Guardian safely stores and analyses data, greatly simplifying the process of managing obsolescence.

Although protecting process control system software may seem daunting, it need not be. In just the same way that solutions exist for safeguarding structures and vessels, the technology and expertise is also available to keep data and code safe.

"Since 2010, we have witnessed a marked increase in energy companies taking action to safeguard their hidden assets and ensure effective process software management," explained Sam Mackay, CEO of Asset Guardian Solutions. "In addition to Total E&P UK, others benefitting from the solution include EDF Energy, Inpex, Dana Petroleum, McDermott, Dolphin Drilling, GDF Suez (Engie), Stena Drilling, Nexen Petroleum UK, Woodside Energy and BP. This is encouraging, but ever-increasing demands on companies to meet their compliance obligations, combined with the escalating risk of software security breach, means that much more attention and investment is required."

Evaluation service aims to optimise IT asset management

Rockwell Automation recently released new software and enterprise evaluation services which are designed to help manufacturers and industrial operators better manage their assets and reduce risk.

The majority of production facilities operating today are a mix of modern technologies with equipment operating well past its expected life cycle. Many companies are not entirely sure what equipment they have, or the specific risks that are associated with aging equipment.

Manufacturers are now looking to converge information technology (IT) and operations technology (OT) systems, to create a unified enterprise. The new Software Inventory Evaluation service provides organisations with analysis of plant-floor IT assets – including servers, PCs, laptops and mobile devices – and of the various software installed on those assets. This can help identify potential compatibility risks between specific firmware and software versions as more systems are connected and devices are updated. It can also help close knowledge gaps among support staff regarding which software versions are used across a myriad of equipment, how many licenses are used or unused, and whether software is being properly supported.

"More than a software audit, the Software Inventory Evaluation service includes valuable analytics-based reporting that details areas of risk and provides insights for taking action," said Andrew Wilber, Installed Base Evaluation service manager at Rockwell Automation. "It can also deliver significant cost savings. For example, it might identify opportunities to eliminate unused software and to migrate to concurrent licenses."

The Enterprise Installed Base Evaluation service can include a multisite Software Inventory Evaluation service or Installed Base Evaluation service, which is used to analyse critical plant assets to provide a full accounting and analysis of an organisation's IT and OT assets across the enterprise.

Organisations can use the service to support specific corporate-wide initiatives, such as identifying the most critical assets, reducing obsolescence risks, managing corporate storeroom and spare parts initiatives, and ensuring all assets have up-to-date bills of material.

"Organisations attempting to do comprehensive evaluations in-house often spend a year or longer collecting hardware data from a single facility," said Wilber. "That can be a strain on resources, especially when expanded across multiple facilities. It also presents challenges in ensuring a standard methodology is used for collection. With the Enterprise Installed Base Evaluation service, we can collect this data and begin delivering actionable, insights-based reports in weeks."

Achieving high asset utilisation in bulk chemical plants

Terumi Okano explains how the use of software technology can improve equipment performance, validate plant bottlenecks, push production constraints and ensure safe, reliable operation in the chemical plants.

Many chemical manufacturers and the control engineers who work for them are focused on maximising yields, reducing costs and ensuring plants meet safety standards.

With high volume output and low margin return, these operations are capital-intensive and companies strive to achieve high asset utilisation while staying on target for production goals.

Identifying operational strategies to bypass bottlenecks and improve operating targets for key plant equipment is a crucial goal. Optimising trade-offs between production, yield and energy performance requires good visibility of plant behaviour, so that the necessary corrective actions to reach operational targets can be made. Validating relief system design for new operating conditions and conducting operability analysis to address stability problems quickly also requires visibility.

Many chemical industry sector leaders will constantly review strategies. It is not easy to balance the trade-off between making the most products without using an enormous amount of energy and a small difference in operations can make a big impact to the bottom line.

A combination of embedded automation devices, high-capacity networks and advanced software can capture, collate and contextualise data into purposeful real-time information that supports better operational decisions. Manufacturing is getting smarter and with the use of cloud computing, visual analytics and mobile platforms, technology can now intelligently aid an organisation's stakeholders to better understand plant data. With the right tools it is possible to respond quickly to operational issues – anytime and anywhere.

Technology challenges

Manufacturers seeking ways to reduce capital and operating costs have implemented process simulation, optimisation and energy management systems to reduce energy usage. Cutting-edge tools can help control engineers continually monitor the operation and marketplace to determine the best operating policies to manage the facility and run plants to the maximum while meeting safety guidelines.

Operational excellence revolves around driving optimum performance from all areas of the business on a second-by-second basis every day. Organisational excellence can utilise proven integrated technology that supports engineers to make better decisions, collaborate more effectively and accelerate performance.

Manufacturers must implement optimisation initiatives through the entire lifecycle of industry assets and address business challenges comprehensively to unlock the value tied up in departmental functions by silo practices. The combination of process simulation tools, manufacturing executions systems (MES) and effective planning and scheduling solutions is vital to optimising the asset.

