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WHAT'S NEW IN PROCESS TECHNOLOGY

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WHAT'S NEW IN
PROCESS TECHNOLOGY
AUGUST 2016

CONTENTS

4 The digital twin

8 New products

10 Hot products online

22 Safeguarding robotics in packaging applications

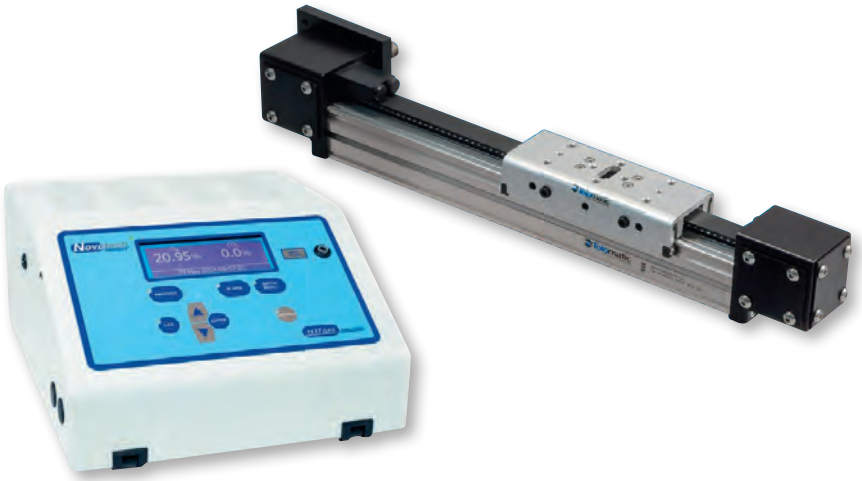
28 Embedded safety drives and networks

32 Digitalisation in the water industry

36 Water storage tanks

45 Conveyor rollers with the smarts

50 Industrial Internet of Things — the next big thing?



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ON THE COVER

Pressure gauges have been serving the industry since their invention more than 160 years ago. These mechanical gauges offer relatively good measurement at a low price. However, they routinely fail, provide unreliable information and cause concern for plant operators. Important maintenance decisions made based on readings from these gauges may compromise plant safety and productivity. In 2016, Emerson finally gives the century-old device an upgrade!

The Rosemount Wireless Pressure Gauge has a robust design that resists common failures, delivers reliable information about plant equipment and continuously informs users of its status locally via a large, 114 mm dial and LED diagnostic indicator, and remotely via wireless communication.

Industry-proven sensor technology provides overpressure protection and multiple layers of process isolation for improved safety and reliability and delivers up to 10 years of maintenance-free operation.

Digital electronics confirm proper gauge operation through local status indication and *Wireless*HART technology delivers reliable field data communications as frequently as once per minute. A full range of process connections is available, including male-NPT, DIN with manifolds and remote seals, factory assembled and leak tested. Modern advances in pressure gauge technology provide a number of advantages for use in demanding process plant applications. To learn more, download the white paper at http://emr.sn/zW1b.

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

EMERSON

THE DIGITAL TWIN

REVOLUTIONISING THE PRODUCT AND THE PROCESS

Glenn Johnson, Editor

The Industry 4.0 evolution will not be possible without a number of technological breakthroughs, not least of which is the successful realisation of the digital twin and the threads that connect it to the physical world.

We are all familiar by now with the plethora of press and publicity surrounding the Industry 4.0 concept, alternatively referred to as the Industrial Internet and the Industrial Internet of Things (IIoT). While many would say these terms are not strictly equivalent, there is certainly much press linking them as being so. While the IIoT is more an extension of the IoT network concept of the commercial world, the first two terms are more central to the idea of industrial systems and manufacturing — and are both centred on the concept of cyber-physical systems.

The concept of a cyber-physical system is in itself very interesting and presents some interesting future possibilities, aside from the utilitarian purpose of business efficiency and competitive advantage for manufacturers. The concept represents the integration of computing, networking and physical processes, in which computers and networks monitor and control physical processes with feedback loops by which physical processes affect computations and vice versa. The cyber-physical system concept is not limited to manufacturing but extends to many other aspects of life and business, including communications, health care, transportation, energy and consumer goods.

Central to the idea of cyber-physical systems in relation to manufacturing (and perhaps in other areas too) is the concept of the digital twin.

The digital twin

The digital twin concept is not new. While the term was first coined by the Defense Advanced Research Projects Agency (DARPA) many years ago, it was first clearly conceptualised by Dr Michael Grieves at the University of Michigan in 2003 in his executive course on product lifecycle management (PLM) — although he called it the 'virtual twin'. In the years that have followed, the technology supporting both the manufacturing of physical product and the development and maintenance of the virtual twin has grown exponentially. In relation to manufactured products, virtual twins are digital representations of the products that are virtually indistinguishable from their physical counterparts. The development of 3D computer-aided design (CAD) and computer-aided manufacturing (CAM), as well as operational technology data systems that collect detailed manufacturing information — such as manufacturing execution systems (MES) — has resulted in a wealth of data collected and maintained on the production of the physical products. The data collection is now being collected by a wide range of sensors, lasers, vision systems, etc.

As a digital model of a particular asset, the digital twin includes design and engineering details describing its geometry, materials, components and behaviour, as well as the as-built and operational data unique to the specific physical asset.

Digital twins provide a way to model and manage the complexities inherent in many products today. Many products now have embedded software and therefore processing capability within them, are customisable and require complex manufacturing processes, supply chains and extended value chains to design, develop, produce and service. Automobiles are perhaps the best example. Virtually modelling a product helps companies avoid costly product quality issues or manufacturing rework because manufacturing and performance variables can be modelled before they occur. Digital twins can therefore help manufacturers make their products right the first time, without failures and recalls. Not only that, they help development and support teams to share the same knowledge about the product, regardless of location.

But perfect production, while highly desirable, is not the end goal. According to Grieves, "it is timely to explore how the Virtual Twin can move from an interesting and potentially useful concept that aids in understanding the relationship between a physical product and its underlying information to a critical component of an enterprise-wide closed-loop product lifecycle. These tasks will both reduce costs and foster innovation in the manufacture of quality products".[1]

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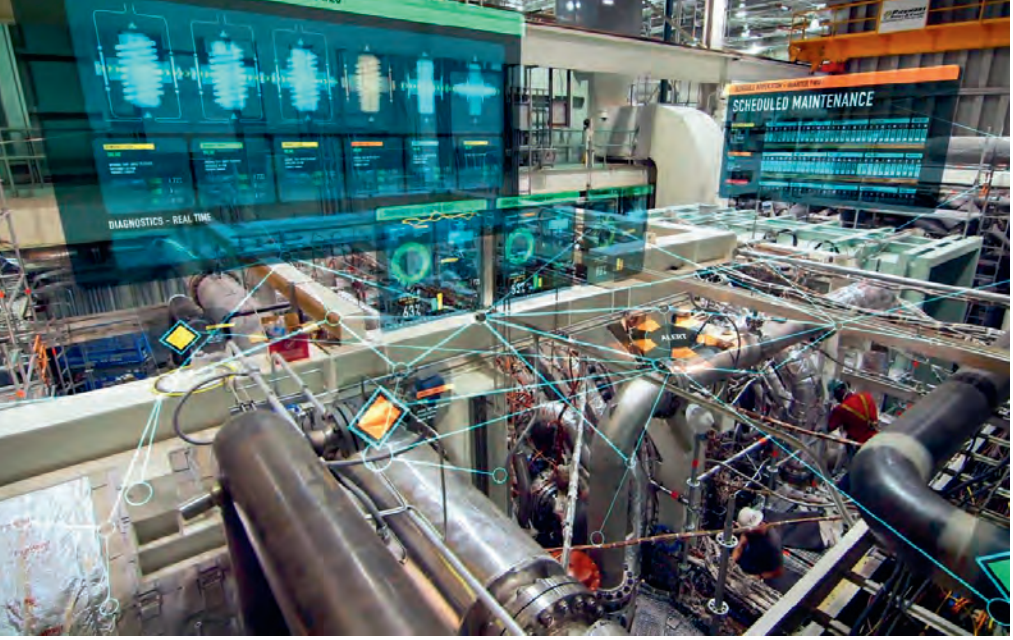


Image source: GE Reports

The linking thread

From a visionary perspective, the ultimate goal in the development of a product is to have sensing in the product itself, which feeds data back to its digital twin over the lifetime of the product, helping to inform future product improvements and to predict potential failures and future maintenance. General Electric and the Industrial Internet Consortium have referred to this concept of the linking of the digital twin with its physical counterpart as the digital thread.

The digital thread refers to the communication system that allows a connected data flow and integrated view of the asset's data throughout its life cycle. The ability to connect the physical product with its digital twin via a digital thread could be seen as the Holy Grail of PLM — the process of managing the entire life cycle of a product from inception, through engineering design and manufacturing, to service/maintenance and disposal.

CAD and PLM software vendors are keen on the concept and its benefits, and believe that a digital twin can deliver efficiencies to the design and production processes, improve product quality and innovation, and foster better serviceability of products, ultimately benefiting customers.[2]

High-flying vision

Some of the most visionary concepts involving digital twins have come from the research of NASA and the US military. An extreme but interesting example of the digital twin vision was presented in the *International Journal of Aerospace Engineering* in the form of a hypothetical aircraft developed for the US Air Force.[3] In the article, the example describes the USAF taking delivery of a physical aircraft along with two digital twins. The first digital twin is a 1000 billion degree-of-freedom (DOF) hierarchical, computational structures model of the aircraft that "is ultrarealistic in geometric detail, including manufacturing anomalies, and in material detail, including the statistical microstructure level, specific to this aircraft tail number". This twin can be virtually flown in simulated real time on a high-performance computer, accumulating usage damage according to physics-based simulations. This testing identifies any unexpected failure modes so that repairs, redesigns and retrofits can be implemented on the physical aircraft before its first flight.

The second digital twin is linked to an actual structural sensing system installed on the physical aircraft:

"This sensor system records, at high frequency, actual, six-DOF accelerations, as well as surface temperature/pressure readings during each actual flight." This data is used as input to the digital twin and "this model itself becomes a virtual sensor, interpolating sparse acquired data over the entire airframe."[4] The twin model is periodically updated to reflect actual usage of the aircraft on real missions and updates reliability estimates for all primary structural components.

While this example may seem like science fiction (the data from a single flight for one hour alone would result in a petabyte of data), the authors state that even if only a portion of this idea is realised, "the improvements in structural life prediction will be substantial".

Twinning the process

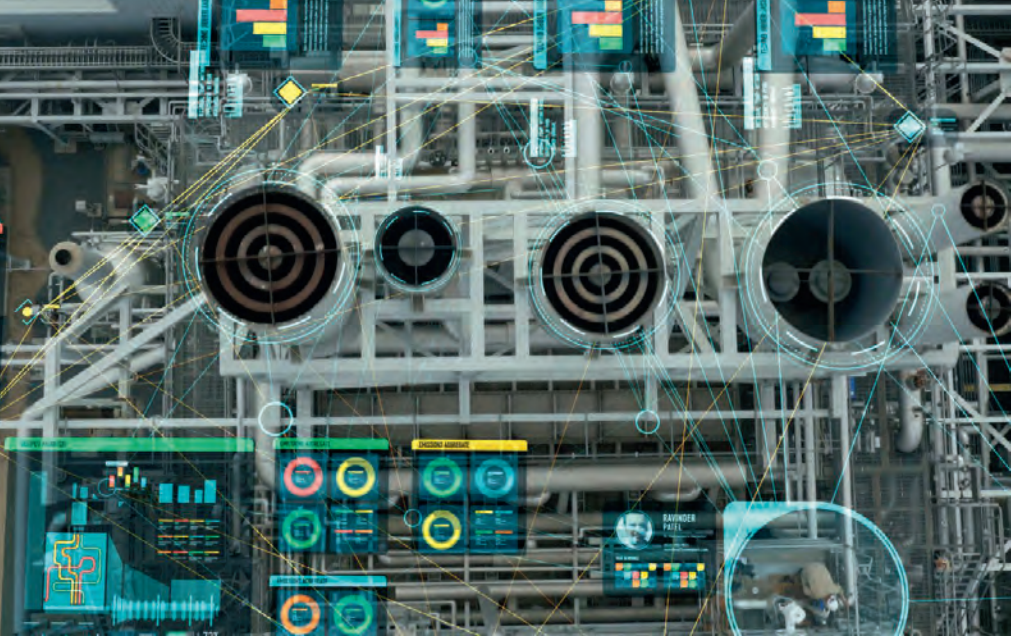
The digital twin concept in relation to the design and manufacture of a product is certainly feasible, but the full life cycle twin concept as described above may yet be some way off, except in the most simple of examples. However, the concept of a digital twin of the manufacturing process itself is not so far-fetched, given that modern automation systems are already capable of providing a wealth of information. The creation of a digital twin of the entire production system opens up new ways to improve productivity. Like any other product or device, production machines and even entire facilities can have a digital twin. Modelling the production line for a product works in harmony with the modelling of the product, and the wealth of data that comes back from manufacturing execution systems can be used to enable the feedback loop between the physical plant operation and the virtual representation in real time.

Extending the digital twin concept from product to production also opens up the idea of digital twins enhancing the operation of continuous processes as well, and not just discrete product manufacturing. A good example is the work done at GE Global Research on creating a digital twin of a sewage treatment process.[5]

The research team first installed chemical sensors inside a sewage plant and then built cloud-based algorithms to mimic the biochemical processes inside the plant. The team is using biochemical and physical simulations as the first step in creating a digital twin. Using the digital twin, the team expects to discover hidden patterns in plant operation, anticipate the amounts of sewage coming in and calibrate the oxygen level needed. Eventually the digital twin would not only alert plant operators to a problem, but identify what portion of the plant is most likely the cause and reduce response times for repairs. Early warning and rapid response in such cases would save plant operators from paying costly fines and ensure cleaner waterways for communities.

Supporting human processes

According to Grieves, the virtual twin concept aligns well with three important aspects of how humans work with knowledge: conceptualising, comparing and collaborating.



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Conceptualising

Virtualising a concept and presenting it visually allows human beings to better visualise a concept, problem or solution.

"Unlike computers, humans do not process information, at least not in the sense of sequential step-by-step processing that computers do. Instead, humans look at a situation and conceptualize the problem and the context of the problem... While they can do this looking at tables of numbers, reports, and other symbolic information, their most powerful and highest bandwidth input device is their visual sight."[6]

Instead of looking at a report and trying to mentally visualise how the process is operating, viewing a digital twin representation will allow people to 'see' the actual process along with relevant information about the physical product, eliminating the counterproductive mental steps in which misunderstandings can occur.

Comparing

In assessing situations, we tend to compare our desired outcome with the actual result and try to find ways to eliminate the difference. When the desired detailed information is separate from the physical product information, we can compare, but it is inefficient. "With the virtual twin model, we can view the ideal characteristic, the tolerance corridor around that ideal measurement, and our actual trend line to determine for a range of products whether we are where we want to be. Tolerance corridors are the positive and negative deviations we can allow before we deem a result unacceptable."[7]

Using visual models, whether it be for the final product or the manufacturing process itself, we can not only directly and visually conceptualise what is going on, but have instant visual comparison information at the same time. We can instantly see 'where we are' and compare it with 'where we want to be'.

