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ON THE COVER



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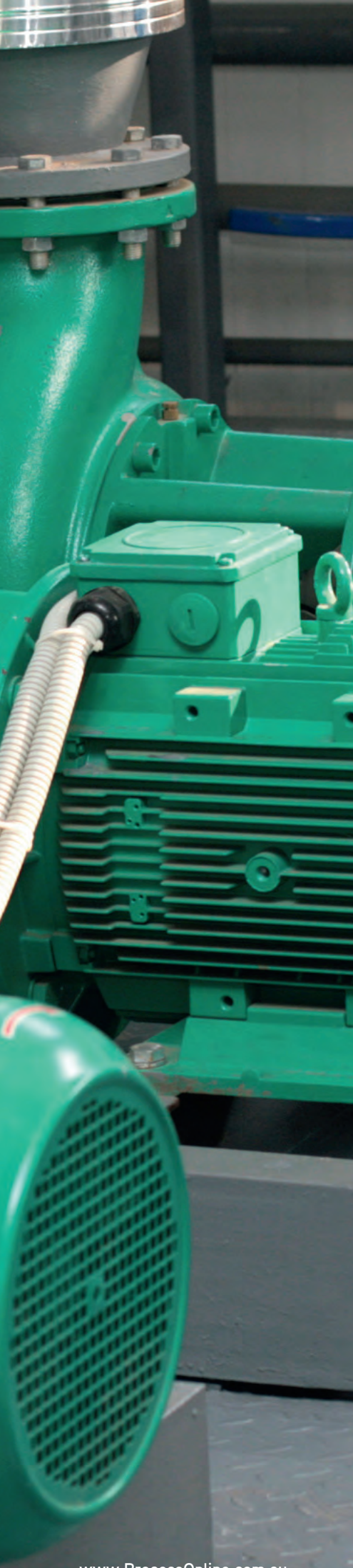
A detailed photograph of industrial equipment. In the foreground, a large green electric motor is visible, with a yellow warning label on its side. Behind it, there are stainless steel pipes, a pressure gauge, and various valves. The background shows more industrial structures, including a tall metal frame.

DIRECT TORQUE CONTROL

A MOTOR CONTROL TECHNIQUE
FOR ALL SEASONS

Ere Jääskeläinen and Pasi Pohjalainen

While enabling unprecedented performance in electric motors and delivering dramatic energy savings, most VSDs rely on conditioning voltage and frequency, causing inherent time delays in processing control signals. In contrast, direct torque control (DTC) drives greatly increase motor torque response, among other benefits.



Electric motors are often at the spearhead of modern production systems, whether in metal processing lines, robotic machining cells or conveyor systems. The motors we see today have certainly benefited from advances in improved materials, manufacturing efficiencies and analytical tools. However, their design principles have remained the same for over 100 years in the case of the work-horse synchronous (or induction) AC motor. Rather, the remarkable performance of these motors in today's applications comes from modern electronic controls — variable-speed drives (VSDs) — and accurate motor models whose sophisticated control algorithms can be rapidly executed by high-performance digital signal processors. Moreover, the development of VSDs has enabled the use of new AC motor technologies such as permanent magnet synchronous motors and synchronous reluctance motors.

Initially, DC motors drew the attention of drive developers. With an even longer history than their AC cousins, DC motors offered inherently simple speed and torque control. However, higher motor cost, more complex construction with a mechanical commutator, and brush maintenance issues were some trade-offs associated with DC motors.

AC induction motors offered simpler, rugged construction and lower cost, and posed fewer maintenance concerns — characteristics that have led to their wide usage with a huge installed base worldwide. On the other hand, control of induction motors proved to be complex. Accurate speed control, and particularly torque control, remained elusive for early AC drives. Naturally the goal of the early designers was to emulate in AC drives the DC drive's simple control of motor torque by using armature current. Over time, AC drive designs have evolved offering improved dynamic performance.¹

Most high-performance VSDs since the 1980s have relied on pulse-width modulation (PWM). However, one consequence of using a modulator stage is the delay, and a need to filter the measured currents when executing motor control commands — hence slowing down motor torque response.

An alternative approach to high-performance AC motor control is direct torque

control (DTC). This method directly controls motor torque instead of trying to control the currents analogously to DC drives. This means better accuracy in matching the load requirements of the driven system. DTC further eliminates the need for an extra modulator stage and thus achieves control dynamics that are close to the theoretical maximum. The first AC industrial drive with direct torque control came to the market in 1995.²

In principle, DTC was already a leading technology back in 1995, but subsequent developments in processor computational power, communication interfaces, application programming etc have enabled higher performance, providing premium motor control for a broad range of applications.

DTC's core is the torque control loop, where a sophisticated adaptive motor model applies advanced mathematical algorithms to predict motor status. Primary controlled variables — stator flux and motor torque — are accurately estimated by the motor model using inputs of motor phase currents and DC bus voltage measurements, plus the states of the power-switching transistors in the drive. The motor model also calculates shaft speed. Temperature compensation also helps to enhance calculation accuracy without an encoder.

Why use DTC?

Superior torque response is just one feature of DTC. The technology offers further benefits, including:

- No need for motor speed or position feedback in 95% of applications. Thus the installation of costly encoders or other feedback devices can be avoided.
- DTC control is available for different types of motors, including permanent magnet and synchronous reluctance motors.
- Accurate torque and speed control down to low speeds, as well as full start-up torque down to zero speed.
- Excellent torque linearity.
- High static and dynamic speed accuracy.
- No preset switching frequency. Optimal transistor switching is determined for every control cycle, allowing the drive to more readily match driven load requirements.

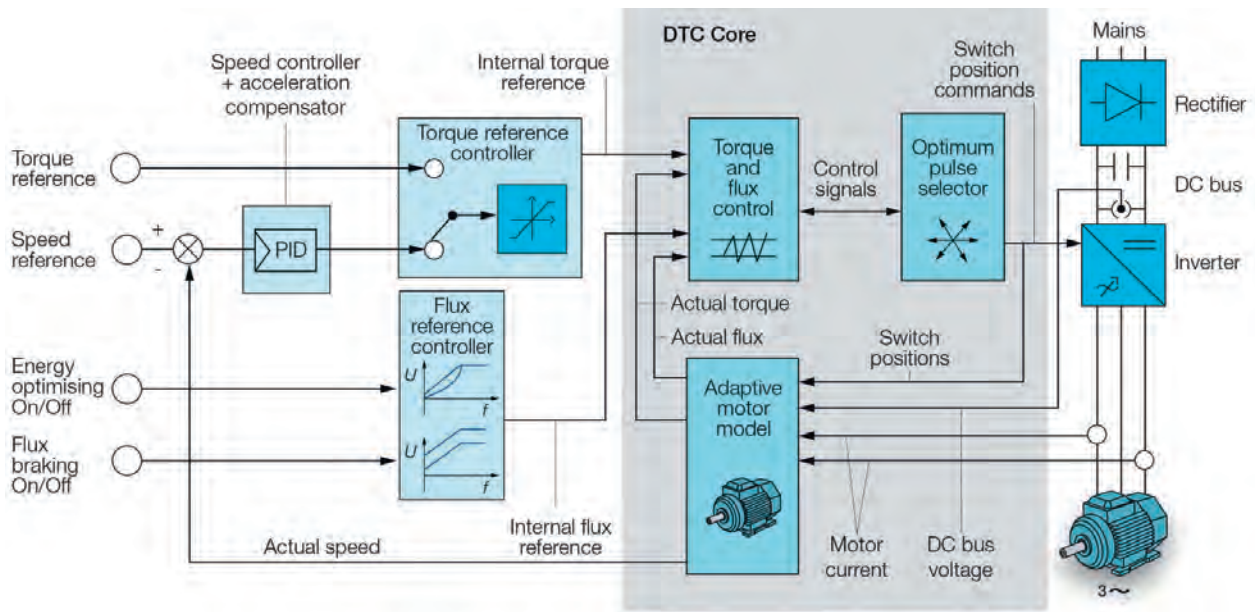


Figure 1: DTC operation principle.

As the name suggests, DTC seeks to control motor flux and torque directly, instead of trying to control these variables indirectly like DC drives and vector-controlled AC drives do. Separate torque and speed control loops make up the full DTC system but work together in an integrated way (see Figure 1).

Additional motor parameters are automatically fed to the adaptive model during a motor identification run when the drive is commissioned. In many cases, appropriate model parameter identification can be done without rotating the motor shaft. For fine-tuning of the motor model, which is only needed for few high-demand applications, the motor has to be run, but then only for a short time and without load.

Stator resistance (voltage drop) is the only measurable parameter needed for estimating the motor's magnetic flux. Motor torque can then be calculated as the cross product of estimated stator flux and stator current vectors. While stator resistance is the main source of estimation error, its influence diminishes with increasing motor speed and voltage. Thus DTC has excellent torque accuracy in a wide speed range. Moreover, DTC includes advanced ways to minimise estimation error at low motor speeds.

Output signals from the motor model — which represent actual stator flux and motor torque — go to a flux comparator and torque comparator respectively. These

separate control units compare their inputs to a flux and torque reference value. Already in the mid-1990s the first DTC controlled drives performed these functions every 25 μs using a high-power digital signal processor (DSP). In the latest control generation the interval is reduced down to 12.5 μs , thus further enhancing control performance. Each comparator seeks to hold its respective flux or torque vector magnitude within a narrow hysteresis band around a reference value. DTC's fast torque response without overshoot comes, in part, from the ability to minimise these vector fluctuations. Exceptional motor response is also due to the DSP control algorithms updating the adaptive motor model at the same high cycle rate.

Flux and torque errors — differences between estimated and reference values — and the angular position (or sector) of the stator flux vector are used to calculate flux and torque status in the hysteresis controllers. Then, these status values become inputs to the optimum pulse selector, where the optimum voltage vector is selected from the look-up table. In this way, the most appropriate signal pulses for each control cycle can be sent to power switches in the inverter to obtain or maintain precise motor torque.

A field-programmable gate array (FPGA) assists the DSP with determining inverter switching logic and other tasks. The FPGA allows for control modifications or drive

design updates versus an application-specific integrated circuit (ASIC) which, if used, requires locking in the design.

Performance

DTC provides superior performance features over competing drive methods. Being a 'sensorless' control method (speed estimation instead of measurement), costly motor speed or position feedback devices are not needed in most cases. Depending on motor size, static speed accuracy as low as $\pm 0.1\%$ is typically obtained. For higher demand applications, a DTC drive equipped with a standard encoder (1024 pulses/rev) typically achieves $\pm 0.01\%$ speed accuracy.

Dynamic speed accuracy (time integral of the speed deviation under a 100% load impact) is 0.3 to 0.4%-seconds with typical equipment driven by the motor. Using an encoder, speed accuracy typically improves to 0.1%-seconds and matches servo drive accuracy.

Torque response time to a 100% torque reference step is typically 1–5 ms, which approaches the motor's physical limit. Torque repeatability under the same reference command is typically as low as 1% of nominal torque across the drive's speed range. As for control at very low motor speeds, DTC provides 100% torque down to zero speed — with or without speed feedback, as well as a position control feature when using an encoder. These performance values refer specifically to induction motor control.

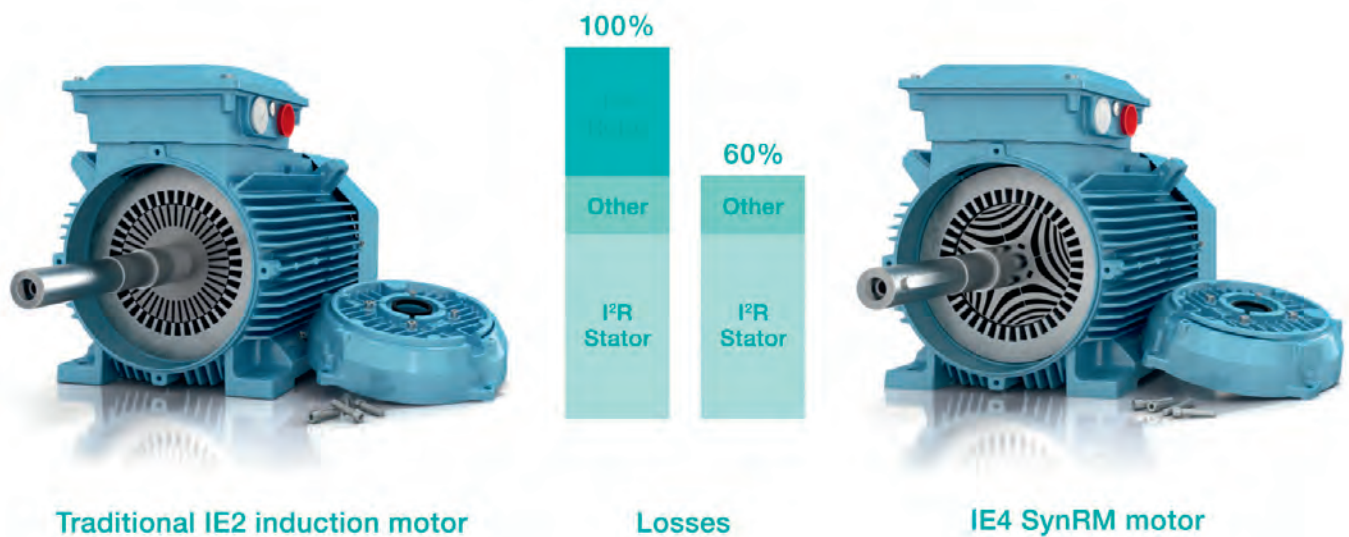


Figure 2: The synchronous reluctance motor utilises a new rotor design and is optimised for VSD operation.