Companies using an advanced process simulator can model their chemical processes to gain better insights and improve designs that will optimise production performance. AspenTech's aspenONE software suite, for example, contains solutions to optimise process designs for energy use, capital costs, operating costs and product yields through the use of energy analyses, economic evaluations and detailed equipment design during the modelling process. With reliable physical properties, thermodynamic data, realistic operating conditions and rigorous equipment models, control engineers are able to simulate actual plant behaviour.

Manufacturers are under pressure to maintain high profit margins and be operationally agile while demonstrating compliance to health, environmental and safety regulations. An MES solution should be able to deliver these capabilities, providing automated workflow and order tracking to facilitate improved operational consistency, better production tracking and reduced errors. Complimentary to the MES functionality, advanced process control (APC) can reduce process variability, enabling operators to push the production closer to safe operational limits.

Manufacturing requires the integration of all process and production information sources to allow data to be tracked in real-time and used to identify root causes of operational problems for immediate corrective actions. Successful manufacturers are now implementing advanced integrated software to help maintain production margins, improve product quality and continue to meet regulatory compliance.

Terumi Okano is a product engineer at Aspen Technology

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Data acquisition solution for off-road vehicle testing

With a focus on shortening development cycles and improving performance, reliability and safety, developers of off-road vehicles need to run more tests and acquire and analyse ever more data. *Bernd Knöll* highlights the features to consider when a selecting a measurement system for such applications.

A series of common measurement requirements typify all off-road vehicle testing scenarios – from a truck transporting material, a tractor ploughing the dusty expanses of a wheat field, to an off road racing car performing under extreme conditions. These include the need to withstand often harsh field testing environments while still providing accurate and repeatable measurements. There is also a common requirement to acquire data over the Internet.

Each individual project will also feature its own unique set of requirements as testing off-road vehicles can present a variety of challenges. With this in mind, the flexibility to adapt to different measurement tasks is important for any data acquisition system used to test off-road vehicles.

One of the biggest challenges, is the operating temperature range, which can vary greatly, depending on the vehicle and the climate in which it is likely to be used. With this in mind, a measuring system should be able to operate within a -40°C to +80°C range, in order to accurately obtain measurements under challenging ambient conditions outside the laboratory.

Other considerations, which need to be taken into account when testing vehicles that operate on unpaved surfaces include shock and vibration. To help ensure that the data acquisition system is able to operate reliably in an environment with harsh vibration and sudden impacts, equipment that has been tested using test procedures found in MIL-STD-202G (Test Method Standard: Electronic & Electrical Component Parts) is vital – ideally, modules should be able to withstand shocks of up to 70g and vibration of at least 10g.

Dusty and wet conditions are also a common factor when testing vehicles so it is important that the chosen test equipment is IP65/67 rated, which determines how well the enclosure is protected against dust and water particles. Incorrect specification could have a detrimental effect on the test results.

The SomatXR system was chosen for use on board a Volkswagon Touareg for a 19,000km Africa to Europe world record tour, to measure quantities such as temperature and acceleration and data from gauges positioned at various points on the axle and wheels of the vehicle.

Extreme conditions

When operating under extreme conditions, it is hard to anticipate all of the problems that may occur – for example, losing measurement data due to unforeseen events such as a power failure or the data acquisition program crashing. Setting the obvious frustration aside, it can also present issues for long-term tests, where the user is not always on site to monitor error-free recording of the measurement data. To effectively deal with such a situation, a measurement system that will save whatever data has been recorded up to the time of the interruption, and which will continue to log data automatically afterwards, without any need for user interaction, is a big help.

Leading on from this, the ability to access a measurement system via the web is another important feature when testing in harsh environments and when performing long-term tests. Having direct access to the measurement data from any location will enable tests to be quickly and conveniently modified – without the need of a physical presence on site, enabling valuable time and cost savings to be achieved.

Because off-road vehicles come in a wide variety of different sizes and shapes, and measurement requirements are so diverse, when it

comes to selecting a data acquisition system, flexibility is key. Systems with a distributed modular architecture will make it possible to structure the system according to varying requirements. For example, when testing a very large system, such as a construction crane, the system should allow for the positioning of a data acquisition module close to where the measurements need to be made, as positioning the module close to the measurement point will minimise the effect of long sensor leads and common mode noise, which can cause measurement errors.

Improved flexibility

Another useful feature that can improve the flexibility of a data acquisition system is universal inputs. Modules with universal inputs allow for the connection of different types of sensors to a data acquisition module and enable recording of different types of parameters with a single module, reducing the number of modules needed for a particular test.

Finally, users also need to consider how the software functionality of a data acquisition system can make the system more flexible. For example, a feature which enables intelligent processing of channel data will offer a convenient platform to perform real-time calculations on acquired data and then record the calculated values as an independent channel, or trigger measurements using the calculated data.

A data acquisition solution, designed specifically for use in mobile vehicle tests or stationary measurements under extreme conditions – the SomatXR system from HBM – was chosen for use on board the Cape-to-Cape Volkswagon Touareg for a gruelling 19,000km Africa to Europe world record tour. Here, the system was used to measure quantities such as temperature and acceleration and data from different gauges, positioned at various points on the axle and wheels of the vehicle. This solution provided technicians on the tour with instant access to important information relating to material stress and loading on components, which proved vital to the success of the record attempt.

