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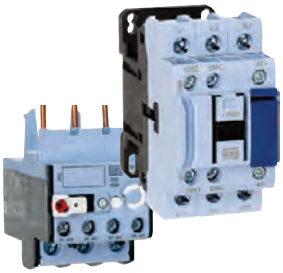

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WHAT'S NEW IN
PROCESS TECHNOLOGY
OCTOBER 2016

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ON THE COVER

Readily recognisable by its dark grey modules, the WAGO I/O SYSTEM 750 XTR'S features make it ideal for extreme environment applications. It has smaller space requirements and lower purchasing, energy and maintenance costs — making it a safe investment for system availability and productivity. WAGO's 750 XTR is extremely temperature tolerant, immune to electromagnetic interference and insensitive to vibrations (up to 5g) and impulse voltages (up to 5 kV). The 750 XTR is therefore the first choice for demanding appliances such as marine systems and onshore/offshore installations; renewable energy systems, such as wind turbines and solar and biogas systems; transformer stations and power distribution systems; petrochemical manufacturing systems; water and wastewater treatment systems; and custom machines.

Regardless of freezing cold, extreme heat and high humidity, the WAGO I/O SYSTEM 750 XTR is engineered for dependability in all climatic conditions, with an operating temperature range of -40°C to +70°C and altitudes of up to 5000 m. Within an application, the 750 XTR series seamlessly communicates with other parts of the system without interference or disrupting other system components. This ensures successful communication and trustworthy reliability. Users can count on long-lasting, trouble-free operation — even in the most torturous applications, such as tunnel boring machines. The extreme strength of the 750 XTR series pays off twice, maximising both uptime and investment security. It will conserve valuable engineering time and ultimately provide peace of mind.

WAGO Pty Ltd
www.wago.com.au

WAGO®

BIG DATA ANALYTICS AND THE IIoT

The so-called new paradigm in manufacturing — the Industrial Internet of Things — has a problem: how to best use the data.

Today's highly volatile market environment and high cost of maintaining ageing infrastructure, as well as the demands of global competition, are challenging companies to sustain their profitability by finding new sources of revenue and by lowering their operating costs. Organisations today need to be more flexible, adaptable and transparent in their practices. Manufacturers therefore need a single source of the truth to help them make the right decisions for improved performance while mitigating risk from unexpected incidents. That is, they need to know what they can do to improve yields, reduce scrap, rework and recalls, and make supply chains more efficient.

While manufacturing systems today generate enormous amounts of data, most business analytics systems do not support any connection to that data, leaving the staff to mentally connect the business and operational worlds in order to achieve a meaningful analysis.

Current megatrends

Today there are significant megatrends at play, greatly driven by the accelerating pace of adoption of digital technologies. These major market trends fall into three different areas that are relevant to digital transformation. While these trends represent a challenge to current business practices, they also represent opportunities to leverage new technologies to maintain competitiveness.

Big data and the IoT

With the cost of computing, bandwidth and sensors decreasing by orders of magnitude in recent years, there has been an explosion of embedded devices that can communicate with one another and produce large volumes of data. Big data can be defined as "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process automation."[1]

The physical world is being digitised, with 'smart' objects linked through wireless networks that carry information forming the much-discussed Internet of Things (IoT). The real-time dynamic analysis of data that is implied by the IoT is a challenge to businesses that rely on static and rigid information architectures.

Digital disruption

Digital innovations are disrupting industries everywhere. Disruption lead to market incumbents getting displaced by nimble companies that have commercialised cheaper, more convenient and widely available digital technologies, creating new markets. Existing manufacturers don't want to be left behind.

Changes to the nature of work

Demographic changes in the workforce are also having an impact, with the composition of today's workforce having never been so diverse. Often millennials are working side-by-side with more experienced workers. As digital technologies further penetrate the workplace, creating new ways of organising work and dispersing knowledge, it will mean finding new ways to manage organisations, their knowledge and their people.

The challenges

The lower cost of storage, sensing and communications technologies is making ever more data available, but this presents a number of challenges.

Unstructured and isolated data

It is not unusual to struggle with data deluge driven by modern automation technologies. Big data that is neither structured nor contextualised is strenuous to cost-effectively store and analyse through traditional computing approaches.

Data islands are formed as a result of operational and project decisions not made in the context of a larger data strategy, leading to a limited view of the data and reducing collaboration. Data gets siloed, whether it is enterprise data, manufacturing data inside an organisation or data across different organisations in a supply chain. When the data is scattered throughout plant and the company, integrating and analysing it manually becomes resource-intensive and tedious. By the time data is analysed, its value may have been lost.

> NEW TYPES OF DATA STRUCTURES ... MAKE IT POSSIBLE TO EXECUTE ANALYSIS ON AS MUCH IoT DATA AS IS RELEVANT TO THE QUESTION, WITHOUT BOUNDARIES OR RESTRICTIONS AND WITHOUT LIMITATIONS AS TO DATA VOLUME OR DATA TYPES.

IT/OT integration

In industrial organisations, there has traditionally been a technological and operational split between information technology (IT) and operations technology (OT). With smarter machines, big data and initiatives like Industry 4.0, a convergence of IT and OT is beginning. IT and OT, having developed separately with independent systems architectures and purposes, need to come together and find common ground.

There is therefore a need to link analytical systems to operational systems, but most business analytics technologies do not currently support any connection back to the originating systems of the data.

Asset management

To achieve production targets, the monitoring of assets in real time is necessary to ensure that all assets — whether in a single plant or across all plants — are performing at an optimal level. They need increased visibility and better insights that can be acted upon. This enables them to detect anomalies and fix issues before they occur, yielding no unplanned downtime.

An ageing workforce

The retirement of experienced workers is already creating a skills gap, so it is essential that the knowledge and experience accumulated by more senior workers is captured and made accessible to the new workforce. Inability to institutionalise this knowledge can be detrimental to the organisation. Preparing for this impending change by using digital technologies can ease the transition.

Cybersecurity

IT/OT integration, as well as smarter assets that network and store information in the cloud, will result in greater cybersecurity risks. Cyber attacks pose a range of threats, making individuals and institutions vulnerable to financial and physical harm. As companies invest in digital technologies, cybersecurity capability must be an important factor in design and purchasing decisions.

New data processing techniques to the rescue

Of course the largest problem to be solved is dealing with the increased availability of data. Overall data generation is expected to grow by 40% per year, totalling 35 zettabytes by 2020[2], with an estimated 25–50 billion connected things generating trillions of gigabytes of data[3]. For the manufacturing domain, this data will allow enterprises to monitor and control processes at a much higher level of sophistication. The ad hoc availability of such a large amount of data opens up new opportunities for novel types of analysis and visual representation, but the issue is how to take such advantage of the data.

Batch-generated static reports will be a thing of the past as it becomes possible to view, chart, drill into and explore data flexibly in close to real time, and automated analytics algorithms can now be applied to provide decisions. And it is not only manufacturing-related data that is relevant for analysis: data from other companies or ecosystems (such as those in a supply chain) also have to be considered. All this of course requires an infrastructure that is capable of supporting very large data sets and the ability to apply machine learning algorithms to the data. The trick is to gather and store only the information required — the right data — as opposed to all data generated from a device, equipment or an operation. Patterns in the data can then be used to derive insights about existing and future operations. The resulting models can be incorporated into operational flows so that as device data is received, the models generate projections, forecasts and recommendations for improving the current operational situation.

Given the amount of information captured and stored, the performance available from such analytics systems is important. The challenge here is to know what subset of right data needs to be accessed to facilitate business process improvement and optimisation. Currently, IIoT data can be analysed deeply and broadly, but not quickly at the same time.

In-memory database processing

The latest developments in big data performance involve in-memory database computing, which is intended to remove the performance constraints of disk-based data storage and retrieval systems. The development of in-memory computing is being spurred on by the decreasing cost and increasing speed of dynamic random-access memory (RAM).

Traditional disk-based database systems (relational database management systems

> FOR COMPANIES TO TAKE ADVANTAGE OF THE NEW PARADIGMS THAT THE IIOT AND BIG DATA CAN BRING TO THEIR OPERATIONS, THERE ARE A FEW CHALLENGES THAT NEED TO BE OVERCOME.

— RDBMS) are transactional systems based around multidimensional linked data structures such as tables, in which transactions are performed against those data structures stored on disk. With an in-memory database, all information is initially loaded into memory, and newer techniques — such as column-centric databases, which store similar information together — allow data to be stored more efficiently and with greater compression. These differences allow larger amounts of data to be stored in the same physical space, reducing the amount of memory needed to perform a query and therefore increasing processing speed even further.

New types of data structures also make it possible to execute analysis on as much IoT data as is relevant to the question, without boundaries or restrictions and without limitations as to data volume or data types. It can also take into account the relevance of the data to be analysed since, for example, recent IIoT data can be more valuable than old data.

New analytic capabilities

Typically, individual IIoT data represents an event taking place in a manufacturing or operational environment. Events may be unrelated to each other or may be correlated. Multiple events may need to be related and correlated in order to determine causal relationships.

In recent times, data analytics capabilities have been developed to more efficiently process such information: event stream processing (ESP) and complex event processing (CEP). ESP is designed to make it possible to stream, process, filter and group all of the IIoT data and events collected. ESP business rules determine which events are important, which data should be filtered out and which should be kept, and which event correlations or patterns should trigger a broader business event, alert or decision. ESP can utilise IIoT integration to stream the data from the edge to the ESP engine for processing in near real time.

CEP is a more sophisticated capability, which searches for complex patterns in an ordered sequence of events. It is ESP and CEP running on big data enabled by in-memory data processing that are making possible the analytics necessary to take advantage of the IIoT.

Laying the groundwork

For companies to take advantage of the new paradigms that the IIoT and big data can bring to their operations, there are a few challenges that need to be overcome.

1. **Get the data:** Organisations need to collect and come to grips with the various data that is available inside the company's operations and outside in the supply chain. Some of the data will come from existing processes, some will be new data that can be collected by implementing new sensing technologies, and some will come from other companies or third-party information services.
2. **Understand the people:** The company may need to employ new staff that have the knowledge of how to make use of new data, and will also need to do something about the traditional separation of IT and OT staff — their experience and expertise needs to be brought together in a cooperative way to break down barriers and exploit their strengths.
3. **Revisit the operational architecture:** The traditional 'air gap' separation between the operational networks and IT networks will need to end, if it has not already. Linking operational data sources with analytics systems (most likely public or private cloud-based systems) will require best practice knowledge in secure and safe data communications, and may require significant change to data network architectures to support it. The choice of private or public cloud processing will also have a significant bearing on the cost and security of the architecture.

References:

1. Gartner Inc 2016, *Big data*, Gartner IT Glossary, ‹http://www.gartner.com/it-glossary/big-data›.
2. McKinsey Global Institute 2011, *Big Data: The Next Frontier for Innovation, Competition, and Productivity*.
3. Schmitt K 2014, *SAP HANA drives Internet of Things Scenarios in Real-time*, SAP Community Network, ‹http://scn.sap.com/community/internet-of-things/blog/2014/05›.

HOT PRODUCTS
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PORTABLE FLUE GAS ANALYSER

The Testo 340 is a portable flue gas analyser that can detect emission problems before they become too severe.

TechRentals

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ULTRASONIC SENSOR

The Banner Engineering Sure Cross U-GAGE K50U ultrasonic sensor is optimised for use in wireless tank monitoring applications.

Turck Australia Pty Ltd

http://bit.ly/2dco7ug

EMERGENCY STOP STATION

The BSH emergency stop station features a fully welded 316 stainless steel enclosure, making it suitable for harsh conditions.

Leveltec Engineering Pty Ltd

http://bit.ly/2cjeryo

PRESSURE TRANSMITTERS

Dwyer Series 628 pressure transmitters are suitable for OEMs and provide an accuracy of 1% FS.

Dwyer Instruments (Aust) Pty Ltd

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The ST51A, ST75A and ST75AV thermal dispersion mass flow meters are designed to provide a rugged solution to measuring air or gases.

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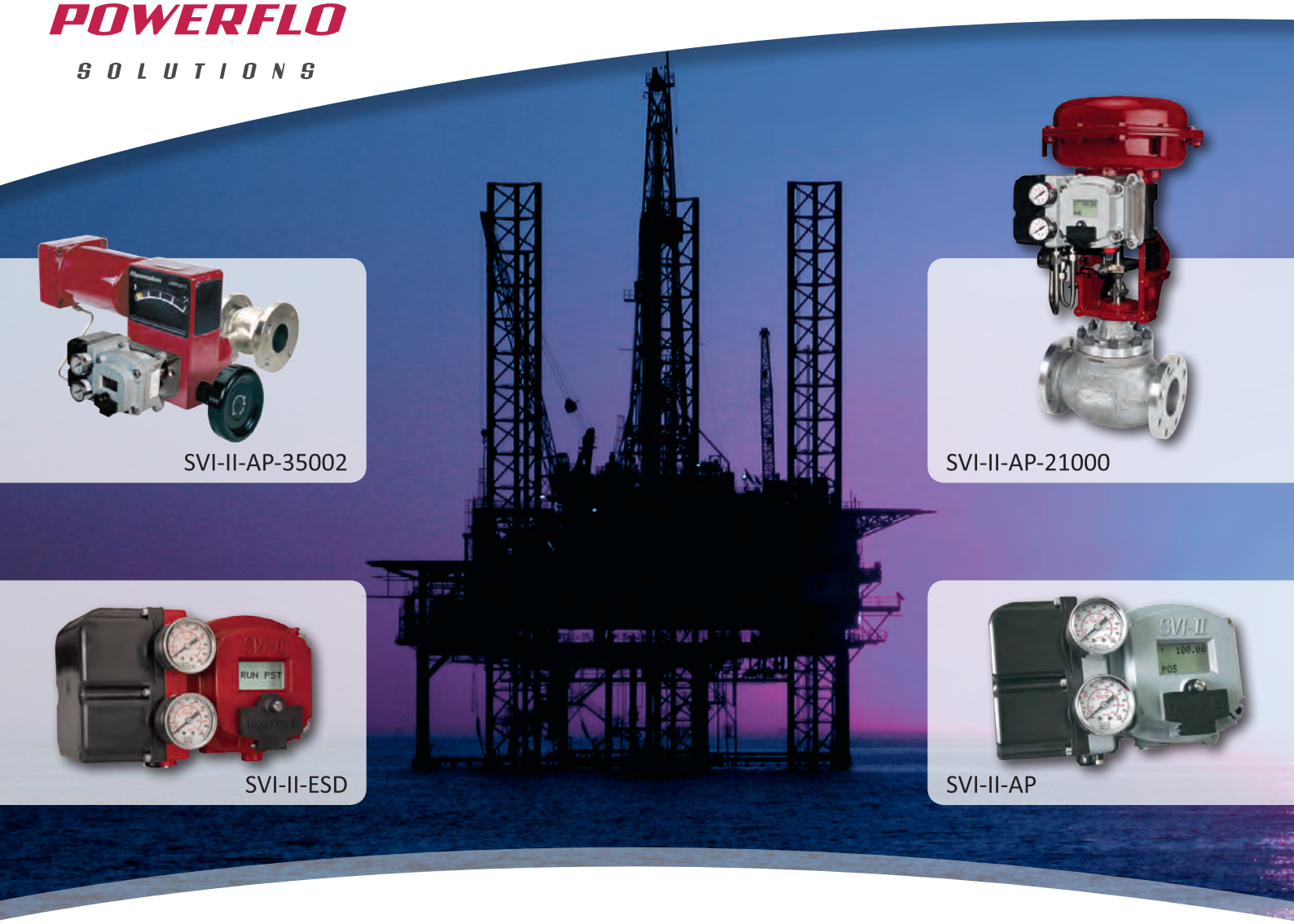

SVI-II-AP-35002

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HYBRID SAFETY BLOCK I/O MODULE

The Turck TBPN safety block I/O module combines both standard and safety I/Os in a single device. The IP67 hybrid modules can be adapted to the specific signal requirements in the machine and, in doing so, help users to save valuable space and reduce overall system costs of their machines.