Beyond induction motors

DTC was originally developed for AC induction motors because of their popularity in myriad industrial and commercial applications. No doubt the 'workhorse role' of induction motor technology will prevail over the foreseeable future. However, in the quest for higher power density and evolving international efficiency regulations, other motor topologies are drawing renewed interest.

For example, standard IEC 60034 part 30³ defines international efficiency (IE) classes, the highest of which — IE4 (super-premium efficiency) — is becoming difficult to meet for induction motors. An even higher IE5 class has also been proposed.

The good news is that DTC is equally applicable to other motor types, such as permanent magnet (PM) synchronous and synchronous reluctance (SynRM) motors. The main difference occurs during motor starting. Unlike induction motors, PM synchronous motors and SynRM motors require the control system to estimate rotor position at start-up from the location of poles in the rotor, if no position sensor is used.

In these motors, absence of rotor windings and the slip-speed effect inherent to induction motors substantially reduce losses. Moreover, synchronous operation means that excellent speed accuracy is achieved even without a speed or position sensor. Thus, a sensor can be omitted in most cases except in applications such as

winches and hoists that require non-zero torque at standstill for long periods.

In a PM motor, permanent magnets are commonly mounted on the rotor's outer surface. However, a PM synchronous motor variant, the internal PM (IPM) rotor design, embeds the magnets within the rotor structure. An extra reluctance torque component generated in IPM synchronous motors makes them attractive for high-demand applications.

In addition, embedded magnets create very pronounced rotor-pole saliency, which allows accurate speed estimation and enhances DTC's basic sensorless operating mode. Due to high torque to motor size ratio, a simpler system drive train may be possible when using PM synchronous motors. For example, a direct-driven low-speed PM motor can eliminate the gearbox in packaging machines.

Numerous applications for PM synchronous motors include machine tools, marine propulsion, wind turbines (generators) and cooling tower fans for electric power plants.

One partly economic drawback of PM synchronous motors is their reliance on so-called rare-earth (RE) magnet materials for best performance, such as neodymium-iron-boron. Recent pricing and global supply issues of RE materials have created serious concern for equipment manufacturers that reaches well beyond electric motors.⁴ Synchronous reluctance motors are therefore providing an alternative to PM motors.

Synchronous reluctance motors have a stator structure similar to induction motors. However, the rotor consists of axially stacked steel laminations shaped to provide a cross-section with four poles — with alternating high-permeability (iron) axes and low-permeability (air) axes. Importantly, no magnets are needed in the rotor.

Versions of DTC modified for PM synchronous and SynRM motors have been implemented. In addition to high dynamic motor control, DTC drives — combined with any of the efficient motor technologies mentioned above — offer great energy savings potential for the large number of variable-speed pump and fan applications.

This can be visualised from so-called 'affinity laws' associated with pumps and fans that relate variables such as flow volume, pump speed, pressure, power, etc. For example, pump speed versus power has a cubic relationship, meaning that when a process sequence allows the pump to run at half speed, only 1/8 of full power is required. Of course, reduced motor and drive efficiencies at partial loads would lower the system efficiency but overall less energy will be used.

Wider applications

Another aspect of the DTC story is its expansion beyond applications for which the technology was created. Demanding, highly dynamic applications were targeted early on, because they could justify costly initial

software developments and available microprocessors. That scenario has changed greatly. Control system software has been amortised over the growing sales volume of AC drives and economically justified to implement in drives for more standard applications. High-performance DSPs also have become common and affordable.

The ability to respond rapidly to changes in process variables such as pressure, tension or position using exceptional speed and torque control dynamics has made DTC attractive to wider industrial and process applications.

DTC can also provide protective functions to connected machinery or the motor itself. Tight torque control can optimise tuning of the speed controller to damp out torsional vibrations.

Minimising overloads and shock loads becomes possible through timely detection of connected system parameter changes and DTC's fast control response. The concept can be extended to driven-system failure detection. For example, sudden torque loss might indicate a conveyor belt breakage, or higher than normal torque needed to produce some output may indicate binding or abnormal wear in the machine. Drives can therefore be used as part of overall process diagnostics.

DTC has also been applied to reduce harmonic distortion from the drive, hence improving power line quality. Low-frequency harmonics can be mitigated in the line currents by replacing the diode rectifier of an AC drive with a DTC-controlled IGBT supply unit (ISU). The LCL filter of the ISU removes high-frequency harmonics and provides additional filtering for the grid. In many cases even voltage distortion in the grid may be reduced by using a drive with an ISU. Moreover, with an ISU it is possible to feed the braking energy back to the grid. Thus in applications that require frequent deceleration energy cost savings can be achieved.



DTC'S CORE IS THE TORQUE CONTROL LOOP, WHERE A SOPHISTICATED ADAPTIVE MOTOR MODEL APPLIES ADVANCED MATHEMATICAL ALGORITHMS TO PREDICT MOTOR STATUS.

DTC today and tomorrow

Resting on firm theoretical foundations, direct torque control has shown a continuum of hardware and software improvements over its more than 25-year lifespan. A DSP-based technology from the start, DTC has overcome the limitations of the early processors for speedy calculation of control algorithms. DSP limitations also restricted the drive's maximum switching frequency in the past, hence its output frequency. DTC relies on rapid switching of the drive's transistors for optimal performance and timely updating of motor model parameters. Powerful processors are now readily available.

Today, DTC drives have higher output frequency, allowing motors to run faster. This is an important feature for certain applications, such as test benches and machine tools. Drives running induction motors in an industrial application typically provide 2–4 kHz switching frequencies that maximise the efficiency, while machinery drives powering PM synchronous motors typically supply 5–8 kHz switching to run the motors with best possible dynamics.

Software has been another key element behind the success of DTC: improvements and updates include redesigned and optimised code for the whole control system (from user interface to motor shaft) to further enhance drive response time and performance.

Motor models also receive regular updating. Control algorithms are periodically analysed and the resulting improvements are thoroughly verified through laboratory testing with different motors. This can include investigating some new features or control ideas with an existing or modified motor; or looking at some special customer application requirement.

Today, DTC remains a living technology, having built a continuum of advances atop a solid foundation.

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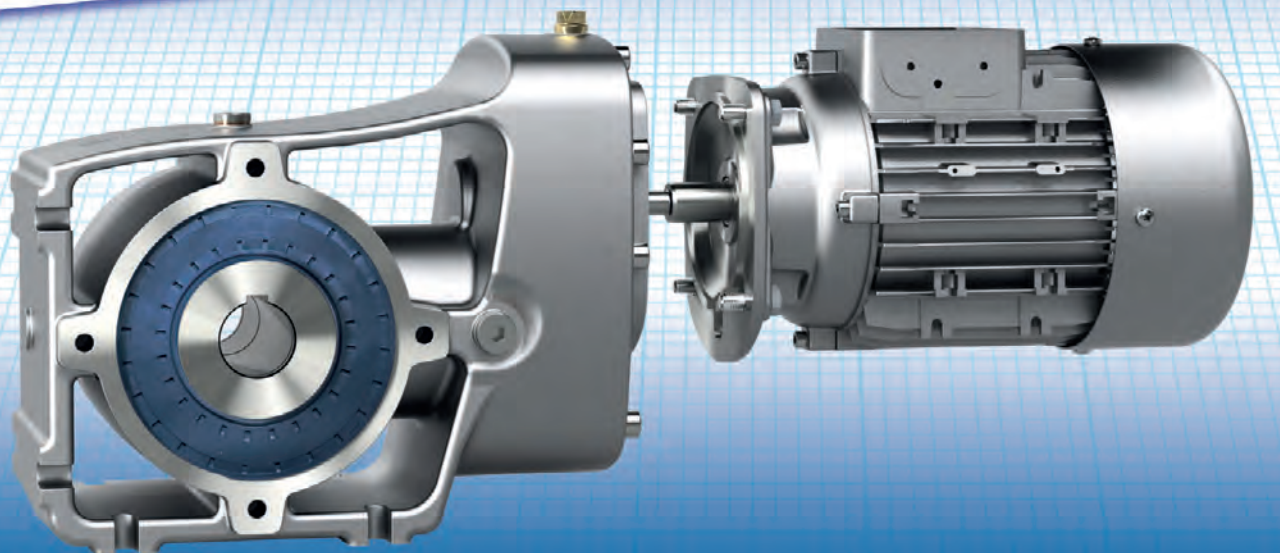
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DC MOTOR GEARHEAD COMBINATION

Higher levels of torque and position capability are now possible with the development of adaptive hardware for maxon low-profile brushless DC motors and harmonic planetary gearheads.

Combining a brushless DC 70 W 24 V motor, a 2048 counts/turn internally integrated encoder and a harmonic, lightweight, low-profile zero backlash gearhead, maxon motor has produced an assembly that increases the torque and reduces the size compared to previous solutions using planetary gearbox technology.

The output capability is 19 Nm repeated and 31 Nm intermittently, for a combination just 55 mm in diameter and 59 mm long for all three components. Having an internal encoder

and a zero backlash gear makes the unit suitable for robotic joint and positioning applications in industrial automation, process control and also for precision laboratory and scientific equipment.

maxon motor Australia Pty Ltd

www.maxonmotor.com.au



MULTIFUNCTION SAFETY GATE LOCK

The MGB2 is a further development of Euchner's Multifunctional Gate Box (MGB). The updated design offers new and extra functions, as well as a modular layout and maximum flexibility all integrated into the one device.

The modular version is equipped with a bus module (MBM) with integrated Profinet/Profisafe. It can be connected directly to the MGB2 or, if space is tight, can be mounted remotely and connected using cables. If the bus module is mounted remotely, up to two MGB2 modules can be connected to one MBM.

The modular design allows the MGB2 to be equipped with different functions. It offers space for two submodules, with up to three different controls each. A submodule can be replaced at any time, even during operation, as the MGB2 is hot-pluggable.

The MGB2 features a robust industrial housing and has an integrated solid door stop and mounting plate. It can be mounted on doors hinged on the left and right, as well as sliding doors. The locking force of 2000 N prevents unintentional opening of the safety guard. It meets requirements of all relevant standards including EN ISO 13849-1 and EN ISO 14119.

Treotham Automation Pty Ltd

www.treotham.com.au



HMIS WITH DNP3

Red Lion recently expanded its serial and Ethernet driver range with the addition of DNP3. This driver will allow the Red Lion Graphite series HMIs and Graphite Core Controllers to support both DNP3 master and slave communications.

With DNP3 now native on board the Graphite HMIs, it is possible to add a HMI to remote pump stations and well head monitoring stations where typically an RTU would be required. This also allows non-DNP3 devices to communicate via the Graphite HMI upstream to a suitable SCADA but still maintain the integrity of data. With an extensive list of both serial and Ethernet drivers, many common industrial products can be connected.

The driver supports both serial and Ethernet media, allowing the Graphite HMI to be easily retrofitted into both new and existing applications.

With the addition of the Core Controller PLC engine and combined with Crimson 3.0 IEC61131 programming software, the Graphite platform will offer both DNP3 communications and hardware capable of running HMI and PLC logic.

Control Logic Pty Ltd

www.control-logic.com.au

SERVICE INTERFACE

Weidmüller's FrontCom Vario is a compact service interface for switch and control cabinets, providing easy access to the control system or PC and electronics.