Featuring three different modules in the range, each featuring 16 individually configurable and galvanically isolated inputs, the SomatXR measuring amplifier provides support for numerous different transducer technologies. Protected against moisture, dust, shock and vibration, all modules meet protection class IP65/67 and can be operated in a -40°C to +80°C range, making them suitable for taking measurements under challenging ambient conditions outside of the laboratory.

Bernd Knöll is international product manager at HBM.

Integrated charting tool for the simple graphical display of signal curves

The acquisition and analysis of data on machines is becoming more important. Process data needs to be clearly and graphically displayed and analysed across the entire lifecycle of a machine in the correct chronological order. Using TwinCAT 3 Scope from Beckhoff, it is possible to display curves with a resolution up to the microsecond range.

The software oscilloscope is fully integrated into the TwinCAT control architecture and enables the simple graphical display of signal curves. Its multi-core capability also makes it suitable for large recordings with several hundred variables.

Seamless integration into Microsoft Visual Studio, and therefore into the TwinCAT engineering environment, makes the solution user-friendly

and gives machine developers a charting tool which helps to simplify the engineering process during the development phase as well as during process monitoring.

In combination with the new TwinCAT Analytics and TwinCAT IoT software modules, acquired process data can be analysed either locally or via the Cloud. Users can choose between signal representation in XT and XY plots or using new bar charts within TwinCAT Scope.

Vibration: position servo considerations

Mark Howard looks at the issues surrounding the choice of sensors when designing servo solutions for machines that may be subject to harsh or prolonged vibration.

Potentiometers are the most common form of position sensor but generally are not suitable for environments with extreme vibration owing to their use of sliding contacts which wear, giving them a finite lifetime. Take, for example a potentiometer with a life-time of one million cycles. In benign applications, which cycle around 100 times per day, this will equate to 10,000 days (or 27 years). However, the same potentiometer in an application that is also vibrating at 20Hz is likely to fail in less than a day because its contacts will see each vibration as a cycle on a microscopic scale. If the potentiometer is normally positioned at a particular point, the wear effect is accelerated and the potentiometer may fail even more quickly.

Stress relief connecting wires – Wires and cables tend to be forgotten in stress and vibration analyses. It is important to remember that a moving cable can generate problems due to conductors or electrical joints cracking through fatigue. A variety of simple ways to relieve stress include the use of cable ties, P-clips and conduits.

Lock any fasteners – Fasteners that secure position sensors should be bonded into position with thread lock or, preferably, an anti-rotation fastener such as a tab washer to prevent hex-headed screws from turning and becoming loose.

Avoid delicate glass scales – Optical position sensors often use a glass scale through which they shine and measure their light path. In benign environments most optical sensors perform well – provided that there is no foreign matter to interfere with the optical path. However, any glass scale is susceptible to fracture in environments with heavy shock or vibration which will result in optical sensor failure with little or no warning.

Measure directly – If position or speed is measured in a vibrating system, it is likely that different components will be vibrating at various frequencies and amplitudes. It is more important in vibrating environments to measure directly the position of the actual elements, rather than inferring position from indirect measurements the end of a gear train or multi-link mechanism.

Minimise the weight of the sensor – Sensor damage is usually not directly as a result of vibration, but rather as a result of the momentum of the components within the sensor. Minimising the weight of a sensor in vibration prone applications minimises momentum and so will minimise the potential for damage.

Use heavy-duty connectors, or preferably no connectors – The most common cause of failure in harsh vibration environments comes from cables and connectors so choose heavy duty connectors or include jack screws to bind the male and female elements. If possible, connectors should be eradicated and electrical interconnections made by direct wiring or flying leads.

Potting and encapsulant – A good way to mitigate problems due to vibration is to pot sensors and cables into position.

Vibration monitoring for low speed machines

Slow speed rotating machinery – typically at less than 300rpm – is common in many industrial applications. To ensure that such machinery and plant is functioning at optimal levels it is necessary to measure vibration, in the same way that it is a critical requirement for standard speed machinery applications.

It is important to understand the dynamic behaviour of the machinery, to establish a baseline vibration performance, and then to detect the early onset of failure in rotating parts. If left unchecked vibration has the potential to result in more serious damage to the machinery, which can affect its overall performance.

Although the use of accelerometers is a common solution on standard speed machinery they can become problematic at lower speeds as the absolute accelerations measured are much smaller in value for similar vibration displacements. Recognising the need for a sensor that is able to meet these requirements, Sensonics has developed a low frequency velocity vibration sensor, the VEL/GLF. The electro dynamic sensor combines high measurement sensitivity with a frequency response down to 0.5 Hz, which makes it suitable for use as a tool for measuring velocity vibration on equipment with speeds below 300rpm. The sensor offers a standard IEPE type interface to enable simple integration into existing plant protection and monitoring equipment.

It is not susceptible to the many forms of interference in low frequency applications which can result in spurious readings and alarms.

It offers high noise immunity because of the low impedance electro dynamic nature of the sensor assembly. The design is also immune to saturation problems because no electronic integration is needed.

This has the added advantages of providing a barrier against contaminants and improving heat dissipation at elevated temperatures.