On the safety side of the PROFInet/PROFIsafe module, the user has two safety inputs for connecting different safety sensors. Two additional safety channels can be used either as safety inputs or outputs. The module also offers two channels of internal safety outputs that can be used to remove power to the universal discrete I/O ports as well as to one of the IO-Link ports on the standard side of the block.

For the standard side of the PROFInet/PROFIsafe module, four universal discrete I/O ports are available for connecting general-purpose signals and can switch up to 2 A. Two of these ports can also be configured as IO-Link masters. In combination with Turck's I/O hubs, TBIL-M1-16DXP, users can connect up to 32 additional discrete I/O points to the module.

Both the standard channels as well as an IO-Link channel can be disconnected for safety-related applications, considerably simplifying the wiring of auxiliary drives and valve blocks. The unit has an extended operating temperature range of-40°C to +70°C. The IP65/IP67/IP69K protection types allow use in the most demanding environments.

Turck Australia Pty Ltd
www.turck.com.au

WIRELESSLY MONITORED EPRV

Emerson has introduced wirelessly monitored Enardo 2000 emergency pressure relief vents (EPRVs) that provide safety control by managing abnormally high storage tank pressures in the oil and gas, chemical, petrochemical and pharmaceutical industries.

Under normal operating conditions, an EPRV remains closed. The immediate knowledge of an open position can be vital and should warrant quick investigation. However, because EPRVs are located on top of storage tanks, they are difficult to monitor. Site managers are increasingly looking for ways to increase safety and efficiencies.

The Enardo 2000 consists of a proximity indicator and wireless transmitter integrated with an EPRV. The proximity indicator senses movement of the emergency vent — 'open' or 'closed' signals are received by the wireless transmitter and can be sent to a control room via a WirelessHART gateway.

Emerson Process Management Aust P/L
www.emersonprocess.com.au

HIGH-PRECISION CALIBRATOR

The Burster Digistant Model 4462 is designed for high-precision calibration of voltage, current and thermocouples. Applications include calibration of current and DC voltage meters, thermocouple temperature sensors, controllers, sensors and detection devices, and open-loop process control with the aid of an integrated ramp function. This is possible due to its combination of low drift, low noise and long-term stability.

The product offers high-precision current and voltage sources of ±52 mA and ±30 V with an option for ±22 mA and ±60 V. Precision simulation for all conventional thermocouple types is available. The error limit is 0.003% of reading and it comes with RS232, IEEE488, USB and ethernet interfaces.

The device features an illuminated graphics LCD screen, with large, 12 mm figures for easy reading, and can be operated both via a keyboard as well as the interface. The calibrator can be used as a stand-alone tabletop device as well as in an automatic, computer-assisted manufacturing and testing system.

Bestech Australia Pty Ltd
www.bestech.com.au

CENTRAL COMPRESSOR CONTROL SYSTEM

Atlas Copco's ES Controllers increase the efficiency of multiple machine installations, offering a range of control and monitoring functions for a variety of input/output.

The controllers can help reduce the pressure band of the compressed air or vacuum installation, equalise the running hours and minimise the unloaded running of the machines. The systems produce an energy-efficient compressed air or vacuum system that can reduce energy costs.

With a multiple compressor installation, the system will select the machine(s) to run based on demand and when air is needed in the airnet, which ensures efficient use of energy. In an installation with multiple VSD air compressors, one VSD compressor will regulate the demand and the other VSD compressors will run at optimal speed to ensure the best possible energy efficiency.

The core function of the system is to equalise the running hours of a multiple air compressor or vacuum pump installation, which will enable effective and equal use of all machines within the installation. This will ensure the most effective use of the installation as well as enable all machines to be serviced during a single visit, providing potential savings on maintenance interventions.

The controllers will eliminate the need for operators to manually change settings on a continuous basis. The higher-end controllers can be programmed to change the installation sequences automatically. The controllers can control Atlas Copco compressors alongside other compressors in the installation.

Atlas Copco Compressors Australia
www.atlascopco.com.au

WIDESCREEN IP65 PANEL PC

The Advantech SPC-1881WP is an 18.5″, widescreen, multitouch stationary panel PC with an Intel Core i3-4010U 1.70 GHz processor. It is designed specifically to provide easier operation and to boost productivity in areas that require frequent jet washing.

A slender, elegant aluminium housing not only emphasises modernity but also offers all-around IP65 protection with high mechanical stability. M12 connectors and the integrated VESA connector allow the device to withstand high water pressure from cleaning and offer a high level of waterproofing in humid environments.

The product is suitable for applications in such industries as food and beverage and chemical manufacturing, where frequent cleaning is a necessity. The device and its connectors are protected against dust and water to enable them to survive the rigours of jet washing and scrubbing.

The 16:9 widescreen monitor provides 40% more screen area than 4:3 display. With the addition of multitouch capabilities, it provides even greater control and viewing of control system information.

All of this is made possible with the inclusion of an Intel Core i3-4010U 1.70 GHz processor with independent graphical processing unit, which provides support for Windows 10 and DirectX11 so it can handle more complex and detailed graphics.

Advantech Australia Pty Ltd
www.advantech.net.au

FLAME DETECTORS

Emerson has announced the release of the Rosemount 975 flame detectors, a line of optical flame detectors designed to perform in the harshest environmental conditions and connect directly to alarm or automatic fire extinguishing systems.

The range incorporates a variety of flame detection technologies that will provide optimal coverage for a wide range of process industries, including upstream oil and gas installations, chemical plants and refineries. Multispectrum infrared sensor technology detects hydrocarbon fuel and gas fires, as well as 'invisible' hydrogen fires, with wide area coverage and strong false alarm immunity. Integrated ultraviolet and infrared sensor technology rapidly detects hydrocarbon-based fuel and gas fires, hydroxyl and hydrogen fires, and metal and inorganic fires with robust false alarm immunity.

Built to be durable and weather-resistant, the flame detectors feature heated windows for operation in harsh weather conditions, such as snow, ice or condensation; broad operating temperature ranges from -55°C to 85°C; and multiple output options for maximum flexibility and compatibility. The line is approved to Safety Integrity Level (SIL) 2 (TÜV). The detectors can even be tested in-field with a specially designed flame simulator at distances of up to 12 m from the detector, eliminating the need for personnel to stand on scaffolding or supports to access the detector.

Emerson Process Management Aust P/L
www.emersonprocess.com.au

SOLIDS TILT SWITCHES FOR MATERIAL HANDLING

Leveltec tilt switches manufactured by Leveltec in Australia are available in many versions. The LP01-S2 series snap action tilt switches are manufactured to withstand harsh environments. Available in chrome-plated mild steel or stainless steel, the reinforced cable entry provides a solid platform against wear. All Leveltec tilt switch bodies are earthed for safety and are certified to IP66/67. The changeover switch is rated to 250 VAC at 7 A providing a change in state at approximately 1-2 seconds at 20° from vertical.

Connecting cables are available in 6 and 10 m lengths in PVC and heavy-duty steel braided types. The LP03 model comes with an easily identifiable blue IS cable for use in hazardous areas when applied as a simple device.

Leveltec Engineering Pty Ltd
www.leveltec.com.au

CLOUD-BASED DCS/SCADA PLATFORM

Schneider Electric has announced updates to Wonderware Online, its cloud platform capable of collecting, visualising and managing operational data across industrial operations. End users, solution builders and OEMs can benefit from new real-time data and analytics capabilities when using Wonderware Online as a complete information management and decision support solution.

Wonderware Online, built on the Microsoft Azure cloud platform, is designed to offer users a secure, easy-to-use solution that offers seamless convergence of operational and information technology (OT/IT) with security, discoverability and extensibility all being native to the platform.

Wonderware Online includes the Wonderware Online InSight Connector, a productivity tool that allows users to link time-series data stored in Wonderware Online into Microsoft Excel and Microsoft Excel Online. This enables users to run custom formulas, perform ad hoc analysis and create Excel-based reports and charts. The Wonderware Online InSight Connector is available from the Microsoft Office 365 store.

Customers currently use Wonderware Online to consolidate distributed data sources, contextualise that data through the use of advanced applications and provide enterprise-wide access from anywhere on any device. The intuitive interface allows users to easily access intelligence to support smarter, faster business decisions.

With the amount of data from low-cost sensors and smart devices increasing exponentially, industrial organisations are searching for solutions to take full advantage of the industrial IoT. Both end users and OEMs demand a highly secure software infrastructure with broad connectivity, including the MQTT protocol.

Schneider Electric

www.schneider-electric.com.au

DIGITAL PRESSURE GAUGE

WIKA has launched the CPG1500, a precision digital pressure gauge.

The product has been designed for versatile use. It covers pressure ranges up to 0–1000 bar and measures with an accuracy of up to 0.05% of span, while its data logger can record up to 50 measured values per second. The data is transmitted wirelessly and can be processed using WIKACal software. Further functionality, such as min/max memory or integrated temperature measurement, is also available.

The menu structure enables quick intuitive input of all parameters. A 5½-digit display with bar graph and a large text field support the analysis of measuring points on-site.

The gauge is built within a robust housing and is an intrinsically safe instrument (IECEx, ATEX, CSA approvals) with IP65 ingress protection.

WIKA Australia

www.wika.com.au

Helping to rebuild Christchurch: quarry upgrades to meet the demand

Already weakened by a 7.1 magnitude earthquake in 2010, Christchurch was struck by a 6.3 magnitude earthquake on 22 February 2011. Over 100,000 homes were damaged, many of which were condemned, and 185 lives were lost. More than two-thirds of the shops, hotels and office buildings in the heart of the city had to be demolished.

The massive effort being deployed to restore the city's infrastructure has created a need for a huge amount of resources. This unprecedented demand has continued to grow, challenging local building companies and construction material suppliers to step up their production. Isaac Construction has been a longstanding supplier of construction materials to the Christchurch region for many years and is one of the companies that took on the challenge of meeting this ever-increasing demand to help rebuild Christchurch.

Established by the Isaac family in 1957, Isaac Construction's MacLean's Island quarry is one of the oldest established quarries in Christchurch. The quarry converts its raw material feed of incredibly hard, ancient river gravel into coarse natural concrete aggregate, blended sand (natural and Barmac dust) as well as sealing chip for roads.

After the 2011 earthquakes, Isaac Construction ramped up production and was eventually running double shifts to meet the increased demand for concrete production and road-building materials. However, the plant's production capacity and reliability started to become a major issue. This sometimes resulted in the need to buy in products to satisfy supply obligations, so towards the end of 2011 the company's management team agreed that an upgrade was required and boldly decided to treble the quarry's production capacity from 100 to 300 tonnes per hour.

A tender process was initiated in February 2012 and after months of detailed bid reviews, Isaac Construction awarded a NZ$11 million contract to MIMICO — Metso's exclusive distributor in New Zealand. The contract included the design, supply, installation and commission of a new plant based on Metso's crushing and screening equipment as well as its wear protection system. The plant was designed, fabricated and installed by QMI Engineering, a fully owned subsidiary of MIMICO. Commissioning was undertaken by MIMICO's in-house service team. The upgrade was completed in three stages, with the final stage completed by May 2015.

Stu Cameron, Isaac Construction's maintenance supervisor, explained from his perspective why choosing MIMICO as the supplier of the new plant was a good move. "A big factor was the confidence we had in the working relationship. All the key people on the project from QMI engineering and MIMICO knew our plant and company.

"Another important factor was the reliability of our existing Metso crushers. In our old plant, we had a Metso HP100S and an HP200; both machines were close to 20 years old and were still running strong," he said.

The feedstock from MacLean's Island quarry is infamous for its hardness. This factor alone made designing an optimal plant complex. Contributing to this complexity were shifting market demands, both in terms of volume and variety of product. This forced Isaac Construction to change the required project specifications. While changes like this are understandably unpopular with contractors, David McCaffrey, MIMICO's process equipment engineer, believes that his company's ability to quickly interpret changes, adapt process models and select suitable equipment helped them to win the project.

"BRUNO is Metso's easy-to-use software tool for planning and simulating the crushing process. It helps us to quickly explore various machine combinations for different applications. We use it extensively. On this project, I created many alternative models in BRUNO before proposing our overall design," said McCaffrey.

Talking about the project and its outcomes, Cameron said, "Overall things went really well, so it is hard to try to single out anything that stands out. I would say though, that the advanced safety levels in the new plant have really impressed me.

"Based on what I have seen, I think it has possibly worked out cheaper to install new plant than to try to get the existing plant up to the same safety standards required to comply with New Zealand's latest safety rules," he explained.

The project delivered numerous optimisations, cost savings, and process efficiencies for Isaac Construction.

"An example of how the new plant has reduced costs is the elimination of the load-and-carry aspect of the process. Previously the plant consisted of three sections and so at any one time there would be four or five wheel loaders moving product between sections for the next stage of processing, doing up to 120 km a day. The new plant has a network of conveyors, removing this requirement completely," said Rex Davies, MIMICO's managing director.

A longer and more detailed version of this article can be read online at: http://bit.ly/2cMHWqX

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PLANT RESOURCE SOFTWARE

Yokogawa Electric Corporation has released version R3.31 of its Plant Resource Manager (PRM) software tool for the centralised management of data from plant monitoring and control devices as well as manufacturing equipment.

The latest version enables seamless management of the process of detecting and responding to device failures. This has been achieved by linking PRM to a computerised maintenance management system that is used to draw up maintenance plans and manage the progress of maintenance tasks. With version R3.31, field maintenance personnel can also access key performance indicator (KPI) reports on device availability and other indices that until now have been mainly available for use by management. The software works with Maximo, an IBM maintenance solution. Upon detection of a device failure, PRM issues an instruction to Maximo to draw up a task plan and begin the process of managing the progress of task execution. With PRM R3.31, a symbol (maintenance mark) is displayed over the device icon in the device navigator window that communicates the current state of the task that is being managed by Maximo. The tool is compatible with the latest Maximo versions, 7.5 and 7.6.

Field asset KPI reports contain data about the availability of instruments, the number of instruments that are in an abnormal state, warning status, other states, and the number of alarms and events and their ranking. Maintenance personnel can now directly access field asset KPI reports via the PRM user interface.