Without downtime or additional staff, technicians can use the service interface to perform maintenance tasks or rectify errors in the production process. Authorised personnel can, for example,

connect diagnostic hardware

using a data cable or an optional power cable. FrontCom Vario is suitable for use in areas such as machine construction, the process industry and power and traffic engineering — and is compact.

The system supports a multitude of standards for communication interfaces in different designs, such as RJ45, USB or D-Sub, as well as different country-specific socket systems. As a modular service interface, FrontCom Vario offers a combination of single frames, power, signal and data inserts, as well as the correct insert plate. Cat 6A RJ45 inserts from Weidmüller's STEADYTEC series offer high performance (Cat 6A up to 10 GBps).

Touch-protection on the interior offers additional marking possibilities for each port, allowing each interface also to be clearly identified inside the cabinet. Weidmüller also provides an online configurator that can be used to find and configure suitable interfaces from the more than 5000 FrontCom Vario combinations.

Weidmüller Pty Ltd

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IE3 MOTORS FROM 0.12 KW

NORD Drivesystems has expanded its IE3 premium efficiency motor range to also include smaller motor powers. Available as an alternative to its IE2 motor range, the smaller-sized IE3 range with rated power from 0.12 to 0.75 kW — which finds use across a large share of all drive applications — will make it easier to equip entire plants with eco-friendly, highly efficient drive systems.

While the efficiency percentiles for this performance class have only been defined in the last stage of the European Union Ecodesign Directive for electric motors and have only recently been introduced into the international standard IEC 60034-30-1, legally there is no immediate need to act on motors this small as IE3 requirements within the EU only apply to motors rated at 7.5 kW or higher.

Users with a particular concern for the environment and those seeking to truly maximise efficiency may wish to go beyond current legal obligations. NORD supplies the compact IE3 motors in IEC frame sizes. Changing the specifications to IE3 is a smooth process that will not require physical design changes to machinery and equipment.

NORD Drivesystems (Aust) Pty Ltd

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Ethernet improves electricity supply quality

Electricity North West owns, operates and maintains the electricity distribution network in the north-west of the UK, connecting more than five million people in the region to the National Grid. The network covers a diverse range of terrain — from isolated farms in rural areas such as Cumbria, to areas of heavy industry and urban populations including Manchester. Electricity North West is continuously looking to improve the quality of service provided to its customers. Effectively monitoring and controlling the 500 primary substations distributed throughout the region is critical to achieving this. The substations ensure that power can be rerouted should a problem arise, thereby helping to minimise loss of supply.

“Our main aim is to maximise the quality of supply and minimise lost minutes,” explained Paul Gornall, who is the network and field operations manager at Electricity North West and responsible for telecommunications and telemetry systems. “It is imperative that we demonstrate delivery to the edge of the power network and to do this we must have a suitable communications network that supports these operational deliverables.”

The data communications network provides the means of connecting these locations back to a centrally located SCADA system. Remote terminal units (RTUs) installed at the primary substations route voltages, current, switch states, temperature of transformers and alarm data from connected sensors and equipment.

The existing data communications network was a VF serial-based solution, which offered limited bandwidth (only 1200 baud), no redundancy and insufficient resilience. An upgrade to an Ethernet TCP/IP-based solution was required to provide much greater reliability, resiliency and bandwidth. It also needed to support the broader range of enhanced functions and services. The existing communications network was based on copper cabling. It was thought that to support an Ethernet-based network, a vast new fibre-optic cable infrastructure would be required. With approximately 11,000 km of installed cabling potentially needing to be replaced, the size, complexity, time and cost of the project was extremely prohibitive. It was therefore essential to find a solution whereupon the existing cable infrastructure could be used, wherever possible.

Westermo Wolverine Ethernet line extenders presented the solution to this challenge, as they allow effective Ethernet networks to be created over distances of up to 15 km (depending on cable characteristics), while enabling data rates up to 15.3 Mbps. Critically, the SHDSL communications technology the devices are based upon makes it possible to re-use many types of pre-existing copper cables. This meant that Electricity North West could avoid replacing its vast cable infrastructure but still upgrade the network.

“Because we have an ageing copper cable network, we wanted to install and maintain network redundancy wherever possible to ensure we have a very resilient and reliable solution. The Westermo Wolverine Line Extenders are helping us to achieve this while still using the existing cables. As a result, we have installed the devices throughout the entire network,” said Gornall.

Approximately 750 Wolverine Line extenders are being used to connect the RTUs at the 500 primary substations back to the SCADA system.



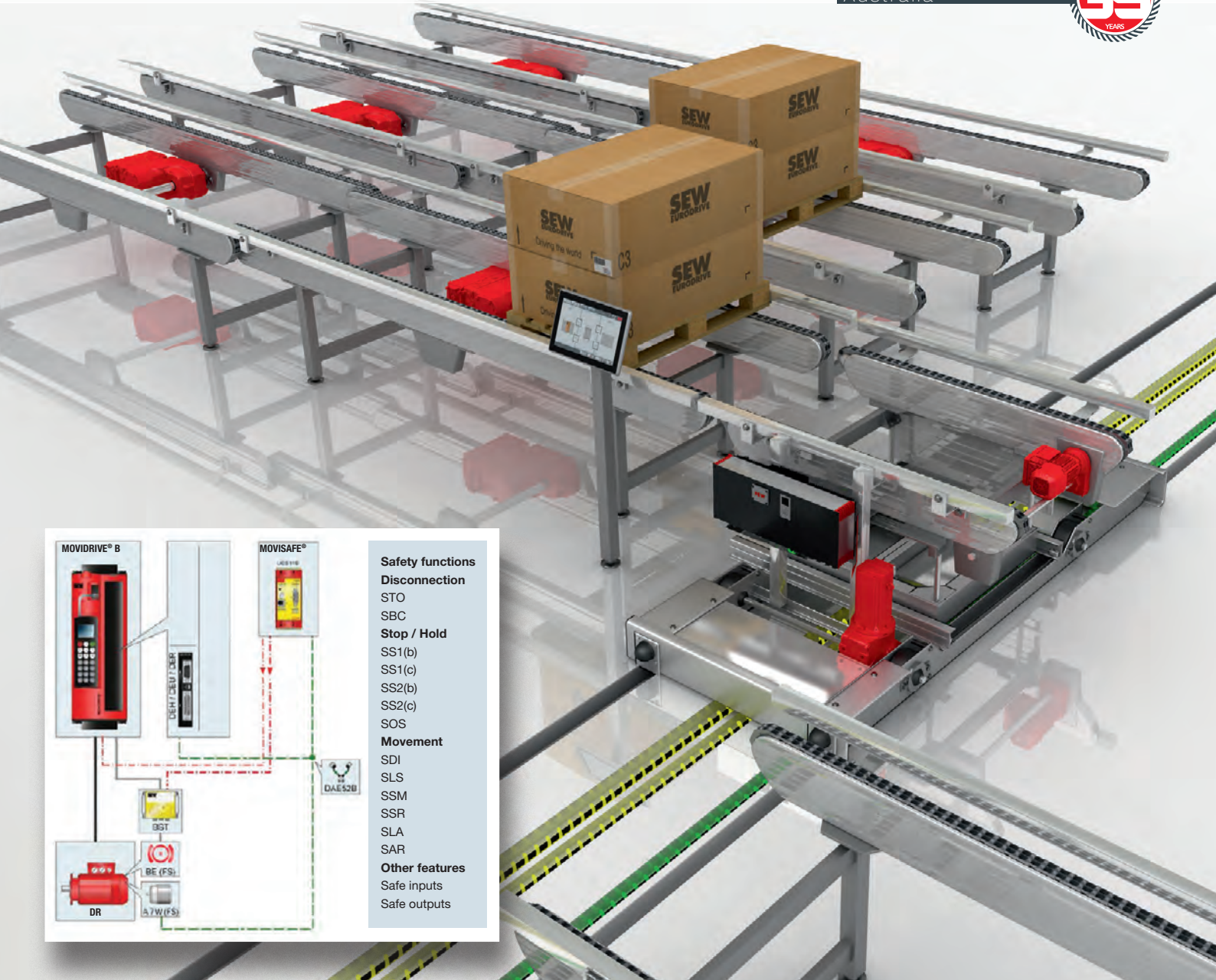
Around 250 devices have been installed to date at sites across the region. “We undertook extensive FAT testing of the Westermo Wolverine and found the performance to be outstanding. Having installed over 250 devices, we continue to be extremely pleased with the devices and the performance of the network as a whole.”

Using a third-party management tool, Electricity North West is able to continually monitor network performance. When starting the project the aim was to attain 2 Mbps of bandwidth throughout the network, but using the Westermo devices it has been possible to achieve, on average, between 4 and 6 Mbps, and up to 12 Mbps on some sections of the network. The upgrade of the network is being performed by Electricity North West’s information technology and telephony networking team. The group found the Westermo devices to be straightforward to install and configure, as well as user-friendly. The DIN-rail mounting and 48 V power supply requirements, typically found in the existing housing cabinets at the substations, meant that the devices integrated very easily with the existing set-up.

The Wolverine’s aluminium housing, industrial-grade components, operating temperature range and EMC, isolation and shock standards approvals meant the products were able to cope with the challenging environment of the substations. This included low ambient temperatures and installation in close proximity to 33 kV power lines, which creates the possibility of interference and power spikes. The operations network is continually expanding as new assets such as wind farms and solar farms are constructed. It was important that the communications network could support this expansion. The two DSL and four 100baseTX ports provided by the Wolverine have helped to futureproof the network by ensuring that additional equipment can be easily connected to the network when required. *A longer and more detailed version of this article can be read online at: <http://bit.ly/2oCAICT>*

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SINGLE-BEAM SAFETY SENSOR

The SLS 518 type 4 from Leuze electronic is a single-beam safety device in a compact design.

It is especially suitable for access and point-of-operation guarding in confined spaces in tool manufacturing, conveyor and lifting technology as well as in the packaging industry.

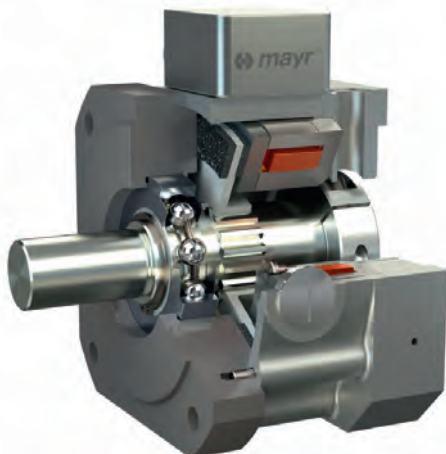
The single beam safety device is housed in an IP67 plastic housing with compact dimensions and M18 cylindrical construction.

It can be easily and flexibly integrated in a wide range of applications using an M12 plug. In combination with the MSI-TRM monitoring device, the product forms type 4 electrosensitive protective equipment for applications which require SIL3 or PL_e.

Designs with infrared LEDs and red lasers are available for different operating ranges. For shorter operating ranges, the infrared model is an entry-level solution.

Leuze electronic Pty Ltd

www.leuze.com.au



INTELLIGENT SAFETY BRAKES

mayr power transmission safety brakes ready for

Industry 4.0 are now

available from Regal Beloit. Modules such as the ROBA-brake-checker or the ROBA-torquecontrol allow permanent brake monitoring. The ROBA-brake-checker module monitors the switching condition as well as the tension path or tension force reserve without sensors and detects safety-critical changes in voltage, air gap and temperature. On reaching the tension path reserve, the ROBA-brake-checker sends a warning signal indicating that the brake can continue to be operated for a certain amount of time. During this time, the machine owner can undertake targeted maintenance in coordination with their work process.

For applications which require braking torque control in addition to status monitoring, mayr power transmissions provides the ROBA-torquecontrol braking torque control module. It shares the features of the ROBA-brake-checker and can also change the level of the braking torque in operation through control of current and voltage. As a result, devices and machines can be evenly and gently decelerated.

The developers at mayr power transmission have also successfully created a new friction lining technology through which the brakes achieve improved torque consistency and a higher performance density. Using the new linings, higher braking torques as well as higher area-specific friction work values can be achieved, which means the brakes are of a more compact design, but with the same features. Under certain circumstances, a smaller, lighter brake construction size can be selected for higher braking torques and for brakes on which higher demands are placed.

Regal Beloit Australia Pty Ltd

www.regalaustralia.com.au



RUGGED TABLET

The Winmate M101B is a high-brightness, rugged Windows tablet that uses the latest Intel Celeron N2930 1.83 GHz quad-core Bay Trail processor, providing both high performance and low power consumption. It is equipped with a 10.1" high-resolution 1920 x 1200 IPS LED display that is 700 nits sunlight-readable, making it suitable for most industrial applications.