Damp the sensor output – By definition, the position being measured is likely to be changing at the vibrating frequency. A sensor with undamped electronics will output the measured position and so its output will appear to bounce along at the vibration frequency. However, if the output of the sensor is electrically damped, the output becomes the average of its measured position. In some sensors the length of time over which the output is averaged can be varied – from a fraction of a second to many seconds – to suit the application.

If a switch is to be activated in the measurement cycle it may be that the switching point is made repeatedly over a short period due to the cyclic nature of the vibration. This will cause the switch to open or close rapidly, in turn causing rapid start-stop of host the system. This can be solved by either damping the sensor or introducing hysteresis which will only allow it to switch after a set time.

Magnetic sensor caution – When vibration is an issue care should be exercised in the selection of magnetic sensors. Modern rare earth magnets are brittle and subject to catastrophic failure if subject to shock. Magnetic reed switches are prone to fatigue over prolonged periods because vibration causes the magnetic switching vane to vibrate and fatigue quickly.

In recent years, a new generation of position sensing devices has become available – the inductive encoder – a non-contact angle sensor that is well suited to environments that include harsh or prolonged vibration and which could offer a good solution in applications where vibration is an issue.

Mark Howard is managing director at Zettlex UK

Servitisation: changing the face of manufacturing

Fabrizio Battaglia reports on the highlights of a recent roundtable event that looked at the issues surrounding the servitisation trend.

Sustainable growth is increasingly the focus for businesses today and manufacturers are having to review their strategic approach. One trend that is bringing significant benefits is servitisation – offering services and solutions to complement traditional product offerings.

The Aston Business School in the UK defines servitisation as 'the process by which a manufacturer changes its business model to provide a holistic solution to the customer, helping the customer to improve its competitiveness, rather than just engaging in a single transaction through the sale of a physical product.'

Servitisation is a process that, increasingly, is shaping the manufacturing landscape, offering a way to escape the commoditisation trap. New technology is making it easier for businesses to make products more quickly and cost-effectively in smaller batches at the point of demand.

The servitisation trend is being driven by the customer. Today's consumers may not always want to own products, but they are looking for a better service and are actively seeking out providers who are able to deliver this.

As Phil Wood, group IT director of Rotork, an actuator manufacturer and flow control company, said: "One of the big challenges driving servitisation is the fact that technology is moving so quickly. Customers often don't understand the more complex technology or what they need to do with it. That's why we see servitisation as far more than just a sales activity, it's really more about how we can help customers to exploit the best value out of what they have got."

Delivering edge

Today, service has become the biggest differentiator for manufacturers as they look to build a clear competitive edge. Aston Business School identified some of the early pace-setters in this field in its 2013 'Servitization impact study: How UK based manufacturing organisations are transforming themselves to compete through advanced services,' This mentioned Rolls-Royce offering TotalCare on gas turbines for their airline customers based on a 'fixed dollar per flying hour'; Xerox delivering 'pay-per-click' scanning, copying and printing of documents; and Alstom Train-Life Services supporting Virgin by assuring the availability, reliability and performance of their Pendolino trains on the West Coast Mainline."

These kinds of models help manufacturers to get closer to their customers and that is important because servitisation can provide an opportunity to drive through new revenue streams. Servitisation can be a financial driver, helping manufacturers achieve healthy margins by developing long-term relationships with customers that enhance loyalty, reduce churn, and yield incremental sources of revenue.

As Wood explains: "It's gone from a case of – here's the product, here's the warranty, thanks a lot, to more of a focus on the customer needing the manufacturer to provide detailed information on how the product was made; its service record and whether it could be quickly repaired if something were to go wrong with it. That puts huge demands on manufacturers internally and they need to ensure that they have the right tools and solutions in place to sift through all the data they have and extract the intelligence from it."

Big data is another active driver of servitisation. Its advent has led many businesses to collect more data but so far not many organisations are efficiently utilising the information it can provide.

"One of the biggest challenges organisations face is that they often have huge volumes of data at their disposal but it's rarely served up to them in a way that is easily digestible," said Jamie Hall, UK lead - Manufacturing, Distribution & Retail at Microsoft. "A raft of different customers may have bought one of your products, for example. Big data, when implemented and applied properly could potentially reveal that a large proportion of these are only using 50% of the functionality, for example, giving the manufacturer the option to remove some of the unwanted functionality.

"For the manufacturer, it may well be about using this enhanced insight to redesign a product or even introduce a new product to fit demand over a different customer demographic? Key questions are likely to include: how can we enhance our product to better meet customer needs and ensure they buy into the concept over the long term and how can we cut the costs of production?"

From challenge to solution

Servitisation provides the potential solution. But, how can it be made to work? Technology – specifically the latest enterprise resource planning (ERP) software – can play a key role in addressing many of the issues and challenges.

The great benefit of ERP in this context is its ability to integrate and connect. Not only can it help to link different kinds of information – from customers, suppliers and partners, both in real-time and historically to drive decision-making, it can also provide a critical link between the previously siloed departments within an enterprise, including production, marketing IT and customer service, and use that to deliver operational efficiencies and a better response to customer needs.