Yokogawa Australia Pty Ltd
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ANALOG SIGNAL CONDITIONER

The ACT20P-UI-AO-DO-LP is a 2-wire loop analog signal conditioner with genuine universal inputs. Based on Weidmüller's ITX+ series, there is now the capability for voltage measurements to 250 VAC and up to 5 ADC alongside the standard process temperature, resistance or V/I inputs — all configurable from the same 12.5 mm wide module.

Now also featuring a digital output, the module can be programmed as a simple trip relay or can be used in fault condition monitoring. LED indication provides full visibility of the unit's status and it is fully programmable via free software using FDT/DTM technology. The device fulfils the strict standards and requirements of the process industry, with isolation better than 3.5 kV and accuracy better than 0.1%.

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IP UPGRADEABLE ENCLOSURES

Finding standard off-the-shelf IP67 or IP69K rated enclosures used to be a real challenge for electronic design engineers. ROLEC is now offering three of its die-cast enclosures with a standard protection class rating of IP67, which can be upgraded to IP69K.

The aluCASE (IP67, IP69K) is a die-cast enclosure for walls, bulkheads and machines, and can be fitted with the lid closed. Features include hidden fixings, transparent lids (two models) and optional key locks.

The aluCLIC (IP67, IP69K) is a modern enclosure that clicks into place, speeding up installation with no visible fixings. It can be installed with the lid closed to ensure complete protection of the electronics inside.

The aluDISC (IP67, IP69K) is a round standard aluminium enclosure, also with hidden fixings and an optional lid hinge. It is available with a transparent lid cover.

In addition, the aluPLUS series is a range of industry-standard size die-cast aluminium enclosures that can be upgraded from IP66 to IP67.

The upgrades are carried out at ROLEC's factory by fitting special gaskets to the enclosures prior to final assembly. ROLEC can also carry out all the necessary customisation in preparation for assembly of the electronic or electrical components. Options include CNC milling and drilling, custom colours, silk-screen printing, and the assembly of cable glands and terminals — providing fully finished housings ready for fitting to the equipment.

ROLEC OKW Australia New Zealand P/L
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COMPLETE TRACEABILITY IS A MUST FOR MODERN BUSINESS

The counterfeit medicine market internationally is worth some US$32 billion and causes about one million deaths each year. This is a huge cost to the general health and wellbeing of society worldwide.

Further, the pharmaceutical companies that have invested considerable sums in designing and patenting their medicines are being seriously undermined by counterfeiters. Their reputations are tarnished whenever there is an adverse outcome from an unscrupulous operator.

So the motivation to combat the illegal medicine trade is very high. Counterfeiting is also becoming prevalent in other industries, like medical devices, tobacco and food and beverage — all of which have encountered similar issues to varying degrees.

Traditionally, batch and lot numbers were used to find the source of faulty products. However, these could not accurately determine the root causes of defects in production. They also provided no real assistance in preventing counterfeiting, as lot and batch numbers could be easily duplicated.

Serialisation is the allocation of a unique serial number to each item of production. The serial number is printed on both the packaging and as near to the actual item as possible. Serialisation allows traceability, which is the tracking of individual items through the entire supply chain. As every single item produced will have a serial number, the details of when and where it was manufactured can be confirmed by merely querying a database.

A system of serialisation has been in place for many years in the production of banknotes — each of which has a unique serial number clearly printed on it. While counterfeiters may still attempt to produce their own legal tender, the presence of a serial number presents an immediate hurdle for them, as it helps authorities in their tracking process. Serialisation validates both the product itself and legitimises the supply channels.

Pharmaceutical and food industries face a number of challenges in implementing an effective serialisation system, however. Firstly, there is a lack of standards in relation to serial codes and how or where they can be printed. This is currently being worked on by the various standards organisations. The OPC Foundation has produced the Open SCS standard for example.

There is also a challenge in relation to managing the considerable data generated, given that each item will have multiple vendors and collection points. This will require several databases and much activity between them.

Implementing serialisation on current manufacturing systems, which have been certified for their particular industry, is also a challenge.

Two possible solutions have been recently proposed for tracking and tracing. The single-system point-to-point solution — where there is a single supplier only and data is closed off — is the simplest solution, and in many cases ready to implement.

Alternatively, the flexible layer solution — where production is separated from the data — is an open solution. While it is more complex and will require additional implementation, it provides a number of clear advantages, in that data is more flexible and can be easily tailored by the various parties.

With the technology available today, both systems can be supported. Current technologies in visual inspection are capable of reading many barcodes at high speed, as well as performing optical character recognition (OCR) in the same sensor.

A vast array of visual inspection functions are supported to ensure the quality of the final output. Controllers are available that are capable of supporting up to eight cameras and can be connected to automation controllers via modern digital technologies such as EtherCat.

This technology provides a giant leap forward in combating the counterfeit medicine trade. Most importantly, it will help to restore consumer confidence. Consumers can be assured they are receiving the genuine medication for which they have paid.

Harry Mulder is Engineering Manager at Omron Electronics Oceania and has been involved in the industrial control industry for almost 30 years. With a degree in computer science, his experience includes sales, engineering and product management. He currently manages engineering and marketing teams but still enjoys getting involved with day-to-day problem-solving.

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24-VOLT DRIVE TECHNOLOGY

IN CONTINUOUS CONVEYOR SYSTEMS

M Braun, P Linsel and K Furmans, Institute for Material Handling and Logistics (IFL), Karlsruhe Institute of Technology

In addition to the standard 400 V drive technology, 24 VDC technology for conveyor systems has become increasingly popular in recent years.

Today's continuous conveyor systems can be used in many different sectors and branches of industry. As well as classic 400-volt drive technology, 24-volt drive technology has increasingly been used over the past few years. Since 24 V and 400 V drive technology share some common distinguishing features, the two drive technologies will be compared. Possible distinguishing features include the operating mode, drive-train design and conveyer task.

Application areas for 24-volt drive technology

24-volt drive technology is primarily used in accumulating conveyor systems these days. Each module of a longer conveyor is fitted with a roller drive that is separately powered and with a decentralised control unit that can be directly activated. Each drive has an interface to an external master control system. This means various modules can communicate with each other to facilitate material flows. In each case, the drive is only switched on and ready for action when a unit needs to be moved across that particular module of the conveyor. Once the unit has gone, the conveyor module is immediately switched off again. Long conveyors can thus be divided into segments that automatically switch themselves on and off again.

Such transportation tasks are common in many different sectors. In the packaging industry, the main tasks are dynamic positioning and precise delineation of the distances between transported units. This ensures high availability of the conveyed goods at the unloading points. The challenge in such cases is usually that the loading frequency of the conveyed goods is asynchronous with the unloading frequency.

Similar key tasks are handled by distribution centres or mail order firms with manual picking systems. Roller conveyor systems with 24 V drive technology are also suitable for use in such instances.

As a general rule, 24 V drive technology can be used in logistics centres handling throughputs of between 100–1000 unit loads per hour, eg, in the entry zones of automated high-rack warehousing systems.

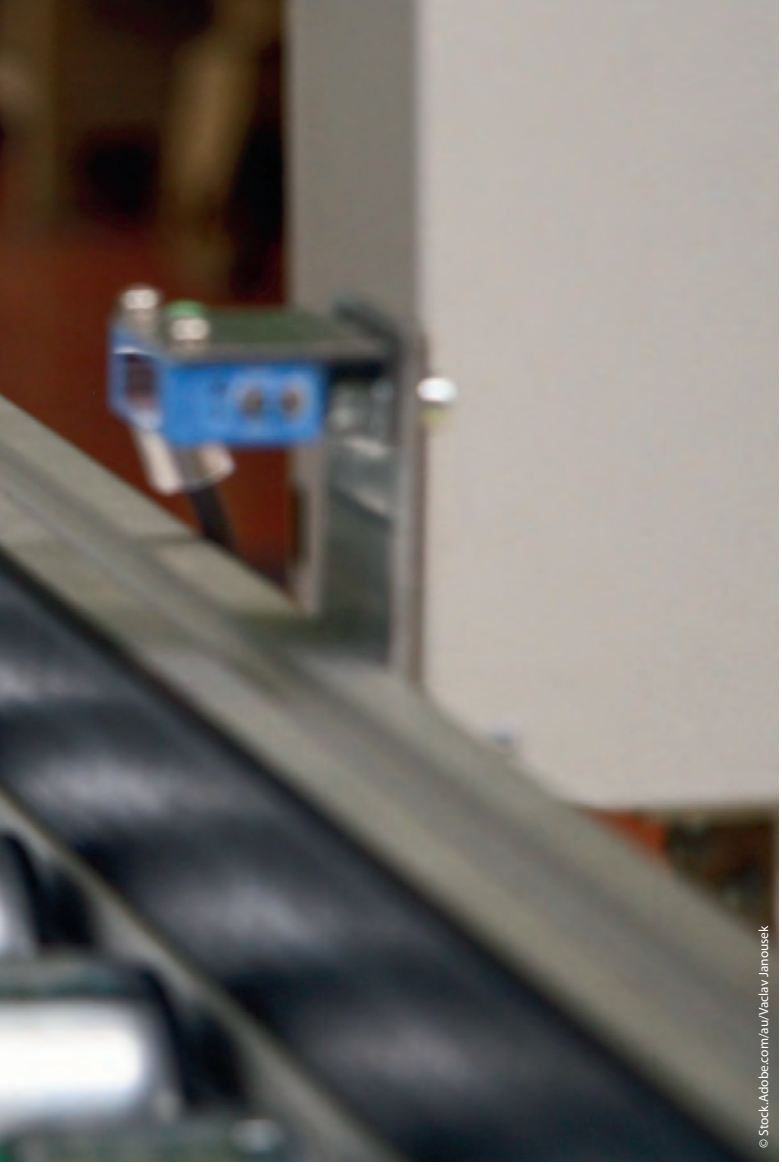
Advantages of 24-volt drive technology

Fundamentally, 24 V drive technology can be described as one of the safest options for powering continuous conveyors, since the lower voltage involved makes the systems easier to maintain and service.

The ability to divide longer conveyor lengths into individual modules with decentralised control units that allow information to be shared with other modules can also increase the flexibility of the system. Any changes as a result of remodelling or extending the system to include extra modules can thus be implemented relatively simply, like 'plug-and-play' solutions.

Integrated roller drives represent a low-maintenance, low-noise option and the advantages of such technology also lie in its compact, space-saving design. The fully enclosed unit protects all transmission elements such as bearings and couplings from external environmental influences such as dust, water, grit, chemicals, fat, oil and the high-pressure steam typically used to clean conveyor systems.

Simple integration of the conveyor rollers with their built-in drive facilitates quick maintenance of each module, and the redundancy of the system allows a fault within the system to be more easily rectified. Since it is possible to simply replace one defective module,



the fault no longer has to be fixed within the entire system, as the unit in question can be taken away and checked for identification and repair of any problems. This means the conveyor process is only interrupted for a brief period.

The combination of a decentralised roller drive with modern, decentralised control technology offers great potential, for conveyor modules can be strategically switched on and off without having to be centrally administered within the overall control system.

Whenever electrical power is converted to mechanical energy, a certain degree of heat is also generated. The use of new materials in roller drives lowers the surface temperature of the 24 V system by generating less friction than comparable, centrally controlled, gear-motor combinations. This means less heat has to be expelled and at the same time the degree of power loss is also significantly reduced. Ultimately, this lengthens the service life of the drives and extends the lifespan of the entire system.

Disadvantages of 24-volt drive technology

The task of many distribution centres is to make products available 24/7 so that goods can be taken from the warehouse and distributed to customers at any time. If high throughput is required at the same time, the entire continuous conveyor system is usually operated in non-stop mode. For such usage, 400 V drive technology with central gear-motor combinations is still the recommended option, since these motors have a high power density, long lifespan and, when operated at nominal power, very good efficiency. Because long conveyor lengths are divided up into smaller conveyor modules when 24 V technology is used, it also means a larger number of motors is used. Every additional motor-gear combination increases the potential for problems to arise. The overall availability of such a system, compared to that of an otherwise constant, non-segmented conveyor, is therefore lower. As well as the use of more drives, more sensors and control units are also used. The required basic output, due to the increased incidence of standby power, thus also increases.

Currently, 24 V drive technology is capable of transporting light-weight goods in the 30–50 kg range. In order to be able to move heavy pallets higher-powered drives are required, at least according to the current state of technology. Both heavy and lightweight goods can be easily transported with the aid of 400 V drive technology since, depending on the transportation task, the conveyor can be adapted by adding tried and tested versatile modular products to certain drive elements to improve the energy efficiency and throughput rates.

Comparison of 24-volt and 400-volt drive technology

A comparison of 24 V and 400 V drive technology can be made using various criteria. To be more specific, energy consumption, the costs of installation, operation and maintenance, the overall flexibility and system performance are the most important criteria.

Energy

To compare the energy usage of the different drive concepts, the transportation of a unit load weighing 50 kg was analysed. In order to quantify the required energy consumption for other transportation tasks, a simulation model was developed at the Institute for Material Handling and Logistics (IFL), with which the energy consumption of both 400 V and 24 V drive technology can be quantified for the different scenarios. This model is not limited to a particular type of conveyed goods or roller conveyor as it is individually adaptable to various tasks.

	Details of 400 V drive technology Centralised System	Details of 24 V drive technology Decentralised System
Weight of conveyed goods (kg)	50	50
Acceleration (m/s²)	1	1
Speed (m/s)	0.8	0.8
Length of conveyor (m)	32	32
Number of gears	2 (1 every 16 m)	40 (1 every 0.8 m)
Angle of elevation	0	0

Table 1: Overview of comparative parameters of 400 V and 24 V drive technology

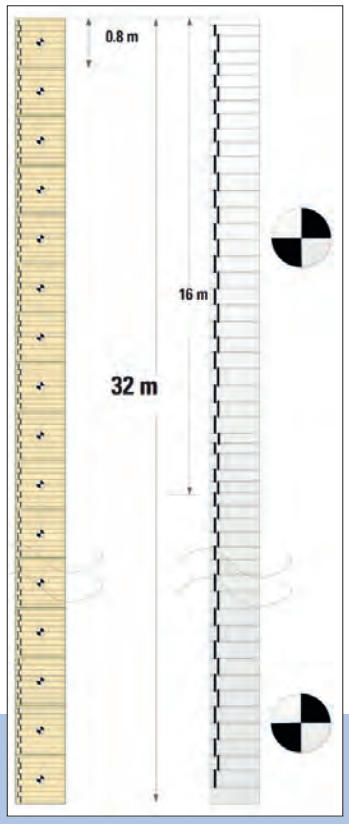


Figure 1: Comparative layouts of 24 V drive technology (left) and 400 V drive technology (right).