Collaborating

Collaboration is the most powerful thing that we do — allowing us to bring more perspectives and knowledge to problem-solving and innovation.

The advantage proffered by a digital twin is that it "allows a shared conceptualization that can be visualized in exactly the same way by an unlimited amount of individuals and by individuals who do not need to share the same location."[8]

It has been common over the years for factory managers and operators to have their office overlooking the factory so that they could see what was going on. A digital twin of a manufacturing process allows everyone associated with the process to be able to see it, from anywhere, without having to be physically present at the plant.

Conclusion

The digital twin is a means by which we can merge the virtual product or process with how the actual product or process manifests, making it possible to have a real-time perspective on how the manufactured product is meeting its design specification goals or how the process is functioning within desired tolerances and measures of efficiency. Still further, it will be possible in the future to have a physical product communicate with its digital twin throughout its life cycle, enhancing product development, maintenance and customer service.

However, there is still a long way to go in making the digital twin concept a reality in all the aspects mentioned above. While there have been great advances in product modelling at the design phase, and in the modelling of physical production processes (both continuous and discrete), the connection between the model and the physical process still in most cases lacks the digital thread tying them together. One of the many goals of Industry 4.0 is to make the benefits of digital twins a reality. The plethora of information available in modern manufacturing and process plants lends itself well to this goal — it is now necessary to invest in the networking and data infrastructure to create the digital threads that will bind the virtual world of the product and the process data to their physical counterparts.

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ibid.project activities

MULTIFUNCTION I/O MODULES

Acromag has expanded its BusWorks XT Series of Ethernet I/O modules to include models with multiple I/O functionality.

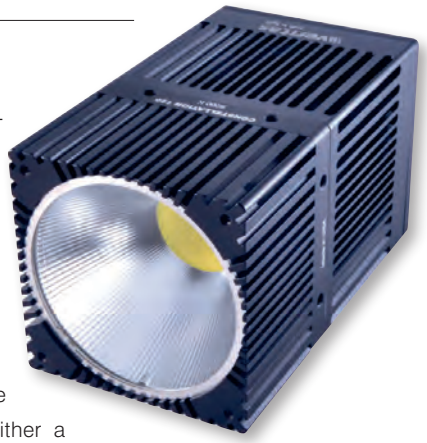
The BusWorks XT Series is a rugged, flexible line of Ethernet I/O modules that features channel versatility with housing to reliably withstand harsh industrial environments. Rugged construction, high density design and USB programming make these instruments suitable for many applications including remote monitoring, distributed control and SCADA.

Each module processes I/O signals on up to 16 channels and features dual Ethernet ports, as well as pluggable front-facing terminals, for more convenient wiring. Users can choose to interface signal devices on any of three different protocols: Profinet, EtherNet/IP and Modbus/TCP with i2o peer-to-peer. This arrangement allows the daisy-chaining of modules to simplify installation and minimise switch requirements to reduce cost.

Model XT1530 is a multifunction Ethernet I/O module with 4-channel analog current output, 4-channel discrete I/O and 12–32 VDC power. Model XT1540 is a multifunction Ethernet I/O module with 8-channel analog voltage output, 4-channel discrete I/O and 12–32 VDC power.

Metromatics Pty Ltd
www.metromatics.com.au

HIGH-SPEED ILLUMINATION LIGHTS



Veritas illumination lights are used for high-speed imaging applications and use LED technology coupled with multifunctional digital controls to achieve highly efficient illumination. The systems are compact and energy efficient, yielding high luminous outputs in both continuous and pulsed operation.

The illuminators can be used as stand-alone units or in multiples when combined with the LED Access Point and support operation in continuous or strobe mode. The Constellation luminaires are offered in either a 60 or 120 W configuration.

The Constellation 60 series comprises a 12-LED array designed to deliver maximum light output in an ultracompact and lightweight arrangement. Active cooling allows extended use and lensing provides uniform light distribution. The lights have compact construction and anodised surfaces for increased durability.

The Constellation 120 series provides a high-intensity luminous output (20,000 lm). Specially designed accessories such as an 8-leaf light shield, and flexible mounting options, make the light easy to deploy in a wide range of applications.

The Constellation 500Quad system combines four miniConstellation light heads into one package. 4″ spacing between the centres of each LED creates a symmetrical grid. The product is designed for use as a stand-alone unit or to be stackable in user-defined configurations.

SciTech Pty Ltd
www.scitech.com.au

PANEL PC

Advantech has launched two ultraslim, low-power, fanless touch panel PCs. The 10.4″ PPC-3100S and the 12.1″ PPC-3120S use the latest Intel Atom processor and have an easy-to-read diagnostics display.

These latest models have die-cast aluminium alloy enclosures with IP65 protection ensuring usage in tough environments without fear of knocks, water and dust ingress. To aid users, these PPC models also feature durable industrial LED panels with ELO 5-wire touch screens.

Intel's Atom Quad Core N2930 processor is its least power-consuming model yet. It also has four times the graphics performance and a 40% improvement on processing power compared to previous models, thus it works better and saves energy consumption.

These models employ a unique E-eye providing error information in an easy-to-read, two-digit code on the rear of the models. This new feature speeds up diagnostics and ensures that any downtime is reduced.

The PPC-3100S and PPC-3120S feature dual GbE LAN for redundancy, two serial ports and three USB ports to satisfy various simple industrial applications. With a wide range of DC power input support, the PPC-3100S and PPC-3120S will work stably between 15–24 VDC and have been FCC class B certified. They are also compliant with the EMC immunity, emission standards EN55011, 61000-6-2, and 61000-6-4 for industrial environments.

Advantech Australia Pty Ltd
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THE SPIRIT OF SAFETY

The safety gate system PSENmlock offers a safe interlock and safe guard locking device in one product. The latter is enabled by the dual-channel control of the guard locking. That makes the switch 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 3 sides for easily visible diagnostics and its mechanical robustness ensures a long service life.

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FLOW SENSOR UPGRADE

As part of its product development in the area of orifice plate, differential pressure flow sensors, Eletta has released simple methods for upgrading its existing flow devices.

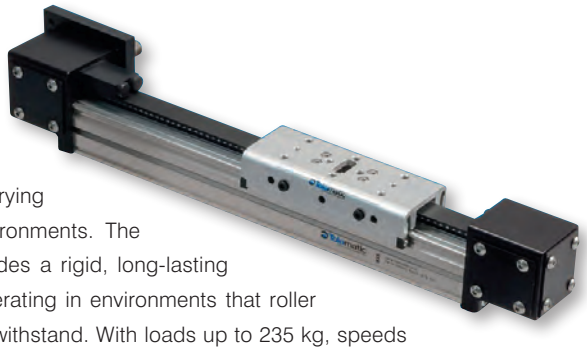
Without having to remove the threaded or (wafer) flanged pipe section from the line, the flow sensor can be upgraded by replacing the controller module. All new controllers have been designed reverse compatible and interchangeable with all existing Eletta pipe sections.

For sites with purely mechanical devices such as the V or S Series, this upgrade would allow the conversion of a simple flow switch (eg, V15-GL15 or S2-GL25) to an analog flow meter (eg, M3 Series) or self-contained digital flow totaliser with backlit display (eg, D Series).

On sites where technicians routinely check flow conditions by looking at the large dial gauge of their S Series flow switches, the company has created a Combi-Kit that allows the addition of a compact M3 Series 4–20 mA controller — providing a dial gauge reading with online process control signals.

Control Components Pty Ltd
www.controlcomponents.com.au

ELECTRIC ACTUATORS



Tolomatic's range of MXB electric belt-drive actuators includes a solid bearing load-carrying design suitable for harsh environments. The trapezoidal solid bearing provides a rigid, long-lasting bearing system capable of operating in environments that roller bearings would not be able to withstand. With loads up to 235 kg, speeds up to 2.54 m/s and strokes up to 5.8 m, the MXB-S belt-drive actuators are an economical solution for light- to moderate-loading applications requiring high duty cycle and high speeds over long strokes. The MXB-S actuator can withstand light washdown.

The MXB-S is available in six body sizes with inline motor mounts as well as reverse parallel mounts with 3:1 timing belt reductions. When paired with the ACS servo or stepper EtherNet/IP-enabled drive and motor package, or with third-party motor and drive utilising Tolomatic's Your Motor Here program, the MXB-S actuator is claimed to be easy to set up and integrate into many applications.

Pneumatic Products
www.pneumatics.com.au

ELECTROMOTIVE PROCESS VALVES

The Bürkert types 3360 and 3361 electromotive process valves offer precision control without the need for compressed air. The valves are designed as a complete unit and provide a robust, highly efficient solution suitable for process applications where reliability and precision are key factors. They are available with either a globe valve (Type 3361) for the highest precision or an angle seat valve (Type 3360) for more general applications.

The actuator can be specified with an HMI display module for configuring the valve settings, or for a more basic application, the HMI can be omitted and the fundamental functions of the valve can be operated via a series of four DIP switches and two buttons.

An optional feature ensures a safe valve position is achieved in the event of a power failure. The SAFEPOS energy pack allows the valve to be operated automatically to a predetermined position. The energy pack, with a nominal lifetime of 10 years, can be monitored through the network connection.

The control valve housing incorporates an illuminated LED ring which indicates the status and can be seen from any direction, and there is a mechanical position indicator which shows the exact valve position that still works in the event of a power failure.

A service connection enables the COMMUNICATOR software to configure the device, apply fault diagnosis and update software. There are also several fieldbus options for networking, such as EtherNet/IP, Modbus and Profinet, which are provided through the fieldbus gateway.

Burkert Fluid Control Systems
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INTELLIGENT PANEL METERS

The Camille Bauer SIRAX series measure voltage, current, power, energy, reactive power, THVD, THID and harmonics for single- and three-phase (both 3- and 4-wire) symmetric/asymmetric systems. The RS485 Modbus RTU/Ethernet (Modbus TCP) interfaces make the SIRAX series suitable for building and industrial load control. The instruments feature analog 4–20 mA and relay outputs as well as pulse outputs for external energy meters.

Camille Bauer SMARTCOLLECT data management software stores data in an SQL database, installable on individual systems or servers. The SIRAX instruments are IP20 rated, require the standard 96 x 96 mm cut-out and are Cat III 300 V, double insulated.

The SIRAX BM1200 basic model has an automatic cyclical parameter scrolling LCD display and is suitable for single- and three-phase, 3- and 4-wire systems. The SIRAX MM1200 has an icon-based TFT for operation via a touch screen.

Power Parameters Pty Ltd
www.parameters.com.au

COMPRESSOR

Southern Cross Compressors has added the 4.5 kW tank-mounted version to its Ganey Scroll series of orbital technology air compressor.

Designed to be ultra-quiet and energy efficient, the lightweight, high-output compressor offers a higher output than a conventional 5.5 kW, reciprocating, piston type.

With capacities from 4.5 to 7.5 kW, the Ganey range of advanced, lubricated, scroll technology compressors provides good energy efficiency with minimal moving parts.

The compact air compressors are vibration-free, quiet and reliable. Suitable for applications where low noise is a consideration, the dynamically balanced, non-contact orbital scroll results in ultra-quiet operation. Maintenance requirements are minimised as the unit is direct drive, meaning there are no drive belts to wear or need replacement.

Continuous load capability and an integral aftercooler delivers high-quality, clean air, while advanced control and monitoring technology provides simple, positive operation with built-in temperature and overload protection.

Southern Cross Compressor Technology Pty Ltd
www.sccompressors.com.au

DIN RAIL MOUNT HOUSING

OKW Gehäusesysteme has added a vertical DIN rail mount housing to its enclosure portfolio. Supplied complete with terminal blocks, it is suitable for DIN EN 60715 TH35 and features a clip-together design for fast assembly.

The CVB-Plus housing is a 22.5 mm-wide vertical DIN rail mount enclosure moulded in green self-extinguishing UL94-V0 flame retardant PA66. With solid and vented versions available, it features front and side label recesses and is supplied with four 4-pole 5 mm pitch pluggable terminal blocks yielding 16 poles within the width of the enclosure.

The product features spring-loaded clips that can be snapped into position to make the housing chassis- or surface-mountable. This added flexibility makes the versatile device useful in numerous electrical and electronic applications, including security, control products, energy management, embedded systems and HVAC.

The DIN rail mount housing incorporates two vertical PCB slots to ensure boards are held in place firmly and a development PCB is also available as an option. Specifications include 15 A, 300 V rated terminals with 20 mΩ contact resistance, 500 mΩ/500 VDC insulation resistance and ability to withstand 2000 VAC for up to 1 min. Pin headers are tin-plated brass.

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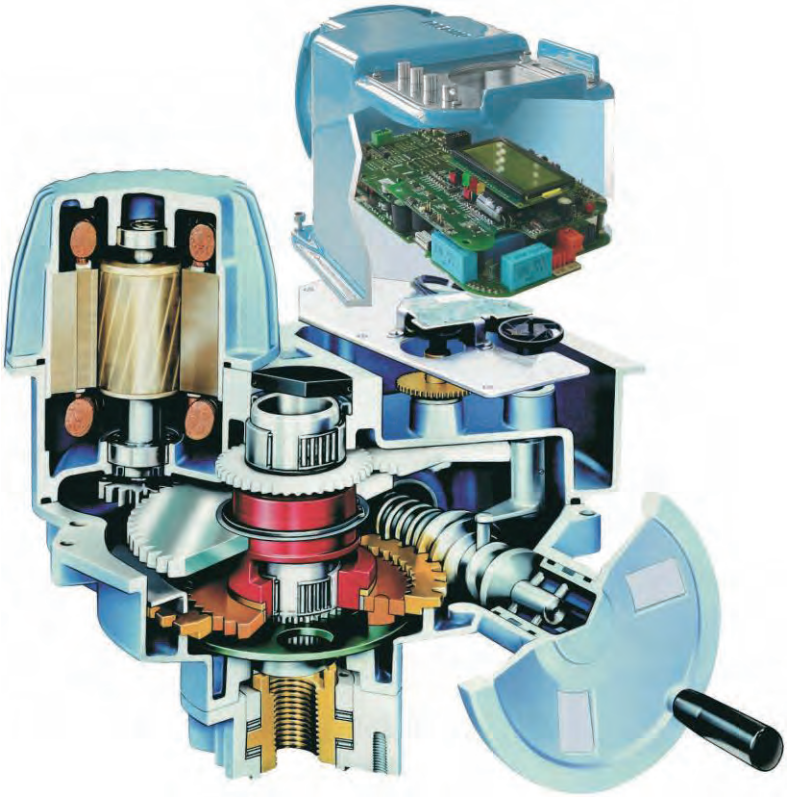
DREHMO
VALVE ACTUATORS

ANOTHER PREMIUM ACTUATOR PRODUCT FROM THE AUMA GROUP



Defining the limit as standard

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RFID SYSTEM

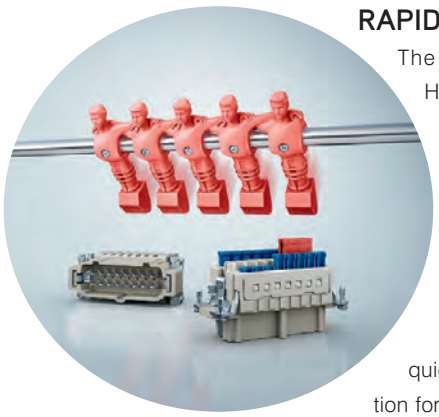
The RFU65x RFID is designed to enable a consistently transparent material flow. It detects tags at long range, recording the direction in which objects are moving at the same time. The associated user data can be sent directly to an ERP or MES system, reducing processing times and increasing production efficiency.