The product features a rugged design with a full IP65 rating that enables it to withstand a wide range of temperatures (-20°C to 60°C in AC mode, -10°C to 50°C in battery mode). The tablet is resistant to shock, vibration and dropping (1.3 m drop certified), making the unit both robust and tough.

The device also features a multitouch projective capacitive touch screen, allowing users to take full advantage of the modern Windows operating environment.

The product has an ergonomic design that is lightweight and has many features packed in, including Wi-Fi and Bluetooth. It can be optioned with many different accessories that expand the functionality of the tablet, including 3G/4G functionality and a 1D/2D barcode scanner or HF RFID reader. It also has a hot-swappable 5300 mAh battery, allowing the user to swap out the battery when needed, reducing downtime and the need to keep recharging the system.

Backplane Systems Technology Pty Ltd

www.backplane.com.au



ENCODERS

Simple configuration and flexible programming options are important features of SICK encoders. Based on optical and magnetic technologies, the encoders offer solutions for a variety of different sectors.

With a high resolution of 18 bits (AFS60 Inox) or 30 bits (AFM60 Inox) and a large selection of programmable parameters, the AFS60 absolute single-turn encoder and the AFM60 absolute multi-turn encoder offer a high-resolution, high IP enclosure rating, and stainless steel housing, so they can be used in applications with harsh ambient conditions and strict requirements regarding resistance to aggressive media such as cleaning agents or salt.

The encoders are equipped with an SSI interface, while the AFM60 Inox is also available with combined SSI and incremental or SSI and sin/cos interfaces. Both encoders can be programmed via the PGT-08-S PC-based programming device or the PGT-10-Pro handheld programming device.

The DFS60 Inox is a high-resolution incremental encoder with a diameter of 60 mm in stainless steel design. It offers a large range of mechanical and electrical interfaces and can be programmed by the user if desired. The rugged mechanical design, the wide temperature range as well as the IP67 enclosure rating also make the DFS60 Inox a suitable encoder for applications in harsh ambient conditions. There is a large range of options for programming the electrical parameters, including the output signal level, the number of pulses per revolution and the zero pulse width.

SICK Pty Ltd

www.sick.com.au

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PART 2

Glenn Johnson, Editor

There are, of course, many advantages in deploying wireless technologies for greater efficiencies and improved functionality at lower cost. However, the deployment of such technologies can potentially open up a veritable 'can of worms' in relation to plant cybersecurity, so understanding the inherent risks and applying

One of the aspects of wireless networks that is not normally transparent to those managing the network is how the network manages itself. While network management in a wired network is



WPA2 DOES NOT ENCRYPT OR AUTHENTICATE MANAGEMENT FRAMES, AND SO THESE DATA FRAMES ARE VULNERABLE TO TAPPING AND BEING FORGED.

in the network this way, they can also completely disrupt the network, causing communication failures, and even lock out the plant operators or network administrators.

Fortunately, the IEEE introduced a standard (IEEE 802.11w1) in which a technique called 'protected management frames' (PMF) was introduced. This feature makes it possible to encrypt and protect management frames against forgery. In doing so, the mechanism for authentication and encryption present in WPA2 is extended to achieve the confidentiality and integrity of the management frames. Currently, there are not many device vendors that support this function in industrial WLAN equipment, so this should be taken into consideration when designing a WLAN deployment and choosing your equipment.

Wired network integration

As has been well known in cybersecurity circles for many years, most cyber attacks are actually perpetrated from inside the network, rather than directly 'hacked' from outside. These security incidents can be caused by malicious insiders, or simply by accidents and poor internal policies, and now more often are caused by malware and phishing attacks (external adversaries acting from the inside). Even the most effective WLAN encryption does not offer protection when the attacker is coming from the internal wired network. In the interest of being consistent with the principles of defence in depth, it is important to establish barriers that deter internal attackers from extending their influence by compromising other systems in the network.

The issue also works the other way: as soon as a client device has been integrated into a WLAN, it can communicate with other devices in the same network or subnet, which means an attacker can use the wireless network to infiltrate additional network systems to extend their influence. It is therefore necessary, as part of a defence in depth strategy, to selectively limit communication between devices.

It is a feature of many wireless access points that they can be configured to suppress all communication between all connected clients, thereby isolating all clients from one another. This may not be useful, however, because the connected WLAN clients may have to directly relay information in order to perform

largely related to physical connections and switches, all of which may be able to be monitored and controlled, WLAN networks tend to be self-managing. The protocols by which wireless devices manage their connections with each other are largely transparent to the user, in the interest of making them 'user-friendly'.

The management functions of the network are controlled using 'management frames', which are transmitted wirelessly but instead of containing user data they are used to organise the internal operation of the network. Devices can use management frames to log on and off the network, initiate new key exchanges and report when they roam from one access point to another.

WPA2 does not encrypt or authenticate management frames, and so these data frames are vulnerable to tapping and being forged. Attackers can use forged management frames to send commands to an access point, and the access point has no means of detecting that the command came from the attacker and not the victim device. Not only could an attacker insert a new device



AN INTERNAL FIREWALL IN THE ACCESS POINT OR WIRELESS ROUTER THAT CAN PERFORM STATEFUL PACKET INSPECTION CAN BE USED TO RESTRICT COMMUNICATION TO DESIRED PEERS, COMMUNICATION PROTOCOLS AND PROTOCOL BEHAVIOURS.

a function. More fine-grained control of traffic is therefore required in order to allow desired communications while blocking all undesired communication.

An access point that incorporates a Layer 2 firewall can selectively filter traffic between WLAN clients, limiting the traffic to the required peers and protocol, which is more selective than a VLAN. Layer 3 firewalls are not of any use in this scenario, because they only filter between entire Ethernet or wireless networks, and therefore permit all devices on a given subnet to communicate with each other.

More on firewalls

According to the principles of defence in depth, individual segments of a plant network must be isolated from one another. Because an access point often wirelessly connects clients to the routed network or connects distant sites through wireless point-to-point links, it is a good device to help selectively enforce the isolation of the different devices and networks by providing firewalling functionality. An internal firewall in the access point or wireless router that can perform stateful packet inspection can be used to restrict communication to desired peers, communication protocols and protocol behaviours. In this case a Layer 3 firewall is performing the filtering for devices across network boundaries, such as across wireless links.

Firewalls can also provide alerting about attempts to violate the firewall rules, notifying administrators and operators that a device on the network is acting inappropriately.

Firewalls other than those built in to Wi-Fi access points are also of importance in the network particularly at Layer 3, regardless of whether WLANs are deployed or not. However, there are firewalls and there are firewalls. A firewall that is easy to use is important: it can be an enabler of better security. Firewalls that are complex and need an extensive training course or a degree in data communications to manage can inadvertently become security risks.

When a firewall software or device is too complex, and the user cannot be sure of how it is working, it may be too easy to implement security holes, rather than walls, albeit inadvertently. In complex networks where many different secure access paths and protocols must be finely managed, complexity in the firewall itself can lead to erroneous and insecure configurations, while at the same time creating a false sense of security. In environments where modifications and the deployment of new technology is commonplace — or where there are technical problems that are being managed — it is often tempting to introduce 'temporary' firewall rules that open the security to 'make life easier'. The risk here is that these temporary fixes get forgotten after the fact, leaving a potential gaping hole in the defence the firewall is meant to be providing.

In summary, a firewall that provides support for all the necessary protocols, while at the same time is simple and clear to manage is the best solution.

The management of firewalls should also be clearly documented and reviewed — ALWAYS. Ad hoc undocumented changes

should be completely against policy in any organisation.

Attack detection

As described above, there are many functions that occur on networks that are invisible to the network users, such as those that occur via wireless management frames. For this reason, it is important that a WLAN system can detect anomalies in the wireless communication before an attacker can affect the operation of the plant.

Some access points offer a wireless intrusion detection system (WIDS) that can detect suspicious behaviour, such as forged management frames, forged authentication messages or open network scanning. WIDS solutions can also be installed as a solution separate to the access points, but they are typically more expensive and may only be cost effective where a large number of access points need to be monitored.

So-called 'rogue' access points are also a common attack vector. A rogue access point may be an unsanctioned access point added by an employee for their own reasons (malicious or not) or an access point maliciously deployed by an intruder within the wireless range of the network. The employee may only be doing this for some perceived convenience to themselves in performing their job (a security awareness issue), but a malicious actor will have done it to attempt to join the network and gain access.

Wireless phishing ('wiphishing') is an attack in which a rogue access point is used in an attempt to lure wireless clients to connect to it instead of the legitimate wireless network. This is done by configuring the access point with the same SSID (service set identifier) and no password protection to allow legitimate clients to connect to it. Because the names are the same, it is difficult to detect when this has happened. In connecting to the fake access point a WLAN client may disclose sensitive data or internal information regarding the structure of the industrial network. Man-in-the-middle attacks are also possible and may go undetected.

Rogue access points and wiphishing are only possible when there is insufficient visibility of the structure of the wireless network. Having the right type of WIDS solution and management tools that clearly show the network structure, including rogue access point detection, is essential.

Summary

WLANs provide many possibilities for increased efficiencies in process plants, factories and critical infrastructure organisations. However, the possibilities for network intrusion, and also the

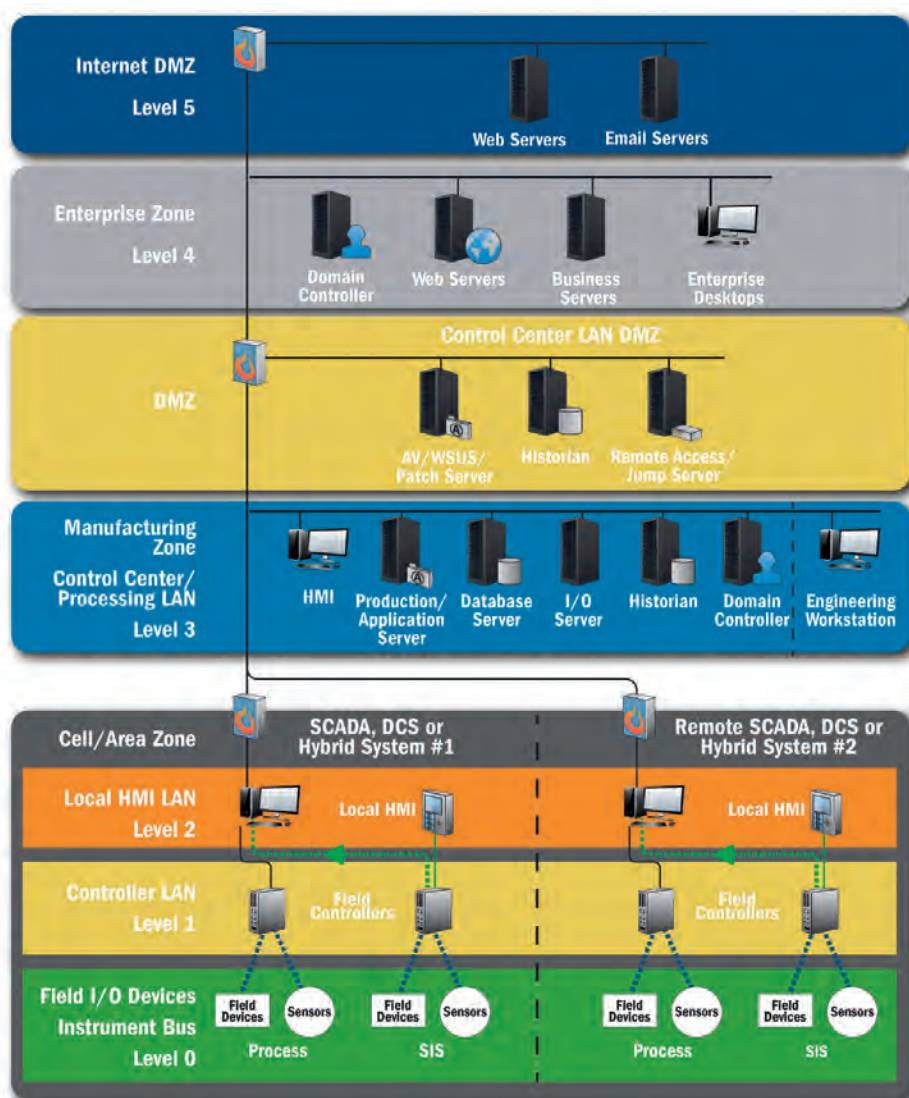


Figure 1: Defence in Depth architecture.²

options for securing against them, are more diverse once WLAN networks are deployed. Adding Wi-Fi in a plant environment effectively multiplies the potential attack surface for a cyber adversary and should be well planned, and the extra cost of protecting the network taken into account.