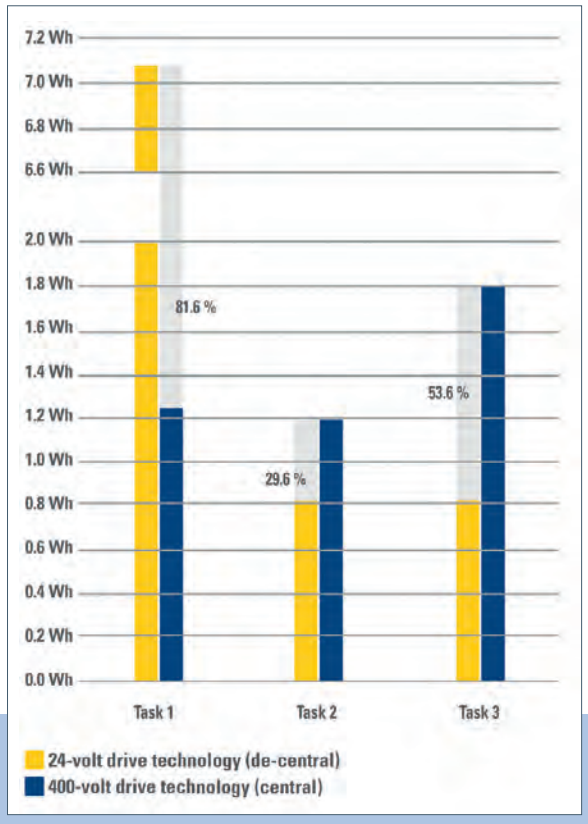


Figure 2: Comparison of energy consumption for each layout when transporting one low-load carrier for the three tasks.

The model of the roller conveyor is basically designed to suit the relevant drivetrain. The stand-by consumption of such elements as current converters, frequency inverters and control units is included in the calculations.

Performance measures on real systems were undertaken to verify the model and determine any missing parameters such as resistance coefficients. As well as the latest advances of contemporary current systems, with the help of the model, the energy-savings potential of new technologies and the influence of various operating strategies can be determined.

For a direct comparison of both technologies, the layout of Figure 1 consists of a straight-line conveyor of 32 m in length, 24 V modules of 0.8 m and 400 V modules of 16 m. Other parameters are shown in Table 1.

Using this overview of the parameters and comparative layouts, three different tasks were investigated:

- **Task 1 — continuous operation:** The entire conveyor was switched on without any conveyed goods. Then a low-load carrier weighing 50 kg was transported across the entire length of the conveyor. When the unit reached the end of the line, the conveyor was switched off. This task was carried out on both modules of the 400 V and all 40 modules of the 24 V system.
- **Task 2 — intermittent service:** This task was used to test the intermittent mode described in section 2.2. For both forms of drive technology, the conveyor modules required to transport goods were turned on and then immediately switched off again once they were no longer needed. Here, too, a low-load carrier weighing 50 kg was transported and its energy consumption measured.
- **Task 3 — accumulation:** To investigate the accumulation process, individual modules or the conveyor with the weight of one low-load carrier were switched off after 16 m and then accelerated again with that weight for the purpose of further transportation.

The resultant energy consumption levels are shown in Figure 2.

For Task 1, when continuous transportation occurred, the theory that less energy consumption was required using 400 V technology was confirmed. This is primarily due to the fact that in the case of 24 V drive technology, 40 modules and thus 40 motors were switched on at the same time and operated for the entire period the weight was carried, which was about 41 seconds. In the case of the 400 V system, only two drive units were involved.

In the case of Task 2, more energy-efficient transportation occurs when 24 V technology is used in intermittent mode. Unlike continuous operation, this mode of operation with 24 V technology enables energy consumption to be reduced by 88% through intelligent control of energy consumption alone. Even when 400 V technology is used in intermittent mode, by halving the length of the relevant conveyor required to transport the goods, the required energy consumption can be reduced by 9%, as shown in the sample layout.

Task 3 investigated what happens when the weights involved are decelerated and re-accelerated. It is clear here that in the case of 400 V technology significantly more energy is required when switching on the longer conveyor lengths. For this task, there is a 53% difference between 24 V and 400 V technology.

When throughput is increased to 10 boxes of 50 kg each (see Figure 3), Task 1 and Task 3 present a similar picture. In the case of Task 2 it is clear that decentralised 24 V drive technology requires more energy than 400 V technology. It can thus be shown that when throughput is increased, both technologies should be explored further in relation to the task and operating mode.

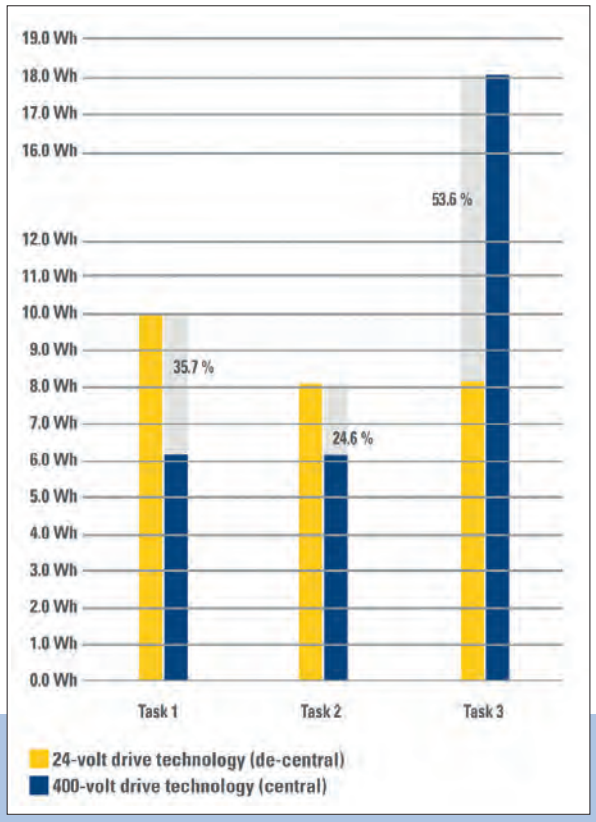


Figure 3: Comparison of energy consumption for each layout when transporting 10 low-load carriers.

Overall these investigations show that the use of 24 V drive technology over short conveyor distances in intermittent service and accumulating mode requires significantly less energy than comparable use of 400 V drive technology. This means the decision whether to use 24 V drive technology or 400 V drive technology should be based on customer-specified throughputs and transportation tasks and the appropriate technology selected accordingly.

Costs

For a general roller conveyor system, various costs can be identified and quantified. The life cycle of the system can be used as a reference for classifying the costs. Manufacture of the system requires some initial outlay, operation or use of it leads to operating and maintenance costs and removal of it incurs recycling or waste disposal costs.

In this case, the initial outlay, operating and maintenance costs will need to be studied in more detail. Calculation of the recycling or disposal costs would require further detailed information about the material used to build the system.

As far as the operating and maintenance costs are concerned, a direct link is identifiable between energy consumption and energy costs.

Flexibility

As mentioned earlier, 24 V drive technology with decentralised drives and decentralised control units enables the use of shorter, modular conveyor segments. As well as the aspect of reduced wear and tear with intermittent use and the possibility of longer maintenance intervals, the conveyor can be extended or remodelled in a similar way to a plug-and-play solution.

Roller conveyors thus no longer represent physical obstacles that are fixed in one position for several years but rather versatile systems that can be altered to meet the changing seasonal demands of a distribution centre. Thanks to the added safety of low-voltage DC solutions, such changes can even be made by in-house staff.

> THE COMBINATION OF A DECENTRALISED ROLLER DRIVE WITH MODERN, DECENTRALISED CONTROL TECHNOLOGY OFFERS GREAT POTENTIAL, FOR CONVEYOR MODULES CAN BE STRATEGICALLY SWITCHED ON AND OFF WITHOUT HAVING TO BE CENTRALLY ADMINISTERED WITHIN THE OVERALL CONTROL SYSTEM.

System performance

As described, there are two main operating modes for roller conveyor systems — continuous and intermittent. Depending on the required throughput, the two operating modes can be directly compared with each other and evaluated according to ecological and economic principles before one mode is selected.

For intermittent service, which can be used for throughputs of 100–1000 units per hour, it makes sense to use 24 V technology with decentralised drives and decentralised control units in order to reduce not only the costs but also the energy consumption of the system. On the other hand, for continuous operation and piece numbers of several thousand units per hour, it pays to use 400 V technology with central drives and controls.

Summary

An in-depth comparison has been made between 24 V drive technology and 400 V drive technology for roller conveyor systems. In principle, 24 V and 400 V technology can be described using similar classification criteria. Based on this overview, which reflects the current state of roller conveyor technology, the advantages and disadvantages of 24 V technology were able to be determined. Apart from safe usage, this technology stands out for the increased degree of flexibility derived from dividing one long conveyor into smaller, decentralised modules, which leads to energy-efficient operation and immediate cost savings. Over longer conveyor distances, the use of 400 V drive technology is still indicated, since 24 V drive technology involves a host of motors which cause increased maintenance and servicing costs and significantly diminished availability of the system as a whole. As a general rule, 24 V drive technology can be used in many different application areas. Thanks to the fundamentally modular system of continuous conveyors, 24 V technology is thus ideal for certain transportation tasks.

Authors

Dipl.-Ing. Meike Braun works as an academic assistant at the Institute for Material Handling and Logistics (IFL), within the Karlsruhe Institute of Technology (KIT). She focuses in her research work on analysing and enhancing the energy efficiency of various types of intralogistics systems.

Dipl.-Ing. Peter Linsel is head of the Warehouse and Material Handling Technology Department of the IFL. He focuses in his research field on energy-efficient, lightweight conveying systems.

Prof. Dr.-Ing. Kai Furmans is the Director of the Institute for Material Handling and Logistics (IFL).

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LOAD CELL

The Futek Model LCM200 is a miniature tension and compression load cell built for endurance or inline tension or compression applications.

Weighing 17 g, the standard LCM200 miniature tension and compression load cell model has a robust construction and is available in 17-4 stainless steel, with male threads on both ends and a 3 m-long 29 AWG 4-conductor shielded Teflon cable.

It offers high accuracy and has a nonlinearity of ±0.5% and deflection of 0.05 mm nominal. The standard LCM200 can be modified or customised to meet user requirements. A TEDS/IEEE1451.4 option is also available.

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ENDOSCOPE

The Olympus Series C is a compact endoscope that is designed to provide a practical solution for inspecting hard-to-reach areas. The instrument's waterproof insertion tube allows for 120° articulation. It is available to rent from TechRentals. The Series C includes eight brightness settings, glare reduction, high-intensity LED and light-sensitive CCD camera chip technologies.

This industrial endoscope can be used to solve issues in multiple industries and has a spring neck design that easily navigates through tight bends.

The Series C has a lightweight (735 g) ergonomic design, has features that are easy to navigate for first-time users and experts, and offers 3x digital zoom as well as an 8-step brightness control.

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REMOTE MONITORING FOR UV PURIFICATION SYSTEM

UV water purification systems are a cost-effective and environmentally sustainable option for a variety of water treatment applications, but there has been a problem with monitoring the equipment in areas that are remote or difficult to reach.

UV-Guard has released a module that will send status alerts to maintenance staff or facility operators via SMS. The alerts include warnings of lamp failure, low UV intensity readings, power failure, end of lamp life and system operation initialisation.

The SMS module is suitable for UV water treatment systems located in hard-to-access areas like roofs. It is also proving popular with mining and remote communities as well as farmers.

The SMS module integrates into UV-Guard's PLC. It provides specific UV system status descriptions so users know exactly what the issue is in real time. As a result, maintenance interventions can be arranged easily and efficiently.

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INTELLIGENT PANEL METERS

The Camille Bauer SINEAX 4-quadrant AM 1000, 2000 (both class 1) and 3000 (class 0.5S) intelligent panel meters are suitable for 3-wire, 4-wire, single-phase and three-phase balanced, unbalanced and open wye circuits. Neutral current is calculated for the SINEAX AM 1000 and 2000 products, while it is calculated or measured for the 3000. Communication options include Ethernet (Modbus/TCP, web server, NTP), RS485 (Modbus/RTU), digital I/O and 20 mA analog with linear and segmented linear outputs.

Internal data storage is via Micro SD card and monitoring functions include periodic, event and disturbance recording (with pretrigger) based on half-cycle rms. Complete characterisation of three-phase parameters is provided including imbalance, symmetrical components, harmonics to the 50th order, phase total active power, power factor, fundamental power, reactive factors, distortion reactive power and apparent power. A phasor display of voltage and current, including symmetrical components, is also available. The instruments are Cat III rated for all inputs.

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SAFETY GATE SYSTEM

Pilz has added PSENmlock to its range of safety gate systems. The mlock offers a safe interlock and safe guard locking device in one device. The safe guard locking is enabled by dual-channel control of the guard locking solenoids. With a strong holding force of 7500 N and an integrated latching force of 30 N, the safety gate system prevents the guard from opening inadvertently. The switch is therefore particularly suitable for machines that have hazardous rundown that require Cat 4 or PL e protection, such as rotating equipment, robots or moving process lines.

The slimline design makes the PSENmlock flexible to use and easy to install. The flexibly mounted actuator ensures high tolerance compensation even with sagging gates. PSENmlock has LEDs on three sides for easily visible diagnostics and its mechanical robustness ensures a long service life.

Pilz Australia Industrial Automation LP
www.pilz.com.au

MINI DC LINEAR ACTUATOR

A customised miniature electric linear actuator for positioning tasks has been built by maxon motor by combining a 16 mm, 60 W, 24 V brushless DC motor with an integrated radial and axial thrust block bearing system. The shaft is manufactured directly as a ball screw assembly. Despite the tiny dimensions available, with motor diameters as low as 6 mm the units can deliver high linear forces. The 16 mm ball screw version has a force delivery capability of 403 N. With the brushless motor's high speed capability, having the ability to accelerate to 12,000 rpm in under 2 ms, the actuator is also dynamic.

The motor is fitted with an integrated digital encoder for detent-free smooth positioning. The length of the ball screw and the nut details are all configurable to suit the machine design requirements.

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TEMPERATURE CALIBRATOR

Calog-Temperature is a portable multifunction calibrator for troubleshooting and calibrating process control instrumentation.

Using the simultaneous isolated combination of Tc or RTD sourcing and mA measuring allows the calibration of any Tc/mA or RTD/mA temperature transmitter. Calog-Temperature sources and measures 10 types of thermocouples and seven types of resistance temperature detectors. In addition, Calog-Temperature measures mA while sourcing or simulating mV, thermocouples, RTDs or ohms, in order to calibrate transmitters.

The mA measurement may be passive with a remote supply or active with Calog-Temperature generating the 24 V 2-wire loop supply. For monitoring over a period of time, Calog calibrators may be set in trend mode with a selectable time-base to graph temperature profiles, making it suitable for testing ovens or for optimising PID temperature controllers. Data may be logged to the removable SD card in CSV format with user-selectable data fields and time-base, also retrievable via the USB port.

Thermocouple cold junction compensation may be set for internal or external measurement, or entered manually. Calog-Temperature is supplied with a carry case, operating manual, factory calibration certificate, four test leads, SD card, battery charger, and plug-on Tc bare-wire cold-junction module.

The small size, rugged design, rubber protective boot, high precision and long-lasting rechargeable Li-ion battery pack makes Calog-Temperature suitable for industrial field calibration.