Identification and location solutions that combine maximum availability with a transparent material flow are vital for effective product traceability. Conventional RFID devices record RFID tags over long distances depending on sender power, aperture angle, tag properties and application environment. Until now, directions of movement could only be derived by using additional, external antennas and intelligent algorithms. With the RFU65x, both position and angle can be determined and direction of movement can be detected. Even tags which are moving in opposite directions at the same time can be detected and their directions of movement recorded.

The operating range of the unit covers an angle of ±45°, with a typical sensing range of up to 5 m. RFID tags are recorded below a certain measuring angle in relation to the zero point of the reader. Algorithms can be used to derive instances of passage — including the direction of movement — from the various measuring points.

Although objects with tags that are located in the immediate vicinity are identified, they are filtered out as 'static' tags and only used if required for diagnostic purposes.

SICK Pty Ltd
www.sick.com.au



RAPID TERMINATION DEVICES

The Han ES Press series is an expansion of Harting's Han E series and includes multifunctional connectors that employ plug-in jumper technology for rapid termination without tools, thereby providing significant time saving during assembly and increased process reliability. The termination of the conductor is based on cage clamp technology, which allows the simple, quick and vibration-proof assembly of conductors with or without ferrules.

This design means it is simple, safe, easy and up to 50% quicker to assemble connectors. In addition, due to zero insertion force (ZIF) capability, conductors can be easily pushed into the contact cavities, which can be closed with light finger pressure on the device's blue press button. There is also an audible and tactile snap-in for the press buttons and plug-in jumpers.

The series also provides plug-in jumpers, enabling multiple contacts to be bridged directly at the connector. This allows for rapid reconfiguration, as well as bridging star and delta circuits. All jumpers are plug-compatible with Harting's Han E, Han ES and Han ESS product families and are available in red, blue and black.

Available in 6-, 10-, 16- and 24-contact variations, they also feature an integrated opening for use with a measuring probe, current ratings of up to 16 A at 500 V with 6 kV impulse voltage and a minimum of 500 mating cycles.

RS Components Pty Ltd
www.rsaustralia.com

SOUND LEVEL METER

The Larson Davis SoundExpert LxT sound level meter is a full-featured meter designed for general product evaluation and noise-monitoring applications. The product comes with a graphic display and a fixed set of firmware options applicable for logging, metrics and octave band analysis, as well as 2 GB of internal memory. It is available as a general handheld meter or data acquisition tool and also in a short-term noise monitoring kit.

For short-term monitoring projects, the battery-powered device provides a simple noise-monitoring solution for periods less than two weeks. It is small, lightweight and easy to transport with a basic D-cell battery pack. Optional tripods and analysis software are available.

Applications include environmental noise monitoring, site assessment, attended noise measuring, product noise evaluation and production line acoustic testing.

Thermo Fisher Scientific
www.thermofisher.com.au

WHAT'S UP WITH DIRECTAUTOMATION

Productivity2000 adds new analog, thermistor and discrete modules, plus an new power supply.

Productivity2000 programmable controller line now includes

• New! ... for 2016

12-24 VDC / 24VAC Power Supply

Additional 8-pt,16-pt and 32-pt 12-24 VDC input modules (wider voltage ranges)

Thermistor input module,8-channel, 16-bit resolution

New 32-point, 24VAC/DC input module

Additional lower cost analog modules (without OLED display)

Remote I/O Expansion Module

New software features

The user-friendly Productivity Suite programming software, designed to allow quick and easy programming of ladder logic programs for the Productivity2000 is available as a free download at www.directautomation.com.au.

New C-more Micro touchscreen operator interface panel

Our new EA3-T6CL 6" C-more Micro touch panel has a 5.7-inch TFT LCD 320 x 240 dot display and a palette of 32K colors for customizing objects, screen backgrounds and displaying bitmap graphics.

Powered from a Class 2, 12-24 VDC power supply, it features three communications ports (USB programming, RJ12 and DB15) and an optional EA-ECOM module ad ds Ethernet port for programming / PLC communications.

Five user-defined function keys, each key with a user-defined red LED indicator.

In landscape orientation, the panel can display up to 40 lines by 80 characters of static text or up to 40 lines by 40 characters of dynamic text with embedded variables and phrases mixed with graphics; portrait orientation can display 53 lines by 60 characters of static text or 40 lines by 40 characters of dynamic text.

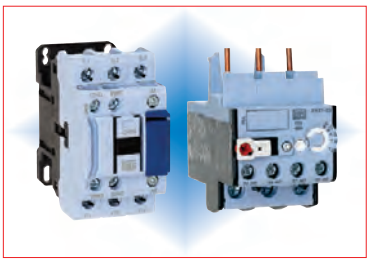
The 6" C-more Micro TFT panel is priced at $499.00 and is backed with a two-year warranty.

AutomationDirect adds Ethernet PLCs to CLICK® line

AutomationDirect has added Ethernet basic and standard PLCs to the CLICK line. The new PLCs are 3 to 10 times faster than the existing CLICK PLCs and are 100% upward compatible with the existing CLICK units. With 8 input points and 6 output points built in, CLICK Ethernet PLC units are available with 24 VDC or 120 VAC inputs and DC or relay outputs and can be used as a complete PLC system. Ethernet Basic PLC units (starting at $249.00) and Ethernet Standard PLC units (starting at $279.00) feature one built-in 10/100 Mbps Ethernet communications port for both programming and Modbus TCP networking, plus one standard RS-232 serial communications port; Ethernet Standard PLC units add an RS-485 port.

Additionally, CLICK Ethernet PLC units include a calendar/real time clock and battery backup for the internal SRAM; the battery, sold separately, allows data to be retained for five years. The Ethernet capabilities of these new CLICK units also allow for run time edits, which means edits to the ladder project can be downloaded while the CLICK PLC keeps running, an important addition to an already extremely practical PLC.

The new CLICK Ethernet PLC units are configured with the easy-to-use programming software, available as a free download.



DirectAutomation adds CWB Contactors

Direct Automation has added the new CWB contactors and overloads to the WEG switchgear line.

Developed according to IEC 60947 and UL 508 international standards, the new WEG CWB line of contactors meets the requirements of a wide range of industrial applications worldwide.

The contactors offer a compact solution because they are compact, 45 mm wide and available in up to 38 A (18.5 kW @ 400 V), CWB contactors lead to an overall reduction in size of electric panels if compared to traditional solutions of contactors with the same ratings.

DC Coils with no Inrush Pick-Up Current Low consumption D.C. coils allow direct control through PLCs without the need for coupler relays.

CWB Contactors range from 9 up to 38A and prices starting at $32.00

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*All prices are subject to change, orders will be accepted at the pricing ruling at the time of acceptance of orders and do not include GST.

Safety solved through trusted partnership

Nexeo Solutions is the largest global chemical and plastics distributor with a centralised business model. With operations worldwide, Nexeo Solutions offers over 27,000 products used in a broad cross-section of industries, including chemicals manufacturing, energy, paints and coatings, automotive, health care and personal care.

For Nexeo, traditional methods of managing a project meant contracting several different providers (outside engineering and programming, mechanical, electrical, purchasing equipment) in order to get a job done. Not only was this highly inefficient, this was also proving to be an issue with after-installation support and resulting in inconsistent programming updates.

As part of a 2-year HSSE initiative, Nexeo Solutions required an accurate, consistent and repeatable truck loading automation solution that could easily be implemented across its 26 sites. Because implementing this type of initiative across 26 sites was an immense task, Nexeo needed to find a way to better streamline its project management process. But, this task could not be taken on by any partner — Nexeo needed a trusted advisor that it could depend on for all of its project needs.

To ensure safe loading of hazardous and expensive products, Nexeo first required accurate and reliable process measurements such as flow and level but also a correctly designed and implemented control system that would ensure the safe and timely loading of raw goods. Nexeo also needed a solution that could decrease truck loading times while guaranteeing product quality for its customers.

However, Nexeo needed more than just instrumentation and process control — they needed a 'total turnkey solution' provider with a high level of expertise whom they could depend on to support their ongoing needs throughout the entire life cycle of the project.

By taking a team approach, Nexeo and Endress+Hauser project managers, engineers and contractors partnered to deliver a solution for truck loading, which included complete project management (including the general contractor role), embedded on-site engineering resources, start-up services and training, and around-the-clock support and troubleshooting.

To ensure best practices for the safe loading of expensive, flammable liquids into trucks, Endress+Hauser incorporated safe truck mass flow metering skids and truck overspill protection into Nexeo's loading process in order to mitigate any associated risks and increase efficiencies. Integration with a Rockwell Automation Allen-Bradley CompactLogix control system and PanelView was also included.

At Nexeo, safety is always the first priority. "We take great pride in constructing a safety-conscious culture," said Nexeo Solutions. "In selecting a solution provider, it was important we partnered with a business that shared these same values — Endress+Hauser truly lived and breathed the same culture so it just made sense."

Endress+Hauser fully integrated all scales, pumps, grounding and bounding, and high-level instrumentation with the necessary

emergency stops, pump shutdown and alarm to safeguard against any static discharge or overflow events during loading. New truck rack air ventilation systems were also upgraded and installed where needed resulting in improved working environments for operators while ensuring compliance.

From start to finish, Endress+Hauser project managers and engineers managed the entire project, serving as the general contractor role and single point of contact. Instead of Nexeo having to hire a project manager on its own to manage the job, which would have taken time and money, Endress+Hauser stepped in and supported the entire life cycle and all key components of the project — providing the highly skilled engineers, hiring and managing the contractors, procurement, design and fabrication, installation, overall engineering, start-up, commissioning, and even training Nexeo site operators on how to use the new equipment and processes put in place.

"What differentiates Endress+Hauser from all other providers is — not only did they have a large team of technical experts and engineers to provide Nexeo with additional horse power we wouldn't have had on our own, they truly have skin in the game," the director of engineering at Nexeo Solutions explained. "Endress+Hauser jumped in and was ready to problem solve and provided us with a solution that was unique to us."

By embedding the necessary Endress+Hauser engineering resources on-site, Nexeo was able to substantially reduce project overhead costs, speed up the project timeline resulting in faster time to market, mitigate risks and increase efficiencies by quickly responding to day-to-day hurdles and adapting to change.

Endress+Hauser Australia Pty Ltd
www.au.endress.com

MULTIFUNCTION GATE DEVICE

The Euchner Multifunctional Gate Box (MGB) is a safety system with guard lock monitoring for the protection of safety doors on machines and installations.

The MGB meets all the requirements for safety-related applications and can be equipped for customer specific applications. Its many functions include interlocking, escape release, guard locking, buttons for start/stop, emergency stop, selector switch, etc.

With the EtherNet/IP version, users can decide which element is to be integrated and the related function. The comprehensive diagnostic information provides a fast and detailed overview of the device status, and as the parameters are easy to set, the replacement of the systems in case of a service is simple and can be completed in just a few minutes.

Treotham Automation Pty Ltd
www.treotham.com.au

ETHERNET SPANNER

The TBEN-L Ethernet spanner is designed to provide a robust protocol converter for applications dealing with multiple protocols on the same network. It capitalises on Turck's multiprotocol technology and serves as an easy way to link multiple Ethernet networks together. Its master-to-master data exchange allows PLCs to exchange data easily.

By utilising Turck's multiprotocol Ethernet technology and the embedded Ethernet switch, the device can allow isolated networks to pass data between them (up to 256 bytes), even if the networks are on different Ethernet subnets or using different protocols such as Modbus TCP, Profinet or EtherNet/IP. Additionally, by utilising the isolated Ethernet network, the TBEN Ethernet spanner offers the ability to set up a NAT router for up to five IP addresses. The devices also include an embedded web server for a streamlined set-up and configuration process.

The TBEN-L spanner offers 16 digital inputs that are available to both networks and allows data transfer speeds of up to 100 Mbps. Additionally, the spanner comes in a glass-fibre reinforced housing with fully potted electronics and offers a IP65, IP67 or IP69K rated housing.

Turck Australia Pty Ltd
www.turck.com.au

New from VEGA: the radiation-based instrument series, ProTrac.

ProTrac delivers reliable measurements for level, density, mass flow or point level. Using four detector variants, ProTrac can solve the most difficult measuring problems – whether in extreme temperatures, high pressures or aggressive media. The system also provides additional security with integrated asset management.

www.vega.com/au/innovation
Phone: 1800 817 135

Looking Forward VEGA

NETWORK MANAGEMENT TOOL

Westermo has released the latest version of its WeConfig network configuration management tool, which allows users to save time and cost when configuring large and complex industrial data communication networks. WeConfig 1.4 not only enables the configuration of these networks to be implemented quickly and reliably, it also features enhanced functionality to bolster cybersecurity.

The latest version of WeConfig enables users to configure and maintain cybersecurity features on devices delivered by the Westermo Operating System (WeOS). Spoofing protection features such as MAC address filters and the configuration of IEEE802.1x port access authentication can be easily deployed and maintained. This helps to prevent unauthorised access to the network. It is also possible to scan and then harden the security features of switches with factory default passwords or which use unsecure protocols. It is possible for the default password of all switches across a network to be changed simultaneously and also for unused ports to be disabled, further securing the network from unauthorised intrusion.

For increased network security, WeConfig has a configuration baseline feature that creates alerts in an alarm window if changes have been made to network settings. When firmware upgrades are made available to address potential device security vulnerabilities, WeConfig 1.4 makes it easy to manage a system-wide implementation.

WeConfig also features comprehensive diagnostics to aid troubleshooting should network problems arise. Network failures can be visualised and diagnostic information displayed at the click of a button to enable rapid and effective maintenance.

Westermo Teleindustri AB
www.westermo.com

HEAT EXCHANGER

Alfa Laval FrontLine, with design pressure up to 305 psi, allows a flexible design with plates tailor-made for hygienic applications. The plate pattern, the channel depth and the overall dimensions are designed for gentle, uniform heat transfer for sensitive dairy, food, beverage and home personal care products.

The heat exchanger can be configured with different sections, using plate and gaskets in different materials with several types of connections, making the final unit suited to the processing task. A herringbone plate pattern with optimised pressing depth and plate material provides gentle, uniform heat transfer of sensitive hygienic products. It is also designed with a wide stream plate for product containing particles or fibres like fruit juices, etc. In addition, the design of the distribution area ensures a uniform flow over the entire plate surface, with no stagnant flow zones and less risk of fouling build-up.

With increased CIP efficiency and less fouling, the plates of Alfa Laval FrontLine are easy to clean and provide a longer time between cleaning cycles, ensuring more production output.