A well-planned and structured strategy of deployment and cybersecurity protections can help to mitigate the risk associated with WLAN deployment in your plant. As always, cybersecurity expertise is rare in most industrial control system environments, and engaging an appropriate cybersecurity consultant — vendor based or independent — may well be crucial in making sure that all your wireless cybersecurity issues are covered.

References

1. Institute of Electrical and Electronics Engineers, Inc. 2012, *ANSI/IEEE 802.11-2012: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*.
2. US Department of Homeland Security 2016, *Recommended Practice: Improving Industrial Control System Cyber Security with Defense-in-Depth Strategies*.



INTRINSICALLY SAFE I/O MODULES

WAGO has added two intrinsically safe I/O modules to its range for connecting sensors and actuators in hazardous locations. The 4-channel 24 VDC Valve Ex i digital output modules and 4-channel 24 mA Ex i analog input modules control various types of valves and work with 0–20, 4–20 and 3.6–21 mA standard signals, offering a higher output current than previous models.

Both modules are ATEX and IECEx certified, making them ready to connect to sensors and actuators in hazardous areas designated Zones 1/21 and 0/20. Diagnostics are performed channel by channel (eg, short circuit, wire break or out of measurement range). The modules' compact design saves space in the control cabinet.

WAGO Pty Ltd
www.wago.com.au

FLOWMETERS

The Proline 300/500 Coriolis and Electromagnetic flowmeters from Endress+Hauser offer added value throughout the entire lifecycle of a plant. The latest generation of flowmeters is based on decades of experience in safety-related applications and entirely developed according to SIL (IEC 61508). Due to features such as a web server, WLAN, Wireless HART, industrial Ethernet, and Heartbeat Technology with comprehensive diagnostic and verification functions, Proline is designed to maximise plant safety and availability.



The Proline 300/500 ranges are multifunctional transmitters for premium measuring performance in process industries, and are combinable with all Promass and Promag sensors from Endress+Hauser.

Commissioning is accomplished quickly via the built-in web server via WLAN or industrial Ethernet, and integration with existing systems is seamless via HART, Profibus PA/DP, FOUNDATION Fieldbus, Modbus RS485, EtherNet/IP and Profinet. Endress+Hauser's Heartbeat Technology provides continuous device verification during operation (TÜV inspected).

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

SERVO MOTOR

The Allen Bradley Kinetix VPC servo motor is designed to provide high continuous torque at high speeds over long periods of time. Its interior permanent magnet (IPM) design allows for field weakening, which reduces electromagnetic resistance, so a machine can carry loads continuously and well above motor-rated speeds.

A cooling fan and cooling fins on the motor provide increased torque and power output. In addition, encoder options with improved resolution provide more precise and responsive control, which is especially valuable for the printing industry.

The Kinetix VPC servo motor also helps reduce machine downtime in multiple ways. It uses larger, more robust bearings to improve L10 bearing life by up to 60%. An optional single cable for power and feedback helps reduce installation, set-up and maintenance time compared to dual-cable motors. In addition, a quick-change fan is field-replaceable, which helps maintain maximum machine uptime.

The VPC motor line meets or exceeds IE4 efficiency ratings, which can save energy costs compared to using an IE3 or lower-rated motor. When used with the Kinetix 5700 servo drive, the Kinetix VPC servo motor can also help manufacturers use less current.

Rockwell Automation has designed an integrated foot-mount option for the Kinetix VPC motor, which provides an alternative to the traditional, flange-mount method. This is beneficial in many applications where foot mounting is preferred.

The Kinetix VPC servo motor is currently designed only for use with the Kinetix 5700 servo drive. Rockwell Automation plans to evaluate functionality with other drives in the future.

Rockwell Automation Australia
www.rockwellautomation.com.au





PANEL PCS

Aplex Technology's APC-3072 and APC-3082 Series of IP66 7" and 8" panel PCs are powered by the Intel Atom E3845 processor to deliver high performance with minimal power consumption.

The panel PCs also support optional GPS and 3G/4G network functions for real-time GPS tracking and asset management, along with integrated Bluetooth and Wi-Fi connectivity.

The series both feature a rugged design with their IP66-rated panel and a rich selection of I/O ports, multiple peripherals and M12 I/O connectors. They can withstand a wide operating temperature range of -20°C to +60°C.

The LCD panels are optically bonded and feature anti-reflection technology, making them suitable for use in sunlight or applications where bright light can affect a screen's readability. The 1000 nits high-brightness screen has been designed for environments where harsh daylight is an issue.

The panel PCs have been developed to meet the needs of a range of industries requiring a suitable solution for rugged environments. These include food and beverage, manufacturing, factory automation, communications and in-vehicle computing applications.

Backplane Systems Technology Pty Ltd

www.backplane.com.au



MINIATURE TORQUE SENSOR


Futek has announced the QTA141 micro reaction torque sensor. With its miniature footprint, the sensor is designed to provide a precision torque measurement solution for miniature DC servo motors.


Traditional reaction torque sensors are more bulky, while the QTA141 measures only 22 mm in diameter and 10 mm in height. It additionally features a 10 mm diameter central hole, allowing a motor drive shaft and coupling to pass cleanly through the sensor. The significant reduction in size allows the unit to fit where most reaction torque sensors cannot.

Along with its small size, the product features $\pm 0.5\%$ non-linearity, $\pm 0.5\%$ hysteresis and $\pm 0.1\%$ non-repeatability, with metal foil strain gauges in both clockwise and counter-clockwise torque directions. Additionally, the device features a 1 Nm capacity that exceeds the stall torque of most 22 mm gear motors, a rated output of 1.3 mV/V and a safe overload capacity of 150%.

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INNOVATION BEYOND THE ISO STANDARD

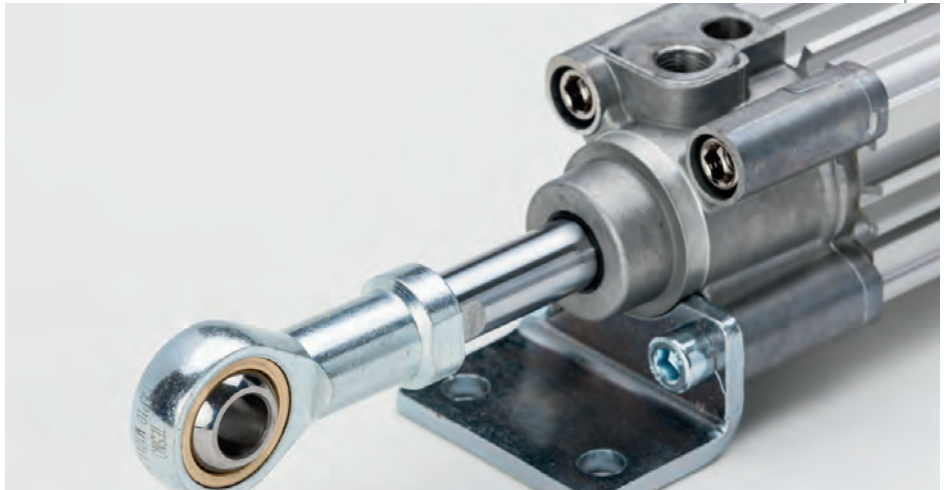
ISO standards are important benchmarks for industrial products, but sometimes it is necessary to go beyond the standard to create devices that meet the real needs of the application. Standards are undoubtedly valuable and set important industry benchmarks and controls; however, they don't always deliver the best product solution.

Designers and manufacturers often have to think outside the box; therefore, it is often important to look beyond ISO standards to realise product development excellence and, ultimately, leading industrial solutions. ISO (International Organization for Standardization) is an independent non-governmental organisation which publishes standards that cover almost every industry and has a membership of 163 national bodies. To date, the organisation has published more than 21,000 standards and related documents covering a myriad of industries and applications.

ISO standards must in some cases be set aside when they don't address the requirements of an application or exclude important criteria crucial to the design process. Trying to conform to a standard can compromise the design or process requirements and, ultimately, the final product.

ISO sometimes falls short due to the sheer scope of industries and standards it has to cover. That's why it comes down to fully understanding the application of a product and then designing it to be as safe and efficient as possible.

For example, in the food and beverage sector hygiene is paramount, and the resultant ISO standards place it at the top of the priority list. However, ISO standards for pneumatic valve and cylinder design in particular don't specify hygienic design — which means manufacturers could miss out on important criteria if they follow the standards to the letter. In an extremely competitive environment where cost of ownership, energy efficiency, safety and functionality are key concerns, the use of technology improvements and innovative features that go beyond ISO standards must be considered.



The perception is that ISO-compliant products are safe, readily available and cost competitive, and can be interchanged with other brands. Also, industry players believe they mitigate the risk of developing orphaned products if they meet the necessary standards. This isn't necessarily true: products should be developed to deliver optimal features and performance and not just tick all the industry standard boxes.

Ask your supplier about engineering products around your applications. Your supplier should be able to provide you with the correct selection of components and offer options and solutions that meet your application requirements. Customers are not made to fit into catalogues, but catalogues should be built around customers. Services also exist where a supplier can make the selections for the customer — for example, help you to swap out old technology for newer, or choose the correct ISO product or ISO replacement product. By assisting their customers in selecting the new standard product replacement, suppliers can assist their customers in realising large improvements in operating efficiency.

Products which are not necessarily ISO compliant but which exceed ISO specifications are sometimes available. These could solve many of the end user's problems, such as clean design; various connector options; rubber and metal seal options; lighter weight; and a dustproof or splashproof design.

Alternatively, look out for products which meet the relevant ISO standard but can be modified to fit into the application. This ap-

proach provides users with the freedom to choose the best product for each application. In the case of cylinders, for example, it allows customers to meet specific machine requirements in areas like piston rod modifications; cylinder mounting modifications; corrosion-resistant design; barrel, end cap and porting modifications; and additional rod wiper solutions.

While standards provide a minimum quality and feature set that everyone making a particular product must comply with, standards-based solutions are not always the most suitable for the application. Suppliers that can provide 'better than standard' products, or that can modify the product to suit the application, should be well considered for the best results.



Bill Blyth is the OEM – Key Accounts Manager for SMC Pneumatics (Australia) Pty Ltd. He has been with the company for more than 10 years and provides commercial and technical support to Australian machinery manufacturers (OEMs) and end users. Bill has been associated with manufacturing technology and processes for over 20 years and has completed studies in Australia, New Zealand and the USA to remain abreast of the latest technologies and skills with respect to process and factory efficiency, especially with compressed air systems.



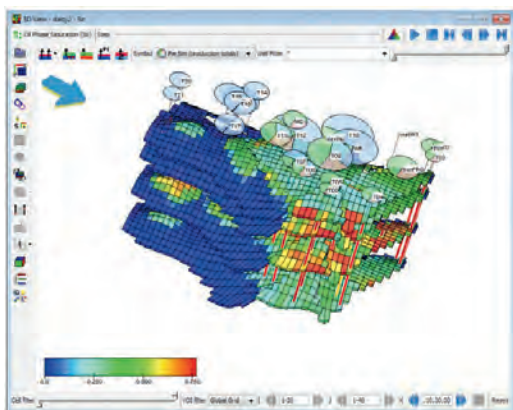
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Every operator knows how dangerous an arc-flash event can be. They know that preventing serious injury to personnel while limiting equipment damage is crucial. That's why the SEL-849 Motor Management Relay with built-in arc-flash detection is so revolutionary. The SEL-849 provides the best motor protection in the industry while reducing incident energy and its risk to personnel and motor control centers.

For more information about the SEL-849 or to request a product demonstration.

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RESERVOIR MANAGEMENT SOFTWARE

Emerson Automation Solutions has launched the latest version of its reservoir management software suite — Roxar Tempest 8.0 — designed to bring reservoir engineers more tools to maximise the potential of their fields.

Roxar Tempest 8.0 provides several improvements. The Tempest ENABLE uncertainty management and history matching module includes Ensemble Smoother-based history matching, a complementary technique to proxy-based history matching which enables conditioning on all types of data — in particular spatial data, such as seismic — ensuring that all uncertainties are comprehensively accounted for. The Tempest MORE reservoir simulation module has increased software performance and improved user experience. The latest features include API tracking to efficiently model the flow of fluids with different properties, enhanced aquifer and pore volume specification, and control over relative permeability and capillary pressure at the completion level.