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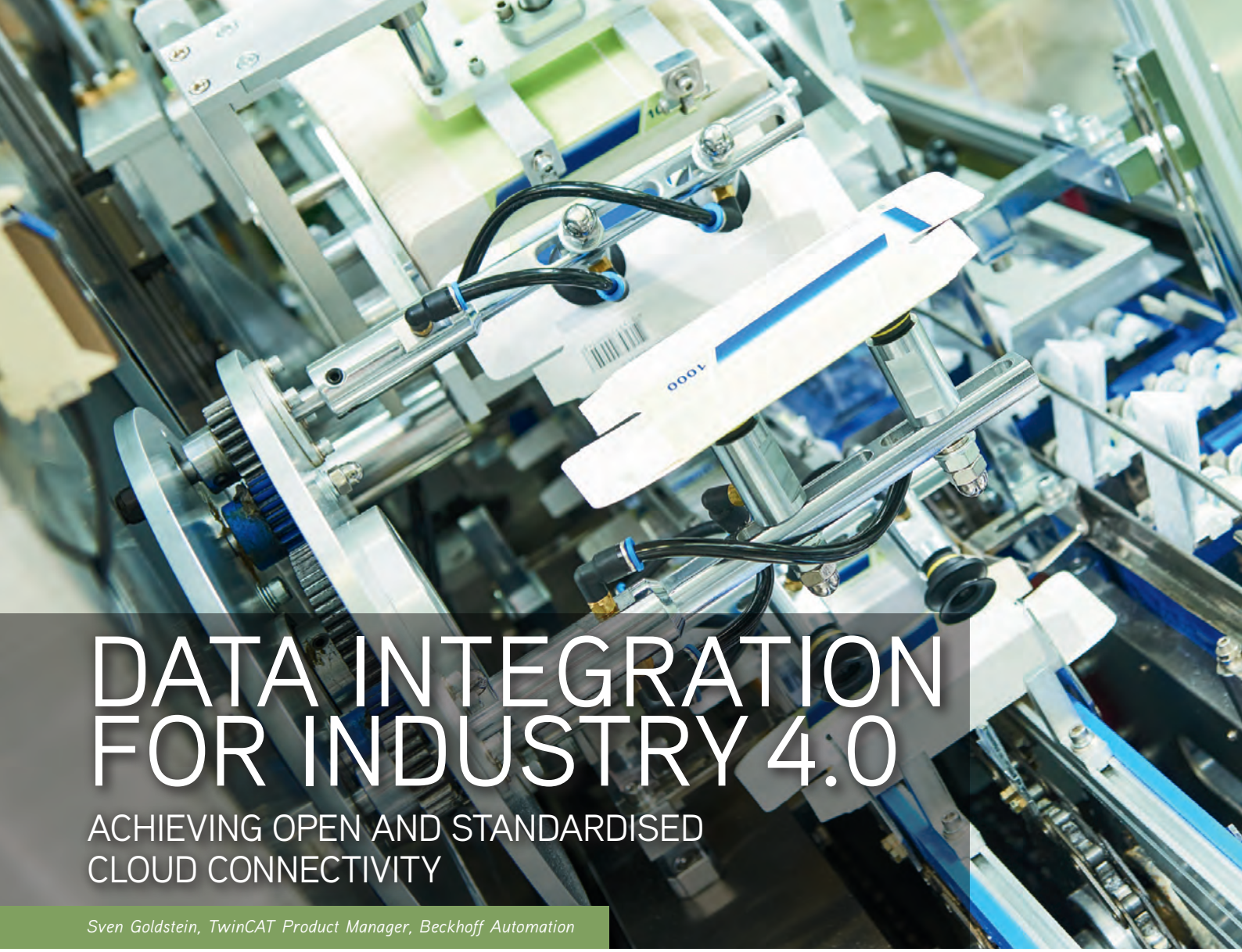

DATA INTEGRATION FOR INDUSTRY 4.0

ACHIEVING OPEN AND STANDARDISED CLOUD CONNECTIVITY

Sven Goldstein, TwinCAT Product Manager, Beckhoff Automation

In order to take advantage of the promise of Industry 4.0, one of the problems that must be solved is the integration of process data with IT systems.

As information technology and automation technology continue to converge, cloud-based communication and data services are increasingly used in industrial automation projects. Beyond the scope of conventional control tasks, applications such as big data, data mining and condition or power monitoring enable the implementation of superior, forward-looking automation solutions.

Industry 4.0 and Internet of Things (IoT) strategies place strict requirements on the networking and communication capabilities of devices and services. In the traditional communication pyramid point of view (Figure 1), large quantities of data must be exchanged between field-level sensors and higher-level layers in these implementations. However, horizontal communication between PLC control systems also plays a critical role in modern production facilities. PC-based control technologies provide universal capabilities for horizontal communication and have become an essential part of present-day automation projects exactly for this reason. Today, new IoT-compatible I/O components are becoming available, which enable easy-to-configure and seamless integration into public and private cloud applications.

Definition of business objectives for increasing the competitive edge

Industry 4.0 and IoT applications do not start with just the underlying technology. In reality, the work begins much earlier than this. It is critically important when implementing IoT projects to first examine the corporate business objectives, establishing the benefits to be gained as a company from such projects. From an automation provider perspective, there are two distinct categories of customers that can be defined: machine manufacturers and their end customers — in other words, the end users of the automated machines. In the manufacturing sector in particular, there is an obvious interest in reducing in-house production costs, both through efficient and reliable production control and also by reducing the number of rejects produced. The traditional machine manufacturer pursues very similar objectives and above all is interested in reducing the cost of the machine while maintaining or even increasing production quality. Optimising the machine's energy consumption and production cycles, as well as enabling predictive maintenance and fault diagnostics, can also be rewarding goals. The last two points in particular offer the machine manufacturer a solid basis to establish services that can be offered to end customers as an additional revenue stream. Of course, what both customer categories ultimately want is for the machine or product to be designed more attractively and to increase competitiveness in the marketplace.

Collecting, aggregating and analysing process data

The process data used during production provides a foundation for creating added value and for achieving the above-mentioned business objectives. This includes the machine values that are recorded by

a sensor and transmitted via a fieldbus to the PLC. This data can be analysed directly on the controller for monitoring the status of a system using integrated condition monitoring libraries, thereby reducing downtime and maintenance costs.

However, where there are several distributed controllers in production areas, it may not be sufficient to analyse data from a single controller. The aggregated data from multiple or even all controllers in a production system or a specific machine type is often needed to perform sufficient data analysis and make an accurate analytical statement about the overall system. However, the corresponding IT infrastructure is required for this purpose. Previous implementations focused on the use of a central server system within the machine or corporate network that was equipped with data memory, often in the form of a database system. This allowed analysis software to access the aggregated data directly in the database in order to perform corresponding evaluations (Figure 2).

Although such an approach to realising data aggregation and analysis in production facilities certainly worked well, it presented a number of problems at the same time, since the required IT infrastructure had to be made available first. The fact that this gives rise to high hardware and software costs for the corresponding server system can be seen right away. However, the costs with respect to personnel should also not be overlooked: because of the increasing complexity involved in networking production systems, especially with large numbers of distributed production locations, skilled personnel are necessary to successfully perform the implementation in the first place. To complicate matters, the scalability of such a solution is very low. Ultimately, the physical limits of the server system are reached at some point, be it the amount of memory available, the CPU power or the performance and memory size required for analysis. This often resulted in more extensive, manual conversion work if systems had to be supplemented by new machines or controllers. At the end of the day, the central server system had to grow alongside in order to capably handle and process the additional data volume.

The path to the public cloud

Cloud-based communication and data services now avoid the aforementioned disadvantages by providing the user with an abstract view of the underlying hardware and software systems. 'Abstract' in this context means that a user does not have to give any thought to the respective server system when using a service. Rather, only the use of the respective services has to be considered. All maintenance and update work on the IT infrastructure is performed by the provider of a cloud system. Such cloud systems can be divided into public and private clouds.

The so-called public cloud service providers, such as Microsoft Azure or Amazon Web Services, provide users with a range of services from their own data centres. This starts with virtual machines, where the actual user has control of the operating system and the applications installed on it, and stretches to abstracted communication and data services, which can be integrated by the user in an application. The latter, for example, also includes access to machine learning algorithms, which can make predictions and perform classifications regarding specific data states on the basis of certain machine and production information. The algorithms obtain the necessary contents with the aid of the communication services.

Such communication services are usually based on communication protocols, which in turn are based on the publish/subscribe principle. This offers definite advantages from the resulting decoupling of all applications that communicate with one another. On one hand, the various communication participants no longer need to know each other — in other words, any time-consuming disclosure of address information is reduced. All applications communicate via the central cloud service. On the other hand, data communication with the cloud service, via the message broker (Figure 3), involves a purely outgoing communication connection from the perspective of the terminal device — regardless of whether data is sent (publish) or received (subscribe). The advantages this offers for configuring the IT infrastructure are immediately clear: no incoming communication connections have to be configured, eg, in firewalls or other network terminating devices. This significantly reduces IT infrastructure set-up time and maintenance costs. Transport protocols used for data communication, such as MQTT and AMQP, are exceptionally lean and standardised. In addition, various security mechanisms can be also anchored here, eg, encryption of data

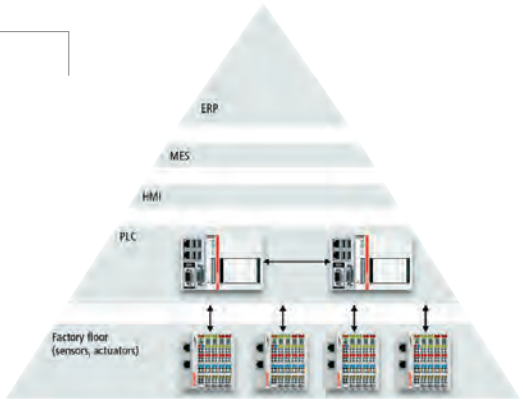

Figure 1: Communication pyramid.

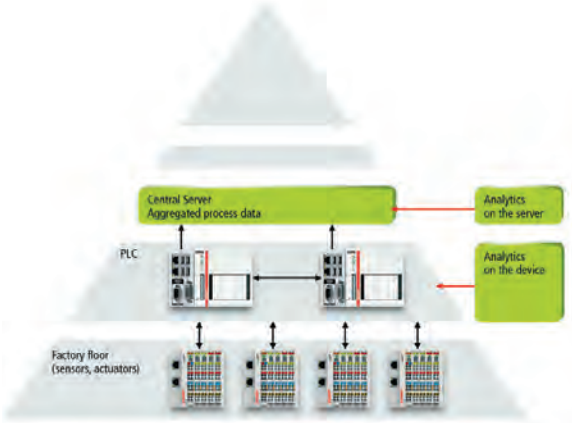

Figure 2: Analysis on the controller or server.

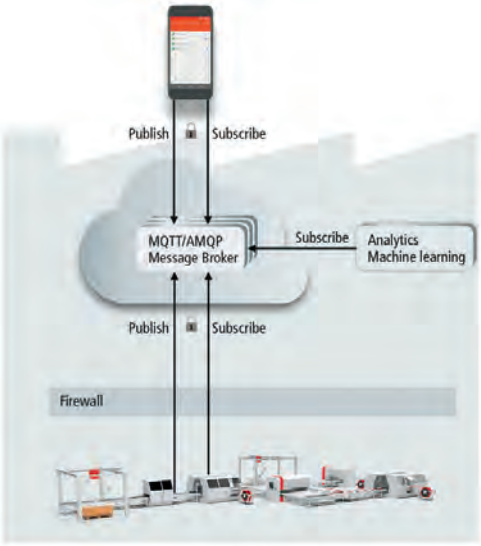

Figure 3: Publish/subscribe communication in the machine network.

communication and authentication with respect to the message broker. The standardised communication protocol OPC UA has likewise recognised the added value of a publish/subscribe-based communication scenario and taken appropriate steps to integrate this communication principle in the specification. This means that an additional standard besides MQTT and AMQP is consequently available as a transport mechanism to the cloud.

The private cloud

However, such publish/subscribe mechanisms can not only be used in public cloud systems, they can also be used in the company or machine network. In the case of MQTT and AMQP, the infrastructure required for this purpose can be installed and made available easily on any PC in the form of a message broker. This means that both M2M scenarios can be implemented and any terminal devices, such as smartphones, can be connected to the controller. Moreover, access to these devices is further secured by means of firewall systems (Figure 3). The extensions of the OPC UA specification with regard to publish/subscribe will also simplify the configuration and use of 1:N communication scenarios within a machine network in the future.

Technologies for Industry 4.0 and IoT

Automation vendors are now beginning to provide users with components for simple and standardised integration into cloud-based communication and data services. For example, the IoT products within Beckhoff's TwinCAT 3 automation software platform offer varied functionalities for exchanging process data by means of standardised publish/subscribe-based communication protocols and for accessing special data and communication services of public cloud service providers. Corresponding services can be hosted in public cloud systems, such as Microsoft Azure or Amazon Web Services, but can be used just as effectively in private cloud systems. Using the standardised communication protocol OPC UA for data export means that data can be exported from multiple vendor technologies, and extended mechanisms — such as local buffering of I/O data in the case of an interrupted internet connection — need to be provided in the same way as a monitoring function for connected fieldbuses.

Analytics and machine learning

Once the data has been sent to a public or private cloud service, the next question is how the data can now to be processed. As previously mentioned, many public cloud providers offer various analytics and machine learning services that can be used for further examination of process data. Automation technology vendors may offer their own analytics platform for users to take advantage of, providing relevant mechanisms for data analysis and making it possible for all process-related machine data to be recorded in a precise and cyclical manner.

Depending on requirements, this data can either be stored for evaluation locally on the machine processor or within a public or private cloud solution.

Conclusion

Industry 4.0 and the IoT are on everyone's minds. Likewise, these concepts are important when the realisation of innovative new business models is a requirement for the underlying infrastructure. This drives the increased convergence of IT and automation technologies. Cloud-based data services can help implement such automation projects, as they save the machine manufacturer or end customer from having to provide the corresponding IT expertise. Hardware and software services are now available for integrating such cloud-based data services quickly and easily into a control project and facilitating comprehensive analysis of the recorded process data.

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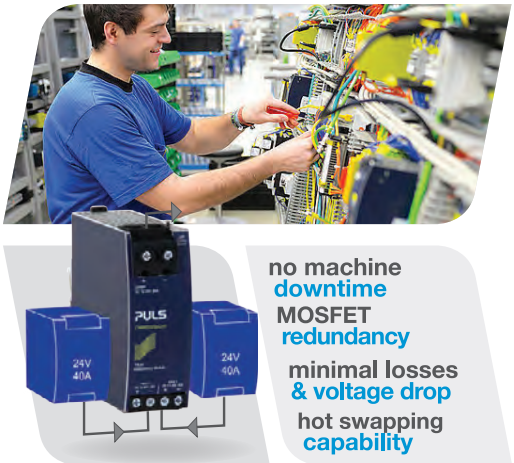

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The MAXBES solution is compact and can be used as an open frame solution or in a MIL housing with connectors of choice. The power supply input is 8–36 VDC and uses less than 15 W, while the operating temperature range is -20 to +60°C and optionally up to +70°C. For the fibre ports, most Ethernet compatible transceivers can be used, allowing the users to select the appropriate transceiver for each link. As a managed switch, various features are available such as QoS, VLANm and Rapid Spanning Tree.