"By making the move to ERP, manufacturers have the opportunity to effectively redesign their business," said Wood. "When you sign up for ERP, you are taking everything that works today and challenging its existence. As part of that process, you have the opportunity to formally redesign the whole way your business works – from the front door to the back – and this creates an opportunity to look at and migrate to a best practice approach, which for many manufacturers equates to a move to a service model. "

Embrace the new

To maximise the benefits of ERP as an enabler for servitisation, manufacturers also need to consider how it can be applied in conjunction with other emerging technologies. We have already discussed the importance of big data. Today, the proliferation of connected devices that drives the Internet of Things is growing in significance, serving to extend the potential for organisations to gather information and use it to deliver business benefits.

An engineering company producing wind turbines, for example, might well deploy a series of sensors on those turbines that detect temperatures and make qualitative measurements of component wear and tear. That information can then be fed back into ERP systems like Microsoft Dynamics AX. Specific parameters related to product lifecycle management, or service and maintenance, can then be set up, alerting businesses to problems, sometimes before they have happened, and proactively triggering maintenance before an incident occurs.

Organisations can take this a step further by coupling this kind of information with information from social media or other data sitting in the cloud to achieve both a relationship and technically-focused real-time view of customers, suppliers and stakeholders. This enables the business to make more informed decisions about enhancing innovation and efficiencies, to optimise products for consumption, usage, service and maintenance and to improve the overall customer experience.

"For the last ten years, we have been able to get information on what is going on with our products in the field. IoT increases the quantity and the granularity of that information and the frequency with which you can use it," said Wood. "That is a huge increase in the decision-making capability of any service organisation.

"When you combine it with ERP, there is an opportunity to bring engineering, production and service departments together on the same platform; effectively driving business change and redesigning the whole future of manufacturing. Ultimately this makes the whole sector stronger and more competitive while enabling servitisation to happen. We are no longer just on the cusp of a manufacturing revolution – today we are actively in its midst," Wood concludes.

Fabrizio Battaglia is head of manufacturing at ERP solutions provider, HSO.

PC-based control drives global adoption of Industry 4.0 and IIoT concepts

PC-based control systems are at the front line of automation technology and information technology convergence (AT/IT) as businesses find ways to funnel data into a useful, actionable form designed to empower decision makers as they look to stay competitive.

Everyone has been talking about the Industrial Internet of Things (IIoT) and Industry 4.0 for quite some time, but there are very good reasons it has stayed on our collective radar. The key themes behind the smart factory concept revolve around establishing high connectivity and managing the critical mass of data generated every day in manufacturing facilities around the world to gain valuable insight to optimise businesses and processes.

about these subjects. Manufacturing operations produce vast amounts of data, and finding ways to funnel that data into a useful, actionable form becomes paramount to empower company decision makers with the information they need to stay competitive and innovative.

However, storing and conveying this data is just the tip of the digital iceberg. Heightened levels of integration with plant operations minutiae enable companies to previously unseen clarity towards increased manufacturing efficiency and driving down production costs.

Though implementation of these concepts can be achieved in many ways, PC-based control systems provide an efficient means to build this type of functionality by relying heavily on standards. In addition, PC-based control systems are at the front lines of automation technology and information technology convergence (AT/IT).

This convergence is occurring almost everywhere in the world of automation and controls, but it has been developing far longer, with the greatest level of integration in PC-based control. Cloud-connected industrial databases, object-oriented manufacturing processes, and control system notifications pushed to mobile devices are just a few of the exciting things on the horizon for forward thinking companies.

Seamless, cycle-synchronous data acquisition and storage are prerequisites for effective production/throughput analysis and correction of processing errors in machines.