In the Tempest VIEW module, users are given the ability to load and display simulation results from METTE, Emerson's production modelling and management tool, allowing for a better understanding of the flow behaviour due to added navigation, filtering and display options.

There is also now further integration from geosciences to production, offering reservoir engineers an automated workflow that tightly integrates static and dynamic domains throughout the field's lifetime, incorporates the stochastic property of geological inputs and ensures optimal consistency of the reservoir properties with the underlying geology. Reservoir engineers can also utilise the Roxar App Connector to run additional third-party programs or in-house applications, leading to improved uncertainty analysis through the closer integration of geology and engineering.

Emerson Automation Solutions

www.emersonprocess.com.au



DAQ UNIT

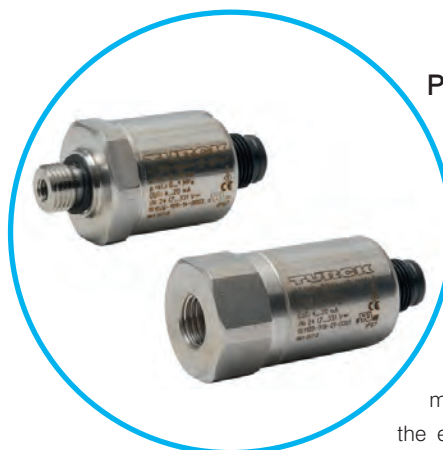
Dewesoft has recently introduced the SIRIUSwe-HD-16xSTGS EtherCAT high-density data acquisition module, designed for application in harsh environments.

The product is watertight and fanless, with improved natural convection heat dissipation and an IP65/IP67 rating. Its temperature rating is -40°C to 50°C and it comes with either an EtherCAT or USB interface. It has a low power consumption of 14 W in voltage mode and 24 W with a 350Ω load at 10 V.

Weighing only 2.72 kg, its dimensions are 282 x 160 x 85 mm. It has 16 analog inputs utilising IP65/IP67 rated DSUB9 connectors, with the EtherCAT connections utilising LEMO EGJ.1T.308 and EGG.1T.308 connectors.

Metromatics Pty Ltd

www.metromatics.com.au



PRESSURE TRANSMITTERS

Turck has introduced the PT2000 line of pressure transmitters, which offer a welded, stainless steel measuring cell for increased durability and increased chemical compatibility. The PT2000 offers a solution that has no elastomer seals, and all wetted materials are 316L stainless steel. This makes the solution capable of meeting the environmental needs in water pumping, hydraulic and refrigeration applications.

The transmitter housing is gel filled, eliminating problems caused by condensation in applications with a wide range of temperatures, such as pumping ground water. Additionally, the housing is more compact than existing solutions, making it suitable for applications with space constraints. The PT2000 is also capable of handling pressures up to 1000 bar as well as process media up to 135°C.

The PT2000 comes equipped with a standard M12 connector that is available in multiple wiring configurations to allow for easy integration into existing applications. The pressure transmitter is also available with process connections such as NPT, BSPP and SAE, which are commonly used in hydraulic applications.

The PT2000 offers multiple output signals to provide additional options for users and allowing it to be adapted to users' existing control circuitry: 4–20 mA, 0–10 V, ratiometric, 1–6 V and 0–5 V. Additionally, it carries an IP67 rating and has an operating temperature range of -40 to 135°C.

Turck Australia Pty Ltd

www.turck.com.au

WIRELESS BRIDGE

The Anybus Wireless Bridge II from HMS Industrial Networks supports up to 400 m of wireless communication and can communicate via either Bluetooth or WLAN. It is designed for replacing Ethernet cabling in hard-to-reach or hazardous locations.

Often used as an Ethernet cable replacement (point-to-point communication), the Wireless Bridge II can also be used as an access point for several WLAN/Bluetooth nodes such as smartphones or tablets within range. It supports a longer wireless range (400 m) than the previous version and an even more powerful integrated wireless antenna. It is easily set up via push-button configuration or via the integrated web interface.

Anybus Wireless Bridge II is built on the same wireless technology as the family member Anybus Wireless Bolt, a connection point for on-machine mounting which HMS released in 2016, making them able to communicate seamlessly, opening up more potential wireless system solutions.

By connecting industrial devices and networks over a wireless link, the Anybus Wireless Bridge II makes life easier for system integrators and automation engineers needing to create connections through hazardous areas or hard-to-reach locations or moving installations where cables are not desirable. It can be used to bridge popular industrial Ethernet standards such as Profinet, EtherNet/IP, BACnet/IP and Modbus TCP and provides users with a robust and maintenance-free wireless connection.

The product comes with two M12 connectors for power and network connectivity and has an IP65 protection class rating.

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FDA-approved alternative to stainless steel in geared motors

According to research by Curtin University of Technology, corrosion is costing the Australian economy around \$30 billion each year.

Within industrial environments, exposure to things like water, acid or salt causes corrosion of geared motors. This, in turn, reduces the strength of the corroded parts and inevitably means they have to be replaced.

In corrosive environments the need for replacement is more than just occasional. Gearboxes need to be replaced as often as every six months. Apart from costs and downtime, such a maintenance regime presents businesses with all too frequent gearbox mounting challenges.

For obvious reasons, businesses in the food and beverage sector are required to maintain high hygiene standards. To do this, they need to follow strict washdown procedures, which have the unfortunate side effect of increasing the rate of corrosion.

Similarly, corrosion is a problem for operations dealing with chemicals, those located offshore or near the coast, and others (such as car washes) which just can't avoid water. Historically, businesses looking to deal with this problem have had two options: to use stainless products or products with a protective coating.

The attraction of stainless steel for this purpose is obvious. It eliminates the need for harsh cleaning chemicals and decreases the instances of leaks, rust and corrosion. To date, stainless steel has rightly been regarded as a better anti-corrosion solution than the alternatives, namely paints and surface treatments.

The problem with such coatings is that when used on an original painted aluminium surface, they simply lie on top of the aluminium substrate and may even bridge across pores in the metal. In other words, they do not form a permanent bond to the substrate. They can easily be removed if bumped or scratched and therefore offer only limited corrosion resistance.

NORD recently released the nsd tupH Sealed Surface Conversion System in Australia. While the system has been available in Europe for some time, this was its local debut. The system provides protection at a molecular level and is claimed to be a breakthrough in corrosion protection.

Unlike surface coatings, nsd tupH includes a base layer that is permanently bonded to the aluminium substrate and provides a powerful foundation for adhesion of the surface sealant. This foundation provides higher roughness, is 6–7 times harder than the aluminium substrate and is up to 1000 times harder than paint.

In other words, the product is superior to surface coatings and is a genuine alternative to stainless steel. Indeed, according to the company, it offers two advantages when compared to stainless steel. Firstly, it is significantly cheaper, and secondly, products coated with the system are much lighter than stainless steel products. This makes mounting and maintenance easier.

The surface treatment creates an easy-to-clean surface that is resistant to acids and alkalis over a wide pH range. Free from



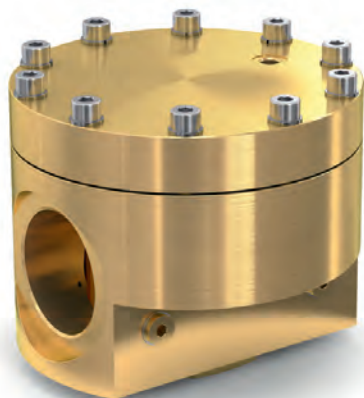
chromates, it prevents the spreading of corrosion, even in cases where machinery is physically scratched or damaged.

The nsd tupH drives can be used in demanding atmospheres much beyond the usual service life of paint-coated systems. Since no coating is applied and only the surface is hardened, contamination of products or process media is avoided, which is not possible with chipping paint.

The system conforms to FDA Title 21 CFR 175.300 and has successfully undergone ASTM D714 and proven its resistance to blister formation. Similarly, it has proven its effectiveness against corrosion through ASTM D610-08 and scribe per ASTM D1654-08 according to DIN EN ISO 2409.

Further tests performed on the system included ASTM B117-09 Salt spray test, ASTM D3170 Gravelometer test, DINEN ISO 9227 Salt spray mist test and DIN EN ISO2409 Cross-cut test. It is approved for food applications according to FDA Title 21 CFR 175.300 with treated systems resisting cleaning agents in the pH 2–12 range.

NORD Drivesystems (Aust) Pty Ltd
www.nord.com



DOMELOADED BACK-PRESSURE REGULATOR

The BPR2 is a dome-loaded back-pressure regulator from German gas systems manufacturer Witt, designed to keep the pressure of gases in processes, system components or tanks constant.

In technical terms, back-pressure regulators regulate a higher inlet pressure, by opening up only as much as necessary to achieve the desired pressure at the inlet. In contrast to spring-loaded systems, the BPR2 controls the gas pressure by means of a dome diaphragm.

This dome-loaded pressure system ensures high precision. Irrespective of the volume or fluctuations in the gas flow, the pressure remains constant — and this is true over the entire performance spectrum of the device.

A typical application is the control of gas blankets in tanks. The overpressure control opens as soon as the supply pressure reaches the set value. The gas is blown off in a controlled manner when the pressure rises, so the pressure in the tank is kept constant. In this way, the BPR2 also provides effective prevention of hazardous overpressure.

The device is suitable for almost all technical gases, including oxygen, in the range 0.5 to 20 bar. Installation can be in any orientation. The wide temperature range from -30 to +50°C ensures it can cover a wide range of common applications. It meets all relevant standards and can even be used in ATEX zones and food environments.

Niche Gas Products

www.nichegas.com.au



See the light.

Pilz has recently released its new range of PSEN Light Curtains which include its second generation Cat 3 & Cat 4 compliant Light Curtains. This means Pilz now has a comprehensive range of light curtains and accessories that can support a large variety of applications in any plant or factory.

Benefits of PSENopt II at a glance;

- ▶ Come with a huge variety of functionality & programmability
- ▶ Large selection of lengths and widths, including a slim line version
- ▶ Highly robust for protection against shock, collision and vibration
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- ▶ Rapid and simple assembly, installation and commissioning



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SANITARY HIGH-LIFT BOX TIPPER

The latest TIP-TITE bulk transfer system from Flexicon moves material from boxes into a mobile bin with a vibratory feeder that services multiple downstream processes. All stainless steel construction allows handling of corrosive materials or washdown between runs of contamination-sensitive food, nutraceutical, pharmaceutical and chemical products. Castors mounted at the base of the bin allow it to be rolled away from processing areas for a complete washdown.

Boxes measuring 915 to 1220 mm on the side and 990 to 1117 mm in height are loaded at floor level and raised hydraulically to sit against a discharge hood. The assembly is then hydraulically elevated and tipped, which mates the spout of the discharge hood to a gasketed receiving ring installed on the lid of the mobile bin.

The dust-tight connection allows opening of a pneumatically actuated slide gate and discharging of material into the bin with no contamination of the product or plant environment, while permitting partially empty boxes to be returned to the plant floor with no dusting. Once the bin is rolled or forklifted to a downstream process, material flows through a pneumatically actuated slide gate into a vibratory feeder equipped with eccentric weights for gentle, volumetric metering.

Separate control systems — housed in NEMA 4 or NEMA 4X enclosures for washdown using steam, cleaning solutions and high-pressure water — provide manual or automated control of all hydraulic, pneumatic and electrical functions. The system is also offered in carbon steel with durable industrial coatings or with stainless steel material contact surfaces.

Flexicon Corporation (Aust) Pty Ltd

www.flexicon.com.au

DAQ MODULE

Dewesoft has expanded the KRYPTON product line with the KRYPTON 6xSTG module. KRYPTON DAQ modules are engineered to operate in harsh conditions such as heat, dust, mud, water and snow.

The product is shock and vibration proof. Being milled from a block of aluminium and then filled with rubber also makes the module completely waterproof.

The universal STG 10 V amplifier runs with a sample rate that reaches up to 20 kHz per channel. Inputs are compatible with DSI adapters, which can additionally support IEPE/ICP sensors, LVDTs, charge and thermocouple sensors.

The product offer six input channels, supporting voltage, full-bridge strain, half -bridge strain and quarter-bridge strain. Input voltage ranges are ± 10 V, ± 1 V, ± 100 mV and ± 10 mV, compatible with DSI adapters. The simultaneous sampling rate is 100–20,000 S/s per channel (software-selectable).