Backplane Systems Technology Pty Ltd
www.backplane.com.au

RESERVOIR ENGINEERING SOFTWARE

Roxar Tempest 7.2 is the latest version of Emerson's integrated reservoir engineering software suite that can be applied in a wide variety of scenarios such as field appraisal, field optimisation and brownfield development.

Tempest 7.2 comes with enhancements to its history matching and uncertainty analysis module Tempest ENABLE that will help oil and gas operators generate accurate production estimates, quantify uncertainty and minimise financial risk. Tempest 7.2 includes the 'Roxar App Connector' that allows users to set up a complex, multi-application description of their reservoir which can be used in ensemble-based workflows — a set of runs of linked programs that can predict how an oil reservoir may respond and provide accurate statistics on field performance. To take into account the natural but unknown variations in the geological representation of a reservoir, Emerson has now augmented and expanded its proxy with a stochastic component. As a result, a more realistic assessment of the underlying uncertainty in the production estimates is achieved as well as encouraging greater collaboration between reservoir engineers and geologists.

Tempest 7.2 also comes with enhancements to its Tempest MORE and Tempest VIEW modules. Updated Tempest MORE features include more stable well control, modelling threshold and breakthrough pressures and handling branched well fractures, improved facilities for sector modelling, and the splitting of models for faster history matching. Users of Tempest VIEW will also be able to conduct more flexible history matching analysis on a wide range of results including water breakthrough.

Emerson Process Management Aust P/L
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POWER QUALITY ANALYSER

The Hioki PQ3100 power quality analyser is a Cat IV (600 V) and Cat III (1000 V) instrument capable of harmonic measurements to the 50th order, interharmonics to the 49.5th order (including power harmonics and phase angles), voltage, current and THVD/THID as well as inrush current and K factor. The analyser is compliant with IEC requirements, Class S.

The PQ3100 is a four-channel instrument for three-phase 3- and 4-wire reticulation as well as single-phase and two-phase systems. The DC capability allows it to be used in the evaluation of solar PV installations.

Sensors, powered from the instrument with ratings to 6000 A, provide for maximum measurement in the MW range as well as apparent power, effective and reactive power including total power factor and displacement power factor.

The Hioki PQ3100 provides numerical displays, voltage and current waveforms (capture up to 10 s post-anomaly trigger) and phasor displays. Interfaces include SD memory card, LAN, USB, RS232C and external control.

Power Parameters Pty Ltd
www.parameters.com.au

THERMAL IMAGING CAMERA

The Flir E60-II is suitable for applications involving the inspection, maintenance and troubleshooting of electrical, mechanical and HVAC/R systems. It is available to rent from TechRentals.

The E60-II offers high performance and usability, with a temperature range of -20 to 650°C, 2x and 4x digital zoom, 3.1 MP visible light camera (with LED lamp), scalable IR picture-in-picture (PiP), laser pointer and multispectral dynamic imaging (MSX).

MSX provides real-time visible spectrum detail on infrared video and images. This results in detailed shots not normally attainable with thermal imaging. In many cases, reports no longer require accompanying digital photos.

The E60-II also features a smartphone/tablet connection through a Wi-Fi application, MeterLink connectivity with compatible devices for collaboration of diagnostic data, Bluetooth support for voice annotations and automatic screen orientation based on camera positioning.

TechRentals

www.techrentals.com.au

Old cables no problem for Massachusetts railroad

The Massachusetts Bay Commuter Railroad (MBCR) is an organisation that is responsible for maintaining and dispatching trains and tracks over more than 800 km in the Boston area. It reports to the Massachusetts Bay Transit Authority (MBTA), which owns the passengers and commuters line.

The Worcester line, previously under CSX dispatch and maintenance responsibility and used as a shared commuter and freight line, has recently been reassigned to the MBCR as a result of increasing passenger patronage in the area, along with too many delayed trains and the resulting pressure to improve on-time performance. The Worcester line is also located in a high lightning potential area nicknamed 'Lightning Alley', which means any new equipment installed requires an extreme level of robustness.

The line is now carrying between 15,000 and 20,000 passengers each day across a distance of approximately 71 km into Boston. As part of the infrastructure upgrades, MBCR needed to make some updates and install telephone lines along the trackside as well as 15 interlocking points — with backup for each of them — for a total of 63 lines. Two alternatives were available: the phone company, which charges a high installation cost and a monthly fee for each leased line, or Westermo's robust DDW-225 redundant ring Ethernet extenders, which allow effective Ethernet networks to be created over long distances at data rates up to 15.3 Mbps. The SHDSL technology makes it possible to re-use many types of pre-existing copper cables, which can lead to considerable financial savings and, depending on cable characteristics, distances up to 15 km can be achieved.

Indeed, MBCR found existing wires along the tracks of the Worcester line — some laid 35 years ago in 1978 and varying from four to 25 pairs — that could be used with Westermo's DDW-225 without having to install new cables.

The company installed two DDW-225s at each location, the first one being used as primary and the second one as the redundant unit, along with a triple redundancy due to the unit's cellular modem backup capability.

Prior to the installation of the Westermo DDW-225 Ethernet extenders, each control point had been connected via various systems: DSL, cellular, satellite and frame relay. Each system required replacement hardware and the knowledge of how to install and configure the equipment during failures. Repairs typically involved multiple technical personnel and coordination before repairs could be implemented. With this new installation completed, MBCR technicians have a minimal number of repair parts to stock and a single configuration style to understand. With the quick repair times, and with the redundant configuration of the system, dispatchers are typically unaware of a system failure. MBCR dispatchers now have real-time information and are expecting a significant improvement toward their goal of 100% on-time train arrival.

Westermo Teleindustri AB

www.westermo.com

TANK FARM MONITORING

MEETING AUSTRALIA'S FUEL RESERVE NEEDS: PART 2

Glenn Johnson, Editor

Australia is not meeting its IEA treaty obligations with regard to reserve fuel storage. In Part 1 we looked at the reasons why and the issues for tank farm operators. So how can modern tank farm monitoring technologies assist?

Australia's high dependence on petroleum fuels for the transport of essential products such as food and pharmaceuticals makes a lack of fuel reserve a significant problem for the country as a whole. A Senate committee on energy resilience and sustainability found that while the IEA obligation is to maintain 90 days' worth of fuel reserve, it has been estimated that Australia only has 34 days of fuel stocks:

"The 34 day figure is calculated on the average daily consumption of fuel in Australia divided by what is believed to be the volume of fuel available to the market."[1]

Many existing tank farms use manual tank gauging methods, which do not support efficient use of available stock, nor meet recommendations for accurate monthly stock reporting. Along with better accuracy, upgrading to modern automated tank monitoring solutions will improve safety and therefore potential storage capacity, and help to maximise business returns by improving business processes.

Types of tank monitoring application

Bulk fuel storage terminals can be split into three types — pipeline, marketing and storage terminals:

- Pipeline terminals are found at the beginning or end of a pipeline and receive products directly from a refinery or from tankers.
- Marketing terminals are for temporary storage prior to distribution and usually store a small variety of products, such as gasoline and diesel.
- Storage terminals may be used for storage of final product for a particular industry, such as jet fuel for an airport, or may store a wide variety of different products.

Measurement of product volume or mass is necessary for both inventory control and custody transfer.

Inventory control measurements are important for understanding exactly how much product is in stock, and reliability and repeatability are important considerations.

Safety overfill prevention systems use a point level sensing solution, since their only purpose is to detect the high level and prevent overfilling.

Accuracy challenges

The application of instrumentation creates opportunities to measure inventory far more accurately than any manual method. Manual methods essentially involve only measuring the level of the liquid surface — and possibly an oil/water interface — and as accurate as these measurements may be, they are not necessarily an accurate indicator of the actual quantity of product, for a number of reasons.

Various deformations and variations to tank dimensions can occur over time. The dimensions of a tank can change through deformation caused by the varying mass of liquid in the tank, and

by temperature variations. Due to their weight, tanks can move or tilt over time, and both the bottom of the tank and the roof can move. All these deformations cause variation in the liquid level for a given volume of liquid. Some but not all of these variations can be compensated for by tank correction and capacity tables.

Hydrocarbons also vary in volume depending on temperature — a variation in temperature of 1°C typically causes a volume change of around 0.1%. Varying amounts of water are normally present as well, which need to be measured to calculate the correct quantity of the stored liquid.

It is the volume or the mass of the stored material that is of interest. There are two main methods of tank monitoring — a mass-based method and a volume-based method. The mass-based method is based on measuring the hydrostatic pressure of the liquid column using pressure instruments. The volume-based method combines a level measurement with a temperature measurement. In either case it is also necessary to measure the free water volume in the tank.

In addition to these two main methods, there has also been an increase in the growth of hybrid tank measuring systems (HTMS), which use highly accurate level measurement combined with hydrostatic pressure measurement for mass. This is often the preferred method, particularly for product that is often measured based on mass. Furthermore, for crude, 'water bottom' can be a very critical measurement as many or most crude tanks intentionally have water at the bottom of the tanks that will need to be deducted from overall volume.

Recommended technologies for volume measurement

Servo level gauges

Servo tank gauges operate on the principle of displacement measurement. A small displacer with a higher specific density than the liquid is suspended on a measuring wire that is unwound from a drum and positioned in the liquid medium using a servomotor. A resolver coupled with the wire drum is used to measure variations in the weight of the displacer, according to Archimedes Law.

When the displacer is lowered and touches the liquid, the weight of the displacer is reduced due to the buoyancy of the liquid. As a result, the torque in the drum is changed, and this change is measured by the resolver along with the distance the displacer has been dropped.

The displacer can also be lowered through the liquid until a new change in buoyancy is detected, enabling the servo gauge to detect an oil-water interface.

Servo gauges are one of the most accurate methods of level measurement, with an accuracy of within ±0.4 mm over a depth of 40 m. They also inherently measure the density of the fuel, since it is directly related to the buoyancy.

Radar level instruments

Radar level instruments are a non-contact method of measurement in which the instrument is mounted at the top of the tank and transmits microwave pulses down into the tank.

For high-accuracy liquid level measurement in storage and process applications, radar gauges operate based on the frequency-modulated continuous wave principle (FMCW). The radar emits a precise crystal-oscillated, continuously varying frequency wave from the antenna. The wave is reflected off the product surface and received again by the radar system.

The reflected energy is dependent on the fluid's dielectric constant, which is significantly different from air for both water and hydrocarbon liquids. Due to the further difference in dielectric constant between the fluid and water, the interface level can also be detected.

Radar level instruments typically provide an accuracy of ±0.5 mm and have the added advantage of low maintenance, having no moving parts as servo gauges do. However, they do not measure density, and this will need to be determined by additional instrumentation.

Vibrating fork level switches

For safety overfill detection, the recommended level-switching instrument is a vibrating fork instrument. Such instruments consist of a fork with tines that are vibrated by a piezoelectric crystal oscillator at a resonant frequency of about 1 kHz in air. When immersed in a liquid, the vibration rate will slow down by about 20%.

The advantage of vibrating fork level switches is that they are maintenance-free and highly reliable — essential qualities for a

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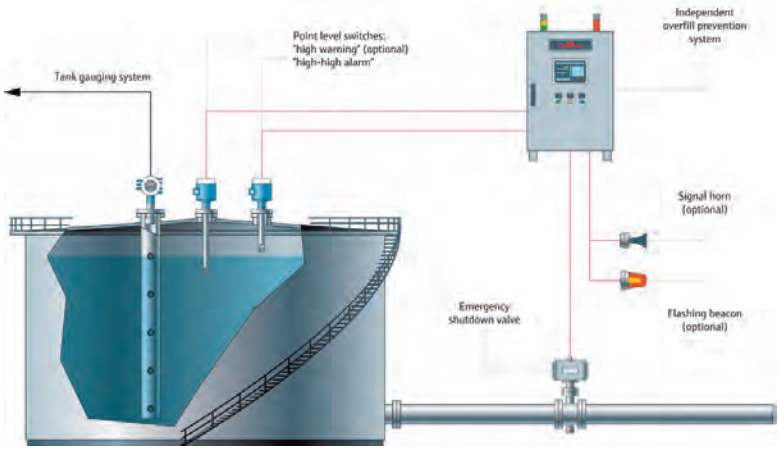

Figure 1: Example of an automated overfill prevention system. Image source: Endress+Hauser.

safety application. They are not affected by material build-up on the tines, nor by turbulence, bubbles or other liquid phenomena.

In addition, there is now an industry trend towards favouring continuous radar, since it allows ramp alerts prior to an overfill 'panic'. This means the operator is given an early warning that if the tank continues filling at its current rate it will overfill in a predicted time.

Tank safety systems

To meet safety requirements and at the same time maximise tank capacity, it is essential to implement an independent Safety Instrumented System for this purpose.

Automated IEC 61511-certified systems are available that make the detection, indication and prevention of overfill simple to implement. Such systems offer complete functional safety loops covering safety integrity levels SIL2 and SIL3.

Such a system (Figure 1) takes its inputs from point level switches at the top of the tank and acts as a system independent of all other controls, automatically closing a safety shutdown valve if required to prevent overfill.

Networking

Implementing or extending a tank farm inventory monitoring system will of course require implementing an infrastructure to integrate the tank instruments into a control system, and many legacy tank farms have obsolete or non-existing signal wiring from the tank storage area. Traditional methods of running cables or optical fibre over large tank farms would normally form the largest part of the cost of deployment, and in many cases may be cost-prohibitive.

In recent years, industrial wireless technologies have all but eliminated the wiring cost, replacing cable runs with wireless instruments. A secure, wireless infrastructure can halve the cost of deployment over a wired solution. Where existing instrumented tank monitoring exists, but improved connectivity is required, wireless adapters or gateways are an option. Wireless tank monitoring means that precise inventory data for tanks that was previously out of reach can be made available.

Automated inventory management

A precise calculation of net volumes is key for accurate business accounting purposes. A 5 mm level measurement error plus a temperature error of 0.6°C in a large fuel tank can cost tens of thousands of dollars per tank per annum. But accurate measurement is not the only thing to consider — it is also important to get best business value possible from the tank monitoring system. By replacing a manual or ageing tank farm monitoring system with an up-to-date automated one that runs closer to constraints, an optimised system can generate higher returns. Closing the gap between planned and actual schedules is a key objective, since deviations between the availability of product and the product delivery schedules not only impact the tank farm process but can also have cost implications for downstream operations.

Automated processes are better able to monitor what's going on in the field to help improve the management of stock and of all activities and workflows — making interoperability important. Fortunately, by networking the tank monitoring systems, data can be integrated with SCADA, DCS and ERP systems via commonly available technologies such as OPC.

Software for non-refinery storage terminals

Where a tank farm is used for only storage and terminal purposes, a separate inventory management system may be appropriate.

An inventory management platform can support users in collaborative demand planning, event-driven replenishment planning and scheduling as well as the reconciliation and consolidation of geographically distributed inventories. It is also possible to involve partner organisations for further improved supply chain operations.