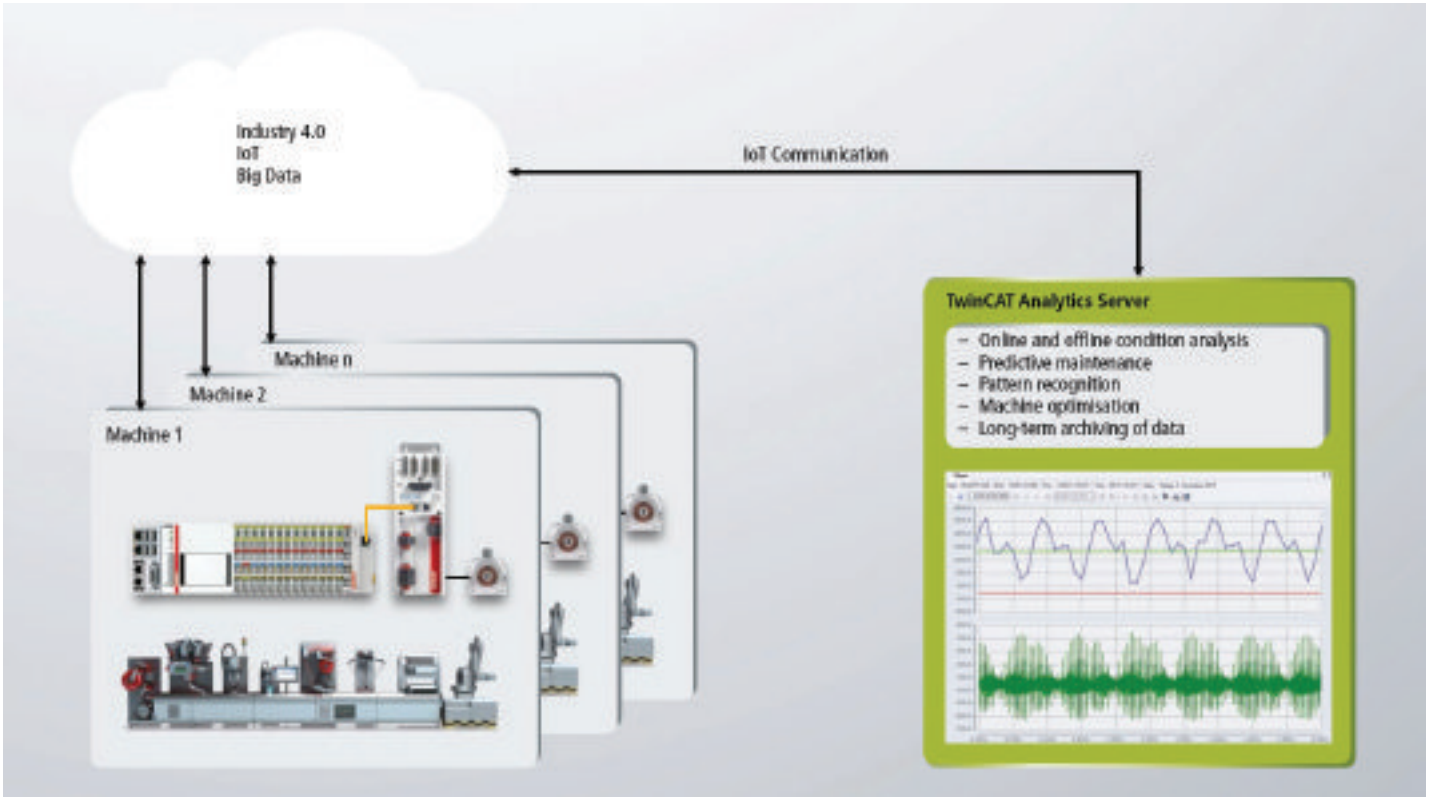
Connectivity and big data

IIoT and Industry 4.0 have a strong hand in connectivity, but the data derived through that connectivity are the valuables being mined. Seamless, cycle-synchronous data acquisition and storage are prerequisites for effective production/throughput analysis and correction of processing errors in machines.

To this end, Internet of Things (IoT) software includes the ability to store all process-relevant data in a cycle-synchronous manner and in a standardized data format. This data can be stored either locally

Regardless of methodology, the business needs that motivate companies to embrace big data and cloud-connected communication continue to grow unabated. This will be a subject of discussion for a long time to come. This is because there is a business case at the center of the constructive conversations

achieve a superior degree of operational knowledge as well as facilitate cutting-edge methods to streamline and optimise processes. Concepts such as predictive maintenance, machine downtime reductions, and control solution optimization – minimising cycle times or energy peaks – offer companies



Integration with plant operations via the Industrial Internet of Things (IIoT) enables companies to achieve a superior degree of operational knowledge and facilitates cutting-edge methods to streamline and optimise processes. Courtesy: Beckhoff Automation

in the controller, in a cloud-based solution on a server in the company network, or in a public cloud, depending on the needs of the company. The platform provides a complete temporal image of the manufacturing process and the production data, offering an ideal information baseline to assist in the event of an error, to enable comprehensive condition analysis of the machine, and other valuable functions.

The recorded process and production data can be analysed online or offline, and machine cycles can be examined for minimum, maximum, and average values of the cycle times. Features such as online and offline condition analysis, predictive maintenance, pattern recognition, machine optimisation, and long-term data archival are designed to help companies that seek complete business intelligence covering the finest details of their operation.

Another new feature deals with moving vital data from point to point, ensuring that authorised personnel can access this data, regardless of time or their location in the world. This feature supports standardized protocols for cloud communication such as MQTT, AMQP, and OPC-UA for smart device integration.

The extension of conventional control tasks through applications such as big data, pattern recognition, or condition and power monitoring in the cloud, can result in major improvements to production throughput, equipment efficiency, and time-to-market with new products precisely tailored to rapidly changing demand.

Through the use of a PC-based control system and IIoT software, establishing a seamless connection between the IoT devices and the Internet of Services becomes a simple matter of configuration via the software graphical user interface (GUI). Corresponding services can be affordably hosted in public cloud systems or within private, local networks. Using these platforms and services in combination with advanced PC-based control systems, which support native connections to these services, offers a solution that is quickly configured; process data can start being captured and analysed.

The value of data in any manufacturing operation cannot be oversold, and the ability to mold that data into the means to streamline plant operations, reduce operational downtime, and cut costs has become today's gold standard for the modern enterprise. This is really what Industry 4.0 and the IIoT discussions should be about. PC-based control is becoming the de facto system for companies seeking to create measurable and compelling business results off the rising tide of the smart factory.

Daymon Thompson is automation product specialist, Beckhoff Automation.