Alfa Laval Pty Ltd
www.alfalaval.com.au

HANDHELD DIGITAL OSCILLOSCOPES

RS Components is expanding its ISO-TECH test and measurement range with handheld two-channel digital storage oscilloscopes (DSOs).

The IDS-200 and IDS-300 series feature touch-screen capacitive-LCD technology, which enables fingertip control of the device. Using only one finger, a waveform can be moved and a line position can be triggered, while using two fingers allows the adjustment of voltage levels and time-division scales. The touch-screen technology also offers an intuitive menu that enables operations such as fingertip control over the location of measurement functions and the saving and retrieving of both diagrams and data.

The handheld two-channel DSOs offer a maximum sample rate of 1 GS/s and are available in entry-level models — the IDS-207 70 MHz, IDS-210 100 MHz and IDS-220 200 MHz — and advanced models — the IDS-307 70 MHz, IDS-310 100 MHz and IDS-320 200 MHz. The IDS-200 models offer memory depth of 1 Mpts/ch and a DMM count of 5000, whereas the IDS-300 models provide a memory depth of 5 Mpts/ch, a DMM count of 50,000 and temperature measurement.

The lightweight, high-functionality devices weigh only 1.5 kg and are robust and easily portable around any worksite, providing easy measurement and fast data analysis. They are supplied with everything needed to get up and running as soon as possible, including a 150 MHz probe for use with IDS-207/307/210/310 or a 250 MHz probe (for use with IDS-220/320).

RS Components Pty Ltd
www.rsaustralia.com

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SAFEGUARDING ROBOTICS IN PACKAGING APPLICATIONS

Mark Lampert, Business Development Manager, Banner Engineering

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As industrial robot technology comes under more widespread use, and for a larger variety of applications, new approaches to safeguarding are necessary to reduce risk while maximising productivity.

Similar to vision technologies, technological advancements in robotics, reduced costs and increased ease of use has enabled widespread robotic adoption in industrial automation, including packaging applications. According to the International Federation of Robotics[1], industrial robot sales worldwide increased by 29% in 2014 to 229,261 units, with Asia (including Australia and New Zealand) being by far the largest robot market with about 139,300 units sold, 41% higher than in 2013. China is now the highest consumer of robots with 25% of the total market.

Recently reported in a US-based business intelligence study, Trends in Robotics Market Assessment 2014, by The Association for Packaging and Processing Technologies (PMMI)[2], more manufacturing companies are investing in robotic technology because of its impact on creating new jobs, greater safety and increased productivity.

Historically, robots were used for palletising and case packing. However, as technology advances, robots are expanding upstream to primary packaging functions, like pick-and-place operations and cartoning applications — and processing tasks, like cutting and coating. According to the 2014 study, respondents anticipate robotics will redefine manufacturing operations, due to:

- hygienic improvements allowing direct contact with food;
- spatial awareness enabling workers to be safely located adjacent to the robot;
- advancements in vision sensors resulting in greater precision and handling, including the ability to sort by colour and use 3D analysis;
- faster speeds and heavier lifting capabilities increasing productivity.

These developments, as well as their more intuitive programming, have increased the use of robotics from only 20% in 2008 to 75% today. As manufacturers employ them in more complex applications, such as food and beverage packaging or pharmaceutical processing, it's apparent that safety measures are vital to their continued adoption.

Robotics has changed the packaging industry's safeguarding needs. A one-size-fits-all safety solution will no longer work for the next generation of packaging machines. A variety of devices should be considered, such as safety controllers, safety light curtains and safety laser scanners, to ensure robots are completely secure and to reduce disruption to production.

Robots mean different safeguarding solutions for packaging industry

As robotic packaging systems grow in scale and flexibility — and become more integrated with packaging lines — enhanced safeguarding measures and better operator communication are needed.

In the past, safeguarding scenarios in the packaging industry followed basic conditional 'if X, then Y' logic. Simple safety modules and guard monitoring controllers could meet the demands of most packaging operations. With the introduction of flexible robots — where a robot may have access to multiple lines or responsibilities to perform more than one task — safeguarding measures become more complex.

Safety controllers address complexities

A single robot with the ability to function in multiple areas requires multiple safeguards, like e-stop buttons, light curtains and guard switches. In addition, these different functions need to be able to operate independently of one another and in conjunction with one another.

Safety controllers provide an integrated approach to risk reduction by managing the operation of multiple safety devices. For example, if a machine has an emergency stop button, two-hand control, safety light screens and interlocked guard switches, a safety controller can be used to manage all of these operations at a fraction of the cost of multiple safety modules or safety PLCs. Safety controllers can also provide several safety-related functions, such as muting or bypassing a safety light screen, external device monitoring (EDM), monitored manual reset functions and logical functions to create separate zones and conditional logic.

Status indication becomes priority at operator level

With robots and humans in such close working proximity, it is critical to keep everyone aware of safeguarding status. One fast-growing trend is to visually indicate safety status. Emergency stop push-buttons, gate interlocks and safety rope pulls are lighting up to communicate armed, actuated and stop conditions.

E-stop buttons with an illuminated base can glow yellow to indicate the machine is enabled or red to indicate a stop condition has been initiated. Status indication not only protects workers, but is also useful in identifying issues with the packaging line — especially when a series of buttons have been connected. The visual status indication will let operators know which button was pushed and help them quickly determine where the issue began and enable workers to quickly resolve issues and get the line running again.

Optical safeguarding technologies provide safe and quick access to robotic cells

When robots become integrated further upstream from the packaging line, it increases the likelihood that robots will work side by side with humans. To keep workers protected without introducing clumsy physical barriers, optical safeguarding technologies are an optimal safeguarding solution for robotic packaging applications.

Safety light curtains

When robots are performing multiple tasks or supporting multiple production lines, various entry points to the robotic cell are present. For example, a palletising robot cell will have access points where cases, new pallets and slip-sheets enter, and where full pallets exit the cell. Safety light curtains can efficiently safeguard several access points with minimal disruption. By selectively muting safety light curtains, pallets and product are allowed to flow in and out of the cell, while personnel are prevented from entering the hazardous area.

Safety laser scanners

A safety laser scanner uses pulsed laser light to scan its surroundings and then compares the scanned information to its predefined zones. If the scanner detects an intrusion into the robot's working area — such as a human — it sends a stop signal to the guarded machine.

Area laser scanners are versatile and non-intrusive safeguards. Unlike hard guards, such as fences or safety floor mats, the laser

> AS ROBOTIC PACKAGING SYSTEMS GROW IN SCALE AND FLEXIBILITY — AND BECOME MORE INTEGRATED WITH PACKAGING LINES — ENHANCED SAFEGUARDING MEASURES AND BETTER OPERATOR COMMUNICATION ARE NEEDED.

scanner works without physical barriers. Safety laser scanners are also an ideal solution for niche packaging applications where a safety light curtain does not cover the area efficiently.

More hygienic robots mean more washdown-rated devices

As robotics enter the processing and primary packaging areas, they come in contact with food, pharmaceuticals and other regulated materials that require frequent washdowns. These robots need to be guarded by IP67- and IP69K-rated safeguarding devices. Washdown safety light curtains, e-stops and door interlocks are becoming more prevalent in the packaging industry.

Robotic packaging applications

Safeguarding a robotic palletiser

When safeguarding a robotic palletiser, there are several safety functions involved. For example, the safety device status needs to be communicated to operators. Status monitoring ensures everything is running smoothly and no safety hazards exist.

A safeguarding solution is needed to control safety light curtains with muting, gate switches and e-stop buttons. The solution also needs to safeguard two conveyors going out, two case in-feeds and a forklift entry where empty pallets arrive.

A programmable safety controller can manage all of the safety devices with one module, communicating the status of safety devices via the fieldbus network and controlling a tower light for visual indication of safety device statuses.

Safeguarding an inspection station

To inspect robotic results, operators need to be able to access materials without compromising safety. Consider a robot engaged in a pick-and-place operation, where the robot places goods in a package as it moves along a conveyor and an operator then inspects the materials to ensure the package is correct.

By defining tiered safety zones and using area lasers scanners, manufacturers can safeguard their employees from robotic injury without shutting down production lines. When operators enter a pre-specified warning zone, a safety laser scanner recognises that activity and sends a signal to the robot to limit its movement and an operator signal that says, "You're in the warning zone, proceed with caution." If the operator continues into a protective field, the same laser scanner can identify that movement and signal a complete shutdown. This approach allows the operator to be in close proximity to the robot, without compromising their safety or shutting down the packaging line.

Safety mats can also fulfil this purpose, but they are costly and wear out quickly. Other machine safeguarding options include protective barriers and gates, which effectively safeguard an area, but limit the operator's access.

Conclusion

As advancements in robotic technology continue to grow, packaging operations will require additional safeguarding methodologies. In order to achieve enhanced efficiency, streamline production and maximise the bottom line with robots, safety measures will be vital to protecting operations against unexpected shutdowns and to keep workers safe.

References

1. International Federation of Robotics 2015, *Industrial Robot Statistics*, <http://www.ifr.org/industrial-robots/statistics/>
2. The Association for Packaging and Processing Technologies 2014, *Trends in Robotics Market Assessment 2014*, <http://www.pmmi.org/files/Research/2014RoboticsExecSummary.pdf>

Turck Australia Pty Ltd

www.turck.com.au

NEW PRODUCTS

USB ISOLATOR

Acromag's compact, industrial-grade isolator provides a high-voltage isolation barrier between a computer and a connected USB device. The isolator protects equipment from electrical surges and transient voltage spikes as well as eliminating ground loop currents flowing between the PC and peripherals, which can damage instruments and cause inaccurate measurements. Additionally, isolation minimises conducted noise from static discharge, magnetic fields and radiofrequency interference.

The isolator inserts inline with the USB connection and operates transparently with no special software drivers required. The unit receives power from the PC's USB port and isolates that power to the connected device. High noise immunity and low radiated emissions ensure reliable data transfer in sensitive applications.

Electrical isolation is provided up to 1500 VAC or 2100 VDC, and surge/transient suppression up to 8 kV on all ports.

A green LED indicates that power is being received and blinks if the connected device draws too much current. The USB isolator has an internal jumper, which allows users to switch from full-speed (12 Mbps) to low-speed (1.5 Mbps) communication. The reset button offers a simple way to reinitialise a connected device without breaking the cable connection. This USB isolator has high-retention USB sockets that keep cables securely attached under shock and vibration.

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BLOWER CONTROLLER

Now available for blower applications, the Sigma Air Manager 4.0 (SAM 4.0) enables optimal coordination and control of all components within a blower station to meet the user's requirements. The real-time gathering, transmission and management of in-process operating data enables users to anticipate faults and act before they occur.

SAM 4.0 forms the core of a blower station and is the key technology for opening up access to the services that Industry 4.0 will have to offer.

The 12″ colour touch screen shows whether the station is in the green zone in terms of energy efficiency. It can also display and analyse pressure data, air delivery, performance, maintenance messages and any fault messages, past or present. A network connection makes it possible to work with the data on a PC.

In addition, multidevice control opens up possibilities for the advance planning of blower maintenance. It is possible to initiate maintenance work before faults occur, helping to avoid downtime and the further damage that faults may cause. The onboard sensors in the Keaser machines, and the Sigma Control 2 compressor control system, collect process data and forward it to SAM 4.0 in real time. With special software, the data is then forwarded to the Kaeser Data Center and subjected to real-time analysis. The Kaeser Data Center performs central monitoring and handles system messages, initiating predictive maintenance measures as needed.

Kaeser Compressors Australia
www.kaeser.com

COMPACT WALL-MOUNTED ENCLOSURE

The Rittal AE compact wall-mounted enclosure is available in over 75 variants including powder-coated steel in light grey RAL7035, 304 and 316 stainless steel with 400 grain finish.

Standard gland plates can easily be exchanged for those with metal or plastic knockouts for simple and fast cable entry and wall-mounting brackets can be attached to the enclosure from the outside, meaning retrospective fitting is achievable.

An installation rail can be fixed to the side, floor or roof areas, creating a larger internal workable area and doubling the mounting area within a small exterior enclosure footprint. The enclosures are compatible with other Rittal accessories such as door switches, light systems, fans, filters and connectors.

The AE features high corrosion resistance, made possible by a three-stage surface treatment and paint process. The surface finish provides optimum corrosion protection and is resistant to mineral oils, lubricants, machining emulsions and solvents. It is certified in protection ratings IP55 to IP66 to provide protection in harsh environments and all parts are manufactured from a single piece of steel, seam welded, providing optimum strength.

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FLOW COMPUTERS

Emerson Process Management has introduced its next-generation flow computer family consisting of both single and dual meter run gas flow computers. These field-mounted flow computers provide a solution to flow metering and flow computing where challenges with power, safety and measurement accuracy are addressed, delivering a more convenient approach to remote oil and gas production sites, and utilising the latest Rosemount multivariable measurement sensor technology.

The flow computer range consists of the FB1100 and FB1200 serving the explosion-proof environment with an ultracompact design including integral sensor, battery and I/O options, providing high-integrity fiscal metering with many different flowmeter technologies.

In addition, the FB2100 and FB2200 models are packaged for C1D2 hazardous area locations and provide additional I/O capacity and capability along with a packaged enclosure designed to minimise installation time.

These flow computers also offer a feature called MobileSCADA, which enhances personnel safety by allowing a technician to use their laptop or tablet from within the comfort of their vehicle and avoid hazardous areas. The flow computer hosts its own secured Wi-Fi network — once the secured connection is made, the technician can download metering reports and make operational changes to the configuration of the flow computer, provided they have the required security credentials.

The flow computer family also features an interactive display, which allows the field technician to securely log in and not only view the data, but also to make operational or configuration changes to the flow computer, while maintaining the full hazardous area approval.

Emerson Process Management Aust P/L
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DAQ SYSTEM FOR VIBRATION MONITORING

The 3340 G-Logger DAQ system can be used for quick and simple vibration monitoring when paired with an accelerometer. One of its key features is the ability to perform a fast Fourier transform (FFT) analysis. Featuring three channels for input (one tri-axial module or up to three single-axis modules), it also supplies power needed for the accelerometers. The 3340 is also easy to set up and can be configured with a Silicon Designs Accelerometer in less than 5 min.

The unit can be powered by USB, AA batteries or an AC power supply via a USB cable, and can be programmed for scheduled monitoring. It includes event detection and isolation during playback, and optionally supports GPS data collection

The 3340 also includes user-friendly software built on a LabView platform. Accelerometer data is graphically displayed simultaneously in three different formats: data versus time, like an oscilloscope; spectrum, showing magnitude versus frequency (FFT); and as meters which show current measurements such as DC, RMS and peaks.

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EMBEDDED SAFETY DRIVES AND NETWORKS

COMBATING INEFFECTIVE, OVER-CAUTIOUS SAFETY PROCEDURES

Jarred Gibbs, Senior Offer Manager, Industry Business, Schneider Electric

Manufacturing, oil and gas, mining, and energy networks are considered some of the most dangerous work environments, both in Australia and the world. In 2015, mining and manufacturing even ranked fourth and fifth on Safe Work Australia's list of industries with the highest number of workplace fatalities.