Overvoltage protection In+ to In- is 50 V continuous and 200 V peak for 10 ms, while input accuracy is $\pm 0.03\%$ of reading, $\pm 0.02\%$ of range and ± 0.1 mV.

Metromatics Pty Ltd

www.metromatics.com.au



PRESSURE TRANSDUCER

The Validyne P895 pressure transducer is designed for applications requiring high performance through ambient temperature changes. It is suitable for laboratory pressure measurement, automotive test cells and any high-accuracy application. The P895 is digitally compensated and corrected to provide good pressure measurement in a robust, cylindrical form factor.

The product is designed for a wide variety of pressure measurements where high resistance to vibration and stability through temperature change is required. It accepts both liquids and gases.

It features accuracy to 0.1% FS and comes in gauge, differential and absolute versions. Full-scale ranges start at 2.22" H₂O, and both ± 5 VDC and 4–20 mA output signals are provided.

Bestech Australia Pty Ltd

www.bestech.com.au

HYGIENIC VIBRATING FORK SWITCHES

Emerson's Rosemount 2120 series of vibrating fork switches are now suitable for use in hygienic process environments. Hygienic certificates enable them to be used in sanitary and aseptic applications in industries such as food and beverages, pharmaceuticals and life sciences.

Based on vibrating short fork technology, the robust switches require almost no maintenance and are easy to install and use. SIL 2 certification enables the fork switches to be used for critical overflow protection, high- and low-level alarm and pump control duties in a wide range of process applications.

Hygienic approvals are now available on tri-clamp process connections. The wet side is machined from solid 316 stainless steel, ensuring zero porosity and increasing robustness. Several surface finishes are available, including an electropolished option.

The product is designed to provide a quick response time, delivering a successful level detection solution across many process industries. Increasing the switch's robustness and gaining hygienic approvals will enable users to take advantage of its switching capabilities in sanitary applications.

Leveraging Emerson's fast-drip fork design, the device offers level monitoring even in sticky or viscous applications often associated with hygienic manufacturing processes.

The hygienic version has been certified by both the American 3-A Sanitary Standards organisation and the European Hygienic Engineering & Design Group (EHEDG). The product is also designed in accordance with FDA and ASME-BPE standards.

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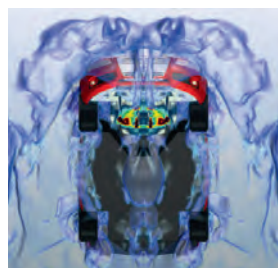
SIMULATION SOFTWARE WITH DIGITAL TWIN CAPABILITY

The latest release of Siemens's STAR-CCM+ software includes several features to help product development organisations enhance and accelerate their ability to digitally simulate and understand how a product will perform in the real world using the digital twin — a precise virtual model of a product's physical and performance characteristics.

Digital twin functionality in STAR-CCM+ greatly facilitates this communication using simulation models that not only behave like their real-world counterparts, but also present a precise visual representation.

STAR-CCM+ v12.02 introduces ray tracing, allowing engineers to apply photorealistic renderings to their design and simulation results — utilising similar technology that is used to provide computer-generated imagery (CGI) in movies and computer games. This enhanced visualisation capability is particularly useful when communicating the results of simulations to stakeholders outside of the core simulation community.

The software also adds capabilities to accelerate simulation throughput for products that deal with reacting flows, such as furnaces, reformers, internal combustion engines and gas turbines. The Adaptive Gridding capability for combustion tables reduces computational effort without any loss of accuracy. Applicable to all flamelet combustion models, adaptive gridding can reduce table size and corresponding memory usage by up to 30 times, increasing efficiency and allowing engineers to iterate designs more quickly.



This version also includes multicomponent gas/liquid species and solid ion models used to analyse electrochemical reactions, such as those that occur in solid oxide fuel cells.

Siemens Ltd

www.siemens.com.au

PLANT DESIGN SOFTWARE

Intergraph Process, Power & Marine (PP&M), together with Bricsys, has announced the release of Intergraph CADWorx Plant 2017 R1.

This release includes a complete DWG file-based range of tools for plant design and offers greater flexibility and collaboration, including the option to run on the AutoCAD or BricsCAD platform.

By including the ability to choose the design platform, CADWorx continues to expand upon and provide powerful and adaptive tools that enable quick and easy creation of fully intelligent 3D plant models. CADWorx continues to provide users with all the familiar benefits, ensuring every plant designer and engineer has the tools they need to complete projects efficiently.

BricsCAD is best known for its feature-rich combination of 2D drawing and 3D modelling and is available in three editions. BricsCAD Classic offers an entry point to CAD, focusing primarily on 2D, while BricsCAD Pro adds 3D modelling, access to all programming tools and third-party applications. BricsCAD Platinum adds features such as 3D constraints, assembly modelling and access to powerful BIM and sheet metal modules.

CADWorx gives the same high degree of performance on both BricsCAD and AutoCAD platforms, and offers flexible licensing.

Intergraph Corporation Pty Ltd

www.intergraph.com/global/au/



INSPECTION DOOR FOR FIELD ENCLOSURES

Intertec has announced an inspection door for outdoor equipment protection enclosures. The GRP Inspection Door comes with a window frame made entirely from GRP (glass-reinforced polyester) — a material offering a high degree of protection against corrosion combined with good thermal insulation.

The design offers a more durable alternative to the conventional aluminium or stainless steel window frames commonly used for field equipment in harsh environments, helping to extend the life cycle of business-critical process control and instrumentation equipment. Doors are available with either IP54 or IP65 ingress protection ratings.

The GRP inspection doors are suitable for enclosures and cabinets containing control and instrumentation equipment fitted with user interfaces, indicators and displays. This

embraces a broad range of commonly used field equipment including process transmitters and PLCs.

GRP is an inherently inert material that is virtually immune to corrosion and atmospheric pollutants. It does not rust or degrade in any meaningful way and it is resistant to a wide range of chemicals. Its thermal conductivity is also around 5000 times less than aluminium and 1000 times less than steel. This helps to eliminate 'thermal shortcuts' between interior and exterior, which can lead to cold spots and condensation problems. In its basic form, these properties make GRP a suitable material for robust outdoor enclosures, allowing maintenance-free life cycles of 30 years and more.

Two variants of the GRP inspection door are available, with window frames measuring approximately 50 x 35 or 67 x 47 cm.

Intertec

www.intertec.info



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The background of the top half of the page features a close-up, artistic shot of several interlocking teal-colored gears. The word 'Lifecycle' is embossed on one gear, and 'Efficiency' is embossed on another, both in a bold, sans-serif font. The lighting creates strong highlights and shadows, emphasizing the metallic texture and the mechanical nature of the gears.

COMPLETE LIFECYCLE EFFICIENCY

INDUSTRY 4.0 AND COMPRESSED AIR SYSTEMS

Industry 4.0 brings significantly enhanced reliability, cost-optimised servicing, longer system service life and assured specific power for compressed air users.

The way we manufacture is no doubt entering a new era led by the advances, networking and connectivity capabilities of production processes and technology. Coined Industry 4.0, this new era presents a number of opportunities and benefits to manufacturers that choose to embrace the concept of the 'factory of the future'.

When it comes to compressed air production, intelligent contracting model-based solutions have been available for quite some time now. These so-called hybrid service bundles combine highly efficient, innovative products with intelligent services in the fields of engineering and predictive maintenance. In essence, it is these solutions that laid the foundation for Industry 4.0 in the compressed

air production sector. Now, thanks to new communications technologies and services, these compressed air contracting models are being further refined and improved.

On the one hand, these solutions include the components of the compressed air station that are responsible for the actual production and treatment of the compressed air itself; specifically the compressors, dryers, filters, etc as well as peripheral equipment such as ventilation louvers. On the other, they also include the many services that can be rendered throughout the entire lifecycle of the compressed air station. These encompass precision air demand analysis, optimal design for compressed air supply systems and regular maintenance and servicing; not to mention energy manage-



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ment options, as well as planning of new systems, expansion of existing ones and investment in replacement equipment.

The components

To take full advantage of their Industry 4.0 capabilities, components must meet two sets of requirements: they must support efficient control when utilised in combination with other machines and also provide real-time operating data for monitoring purposes and be able to forward all relevant data to master control systems.

Modern compressors and compressed air treatment components are therefore equipped with internal controllers based on industrial PC technology, which are able to pass data to a master control

system via convenient networking technologies such as Ethernet. The data generated by the components are first delivered to a master controller. This controller fulfils two roles: it acts as an actual local management system for the compressed air station as well as a central node for the forwarding of relevant data.

Advanced management systems such as these must successfully meet some highly demanding conditions. They must be at least capable of efficient and, most importantly, predictive compressor control, taking into account a range of contributing factors, such as switching losses, control losses, etc. Another key requirement is the ability to handle the volume of incoming data from the compressor station. This data must be compiled appropriately, then sent on to a higher level service centre.

Multiple levels of functionality

Advanced controllers allow for varying levels of involvement by external service providers, so compressed air system operators can still choose to perform all of the maintenance, evaluation and servicing of the system themselves. In this case, the master controller is integrated into the operator's control system and the data can be requested by any desired part of the company.

Alternatively, system operators can simply opt for a conventional service agreement. Or, in order to take advantage of further services, they can choose a predictive maintenance service model, with potentially the option of remote diagnostics. Real-time monitoring of a full range of sensor data enables immediate response to unusual operating conditions and also lays the foundation for optimal service planning. With intelligent predictive tools, operators will already know what's actually going to occur in the compressed air station.

Advanced solutions such as these therefore represent the highest level of operational reliability and offer some key advantages. Firstly, operators are released from the burden of performing maintenance and service on the compressed air station. This saves fixed costs in the form of payroll expenses, as well as the cost of investment in their own service management system. Secondly, outsourcing of these services allows users to benefit from the very latest knowledge and expertise in the compressed air technology sector. The value of this should not be underestimated, since the field of compressed air engineering is now so complex that normal industrial companies are rarely able to maintain such high-level knowledge in-house.

Thirdly, outsourcing of these services to a compressed air specialist delivers clear-cut cost advantages. The data from the compressed air station is requested, transmitted and analysed in



real time. This of course translates into a large amount of data, which, in turn, requires significant investment in IT infrastructure in order to handle and utilise such data volumes. For most operators, such an investment would be neither possible nor economical.

Always up to date

Real-time monitoring gives the service provider a detailed picture of what is happening in the compressed air station. Such detailed monitoring is not restricted to the main system components, but can be extended to peripheral equipment as well, such as control louvres, etc.

If irregularities occur, a notification is automatically generated in the service provider's service centre. This then triggers preventive measures to avoid system disruption or failure. In addition, sophisticated algorithms developed by compressed air engineering experts allow specialists to predictively estimate whether potential disruptions may occur in the near future, and if so, to take appropriate preventive measures.

This type of maintenance, which is based on usage or need, cuts costs and prevents system failures. Operators enjoy significantly enhanced reliability, cost-optimised servicing, longer system service life and assured specific power thanks to needs-based maintenance.

A user's benefits from predictive maintenance agreements, however, extend far beyond the guaranteed high availability of their compressed air systems. For instance, lifecycle costs can be reduced by up to 30% since the compressed air specialists can adjust the energy performance of the compressed air station according to demand (eg, with rising or falling compressed air demand, expansion, etc) to ensure that it operates at peak performance at all times. Needless to say, this increases the system's overall effectiveness.



A USER'S BENEFITS FROM PREDICTIVE MAINTENANCE AGREEMENTS...EXTEND FAR BEYOND THE GUARANTEED HIGH AVAILABILITY OF THEIR COMPRESSED AIR SYSTEMS.