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Enabling IIoT requires protocol translation

As implementations of Industrial Internet of Things (IIoT) and Industry 4.0 frameworks begin, Hilscher is providing network gateways and other communications from the plant floor to the enterprise and cloud for manufacturing data analysis, company executives told *Control Engineering*, recently.

A Hilscher demonstration showed vibration monitoring for drives, with strain gauges, and transfer of data from the edge into the cloud and analytic services. Hilscher plans to be the enabler of field data in Industrial Internet-based architectures. Courtesy: Mark T. Hoske, Control Engineering, CFE Media

Implementations of Industrial Internet of Things (IIoT) and Industry 4.0 frameworks are progressing, and translations of major industrial network communication protocols enable the flow of data that becomes actionable information with analysis. Hilscher is among companies providing network gateways and other communications from the plant floor to the enterprise and cloud for manufacturing data analysis.

Hilscher representatives said the company devices aim to make it easier for end users, device manufacturers, and machine builders to access the benefits of Industrial Internet-connected manufacturing. Enabling technologies extract data in parallel with current control networks and deliver it to cloud-based analytical services without compromising existing systems or services.

Armin Pühringer, Hilscher business development manager, said products are designed to help make industrial cloud benefits a reality today. Hilscher North America CEO, Phil Marshall, also addressed the benefits of connectivity, providing communications for fieldbuses and industrial Ethernet protocols, he said. The goal is to get machine builders, system integrators, and end users "out of the network wars, and allow them to connect easily to as much as they need," Marshall said.

"Devices help IIoT get data off the wire. Products are vendor independent and legacy proof," Marshall said. "You don't have to retrofit the control system to get data to the cloud," for existing and future PLCs, without touching or adding communications responsibilities to PLCs.

Pühringer said customers can use existing infrastructure in plants; deploy reference architectures from Industrial Internet Consortium (IIC) and Industrie 4.0, vetted for all implementations; use cyber-physical systems as a virtual twin; and leverage standards and start again, in a cycle of continuous improvement.

The IIC Reference Architecture includes an edge tier with devices, such as actuators, scanner, sensors, motors, controls; a platform tier; and connections to the enterprise and cloud. Field includes existing real-time infrastructure, Pühringer said, and the edge bridges information technology (IT) and operational technology (OT), then connects to higher level systems. This is valid model, laid out in great detail for all test beds, Pühringer said.

Industry 4.0 uses a three-dimensional RAMI 4.0 model; functional layers are in line with plant floor people, and physical objects enable IIoT functions.

Installations: Flatter, faster

Pilot installations underway are moving to dissolve hierarchical control architectures, Pühringer said, flattening structures and connecting the plant to enterprise resource planning (ERP) systems.

A cyber-physical system holds the model to simulate process behaviour. Models can be put on existing wire in the plant without disturbing the PLC, using presently available protocols and time sensitive network (TSN), an emerging Ethernet standard designed to bring one real-time Ethernet structure to the many-flavored protocol soup of today.

Pühringer said companies are moving beyond prior concerns about safety, security, and privacy risks. For a major IBM pilot installation, expected to be announced at Hannover Messe, Hilscher is supplying network protocol translators. A bottle-filling application was shown in Germany last year at the sps/ipc/drives event.

This article originally appeared in the March 2016 edition of Control Engineering.

OCEAN OPTICS DEVELOPS MINIATURE FLAME-NIR SPECTROMETER FOR FOOD PRODUCTION

Ocean Optics has expanded its Flame spectrometer family. Flame-NIR delivers powerful near infrared spectroscopy in a compact, affordable instrument. Costing around 75 per cent less than a traditional NIR system, Flame-NIR pairs a high-performance uncooled InGaAs array detector with a small optical bench for spectral response from 950-1650 nm. Flame-NIR's spectral sensing can be used in agricultural to gauge crop readiness and characterisation, and in food production to ensure quality and ingredient integrity. The compact Flame-NIR can be used in quality labs or integrated on production lines.

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Radar is unaffected by in flight product, dust and filling noise and this 'W band', high frequency device is so focussed it is able to read right to the bunker outlet, maximising control.

The radar sensor was quickly installed and set up via the in head programmer, it has provided reliable performance ever since, delivering the efficiencies the site are seeking.

Please visit: www.vega.com/uk

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The dawn of a new manufacturing frontier?

Martin Griffiths, senior LabVIEW architect at Metis Automation – specialist software engineers – discusses the evolution of manufacturing processes and the dawn of the next stage – mass customisation.

As manufacturers, our goal is to produce products that customers want, to the quality they expect. There has been a concerted effort over the years to solve this challenge.

In the early days, craft production enabled craftsmen to create small volumes of product with high variety, each product was customised based on the producers skills but there was a limit to the quantities that could be produced. Mass production solved this challenge by enabling larger production volumes, but with a much more limited variety.

The next innovation, Lean Manufacturing, aimed to eliminate the waste and error introduced with mass production. It also enabled the production of large volumes with high variety.

The trigger for each of these new methods has been ideas and technology that enables shifts in how manufacturing occurs.