Ensuring operator safety is always a company's top priority and paramount concern. For this reason, safety does not equal productivity. But ever-increasing demands on outputs have forced companies into a difficult position balancing the two considerations. Traditionally, the functions of automated machine safety and control have been kept separate, resulting in inefficient and overly cautious safety operations that are detrimental to productivity.

Luckily, technological advances and the IIoT now enable safety functionality to be embedded within automation components such as variable speed drives (VSDs) and servo drives. The idea that safety is a costly burden has given way to a new perspective in which safety functionality goes beyond safeguarding people and protecting machinery.

Productivity versus safety — the old debate and the new solution

The challenges in this space are obvious. Safety must always trump production.

Since most industrial operations place a high emphasis on safety, the management of safety constraints is tightly controlled. That is to say, the 'better safe than sorry' approach often includes some built-in buffer that affects profitability. Since safety risk is seldom directly measured, most industrial plants assume that the risk is greater than it really is and operate in a more conservative manner than necessary.

A simple safety stop, for example, can shut down production for as long as it takes to identify the problem and restart the systems. Given today's high-throughput production lines, even a relatively short period of downtime can be costly.

In the past, the functions of automated machine safety and control have been kept separate. Conventional wisdom held that the two systems should be physically and functionally isolated from each other. This was so safety would not be compromised by the same faulty condition that led to the control system's producing a 'dangerous' situation in the first place.

Otherwise, some feared that integrating the safety automation and control automation systems would adversely affect the machinery. Operators were protected from hazardous situations by non-automation control electromechanical hardware such as contactors, safety relays and interlock circuits. The extra expense of OEMs building, and customers maintaining, two discrete systems was seen as an unavoidable cost of doing business.

The concept of embedding safety into processes and product flips these challenges on their head. If the safety constraint functions can be examined with more precision, the operation can be

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driven harder to increase profitability without compromising the true safety levels of the operation.

For this reason VSDs, and servo drives, with safety functionality embedded within automation components are booming in the Australian market. A single drive component capable of standard control functions as well as safety monitoring offers several advantages to OEMs and their end-user customers including improved productivity, reduced costs and Ethernet embedded safety.

These benefits allow for organisations to operate at a pace not possible with separate safety systems. By having safety embedded in technology there is less reason for overly cautious approaches that are guaranteed to slow a company down.

Embedded safety improves productivity

Embedded safety drives integrate safety functions that control the drive output to the electrical motor in response to safety-related events. These functions can either stop the drive without shutting off power to the motor entirely or control the speed of the drive. Embedded safety functionality means a drive does not have to 'wait' for a signal that there is an abnormal condition such as overspeed or a blockage. Three of the most common functions are STO (Safe Torque Off), SLS (Safe Limited Speed) and SS1 (Safe Stop 1), all of which allow a company to bypass overcaution in small but significant ways.

STO ensures that there will be no torque on the motor, so the machine is not able to move and harm operators or damage components. The electronic switching time is much faster than with electromechanical components in a conventional solution.

SLS slows down and then holds the motor at a predefined speed. It automatically kicks in again if this speed is exceeded. SLS protects machinery by ensuring that damage is not caused by machines running too fast. It also enables operators to reduce the speed of a machine to a level where they can safely intervene to correct an abnormal condition.

SS1 stops a motor by controlled braking, according to a predefined speed ramp. It checks that the motor has actually stopped (or reached a predefined minimum speed), then activates STO. This function brakes high-speed motors more quickly and safely than conventional electromechanical solutions. At the same time an automatic switchover to STO enhances operator safety.

A simple example is a woodworking machine. As cutting power to a big machine can take several minutes to stop its spindle, there is always the risk that the operator will try to interact with the machine too soon. The drive with embedded safety functionality cuts off the torque on the motor but does not shut off power altogether, enabling faster start-up. Downtime and potentially costly damages are reduced without compromising operator safety. Once operators are in close proximity to the moving parts of the machine, SLS allows operators to inspect, perform basic maintenance or remove blockages without shutting the machine down completely.

Embedded safety drives reduce costs

Another benefit of embedded safety drives is that organisations are investing in one component that handles both control and safety, rather than two devices. Although variable speed drives or servo drives with embedded safety are likely to cost more than drives solely used for control or for safety, the overall hardware cost savings can be as high as 30%.

Reducing the number of circuit breakers or contactors needed to achieve a safe stop is another way this cuts costs. The STO functionality on the drive enables the machine to be put into a safe mode automatically without the need for a breaker or contactor downstream. Conventional approaches require two circuit breakers or contactors in series (or a breaker and a monitoring device), so reliability is dependent on several components working in conjunction. Embedded safety drives achieve the same level of safety integrity inherently.

Cabling, which can account for 15% of the installation costs, is another saving consideration. A single embedded safety drive eliminates the cabling cost associated with connecting numerous devices. This can be a significant amount and is likely only to increase in line with material costs.

Most importantly, a safety system with fewer devices is likely to be more robust as generally, a simpler system is a safer system. Put simply, fewer devices and less cabling reduces the potential points for failure. With every additional device that is needed to construct the safety system, the overall performance and reliability are lessened. This is true regardless of how highly rated the individual components are.

Replacing hardware with embedded software, which is certified for specific conditions, increases the overall reliability index of the system. When a system segregates safety and control functions, companies must ensure control and safety are well coordinated. With embedded safety on the other hand, the function and the behaviour of the control are certified to be linked to this safety function — precluding a source of failure and allowing a company to move at a quicker pace without fear of danger.

Safety embedded over Ethernet

Modern industrial processes in Australia are employing ever larger, faster and more complex machinery. While more productive, today's machines present more challenging safety conditions and call for more sophisticated safety control, especially as connectivity reaches new heights with the Industrial Internet of Things (IIoT).

Luckily, technological advancements and the IIoT enable safety devices to be networked as a cohesive system. Networking simplifies the integration of automation and safety control, offering all the operational and cost-saving advantages of a less complex system, as well as additional benefits.

A number of safety protocols are already used widely for networking discrete machine safety components. They all sit on top of industrial Ethernet variants that are used for networking of a broad range of industrial automation components. Technological advances have overcome the disadvantages of Ethernet communication in previous years, and today its low cost and high speed have established it as the most widely installed network technology. The compatibility of both the safety-based and control-based protocols means that integration to a single network is quick and straightforward.

Integration allows safety and control systems to 'talk' with each other and share data such as diagnostics, system status, alarms, events and other critical information. Safety over Ethernet simplifies safety system communications, reducing the need for multiple hardware components and their associated expense.

For example, hardwiring communications for a 5-axis machine would require terminal adapters at each drive. Ethernet-networked embedded safety drives would be fully operational as soon as a single standard RJ45 cable is connected — as opposed to a hardwired system, which would require six different wires to achieve the same level of functionality.

The commissioning process is also simplified with Ethernet-networked embedded safety drives. Safety parameters can be specified using standard function blocks in a programmable logic controller (PLC), which can then be connected via Ethernet to multiple drives. This streamlines an often complex architecture, as a single safety PLC can be used to control multiple parts of the production line.

Overall, this makes for a simpler system and improved productivity due to better synchronisation of modules. An example would be a machine where motors are virtually linked, like a packaging machine (in the case of servo drives) or load-sharing applications (in the case of VSDs), in which the wear and tear of the mechanical link among motors could be avoided. Embedded safety over Ethernet also benefits OEMs and their end-user customers during the certification process, saving time by fast-tracking processes.

Throwing overcaution to the wind

Balancing safety risk, production value, energy cost and material cost in a simultaneous manner is equivalent to solving a multiple objective optimisation problem. This process is challenging and time-consuming, but within reach of operators if they have access to the right tools and advice from reliable experts.

Machine process companies today must respond to pressure to improve their bottom line through increased productivity without sacrificing operator safety. Now is not the era for ineffectual safety procedures that hold companies back from achieving their production potential. While it is certain downtime will remain the nemesis of productivity, safety no longer has to be.

Embedded safety drives represent a new, forward-looking alternative to the conventional approach that allows safety to remain a company's top priority while enhancing the efficiencies that drive success in competitive markets.

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TERMINAL MANAGEMENT SOFTWARE

Emerson Process Management's Syncade Logistics management software v4.12 gives terminal managers improved control over terminal traffic and eliminates the need for specialised storage tanks for unique blends. With more efficient traffic and stock management, terminals can drive increased throughput and improved asset utilisation.

Truck schedule management can significantly impact terminal throughput. Syncade Logistics uses built-in algorithms to optimise movement scenarios and then automatically assigns trucks to gantry queues based on customer order specifications. This allows terminal managers to eliminate driver guesswork and measurably increase trip efficiency. With tighter control on terminal traffic, a terminal can increase throughput and react more effectively to schedule changes.

Stock management tools help operators maintain safe operations by accurately controlling transaction quantity and avoiding emissions. Syncade Logistics supports loading by weight for both metered and non-metered loads. Configurable capacity limits for loading LNG and LPG products prevent the release of vapours, ensuring safety and environmental compliance.

Syncade Logistics enables terminal managers to use their storage tanks more efficiently, reducing the inventory footprint required to support customer needs. Terminal operators can deliver automatic management of blend ratios, eliminating the need to build separate storage tanks for different blends. Syncade Logistics also manages multiple stock owners within a tank. Transactions are easily accounted for and reconciled with book inventory, delivering confidence in stock accuracy.

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DIGITALISATION IN THE WATER INDUSTRY

The water and wastewater industry faces challenges of ageing infrastructure, rising customer demands and constant pressure to be more efficient.

The water and wastewater industry faces challenges like never before. Ageing infrastructure, rising customer demands and constant pressure to be more efficient are driving major new trends in the creation and intelligent usage of smart data globally as well as in Australia.

There are two significant elements that impact the forward trajectory of the water and wastewater industry globally and in Australia:

Utilities are coming to terms with the fact that intelligent 'smart' data usage — as opposed to mere 'big data' — relies on strong data analytics capabilities providing utilities with tangible value.

The infrastructure in water utilities has aged significantly. Underground pipe networks installed at the turn of last century had a design life of 100 years and those installed in the 1950s had a design life of 50 years. Hence, the bulk of a water utility's infrastructure is coming to the end of its useful life.

The issue of ageing infrastructure is a global concern. In the US alone, it would require approximately $1 trillion in improvements to meet current design standards.

However, the evolution of technology has presented the industry with new possibilities. Opportunities presented by digitalisation are being used to offset the issues of ageing infrastructure, while concurrently meeting increasing demand. Digitalisation is helping utilities understand their networks' behaviour and dynamics, which in turn helps in reducing loads and stresses — thereby increasing asset life and reducing pipe bursts and leaks.

Analysis of large quantities of data including flow, pressure, water quality and infrastructure condition is helping utilities understand the behaviour and dynamics of their networks like never before. Increasingly, most of this is being done remotely.

Typically pumps and similar critical infrastructure are installed with physical redundancy (for example, two pumps to cover for the case of one failing). However, there is a risk that the redundant assets may not be in optimal condition. Condition monitoring of critical infrastructure is therefore starting to gain traction in the water sector, with more organisations and utilities adopting proactive maintenance strategies rather than remaining reactive.

Operation of remote assets is not new to the water sector, but full utilisation of current technology is lagging. There are several factors at play including an ageing workforce and upskilling crews to adopt technology as a part of daily work, including troubleshooting and diagnosis.

Typically, management of breakdowns on remote assets involves an automated alarm being sent to a list of mobile phones or a central SCADA control room. A technician is usually then sent to the site to begin troubleshooting and diagnosis.

Advances in automation technology now allow the SCADA control room operators to connect remotely to the asset (such as a pump station) and determine the type of fault before sending the appropriate resource to the site. If the fault relates to an instrument, an instrument technician can be sent, while if the fault relates to the power supply, an electrician can be sent. Furthermore, if a pump trips out due to high current draw, a blockage may have occurred, resulting in the need for a pipe technician or plumber.

When combined with corresponding control systems and smart water meters that measure individual consumption, such remote services will, for example, enable municipalities' water consumption to be forecast. Pump operation schedules, for example, could then be adjusted in order to save electricity.

This kind of information analysis is crucial to an economy that is trying to get the best value out of current infrastructure investments and meet rising demands for water on tight budgets. The next 5–10 years will see a shift from using field technicians as the first line in troubleshooting and diagnostics to using the central SCADA operations team, resulting in smarter use of labour and reduced operational expenditure.

Tobias Lang is the head of the Process Automation Business Unit for Siemens Australia and has been managing this area of the business in Australia, Germany and Thailand for the past 20 years.

PXI EXPRESS DMM

National Instruments has announced the NI PXIe-4081 7½-digit high-performance DMM and 1.8 MS/s isolated digitiser. The NI PXIe-4081 is the first PXI Express DMM available.

The NI PXIe-4081 is claimed to be the industry's most accurate 7½-digit DMM, with a 15 ppm accuracy for DC voltage measurements up to two years after calibration. It is capable of voltage measurements from nanovolts to one kilovolt and resistance measurements from microohms to gigaohms. A solid-state current shunt configuration offers eight DC current ranges from 1 μA to 3 A and six AC RMS current ranges from 100 μA to 3 A. The DMM occupies a single 3U PXI slot and provides high channel density for high-channel-count systems, delivering 17 DMM channels in a single PXI chassis occupying 4U of rack space. For high-throughput applications, the isolated digitiser mode can acquire DC-coupled waveforms in all voltage and current ranges with a 1.8 MS/s maximum sample rate. By changing the digitiser sampling rate, engineers can vary the resolution of the digitiser from 10 to 23 bits for the optimal combination of speed and accuracy.

Engineers can use an interactive soft front panel for basic measurements and debugging automated applications, which delivers all the ease of use expected from a traditional instrument. The driver software includes a programming interface that works with a variety of development environments, such as C, Microsoft .NET and LabVIEW. The driver also features help files, documentation and 28 ready-to-run example programs to assist in test code development.

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Better quality control with digital assistance systems

Every manufacturing operation, be it in the automotive industry or another sector, has to run flawlessly. If errors can be spotted early by making it possible for many individuals to share knowledge, then resources can be saved.

If even the smallest tool is worn, finished parts may have to be rejected. Cost and resource efficiency make it essential to eliminate sources of defects and thus ensuing rejects. Since this is Volkswagen's mission in Salzgitter too, the company aims to optimise the process control of honing machines.

A honing machine hones crankcases — one of the most complex and expensive parts of a vehicle — before they can be installed in an engine. It finishes piston ring faces so that the parts meet specified tolerances and shapes exactly and fit well in engines. Cylinder bores are honed to obtain the required surface quality of the crankcases, which minimises frictional losses in an engine later. Workers are unable to see how this massive machine concealed behind its housing does this, so staff have difficulty assessing and analysing the machine's relevant parameters.

The honing machine at VW's plant in Salzgitter ©Fraunhofer IPT.

Researchers at the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg are helping the company improve control with a digital assistance system. The system makes it possible to share knowledge about the machine among several individuals. Anybody working on the machine should be able to assess crankcase quality and to inspect the honing machine — and to take appropriate action whenever necessary. Until now, quality control has been in the hands of a single expert.