Today, organisations can choose to implement an inventory system on their own computing infrastructure — suitable for larger operations — or to use cloud services (software-as-a-service) where the operation is smaller, further reducing business costs. Cloud services also make the management of multiple sites easier and more cost-effective.

System commissioning and integration

In a tank farm operation that was previously manually operated, the implementation and integration of the monitoring and safety systems may present challenges — all of which can be overcome with the assistance of an experienced vendor that can also provide engineering and integration services.

By involving a competent partner right from the start, fuel refinery, terminal and storage operators can be sure of smooth project handling and the seamless handover of a fully operational plant, with increased safety, reliability and availability.

A partner should be selected that has the expertise to ensure the overall performance of the tank monitoring network, and integrate it into any existing DCS, SCADA or ERP system, as well as provide all necessary training and ongoing support.

References

1. Senate Standing Committee on Rural and Regional Affairs and Transport 2015, *Australia's transport energy resilience and sustainability*, Commonwealth of Australia.

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MINI DATA LOGGER

Delta Ohm has released the HD208 series of mini data loggers covering temperature and humidity measurements with internal and external sensors for a variety of applications including food and perishable goods storage, drug and vaccination fridges and freezers, and ambient monitoring for laboratories, museums and archival storage.

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www.wandbinstruments.com.au

Fujitsu IoT innovates toilet production in Vietnam

Developing countries like Vietnam face many issues, including sanitation problems and a lack of toilets. In Vietnam, where the economy is developing rapidly, although infrastructure is being rolled out from the urban areas, when it comes to toilets and sewers, about 40% of households use a chamber pot, and the adoption rate for flush toilets has still not even reached 20% of the country's population. In the rainy season, the filthy water from chamber pots and the like means the spread of infections and diarrhoea, endangering those with weak immune systems, such as children and the elderly.

Toto Ltd aims to promote healthy lifestyles in all regions by providing products using its cutting-edge water-saving and sanitation-preserving technologies, to strengthen the production of sanitary ware, beginning with toilets, and to contribute to the development of a culture which values water used throughout the home. As part of this goal, it has placed the Asia and Oceania regions at the centre of its global supply chain, securing a stable global supply system. In addition to its 29 production-related companies located in the Japan, US, China, Asia and Oceania regions, Toto plans to operate a third Vietnam factory beginning in March 2018.

Sanitary ware is large in size and complex in terms of shape. Greater production reliability requires skilled techniques and advanced technology in areas such as in moulding operations, which must consider warping and shrinkage in post-processing; temperature management in tunnel kilns that require high temperatures and a great deal of attention; and inspections by certified inspectors who possess knowledge and experience.

Toto, together with Fujitsu Systems East, embarked on a project to transform its Vietnam factory production with IoT technologies in September of 2015. The aim was to not only improve production and the quality of the sanitation ware, but also to train employees who can employ skilled techniques and advanced technology.

In order to provide stable production of high-quality sanitary ware, the system enables quality data and information about the status of production throughout the whole manufacturing process to be collected and used.

By using tags and barcodes attached to products in production, as well as collecting a variety of performance information, including data about the mixing of raw materials, the humidity and temperature when raw materials are mixed, and the type of glaze applied to the sanitary ware, it becomes possible to trace individual products in real time. This enables an understanding of quality information from when the product was manufactured, right through to after it ships.

Millimetre-scale distortions and flaws cannot be allowed in sanitary ware that will be installed in plumbing, so it is meticulously designed, taking into account the fact that ceramic materials shrink in the drying and firing process. To enable inspectors to record thorough inspection results, including details, the system displays a diagram of the flush toilet from all six perspectives, above and below, in front and behind, and left and right, where inspectors can instantly record or check the locations

and status of flaws. Using the data collected on these tablets, system operators can digitally grasp locations with a tendency to produce flaws, or elements in the facilities or environment that may cause flaws. This can lead to further improvements in the manufacturing process.

As a result of implementing this system, Toto Vietnam can now share information that was not previously able to be visualised, such as the work procedures taken by experienced workers and inspection results — improving communication and exchanges of opinion among workers.

Fujitsu built a system where production performance and product inspection results, which employees previously recorded on paper, can be easily input on tablets and handy terminals. The companies worked with employees on the actual production line, having them test out the tablet input screen, confirming its readability and usability, collaborating on everything from the size of the text and the placement of input fields to the size of the keyboard.

The system innovates the production of sanitary ware, which requires extremely sensitive operations, such as the mixing of raw materials and adjusting contraction rates. IC tags are used to not only track the progress and quality of products, but also to collect and digitise a variety of data, such as work procedures and other know-how of skilled workers. In addition, Fujitsu has a system which emphasises the operability of tablets that employees use to input inspection information, featuring displays with easy-to-understand graphics and touch input functionality, and customised applications. By implementing IoT technologies, which puts the information created by people and things to effective use, the system enables the visualisation of trained workers' expertise, which was previously difficult to record as data. It also makes possible analysis with the use of statistical data, leading to improved production of high-quality products.

Fujitsu Systems East Ltd

BUTTON LOAD CELL

The Futek Model LLB250 is a miniature load button built for press or inline compression applications.

The standard LLB250 has a robust construction available in 17-4 stainless steel, with a 12.7 mm outside diameter and a 3 m-long 29 AWG 4-conductor shielded Teflon cable.

Although button load cells are traditionally not known for their high accuracy, the LLB250 offers high accuracy and high stiffness. It has a nonlinearity of ±0.5% and deflection of 0.05 mm nominal.

The standard LLB250 Miniature Load Button can be modified or customised to meet user requirements.

For those who are a looking for a complete system solution, FUTEK can also provide both signal conditioned displays or the VCal Portable System. The VCal Portable System brings easy-to-use system verification directly to the user, making it suitable for on-site verification and calibration. The FUTEK LLB Series is also available with a TEDS/IEEE1451.4 option.

Metromatics Pty Ltd

www.metromatics.com.au

REMOTE COMPRESSOR MONITORING

SmartLink is Atlas Copco's flexible solution for data monitoring that is easy to install and customise and user-friendly. The system enables relevant data about central compressed air and vacuum systems and individual machines to be delivered to a mobile phone, smartphone or PC.

Whenever the user has access to the internet, it is possible to display the information needed; from machine alarms and faults to visualised representations of demand and load for complete site vacuum installations. This allows users to respond quickly to changing circumstances, planning service calls efficiently and minimising production losses.

The system features: a web portal with event overview of the last 30 days, access to service data and monthly status report by email; logging + download service data for the last 30 days in Excel, Word or PDF; requirement of machine-related services (service, spare parts) directly via web portal; SMS/email notification for service, failures and warnings; online trend graph: status display.

Atlas Copco Compressors Australia

www.atlascopco.com.au

PIPE STRESS ANALYSIS SOFTWARE

Intergraph Process, Power & Marine (PP&M) has announced that CAESAR II 2017 for pipe stress analysis is now available commercially.

CAESAR II evaluates the structural responses and stresses of piping systems to international codes and standards. The 2017 version includes features that address many longstanding customer requests, as well as some significant industry code updates.

Technical additions include the ability to evaluate creep conditions for all piping codes using EN-13480 guidelines and a dialogue to specify custom nozzle stiffness from the piping input. The version features several interface and usability improvements, including model symbols to show displacements, rotations, forces and moments, and improved display of node numbers and axial stops in piping models.

An update to the 2016 edition of the ASME B31.4 code for liquid pipelines is now included in the product. This update includes the deprecation of B31.11, which is now included in B31.4. Along with this large code update, the software now aids the analyst in evaluating pipelines even further by providing an option to either let the software determine the restrained or unrestrained state of the pipe elements automatically, or the ability to specify the state themselves.

Other code updates include support for the 2015 edition of the Canadian code Z662 for Oil and Gas Pipelines, the 2016 edition of API-560 for Fired Heaters, the 2016 edition of the ASME B31.1 code for Power Piping and the 2016 edition of the ASME B31.5 for Refrigeration Piping and Heat Transfer Components.

Intergraph Corporation Pty Ltd

www.intergraph.com/global/au/

COMPACT TRANSIT TIME SENSOR

With a housing size of only 22 x 32 x 12 mm and a large working range of up to 1000 mm, the Wenglor WinTec P1KY001 is suitable for applications where fast object detection is required in tight spaces.

Despite its small size, the transit time sensor offers many features allowing it to be used in complex automation applications. It is suitable for applications in automated small parts warehouses, the automotive industry, logistics, cold storage facilities and the woodworking industry.

The sensor is equipped with Wenglor's interference-free technology, WinTec, which detects all objects at a switching frequency of 1 kHz. It quickly detects edges and black or glossy objects with high precision, even at very inclined positions.

The high-performance triple dot laser offers protection against reciprocal influence, allowing sensors to be installed directly next to each other. The sensors work every time, even in extreme temperatures from -40°C to 50°C.

The product features two switching outputs (antivalent) and a 270° potentiometer, ensuring the sensor is user-friendly. The LED display provides information regarding power supply, switching status and error diagnostics, informing the user if the sensor may be contaminated, incorrectly mounted or not properly adjusted to the object.

Treotham Automation Pty Ltd

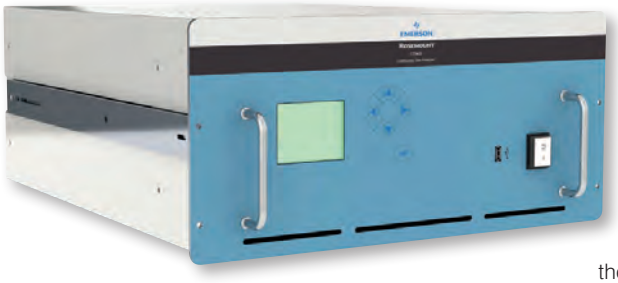
www.treotham.com.au

GAS ANALYSER

The Emerson Rosemount CT5400 continuous gas analyser combines tunable diode laser (TDL) and quantum cascade laser (QCL) technologies within the same analyser, and uses a patented 'laser chirp' to provide near-instant high-resolution spectroscopy to detect and identify a range of molecules in both the near- and mid-infrared range of spectroscopic light with an enhanced dynamic range from sub ppm to percent levels.

Traditional process gas analysers requiring continuous calibration and verification, and single laser-based systems are often limited to measurement of one or two components. The modular and scalable design of the CT5400 can incorporate up to six high-resolution laser modules and can detect, measure and monitor up to 12 critical components simultaneously, eliminating the need for multiple analysers and sample handling systems.

The CT5400 rack-mount analyser is designed for process applications, DeNOX/SCR, ammonium nitrate precursors, continuous emissions monitoring systems (CEMS) and continuous ambient monitoring systems (CAMS).



Sharing many of the same measurement principles as the recently released Rosemount CT5100 analyser, which comes in a ruggedised Class 1 enclosure for hazardous area installations, the CT5400 is a cost-effective alternative for plants with an existing shelter or safe area application.

Sub-second measurements give operators the ability to make adjustments to their processes and avoid costly upsets that can develop into emergencies. The measurement is direct rather than inferred, improving accuracy and eliminating the need for frequent calibration.

Emerson Process Management Aust P/L
www.emersonprocess.com.au

HYGIENIC CONNECTOR

The Han F+B connector meets the demanding and stringent hygiene standards in the food and beverages industry. Its easy-to-clean housing design meets the requirements and conditions in splash zones (Zone 2). The housing design features large radii and smooth surfaces in keeping with the principles of the EHEDG guidelines. As a result, so-called dirt pockets and the potential bacterial load on the connector are avoided.

The connector is designed with IP69K protection for the permanent, durable protection of the electric connections, including in scenarios involving daily high-pressure or steam cleaning. The plastic material is a PP plastic that is resistant to ECOLAB-certified cleaning agents and has also obtained FDA 21 approval.

The variety of possible inserts enables the transmission of data, signals or power. Consequently, the connector offers increased flexibility in the planning and design of modern systems when compared with hardwired systems.

HARTING Pty Ltd
www.harting.com.au

SEALED KEYBOARD

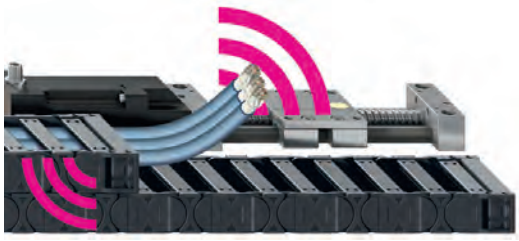
Interworld Electronics has released the BLTX sealed full travel keyboard. The BLTX features 83 keys with an integrated touchpad. Its full travel mechanical keys provide a tactile feel similar to a standard keyboard while a sealed membrane beneath the keys provides IP65 protection from dust and liquids. Drainage holes are provided to prevent liquids from collecting under the keys and to facilitate cleaning. Red LED backlighting makes the BLTX suitable for use under low ambient light conditions.

The BLTX is constructed from tough industrial-grade materials. Polybutylene terephthalate (PBT) plastic is used for the key caps to maintain a surface texture that will not become worn and shiny. The keyboard legend is printed by a sublimation process and will not collect surface oil and dirt.

The small footprint BLTX keyboard measures 304.3 x 196.3 x 32.7 mm and can be used where space is limited. Anti-slip rubber feet provide stability for desktop use while rear VESA mounting holes allow the keyboard to be securely mounted for mobile applications.

The BLTX sealed full travel keyboard is designed for industrial, engineering, laboratory, low light and mobile vehicle applications.

Interworld Electronics and Computer Industries
www.ieci.com.au



INTELLIGENT ENERGY CHAINS

Treotham supplies a range of igus cables, energy chains and linear bearings with added intelligence and networking to enable industry 4.0. During ongoing operation, they detect the degree of wear and emit an alarm as soon as repair or replacement is necessary.

Users can increase reliability and plant availability, minimise downtime and reduce costs through condition monitoring and predictive maintenance. Through extensive testing, igus is able to accurately predict the service life of its motion plastics. igus plastics are self-lubricating and maintenance-free, as well as lighter, hard wearing and energy efficient.

The isense products from igus includes diverse sensors and monitoring modules, while networking with the igus Communication Module (icom) enables direct integration with the user's IT infrastructure or the igus data cloud.

Data can also be optionally shared with the igus data centre, opening up possibilities for customer service life calculation and optimisation of business processes.

Treotham Automation Pty Ltd
www.treotham.com.au

IO-LINK MASTER

The Allen-Bradley ArmorBlock IO-Link master stores up to 40 timestamps of sensor events on each channel. This event history can help users track changes and more easily diagnose issues. Input timestamps of all sensor data also can be sent to the controller upon a change of state. It is claimed that these and other diagnostics available through the device can reduce issue resolution time by as much as 90%, improve preventive maintenance and optimise overall system performance.

While the ArmorBlock IO-Link master is ruggedised for use in harsh applications, the Rockwell Automation portfolio also includes an in-cabinet solution for light applications. The on-machine option requires only a single cable from the cabinet, reducing the number and length of cable runs and potential failure points.