Alongside the evolution in manufacturing processes has been an increase in the range and complexity of products being produced. This places an additional challenge on manufacturers – they need to produce highly complex products; at high volume and with high variety. Manufacturers who are able to meet this challenge are now said to be developing Mass Customisation production methods.

Bespoke products

Mass Customisation is the ability to create custom, almost bespoke, products at the same volume and cost of mass produced products. It goes beyond the ability to change the cosmetic features of a product, or to offer a number of product variations. It is the ability to offer a vast array of product configurations, and to cost effectively integrate this into a production system.

It's at this point that additional intelligence is needed within the production process, because it becomes too difficult a challenge to rely on production operators to cope with this complexity.

When I have been involved in developing Mass Customisation processes, the goal has been to remove manual decision making from the production process and to move the decision making into the production system.

This requires a set of rules to be developed within the production system to handle different product configurations. The production system will then control the production process through manual operations; custom machinery; and product test systems. It is then able to control the journey of a product through a factory, selecting the correct operation at each stage.

The outcome of this is that a wide variety of products can be integrated into a production line with minimal impact.

One Metis Automation client, Bifold Fluid Power, had traditionally designed bespoke products as and when orders were presented. However, the company has now restructured most of its core products to be fully configurable. These use more structured part codes, and a set of rules are configured to determine which configurations are permitted.

Today, 70% of new orders from the company do not see the design office. Customers are able to enter

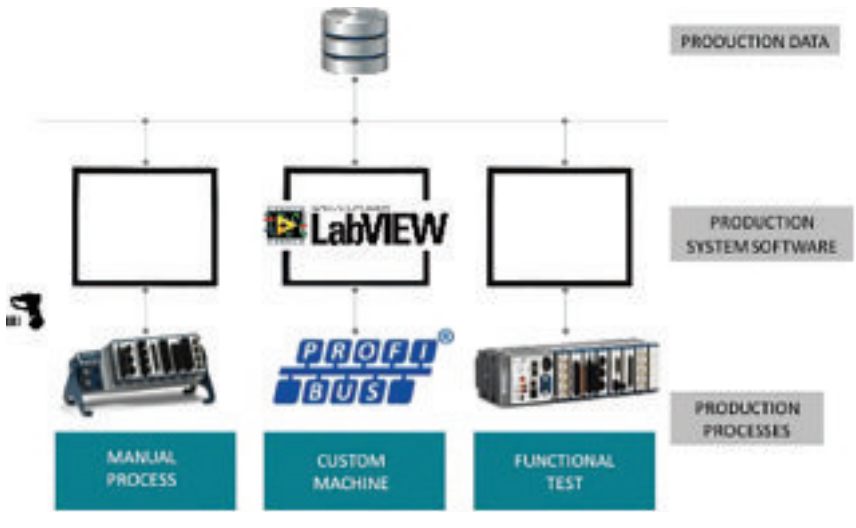

Figure 1: A typical mass customisation system.

specific requirements into the Bifold Configurator App, and will then obtain an instant quote and lead-time, and are able to see a full 3D CAD model and bespoke data sheet for the chosen requirements.

In production, Bifold carries a small stock of main running components, but not complete assemblies. The company has an in-house machine shop with two machines dedicated to short run, fast response machining. This enables it to offer 48-hour delivery for an increasing core range of products. This is critical in the case of urgent spares and replacements.

All the assembly stations are identical. The build/test process is conducted piece by piece at a single station which avoids the need for complex routings and greatly condenses lead times. It also provides full flexibility to produce any product, at any station, improving workflow and work load balancing.

Detailed, digital build and test instructions are available on the production system, and all test parameters are recorded and validated by the production test database.

The key challenge to implement this type of system is to take the production process for a product and to control all manual operations and process machinery involved. When each operation can be controlled, the entire production process can then be connected together to add the intelligence that is needed.

This is where production software can help engineers to connect devices and manual operations to control a production process. It can become the layer that helps join together a production process. Figure 1 shows how a typical system works:

Mass Customisation is the ability to create custom, almost bespoke, products at the same volume and cost of mass produced products.

Production data: This is a database that holds the product order and specification information. It defines what should be produced. The results of the production process as it happens are stored into this database.

Production system software: This controls the production sequence, and is the interaction between the production data and the production processes. It will receive the barcode scan from an operator and then gives the operator instructions and feedback on the production process.

Production processes: These are the value adding manufacturing processes that create the product. It is important to be able to connect to each of these process so that the production system software can connect the whole production process.

Taking some of the product manufacturing complexity into the production equipment offers the following benefits:

- It is easier to produce a wide variety of complex products – Mass Customisation.
- The quality of each product increases due to standardisation of manufacturing being enforced at each stage.
- It also allows for greater insight into the manufacturing process. A large amount of statistical data about the production process is now being stored into the production database.

Production managers and planners will now have instant access to real time data as production happens. It is easy to see how sales orders will be met, and it is also easy to see when any issues are occurring on the production floor.

I have been involved in implementing systems such as this in a range of industries including automotive; food & drink; oil & gas; and heavy machinery. Although it is still early days for this stage of manufacturing, it is achievable and it can provide an edge over your competitors.

Martin Griffiths is senior LabVIEW architect at Metis Automation.

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