The digital assistance system guides workers step by step through the daily quality check on the machine. A digital checklist, as well as virtual models and the expert's know-how, is stored in the system. The user interface has been kept simple: staff see a complete virtual model of the equipment to the right on a large monitor and the checklist to the left. Any tool up for inspection on the checklist is marked by the system on the virtual model of the equipment.

"The experts are informed which tool they have to inspect and where the tool is located," said Tina Haase, a researcher at the Fraunhofer IFF. The system also provides assistance during inspection itself — images show the user what the tool ought to look like ideally and what signs of wear preclude further use.

The system also assists staff with measured parameters, especially when they are assessing and evaluating collected data. The system compares measured values entered in the checklist with stored tolerances.

The car maker aims to use the digital assistance system to enable every employee to analyse and correct the process themselves. Employees should be intervening preventively and rectifying errors long before rejects are produced, rather than merely reacting to defective manufacturing.

The system is currently a prototype. The researchers at the Fraunhofer IFF intend to expand the assistance system in another stage. Workers have to correct the manufacturing process whenever a defective product — in this case, a crankcase — is produced. The researchers now intend to virtually remove the housing enclosing the machine in the assistance system in order to visualise the causal relationships. This will enable staff to view the honing process and test the effect of individual parameters on manufacturing in the system.

"We expect the use of a digital assistance system to disseminate previously pooled knowledge in order to control complex processes preventively and improve them sustainably," said Jörg Rudolph, an engineering specialist at VW's engine plant in Salzgitter.

Fraunhofer IFF

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QUARTER-TURN ACTUATOR

The DFPD quarter-turn actuator is designed to be used in a variety of sectors and markets. It has a modern, simple and compact design and can be used with ball valves, shut-off valves or air dampers in the chemical, pharmaceutical or beverage industry or for water treatment and other areas of process automation.

The single-acting version is compact and modular. Due to the optimised spring design it can be configured in increments of 0.5 bar for more efficient use. With the nine different spring combinations, the DFPD quarter turn actuator meets the most precise operating pressure requirements of between 2 and 6 bar. The rotation angle for standard sizes is up to 90° and for the sizes 40, 120, 240 and 480 the angle can be 180°.

The basic version of the DFPD is suitable for temperatures between -20 and +80°C. The low-temperature variant is designed for arctic regions and covers a temperature range of -50 to +60°C. The high-temperature variant can be used at temperatures of between 0 and +150°C. With its versatile and corrosion-resistant surface coatings, the actuator can also be reliably and flexibly used in harsh conditions. It can be mounted anywhere and the end positions can be adjusted by ±5° at both ends, ensuring high flexibility during operation.

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WATER STORAGE TANKS

THE SCIENCE OF MIXING AND IMPROVING WATER QUALITY

Michael J Duer, P.E., Chief Engineer, Tideflex Technologies

Water storage tanks and reservoirs are a critical component of distribution systems, yet they can pose a significant challenge for water utilities as they often have a negative impact on water quality, due to low turnover or inadequate mixing resulting in short-circuiting.

In water distribution networks, reservoirs are required for flow equalisation, to sustain pressure, to hold several days of storage for redundancy, and provide fire and emergency storage. In order to achieve these goals, reservoirs need to have adequate storage volume based on worst-case hydraulic scenarios and also must be designed to supply the system allowing for future community growth. Some of these design goals are contrasted by what is generally required to maintain safe drinking water.

Common problems in storage tanks and reservoirs are the loss of residual disinfectant, bacteria regrowth, spikes in disinfection by-products (DBPs) and nitrification (chloramines), resulting from hydraulic short-circuiting, poor mixing and circulation, poor turnover and excessive retention time. Many of these water quality problems can be specifically attributed to the location and orientation of the inlet and outlet piping.

In order to minimise water age, tanks must be turned over — that is, water volume must be exchanged to and from the tank by fluctuating tank levels. The required amount of turnover varies depending on the system, but a fairly common turnover goal is 3–5 days, or 20–33% daily fluctuation. However, tanks can have a significant localised increase in water age when they short-circuit and are not completely mixed, even if they are fluctuated 20–33%. Often the increased water age and all associated water quality problems are specifically attributed to the inlet and outlet pipes.

There are three primary design goals to preserve storage tank water quality:

1. Design the piping or mixing system to separate the inlet and outlet to eliminate short-circuiting.
2. Design the mixing system to achieve complete mixing during fill cycles.
3. Fluctuate tank levels to exchange water volume, or turnover the tank, to minimise water age.

The first two are the responsibility of the mixing system designer but they are hydraulically linked with the third. So, the designer must not only understand circulation patterns and mixing characteristics, but must also know how to design based on the tank turnover.

Short-circuiting

The simplistic description of short-circuiting is the last water that entered the tank is the first water drawn from the tank (last in, first out). Water quality problems develop for two reasons:

1. The entire tank volume is not completely mixed.
2. The oldest water cannot be drawn from the tank due to the location of the outlet pipe.

Short-circuiting is often not problematic over one or several days, but it is the consecutive daily fill and draw cycles with persistent short-circuiting that result in a localised increase in water age — resulting in the development of water quality problems such

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as loss of residual, bacterial regrowth, spikes in DBPs, elevated heterotrophic plate count (HPC) bacteria, nitrification and variance in dissolved oxygen and pH. In some cases, short-circuiting can be mitigated by separating inlet and outlet pipes, but a solid understanding of the mixing and circulation patterns within the tank is required in order to know where to locate the outlet pipe. It is often incorrect to assume the best place for the outlet pipe is as far apart from the inlet pipe as possible. For example, Figure 1 is a CFD model of a circular reservoir with a horizontal inlet pipe through the wall of the tank, discharging horizontally towards the centre of the tank. Conventional wisdom would say to locate the outlet pipe on the opposite side of the tank, diametrically opposed to the inlet pipe, to get them as far apart as possible. However, new water would reach this location shortly after the fill cycle starts. There are actually two areas in the tank that mix last — the dark blue zones on each side of the centreline of the tank, in the centre of the semicircular circulation patterns. These areas can get mixed provided the fill cycles are long enough, but if they are not, the proper outlet design would be to locate an outlet pipe in each of those two locations, not a single outlet pipe on the opposite side of the tank from the inlet pipe. What complicates matters is that once there are temperature differences between the inlet water and tank water, the circulation patterns can be completely different and the dead zones are often in different locations.

In the past, much of the focus has been on separating the inlet and outlet pipes, which is a very good design goal. However, the focus needs to be on making sure the tank is completely mixed.

Mixing

Mixing in a water tank is a function of momentum of the inlet flow during the fill cycles. The turbulent jet of the inlet flow creates a velocity discontinuity with the water already in the tank. This creates turbulence and rapid mixing as the jet moves away from the port. Figure 2 shows a 3D laser-induced fluorescence (3DLIF) image of a submerged jet[1]. Due to conservation of momentum from the enclosed water volume, circulation patterns develop through the entire tank volume. The circulation patterns are three-dimensional and quite complex. In the circular reservoir of Figure 1 the circulation patterns persist after the fill cycle has ended, often for many hours. During the fill cycle, new water is dispersed through the entire water volume via the circulation patterns provided that the fill cycle is long enough and temperature differences between inlet water and tank water do not produce circulation patterns that inhibit mixing.

Scale model experiments on various styles of storage tanks have been conducted that yielded a theoretical mixing time equation[2,3]. The degree of mixing is defined by the ratio of the standard deviation of the tracer concentrations to their mean value. This ratio, the coefficient of variation (COV), should approach zero as the tank becomes fully mixed. Full mixing is defined as the time for the COV to fall to 0.05 (5%) or 0.10 (10%) depending on which experiments are referenced. The empirical equation for mixing time, τ_m, is defined as:

$$\tau_m = K' \frac{V^{2/3}}{M^{1/2}}$$

where:

K' is an experimental constant ≈ 10.2 for a single inlet with no temperature difference between inlet and tank water.

V is the volume of the tank equal to $(\pi/4)D^2H$ where D is the tank diameter, and H is the water depth.

M is the momentum flux of the inflowing jet equal to u_jQ where u_j is the inflow velocity and $Q = (\pi/4)Du_j$ is the inflow rate.

Designers can calculate how long the fill cycle needs to be to achieve complete mixing. In addition, the amount of drawdown can be calculated that will allow sufficient fill time on subsequent fill cycles to achieve complete mixing. This is what links the mixing system design with the operation and fluctuation of the tank. Achieving complete mixing yields a homogenous solution throughout the tank water volume and this eliminates any thermal, chemical and microbiological stratification, thereby preserving water quality. However, the above analysis is only one step in a proper design. The effect of potential temperature differences between inlet water and tank water needs to be addressed.

GIVEN THE MANY DIFFERENT TANK STYLES AND GEOMETRIES, THE INLET/OUTLET PIPING OR MIXING SYSTEM MUST BE SPECIFICALLY MODELLED AND DESIGNED FOR EACH TANK STYLE.

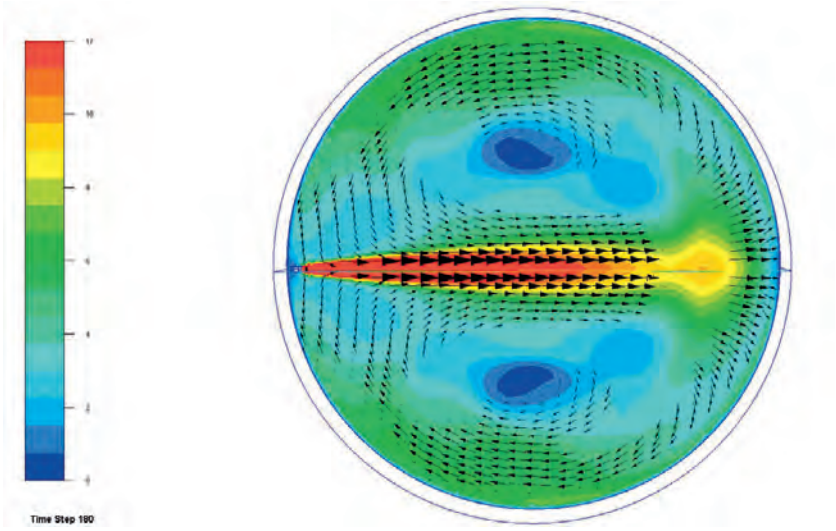

Figure 1: CFD model of circular reservoir showing velocity magnitude and vectors.

Effect of temperature differences on mixing

When inlet and tank water temperatures differ, buoyant jets are formed and the circulation patterns can be significantly altered. This effect can be observed year round, but is mostly problematic in summer when inlet water is colder than the stored water. Colder inlet water is denser, heavier and therefore is negatively buoyant — it sinks. Figure 3 shows a CFD model of the fill cycle of a standpipe with the inlet pipe through the floor[4]. The inlet water is colder and the jet does not have enough momentum to overcome the negative buoyancy so the jet stalls, reverses direction and falls back to the floor. There is no mixing above the height where the jet stalls and stratification develops. In this case, it is about 40% of the water depth. The water in the bottom 40% has good water quality because it is well mixed. However, the top 60% of the water volume is not mixed. With each consecutive fill and draw cycle, the localised water age in the top part of the tank continually increases and water quality problems develop. Note that sampling outside the tank will never indicate there is a water quality problem until, for example, there is a large drawdown, a fire or a line-break. Even autumn and winter turnover, where colder ambient temperatures cool the water in the top of the tank, have also been the cause of poor water quality in the distribution system as the cooler water in the top of the tank falls to the bottom and is drawn out into the distribution system.

Stratification can develop in all styles of storage tanks, not just standpipes. Once the jet hits the floor, all vertical momentum is lost and stratification develops. Note that the outlet pipe, regardless of its location along the bottom of a tank, would not prevent stratification from developing in this tank. Therefore, emphasis needs to be placed on designing the piping/mixing system to achieve complete mixing, not just a simple inlet and outlet separation.

Multiple inlet jets

The effect of multiple inlet ports on mixing has been studied in various tank geometries[5]. Experiments showed that distributing the inlet through multiple inlet ports results in significantly faster mixing — up to 50% faster compared to a single inlet pipe. It is analogous to large public swimming pools that have inlet ports spaced 3–6 m around the perimeter of the pool. The design intent of using multiple inlet ports in pools is for the rapid dispersion of rechlorinated water, and to eliminate dead zones.

In addition to faster mixing, experiments also showed that multiple ports were able to completely mix tanks when inlet water is colder than tank water, as compared with a single inlet that resulted in stratification and an unmixed tank. Critical steps in designing the inlet ports are:

1. Determine the size, spacing, elevation and discharge angles to develop sufficient jet velocity and momentum to mix the tank based on the tank turnover.
2. Calculate the jet rise height of the negatively buoyant jets to ensure that the jets hit the water surface as complete mixing can only be achieved if the jets hit the water surface.

Duckbill valve style mixing systems are often utilised in all styles of storage tanks. Duckbill valves are inherently a variable

> IN SOME CASES, SHORT-CIRCUITING CAN BE MITIGATED BY SEPARATING INLET AND OUTLET PIPES, BUT A SOLID UNDERSTANDING OF THE MIXING AND CIRCULATION PATTERNS WITHIN THE TANK ARE REQUIRED IN ORDER TO KNOW WHERE TO LOCATE THE OUTLET PIPE.

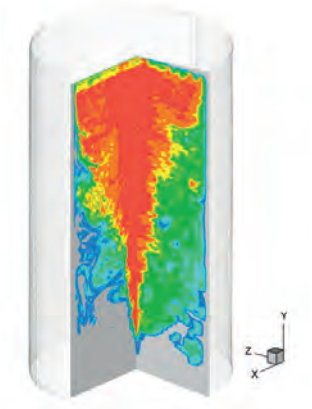

Figure 2: 3DLIF image of jet mixing.

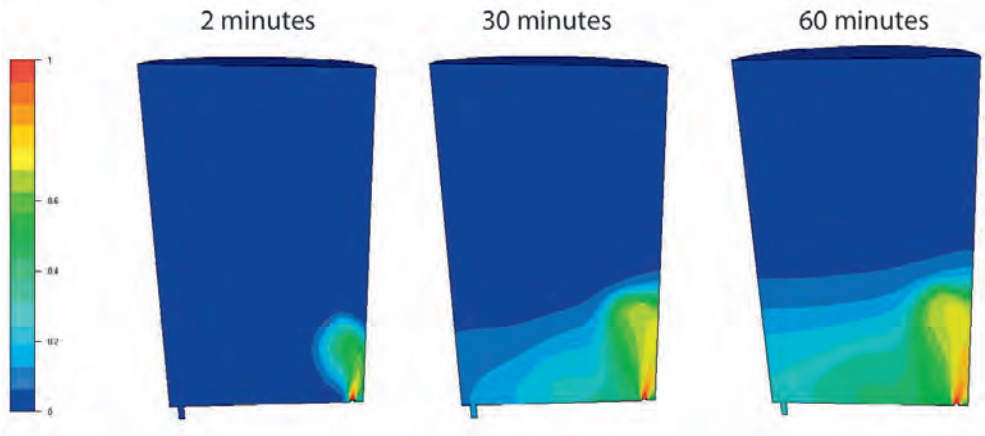

Figure 3: CFD model of standpipe with colder inlet water.

orifice — they progressively open and close with the increase and decrease in flow rate. This characteristic produces a non-linear jet velocity profile that yields higher jet velocity at lower flows, which results in faster mixing compared to fixed-diameter pipes.