The ArmorBlock IO-Link master includes connectivity for up to eight IO-Link sensors. The master and sensors share an IP address, helping end users reduce the cost and time to commission equipment.

Rockwell Automation Australia
www.rockwellautomation.com.au

VIBRATION TRANSMITTERS

Wilcoxon Research vibration sensors include an accelerometer and vibration transmitter combined in a rugged housing for cost-effective continuous vibration monitoring. They provide a 4–20 mA output signal proportional to the overall vibration level.

The vibration sensors are easy to set up and can be used to send vibration data to existing PLC or DCS systems that also process other data such as pressure or temperature. This enables the user to perform simplified condition-based maintenance on machinery without the investment and learning curve associated with traditional vibration monitoring systems with data collection boxes and custom software.

The high compatibility of these vibration sensors has made them widely implemented in industries such as pharmaceuticals, food and beverage, water and wastewater, petrochemical, pulp and paper, and power generation. Generally, they are installed for the vibration monitoring of pumps, motors, fans, cooling towers, compressors and gearboxes. Applying predictive maintenance techniques to these operations and machines can result in significant reductions in maintenance expenses, increased uptime and improved safety.

Bestech Australia Pty Ltd
www.bestech.com.au

ETHERNET SWITCH

Belden has announced its latest switch in the OCTOPUS family from Hirschmann — the OCTOPUS 8TX-EEC. The 8-port, unmanaged ethernet switch is a compact, easy-to-implement device that enables reliable data transmission and increases IT security through its configurable feature set.

Not all industrial applications require extensive, powerful networking devices, so the OCTOPUS 8TX-EEC switch was designed to offer a simple, cost-effective device that can still provide reliable, secure data transmission under extreme conditions.

For engineers, system integrators and machine builders running smaller industrial networks, the OCTOPUS 8TX-EEC provides a simple-to-install and space-saving solution for specific application needs. Due to its ruggedised metal housing, the OCTOPUS 8TX-EEC not only performs well in the transportation industry, but also in general manufacturing, machine building and automotive applications.

With an IP67/65 rating, this compact solution can easily be mounted anywhere, without the need for protective cabinets. The switch can also withstand harsh conditions, including dirt, dust, vibrations and water, as well as extreme temperatures.

Belden Australia Pty Ltd
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Infinity in a grain of sand

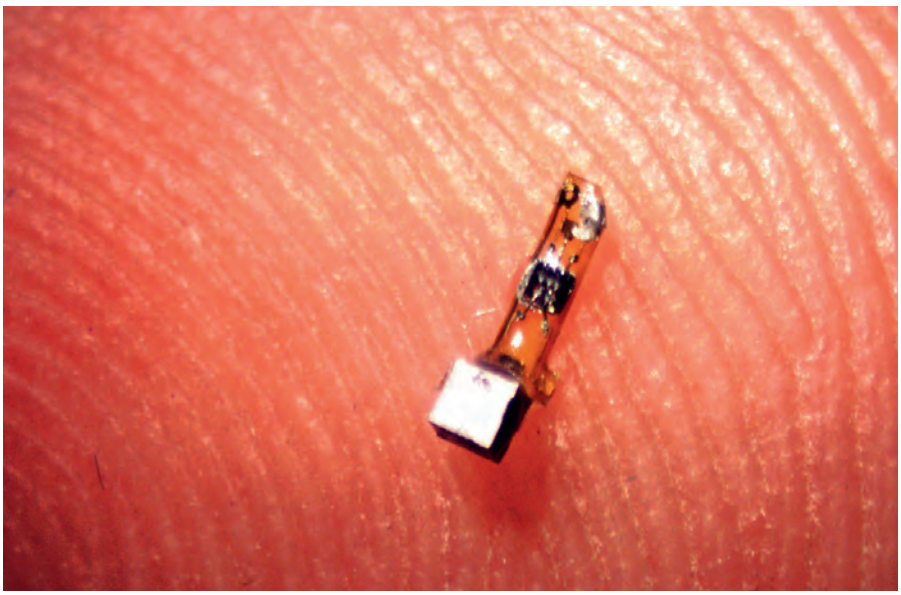
Imagine tiny wireless sensors the size of a grain of sand that can be implanted in the human body to monitor nerves, muscles and organs in real time. Sounds like something from the movie *Honey, I shrunk the kids*, right?

Well, they're already here: engineers from the University of California, Berkeley recently created these batteryless sensors, opening the door to 'electroceuticals' — an emerging field in which these devices are used to treat disorders like epilepsy, stimulate the immune system or reduce inflammation by stimulating nerves and muscles.

The research team implanted this 'neural dust' into the muscles and peripheral nerves of rats to test out its capabilities. It is unique in that ultrasound is used to both power the devices and read out the measurements. Ultrasound technology is already well developed for hospital use, and ultrasound vibrations can penetrate nearly anywhere in the body, unlike radio waves, the researchers said.

"Having access to in-body telemetry has never been possible because there has been no way to put something supertiny superdeep. But now I can take a speck of nothing and park it next to a nerve or organ, your GI tract or a muscle, and read out the data," said Michel Maharbiz, an associate professor of electrical engineering and computer sciences and one of the study's two main authors.

Maharbiz, neuroscientist Jose Carmena, a professor of electrical engineering and computer sciences and a member of the Helen Wills Neuroscience Institute, and their colleagues reported their findings in the journal *Neuron*.



The sensors, which the researchers have already shrunk to 1 mm^3 (about the size of a large grain of sand), contain a piezoelectric crystal that converts ultrasound vibrations from outside the body into electricity to power a tiny, onboard transistor that is in contact with a nerve or muscle fibre. A voltage spike in the fibre alters the circuit and the vibration of the crystal, which changes the echo detected by the ultrasound receiver, typically the same device that generates the vibrations. The slight change, called backscatter, allows them to determine the voltage.

In their experiment, the UC Berkeley team powered up the passive sensors every 100 µs with six 540-nanosecond ultrasound pulses, which gave them a continual, real-time readout. They coated the first-generation motes — 3 mm long, 1 mm high and 0.8 mm thick — with surgical-grade epoxy, but they are currently building motes from biocompatible thin films which would potentially last in the body without degradation for a decade or more.

While the experiments so far have involved the peripheral nervous system and muscles, the neural dust motes could work equally well in the central nervous system and brain to control prosthetics, the researchers said.

"The original goal of the neural dust project was to imagine the next generation of brain-machine interfaces, and to make it a viable clinical technology," said neuroscience graduate student Ryan Neely. "If a paraplegic wants to control a computer or a robotic arm, you would just implant this electrode in the brain and it would last essentially a lifetime."

In a paper published online in 2013, the researchers estimated that they could shrink the sensors down to a cube 50 microns on a side — about half the width of a human hair. At that size, the motes could nestle up to just a few nerve axons and continually record their electrical activity.

The team is working now to miniaturise the device further, find more biocompatible materials and improve the surface transceiver that sends and receives the ultrasounds, ideally using beam-steering technology to focus the sound waves on individual motes. They are also working to expand the motes' ability to detect non-electrical signals, such as oxygen or hormone levels. Maharbiz and Carmena conceived of the idea of neural dust about five years ago, but attempts to power an implantable device and read out the data using radio waves were disappointing. Radio attenuates very quickly with distance in tissue, so communicating with devices deep in the body would be difficult without using potentially damaging high-intensity radiation.

Maharbiz hit on the idea of ultrasound in 2013. "Our first study demonstrated that the fundamental physics of ultrasound allowed for very, very small implants that could record and communicate neural data," said Maharbiz. He and his students have now created that system. "Ultrasound is much more efficient when you are targeting devices that are on the millimetre scale or smaller and that are embedded deep in the body," said Seo.

A longer and more detailed version of this article can be read online at: http://bit.ly/2d09FSr

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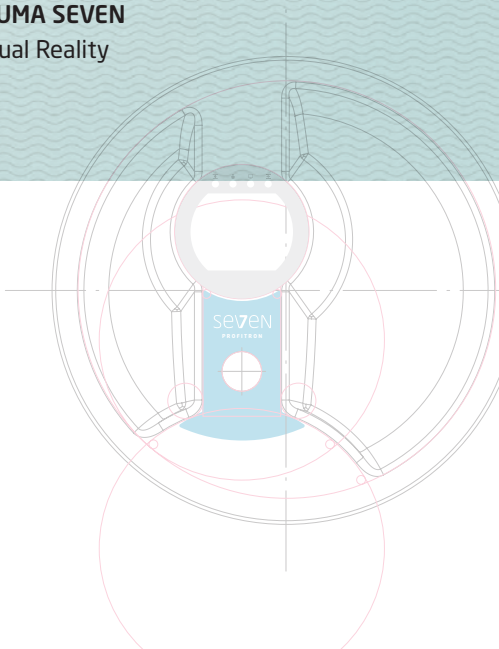

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AS I SEE IT

WORKFORCE EDUCATION IS A SHARED RESPONSIBILITY

It is widely agreed that for Australian manufacturing industries to survive and prosper in the global economy we need to continuously work smarter and invest in new technologies and automation in order to create flexible manufacturing processes with increased efficiency. Companies that want to invest in the factory of the future need to invest in connected technologies and big data analytics — often referred to as Industry 4.0 or the Industrial Internet of Things.

With the increase in automation, many unskilled jobs will start to disappear and the workforce will be required to understand and react to what smart machines require. In the factory of the future, an operator's skill set will shift more towards that currently required by technicians. This enhanced skill set will enable businesses to increase productivity and proactively exploit niche markets. While a skills gap may not be evident today in many businesses, a combination of rapid advancement in technology and changing demographics — with the baby boomer generation approaching retirement — will surely place a spotlight on this issue in the near future.

Developing a highly skilled workforce that is able to adapt to the fast pace of technological change should be a priority for progressive businesses in Australia. Given an investment in new equipment, even highly skilled experienced workers cannot immediately adopt new technology without assistance and training. Investment in the worker to develop the skills to fully understand the potential gains, and to exploit the equipment to achieve the desired increases in productivity, goes hand in hand with the investment in the technology itself.

While government-funded training incentives such as the Industry Skills Fund are available to assist with the digital disruption, it is vital that progressive businesses in Australia recognise and prioritise the investment required to equip their own workforce with the skill set required for the factory of the future. Simultaneously, it is also incumbent on the suppliers of the technologies to recognise that the adoption of the new technologies will advance only with deeper understanding of the benefits that can be realised.

Suppliers must recognise that the product itself is only part of the solution and in many cases will not be adopted until the market is ready to recognise the value of the solution on offer. To increase acceptance of new technologies, suppliers need to work closely with customers and even competitors to ensure that Australian manufacturers are in a position to recognise, accept and embrace the long-term benefits of increased revenues and efficiencies that can be derived from the investment. In many cases this sharing of knowledge will not give an immediate return but can be considered as a longer-term investment in order to develop the appropriate market conditions.

It is paramount, however, for all to recognise that education for the current and future workforce is a shared responsibility for both the suppliers and users of technology, as well as educators. To contribute to an efficient, thriving manufacturing sector, suppliers must be open to share their expertise — and in turn, manufacturers must be open to recognise and accept the support on offer. If we are to survive and prosper in the global economy we need to work together to give Australian industry the competitive advantage that in the long term benefits everyone.

Jim Wallace is the Marketing Manager at Balluff Australia. During his 18 years at Balluff Australia and previously in the UK he has specialised in RFID systems and connectivity systems solutions as well as various sensing technologies.

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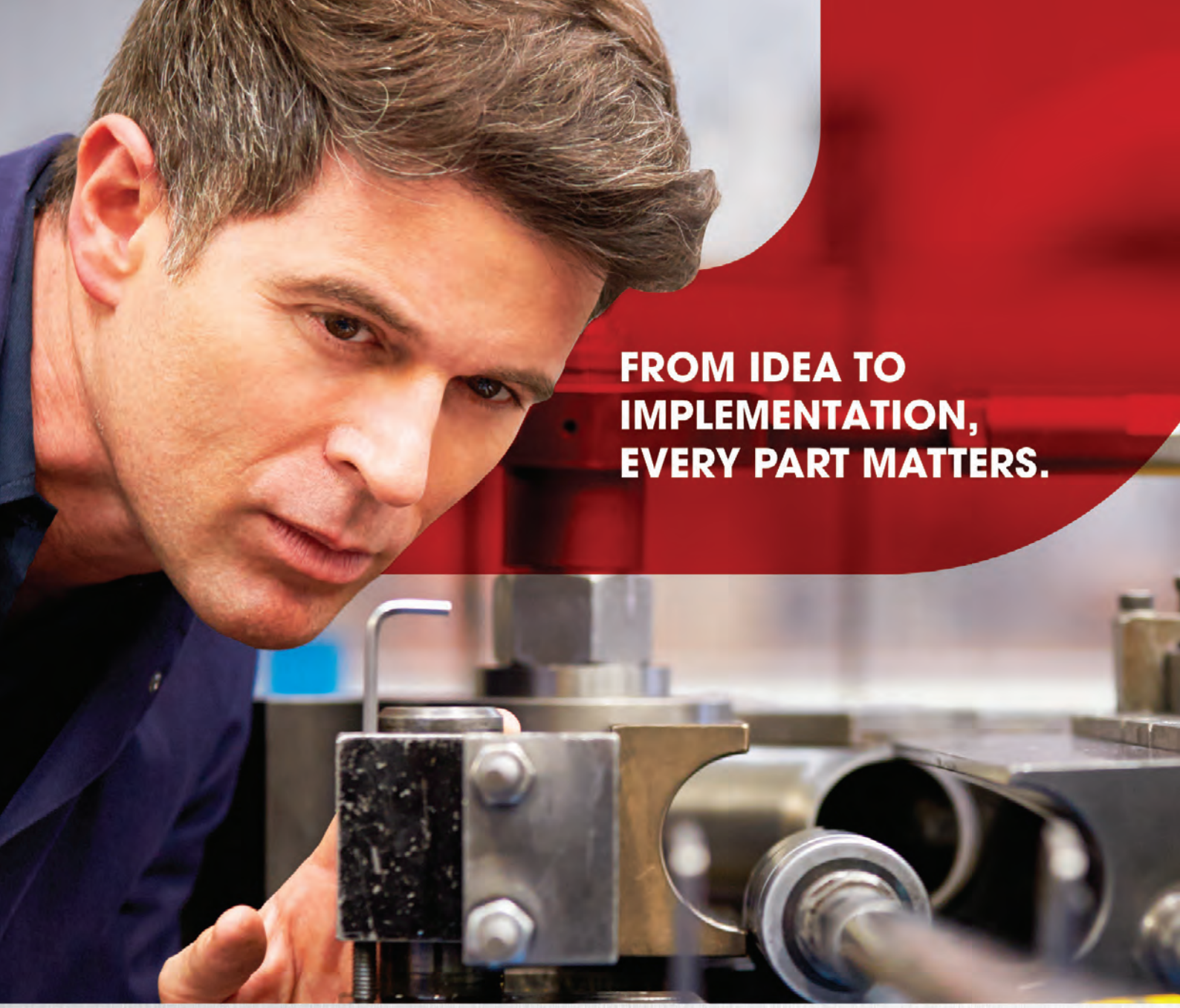

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