Tank-specific design

Given the many different tank styles and geometries, the inlet/outlet piping or mixing system must be specifically modelled and designed for each tank style. A common design for a circular reservoir, for example, is almost always not a good design for a standpipe. The same design process holds for every tank style, which is to determine the size, spacing, elevation and discharge angles to develop sufficient velocity to mix the tank based on the tank turnover and to calculate the jet rise height of the negatively buoyant jets.

Active mixing

Properly designed passive mixing systems have been extensively CFD and scale modelled and utilised for many years and have been proven effective through owner-conducted field sampling to achieve complete mixing, eliminate stratification and maintain water quality.

There are some cases where tanks have minimal fluctuation or do not fluctuate at all. A passive mixing system can be turned into an active mixing system by using a recirculation pump, which pulls water out of the tank and discharges it back into the tank via the inlet pipe or mixing system. Note, however, that mixing is only one component of maintaining storage tank water quality — volume must be exchanged in order to minimise water age. Another role of the pump that can be considered is to induce a forced drawdown whereby the pump discharges tank water into the distribution system, rather than back into the tank. This accomplishes two things — the water volume is exchanged and water age is reduced, and the tank can be passively mixed when the recirculation pump is turned off and the tank refills. The applicability of these concepts would need to be evaluated on a tank-by-tank basis.

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Fluid Control Sales & Installations Pty Ltd
www.fluidcontrol.com.au

COMBINED SCADA AND POWER MANAGEMENT

Schneider Electric has announced the latest evolution of its StruxureWare PowerSCADA Expert power management and control software. The latest release of the software helps users better manage their energy consumption and costs while continuing to maximise the availability and reliability of their electrical distribution networks with a number of updated features and enhancements.

The optional 'PowerSCADA Anywhere' HTML5 remote desktop application offers mobile-friendly PowerSCADA HMI on any device or browser. Cybersecurity has been improved to make the product more dependable and protected, with McAfee Whitelisting, Tofino Firewall, two-factor authentication and RBAC help.

Reporting and dashboard enhancements are included, with more than 30 default reports integrated into the software's runtime display. Users can trigger reports manually, by schedule or via event, or build custom reports to suit specific needs. Dashboard enhancements help solve specific challenges facing facility management and electrical teams, allowing the display of any measured parameter from the database in the dashboard as well as a real-time internet data feed. The software is claimed to be suitable for virtually every industry that needs optimised functionality to solve problems quickly with actionable information.

Schneider Electric Industry Business
www.schneider-electric.com

SENSOR CONFIGURATION APP

SOPASair is a version of SOPAS ET (SICK Open Portal for Applications and Systems Engineering Tool) that is adapted to mobile devices and which is currently able to configure more than 80 of Sick's sensor product families, as well as prepare them for industrial use in factory, logistics and process automation.

SOPASair makes it possible to identify and activate Sick sensors within a network using mobile devices and without the need for a cable connection. Both smartphones and tablets with the iOS operating system are supported, as well as those based on Android. The sensors can be easily configured and visualised. To do this, SOPASair offers the touch options typically used in apps, such as pinching, scrolling or switching views. The app visualises the current operational status, process data and parameter values of sensors, and enables the relevant sensor configuration to be modified if necessary. Bidirectional communication enables parameter sets to be saved and restored to a sensor if necessary, or transferred to sensors with a similar design or application. SOPASair makes it possible to check the configuration and visualisation options in simulation mode, even when there is no physical connection to the sensor.

Mobile devices running on iOS or Android operating systems can connect to sensors via Ethernet, Wi-Fi and Bluetooth LE. Devices running on Android are also able to access sensors via USB and IO-Link. In addition, SOPASair functions within common browsers and can therefore be operated on a PC.

SICK Pty Ltd
www.sick.com.au

SIMPLIFIED CONTROL SYSTEM DESIGN AND ANALYSIS

MathWorks has announced updated apps for the analysis and design of control systems. As part of Release 2016a, Control System Toolbox now offers a Control System Tuner app that allows engineers to automatically tune SISO or MIMO control systems in MATLAB and Simulink.

Controls engineers in industries such as aerospace and defence, automotive, and industrial automation and machinery can use the Control System Tuner app to tune the parameters of fixed architecture MIMO control systems that have tunable elements such as gains, PID controllers or low-order filters. Engineers can specify design requirements such as reference tracking, disturbance rejection and stability margins, and automatically tune control system gains to meet these requirements. Control System Toolbox also introduces an app to compute and compare reduced-order models. The Model Reducer app helps users to interactively simplify linear time-invariant models while preserving model dynamics important for the application. Engineers can use the Model Reducer app to remove states with low energy contribution, select significant modes and cancel close pole/zero pairs.

R2016a also includes a redesigned Control System Designer app. Engineers can now combine plots such as Bode, root locus and closed-loop step response in one window, and compare multiple controller designs.

MathWorks Australia
www.mathworks.com.au

CONDITION MONITORING SOLUTION

FAG SmartQB is a ready-to-use monitoring solution for electric motors, pumps and fans. It is easy to install and does not require any specific knowledge about vibration diagnosis, including for common installations such as vibratory, grinding and rolling processes.

The early warning system comprises a FAG SmartQB sensor unit (a variant of the existing FAG SmartCheck), a cubic housing with a touch panel and a cable for power and data transmission. Specially developed for detecting irregularities in electric motors, pumps, fans and their rolling bearings, the system is supplied with a ready-to-use configuration.

Five faults can be identified and displayed: bearing damage, imbalance, friction/cavitation (for centrifugal pumps), temperature increases and all general changes in vibration patterns that cannot be clearly attributed to one of the aforementioned causes. Due to the automatic fault assessment capability, the system can be operated by maintenance personnel without any knowledge of vibration technology. The fault assessment enables users to immediately initiate maintenance work and order replacement parts where required.

When starting the system for the first time, the user selects the component on which the FAG SmartQB sensor is located (motor, pump or fan), specifying whether the machine operates at constant or variable speed and entering the individual name of the assembly. FAG SmartQB automatically selects the best measurement configuration and is immediately ready for the automatic learning mode.

A total of six FAG SmartQB sensors can be located on a housing and allocated to individual assemblies as required.

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O_2 AND CO_2 ANALYSER

The Novatech 1637-5 oxygen and carbon dioxide analyser/transmitter provides measurement and analysis of oxygen and carbon dioxide levels in food packaging. This instrument measures whether the levels of oxygen in food packaging on a production line are at an acceptable level. It is available to rent from TechRentals.

The analyser is simple to use and can provide a quick and easy means of testing the quality of food packaging. The unit provides oxygen readings from 1 ppm to 100% with 1% accuracy and NDIR carbon dioxide analysis of 0–100% at ±3% of full scale. It has two 4–20 mA outputs, one common and three selectable alarm relays, and gas connection is via a 1/8 Swagelok. Flow rate with the internal pump is from 100 to 500 cc/min.

TechRentals

www.techrentals.com.au

AVAILABILITY SOFTWARE

The latest release of Isograph's Availability Workbench features a variety of modules that simplify the modelling of production processes while integrating with enterprise resource planning (ERP) systems.

Improvements in Availability Workbench now include full integration with SAP and Maximo, providing a seamless flow of data for analysis and ease of using failure data analysis to optimise both maintenance and system availability.

Modules are now in separate windows for maintenance optimisation, availability simulation, life cycle cost (LCC) analysis, Weibull data analysis, process reliability analysis and interface portals. Data is common between modules allowing for standardisation and streamlining analysis.

The use of Availability Workbench ensures that decisions on manufacturing and operational process are reflected in the system availability and maximum production capability. The Process Reliability module provides insight into the causes for downtime and the sustainable production capacity for a system.

Whether predicting the availability of a new production system, identifying bottlenecks, assessing modifications to the design, optimising spares or establishing the best maintenance plans, Availability Workbench is designed to provide an easy, streamlined environment for optimal decision-making.

ARMS Reliability

www.armsreliability.com

DETECTABLE PLASTIC BEARINGS

Treotham supplies the igus range of lubricant-free, high-performance plastics that can be traced with standard metal detection methods. The magnetic motion plastics reduce costs, increase process reliability and help prevent foreign substances from entering food products.

The material is used in the igubal series, which include flange bearings, rod end bearings, clevis joints, pillow block bearings and spherical bearings. Both the housing and spherical balls are made of the detectable plastic.

The plastics do not require external lubrication, which eliminates the risk of products in the food and packaging industry coming into contact with lubricant. The materials A181 and iglidur A350 don't need to be actively lubricated and are compliant with the EC directive 10/2011 and with FDA specifications for repeated contact with food.

Treotham Automation Pty Ltd

www.treotham.com.au

ASSET MANAGEMENT SOFTWARE

FactoryTalk AssetCentre v7.0 software from Rockwell Automation is designed to automate discovery and track the status of devices, network switches and software on workstation computers across an entire facility or production operation.

A modern production environment contains hundreds to thousands of assets. The FactoryTalk AssetCentre asset-inventory agent scans a network to discover hardware, firmware and software information for assets active in the facility. The devices are then tracked in an active asset inventory.

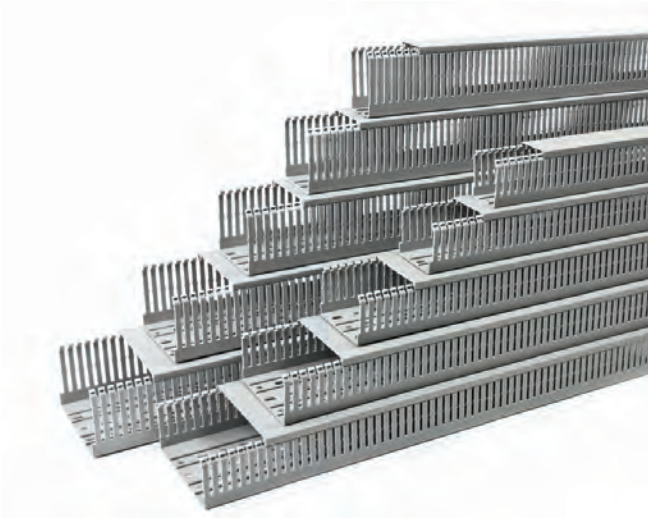
The asset-inventory agent can be scheduled to scan at regular intervals or run on demand. New discoveries are compiled for user confirmation before they are added to the active inventory. Ongoing tracking of updates provides a history of how a system has changed and potential hazards, such as workstation computers running unauthorised software. Manual entry is still available for devices that are not identifiable during the scan or to fill in missing information or attributes for discovered devices. The automated discovery will also help when patching security vulnerabilities.

The latest version of FactoryTalk AssetCentre software also includes a mobile-friendly dashboard, providing access to information about the status of last search results with drilldown capabilities to view failures and successes. The dashboard displays an audit log of changes and asset performance, helping users remotely access the system and address potential issues from the device of their choice.

FactoryTalk AssetCentre software also enables unattended installation. Remote software installation is available for difficult-to-reach locations, reducing labour and transportation costs.

Rockwell Automation Australia

www.rockwellautomation.com.au



CABLE DUCT

Klemsan has expanded the range of sizes offered in the Trunkie range of cable duct. Available in all profile widths of 25, 40, 60, 80, 100 and 120 mm, the company has now added a 150 mm-width profile to the range, along with additional depths in all profile sizes.

Klemsan Trunkie duct features ergonomically designed duct covers that are easily mounted and dismounted; an upper score line that provides for easy removal of the ribs as a result of 90° bending; and a lower score line that allows for easy splitting of wiring duct base and wall.

A dovetail-style rail within the duct provides easy mounting of wiring duct accessories such as cable clips and cable tie mounts inside the duct. A special rib pattern design and narrow finger spacing allow for better wire entry management.

Control Logic Pty Ltd

www.control-logic.com.au

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CONVEYOR ROLLERS WITH THE SMARTS

Conveyor systems are ubiquitous in the food manufacturing industry, but how good would it be if conveyor rollers could communicate with each other and improve the speed and reliability with which goods are transported to their destinations?

Whether it's a pallet load of beer crates or a can of soup on its way through the factory, roller conveyors are used to transport all manner of things from A to B. Roller conveyor systems often form part of production lines where items are moved from one machine to the next so that they can be filled, processed, sorted, distributed or simply transported safely to their destination. These systems represent a significant logistical challenge — one that involves the complex interplay of numerous subsystems and one where there is a lot that can go wrong. A fault with only a few of the thousands of conveyor rollers can lead to an entire production line grinding to a halt or to suitcases ending up in the wrong plane. Today's roller conveyor systems are also restricted to predefined routes, making them quite inflexible as a result.

Now, a team of engineers led by Professor Matthias Nienhaus at Saarland University in Saarbrücken, as well as partners from Saarland University of Applied Sciences and industry, is developing smart conveyor rollers that can communicate with each other.

The team is working on a novel approach to the types of networked production systems envisaged in the Industry 4.0 framework. "Our focus is on the individual roller, which we equip with a drive motor and an intelligent controller. We are developing and testing methods that enable us to gather data from the drive motors," explained Nienhaus.

Conveyor rollers that are smarter than you are

Drive systems specialist Nienhaus and his partners are turning the motor inside every drive roller into a sensor. When the conveyor is running, the drive motors continuously generate data, which allows the rollers to be precisely controlled and thus respond to changing operating conditions. These intelligent roller conveyor systems can identify new routes if a fault arises or can flag up certain conditions, such as when there is space in a box for more cans. The project is now so advanced that the partners are ready to test the system at a large distribution centre.

Who's doing what

Nienhaus' research is centred on the specialist field of miniature electromagnetic motors and microdrive systems with power ratings ranging from a tenth of a watt to several hundred watts. As the system under development does not require any additional sensors, such as position sensors, it is remarkably inexpensive. There is therefore no risk of sensitive sensors becoming damaged or becoming unable to generate a signal for some reason.

The researchers at Saarland University measure signals from specific locations in the motor, such as those that indicate the distribution of the magnetic field strength. An electromagnetic field is generated when electric current flows through the three coils located within the outer ring of rotating permanent magnets.

Knowing how this magnetic field varies when the motor rotates provides the engineers with detailed information about the drive. The measurement data is used by the research team to compute the position of the rotor and to infer important information about the performance of the motor. "By analysing this data, we are able to control the motor in a very efficient manner," explained Nienhaus.

If one of the rollers is not rotating properly because the bearing is worn, or if a short circuit has knocked out one of the coils, the magnetic field generated by the motor will change and this will be immediately registered by the system.

"The data we gather enables us to detect even very small changes," said Nienhaus. The system is able to detect any deterioration in the performance of a roller early on. The engineers perform calculations and experiments to determine how the measurement data correlates with specific motor states. The results are stored in the system's 'brain' — a microcontroller that processes the data in real time. The thousands of individual rollers in the roller conveyor system interact with one another via the network operating system that is integrated into each roller. The rollers can communicate with each other and can therefore respond flexibly whenever an unexpected condition arises. Unlike conveyor systems with a centralised external controller, each conveyor roller 'knows' by itself how to respond at any given time. This makes it possible to build roller conveyor systems that can do new things.

"By analysing angular momentum data, we can draw conclusions about the weight of a box currently being transported and decide whether or not another package could be added to the box," explained Nienhaus.

"We want to develop the transport system to a stage where it can move freely on the ground," he continued. He and his team are also working on ways to make the data even more reliable by computationally filtering out artefacts and interference effects. In addition to Nienhaus' group at the Laboratory of Actuation Technology at Saarland University, other project partners are Professor Martina Lehser from Saarland University of Applied Sciences, Wellgo Gerätetechnik (Nohfelden), HighTec EDV-Systeme (Saarbrücken) and Micronas (Freiburg).

The Federal Ministry of Education and Research (BMBF) has funded the project 'Rolle' to the tune of €4.2 million, of which around €500,000 was allocated to Saarland University.

Image credit: Oliver Dietze

Drive systems specialist Matthias Nienhaus from Saarland University is collaborating with partners to develop smart conveyor rollers that communicate with one another.

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VALVE ACTUATOR SOFTWARE

Emerson Process Management has introduced DCMlink software, a unified electric actuator control, monitoring and diagnostics platform.

The DCMlink platform will allow Emerson customers to diagnose, configure and monitor all electric actuators from a central location independent of protocol, actuator or host system. The software extends the useful life of field assets by providing actuator data gathering, condition monitoring, events log and prioritisation of actuator alarms in a unified and consistent user interface. Actuator configuration includes custom characterisation, as well as the ability to import and export historical configuration profiles.

Whether it is viewing the torque profile, live trending data or actionable alarms straight from the actuator, plant operators will be able to access detailed monitoring and diagnostics data, allowing them to take action before a fault occurs. DCMlink offers advanced control and diagnostics, including torque profile curves, initiating partial stroke test or emergency shutdown and alarms in NE-107 format. Current communications support includes Modbus, TCP/IP and Bluetooth.

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

COMPACT RUGGED COMPUTER

Crystal Group has announced the RE1401 NUC (Next Unit of Computing), a compact, high-performance, rugged embedded computer appropriate for operational deployment in harsh environments.

The product provides current leading-edge computational architecture in a small, rugged package. The platform brings desktop performance to a compact device size, with the flexibility to scale up based on productivity needs for a wide range of applications.

Measuring 16 x 4.83 x 12.20 cm and weighing only 907 g, the unit is small enough for placement in size-constrained areas and rugged enough for the harshest environments, including shock and vibration. It is suitable for military and industrial installations requiring compute processing and data collection.

With a rugged, all-aluminium compact chassis footprint, the device is based on Intel's NUC motherboard form factors 5th or 6th generation i5/i7 workstation. It features a single removable SSD and single fixed SSD with a removable SD card slot. The system utilises standard USB 2.0 and 3.0 ports, a 3.5 mm headset jack, one or two mini-Display ports and HDMI 2.0 or mini HDMI. Mounting alternatives include tabletop and tray options. It is compatible with any of six operating systems — Windows 7/8.1/10, Server 2012 R2, Ubuntu, Fedora or openSUSE.

The product is optimised for environments where a traditional desktop is not suitable and allows for maximum integration flexibility. The unit's low-profile design is easy to use for transportation, storage and deployment.

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POWER MONITORING SOFTWARE

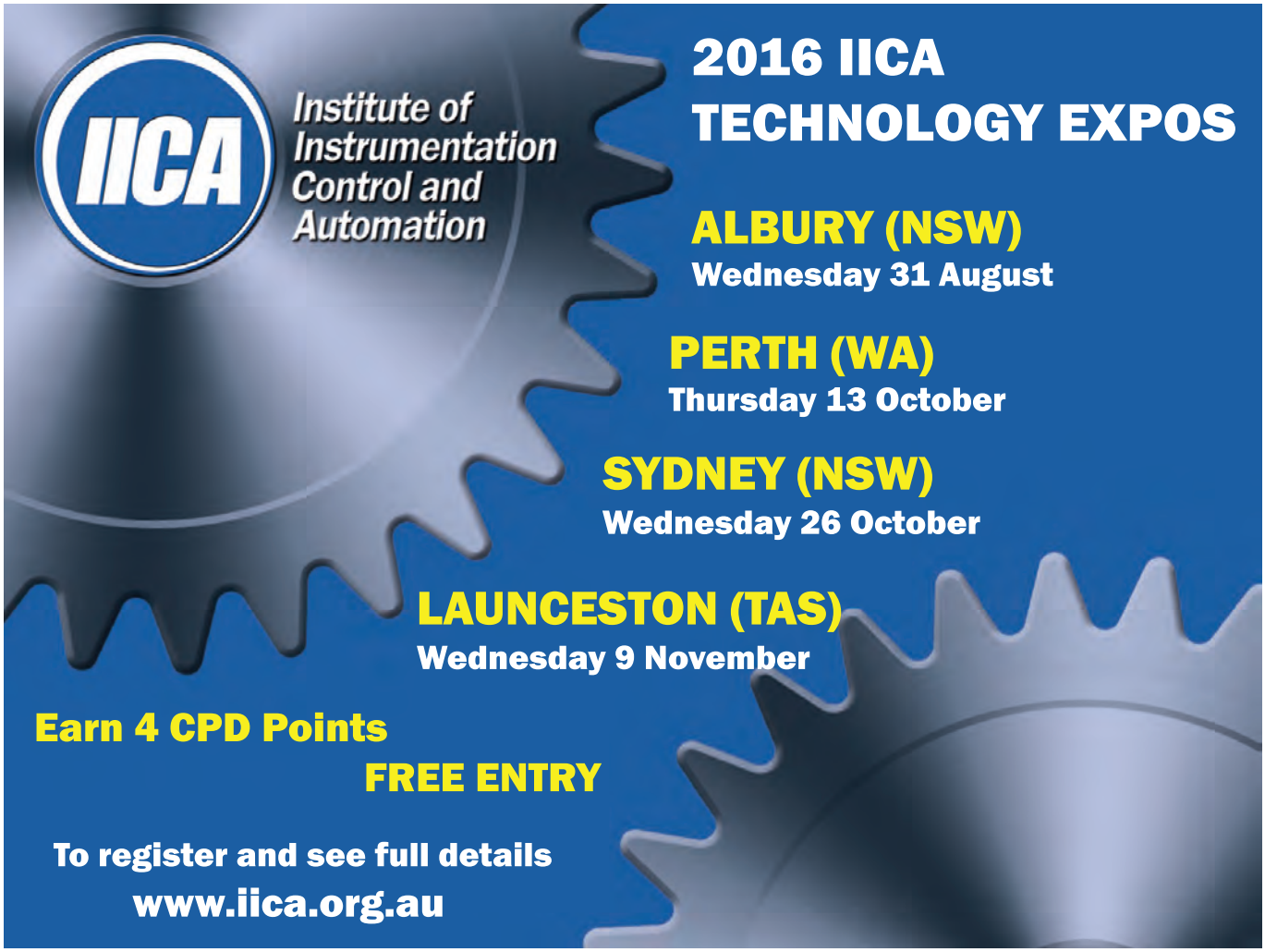
Schneider Electric has announced the latest version of the StruxureWare Power Monitoring Expert software for integrated energy management and electrical distribution management across entire facilities. Deployed for managing critical energy data in diverse environments, from industrial plants to data centres, Power Monitoring Expert 8.1 comes with segment-specific implementation support for project execution teams to deliver custom solutions in a consistent, efficient and repeatable way.

In addition to the existing Power Monitoring Expert 8 feature set, the enhanced software features include Power Quality Advisor, an optional application module that provides power quality analytics, power quality advisor dashboards, as well as power quality analysis and process impact reports; and HTML5 dashboards for simpler workflow and improved visualisations, for mobile-friendly viewing.

Along with enhanced cybersecurity features, StruxureWare Power Monitoring Expert also includes updated energy analysis reporting with four new reports for energy and power usage by state for equipment, and an energy intensity (KPI) calculation procedure, as well as EN50160-2010 report support.

StruxureWare Power Monitoring Expert is interoperable and scalable, allowing data sharing between applications that makes project design, execution and maintenance highly adaptable to users' needs. Users can track the effectiveness of their energy-efficiency measures with the improved Energy Analysis module, while the optional Power Quality Advisor module provides analytics and advisory dashboards to help users gauge the impact of power quality in their facilities.

Schneider Electric Industry Business
www.schneider-electric.com



SIMULATION SOFTWARE

CD-adapco has announced the release of its STAR-CCM+ v11.04 engineering simulation solution. This release is aimed at empowering engineers across industries to make critical design decisions quickly and with confidence through more modelling capabilities, improved simulation workflows and reductions in overall time-to-solution.

The product has added features drawn from the CD-adapco customers' innovation forum. They include expanded multiphase simulation capabilities for turbomachinery users, for applications such as pumps and wet gas compressors; increased accuracy and faster time-to-solution for marine and oil and gas users due to a wave forcing model; and automatic time-step adjustment for transient runs.

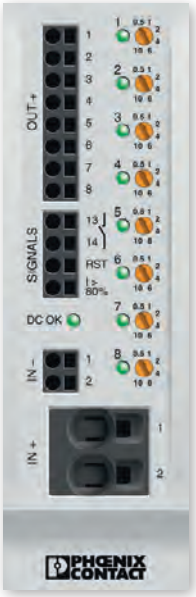
Aerospace and ground transportation users benefit from features enabling steady-state fluid film simulations, when appropriate, for applications such as water management and aircraft icing, while there is increased flexibility and ease of use for ground transportation and electronics customers when modelling conjugate heat transfer of composite laminate structures.

The introduction of 3D finite element electromagnetics further expands the STAR-CCM+ multiphysics platform to model electromagnetic problems for applications such as electric machines, transformers and plasma devices.

CD-adapco Australia

www.cd-adapco.com.au

MULTICHANNEL CIRCUIT BREAKERS



Phoenix Contact has released highly compact, all-in-one, multichannel CBM electronic device circuit breakers to help users significantly save on panel space. With a choice of either a 4- or 8-channel CBM electronic device circuit breaker, users no longer need to stack single 18 mm-wide circuit breakers together in a control cabinet.

At 41 mm wide, the compact design ensures technicians can place the device into smaller cabinets, leaving more space within the cabinet for technicians to add other components.

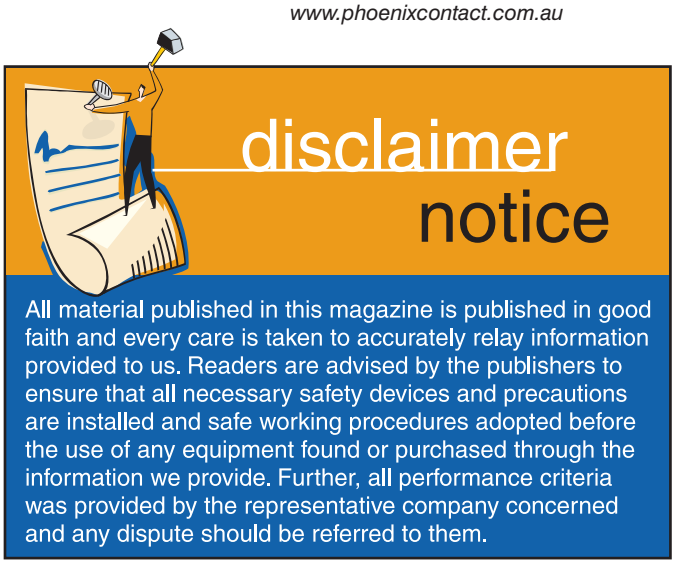
The electronic circuit breakers protect susceptible 24 VDC electronic equipment against voltage dips, overloads and short circuit currents. They feature remote status signalling and a remote reset to clear a tripped channel, eliminating the need for a technician to have to be present to reset a circuit — the channel can be cleared from the convenience of a programmable logic controller or at the operator interface.

The circuit breakers also feature an adjustable current per channel of 0.5 to 10 A. This allows technicians to choose from six ranges and to set the required protection level for individual circuits. For additional safety, an electronic locking mechanism prevents accidental changes to the set nominal currents and push-in technology enables fast and easy connection.

Each unit also comes with an in-built alarm that delivers an early warning when a channel exceeds 80% of the set nominal current. A multistage status indicator that is available for each channel provides constant information about the status of the connected loads.

Phoenix Contact Pty Ltd

www.phoenixcontact.com.au



AS I SEE IT

INDUSTRIAL INTERNET OF THINGS — THE NEXT BIG THING?

Much of what has been heard and read lately claims that the Industrial Internet of Things will be the next big thing in manufacturing and processing. When I see how interconnected equipment can be utilised to provide benefits for preventive maintenance and increasing operational uptime, it sure sounds good. The capability for production managers to interrogate the performance of the plant while off-site, or for technicians to remotely access and fix equipment or adjust settings to tune a process, provides obvious benefits.

Having all of this process data is great, but interpreting and utilising it to capitalise on the benefits requires resources. With big data being a relatively new field, the types of skills required to implement these changes are not yet commonplace. Powerful business intelligence (BI) tools are being developed to be more intuitive and user-friendly, but there is still a learning curve. Partially dependent on the size of the plant, there must be a tipping point where the demands of utilising the data require a larger investment in equipment and human effort than the potential benefits from streamlined production and maintenance.

The security risks of having production tied to the outside world through the internet present other considerations. Inadequate cybersecurity could potentially result in malware infecting your network or, possibly most concerning, the control system being reprogrammed, resulting in faulty goods. There could be downtime while the changes are rectified or PCs are disinfected. The risks are real.

There are steps that can be taken to isolate the control system from the internet. The control system can be connected only through an intranet, and then the relevant data can be dumped into a database which is available externally through the internet, but there are sizeable trade-offs as some of the benefits of running IIoT are removed. There is a time lag between the process's operation and the data dump. The production manager can't view real-time process status while off-site and the technician can no longer remotely access equipment.

My belief is that, for all the potential benefits, IIoT will be more evolution than revolution. We've seen a multitude of new protocols arrive over the years, including HART, Modbus, Profibus and Foundation Fieldbus, which have all provided the capability to access an ever-increasing amount of process data. Even now, after these protocols have been available since the late '80s, these systems are generally used during commissioning and for set-up of replacements, rather than online monitoring. Most plants still rely on the simplicity of an analog signal for their process control monitoring. For legacy plants, part of the reason is process familiarity and training.

Even for new plants, the operational staff are usually sourced through the existing available pool of people who've previously been working on legacy plants and may have limited experience with the more modern protocols, so the issue carries over.

As creatures of habit, sticking to what we know is a human tendency. This will always restrict the pace of change and the implementation of new technology. For new projects, technological change is often incremental, rather than wholesale. For all its potential benefits, I think it will be a while before we see a wide-scale rollout of the IIoT.

After studying electrical engineering and accountancy, Tom Kuiper joined AMS Instrumentation & Calibration and is currently National Sales Manager. He has broad experience in a wide range of applications and industries.

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