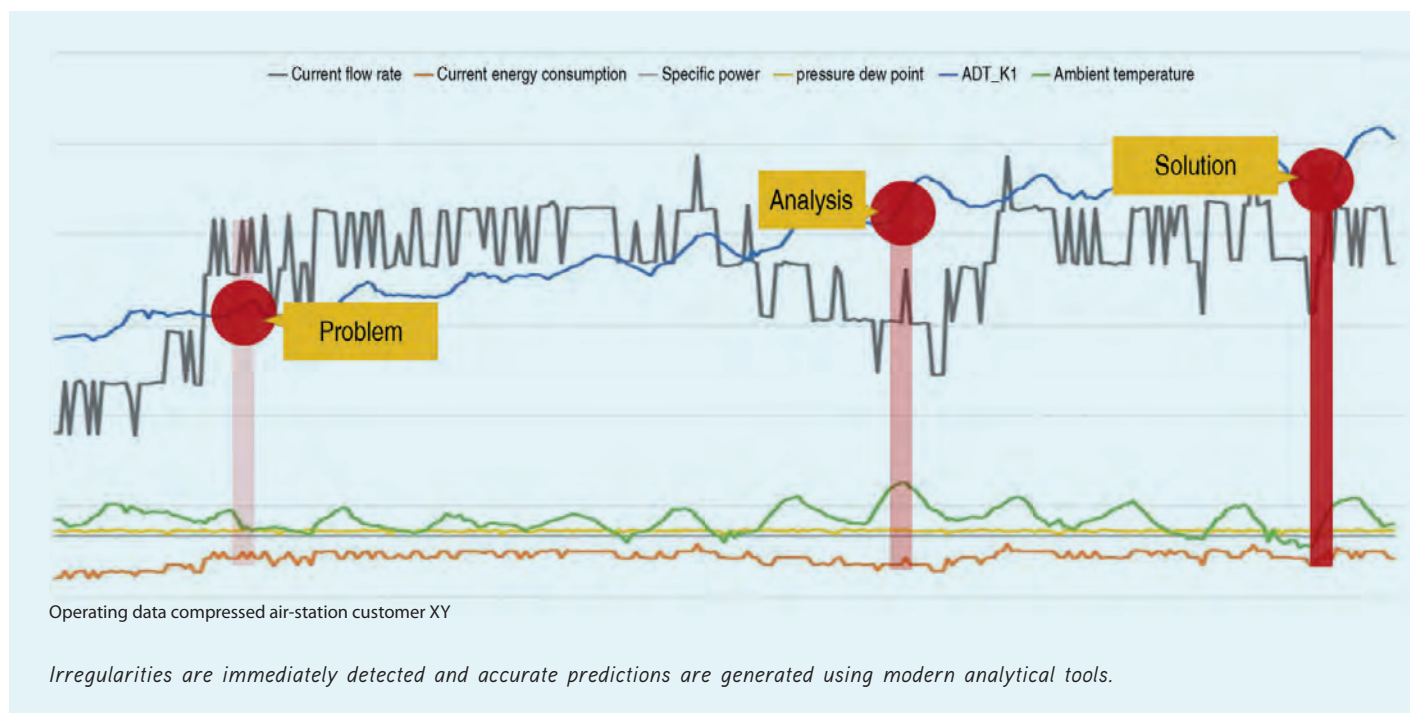
Furthermore, the usefulness of the data does not end with the service technicians who optimise the users' systems: the service provider's research and development department also benefits. Through analysis of how products behave during disruptions, they are able to identify patterns, and the causes of malfunctions — in order to ultimately further develop and optimise the components themselves and to further enhance operational reliability into the future.

Intelligent planning

In most cases, however, another key service is required in order for operators to take full advantage of their compressed air system's Industry 4.0 capabilities: proper planning of the compressed air system.

Such a service involves the gathering of all parameters and components relevant for compressed air production in a planning tool, which allows operators to systematically track every aspect of their compressed air system throughout its entire lifecycle. It also ultimately serves as the foundation for intelligent services, such as efficiency management and predictive maintenance.

In the past, systems were usually mapped out by hand, on paper. The documentation was hardly ever kept together in one



place, but rather stored in disparate locations. Subsequent modifications were not usually recorded or if so, this documentation was stored yet elsewhere. As a consequence, information regarding the compressed air station was seldom up to date and there was no single, centralised way of accessing the information.

Opting for an intelligent planning tool is therefore a powerful way to record and maintain data correctly, quickly and completely, storing it securely and ensuring the information is always up to date. To a certain extent, with such an intelligent planning tool, it is even possible to integrate existing systems or those of different manufacturers, provided the compressors have a suitable microprocessor.

In terms of planning new systems, utilising an intelligent planning tool elevates optimal design of the compressed air station to a new level; it also ensures secure and efficient operation indexed to actual demand, both during and after commissioning.

The data also act as an ideal resource that is always available whenever it is time for implementation of optimisation measures.

Consistent and complete collection of all data for the compressed air station and its peripheral equipment also saves valuable time when it comes to expanding or reconfiguring the system.

Operators that take advantage of all the solutions on offer for their compressed air station enjoy highly efficient components and all of the benefits of precision planning. Yet the whole package is far greater than the sum of its parts: a state-of-the-art system in terms of energy efficiency; which in turn translates into the most significant reductions in energy costs currently possible; not to mention innovative services like predictive maintenance, which reduce other service costs throughout the system's entire lifecycle.

Energy efficiency monitoring also enables yet further savings over the system lifecycle as continuous adjustment to fluctuating operating conditions ensures that the system always operates at optimal load.

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SMALL DIAMETER CAT 6A UTP CABLE

Siemon has released an updated range of Category 6A unshielded twisted pair (UTP) balanced copper cable that offers a significantly smaller overall diameter and improved performance to better support advanced remote powering applications.

Siemon's Category 6A GT UTP Cable with Gap Technology (GT) features a discontinuous foil construction with periodic gaps that enable a typical UTP termination process while providing improved heat dissipation and crosstalk performance to better support applications using both advanced PoE and 10 Gbps application speeds. While standard category 6A UTP cable requires additional space and separation within the cable to meet performance specifications, the discontinuous foil construction of Siemon's Category 6A GT UTP cable results in a 15% reduction in cable diameter.

Along with a 75°C temperature rating, the Category 6A GT UTP cable offers improved heat dissipation over standard UTP, reducing the potential for damaging levels of heat rise that can occur in remote powering applications. The cable's smaller diameter of just 7 mm also means improved flexibility, reduced weight and better pathway fill capacity over standard UTP.

Available in both riser and plenum rating, and nine different jacket colours, Siemon's Category 6A GT UTP cable features good pair geometry and optimal crosstalk performance, exceeding ANSI/TIA-568-C.2, ISO/IEC 11802 Ed. 2.0 and IEC 61156-5 Ed. 2.0 standards to support all applications designed for category 6A cabling, including 10GBASE-T and HDBaseT. It also supports all remote powering applications, including IEEE 802.3af PoE and 802.3at PoE+, as well as future Type 3 and Type 4 four-pair PoE applications.

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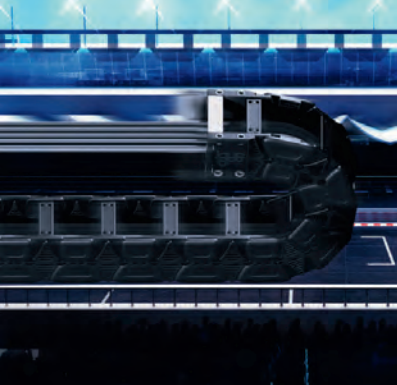


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LOW-NOISE ENERGY CHAINS

The E6.1 series of e-chains from igus has been developed for

applications where low-abrasion energy chains are required, eg, in the clean room in semiconductor manufacture.

As with the predecessor E6 series, instead of a pin/bore connection, elastic polymer spring elements in the side elements serve as connectors for a dampened and smooth running of the chain. The small pitch and contour of the chain links ensure that the polygonal effect is reduced to a minimum and the chain rolls smoothly.

Due to the narrower design compared to the E6, roughly 30% can be saved with the same inner dimensions. This design principle results in a quiet and low-vibration operation with only 32 dB(A), making E6.1 series energy chains suitable for use in stage technology or TV studios in addition to applications in the clean room. The series can also be used for applications with speeds of up to 20 m/s.

Chains in four different dimensions are available from 29 up to 62 mm in height. A larger version of the E6.1, with an inner height of 80 mm, will soon be released.

The crossbars can be removed along the inner and outer radii so that quick filling is possible. The means that when the chain is already installed in the machine, additional cables or hoses can easily be drawn in. Almost all of the crossbars are also equipped with a grid marking, which enables the exact positioning of separators.

Treotham Automation Pty Ltd

www.treotham.com.au

INDUSTRIAL SECURITY APPLIANCE

The Allen-Bradley Stratix 5950 security appliance from Rockwell Automation incorporates security technologies to help protect plant floor systems. The device uses Adaptive Security Appliance (ASA) firewall and FirePOWER technology to create a security boundary between cell/area zones or to help protect a single machine, line or skid. Compliant with IEC 62443, the device also uses deep packet inspection (DPI) technology. Developed in collaboration with Cisco, the DPI technology enables inspection of Common Industrial Protocol (CIP) and other industrial protocols.

An optional subscription license is available with the Stratix 5950 security appliance. Similar to a PC-based antivirus service, subscribers will receive ongoing threat and application-signature updates to help protect against the latest known security threats.

The appliance includes four 1 Gb Ethernet ports and is available with both copper and fibre ports or copper only, with small form-factor pluggable (SFP) slot options. The industrially hardened device is IP30 rated and can withstand electrical shocks, surges and noise. It can operate in temperatures ranging from -40 to 60°C.

Rockwell Automation Australia

www.rockwellautomation.com.au

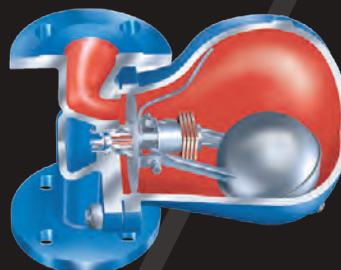
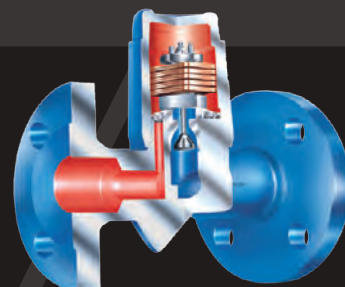


HIGH PERFORMANCE STEAM TRAPS



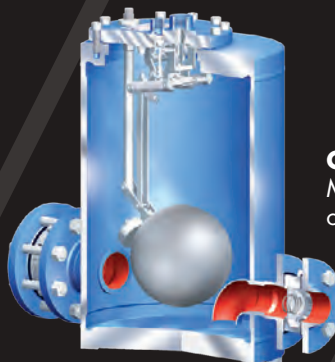
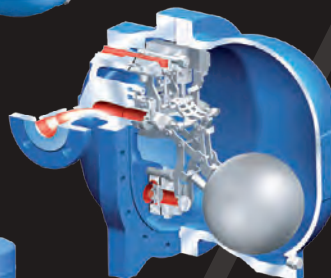
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PID CONTROLLERS

The Red Lion PAX2C PID controllers have been enhanced with the addition of ramp/soak capabilities and FlexCard plug-in options to meet the needs of numerous PID control applications.

The enhanced controllers offer benefits to those requiring flexible equipment that supports display reading at any point in the process, and can be tailored to specific applications by adding option cards. The ramp/soak capabilities enable options to change and hold machine temperature over a specific time period. There are 16 different profiles available with 20 step changes.

In addition, the field-installable FlexCard options allow customisation to add communication, set points, re-transmitted analog, heater current monitor, second analog inputs and second PID control features. With dual-line displays, the controllers are also able to change display colour based on process status.

The controllers feature universal process inputs and AC/DC power inputs and accept DC current and voltages, process signals, thermocouples and RTD inputs to ensure an all-in-one platform that simplifies integration.

Additional features include a large LCD display with easy-to-read bar graphs, programmable annunciators, up to 16 alarms and a built-in USB programming port.

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CHLORIDE AND SULFATE ANALYSER

Mettler-Toledo Process Analytics is launching an online instrument for direct measurement of corrosive ions found in power plant water and steam.

Chlorides and sulfates cause pitting and stress corrosion in expensive power plant components such as turbines and boilers, leading to extensive maintenance and unplanned shutdowns. Monitoring these ions at low ppb levels has therefore been identified as key measurements in power plant chemistry.

The Mettler-Toledo Thornton 3000CS analyser provides online, trace-level chloride and sulfate measurements for corrosion control every 45 min. The 3000CS uses microfluidic capillary electrophoresis, an ionic separation technology, to provide an alternative to expensive offline methods such as ion chromatography and inductively coupled plasma.

The unit features semiautomatic calibration and an intuitive touchscreen interface, allowing operation without the need for extensive training. Mettler-Toledo's Intelligent Sensor Management technology in the analyser provides diagnostics that predict when maintenance or replacement of consumables will be required.

Mettler-Toledo Ltd

www.mt.com



PANEL PCs

IEI Integration's AFL3-W15C-ULT3 IP64 wide screen panel PCs are powered by the Intel Skylake ULT platform.

The panel PC features a 15" wide screen monitor that is available with a 5-wire resistive touch screen and a serial interface or projected capacitive touch screen with a USB interface. The range is powered by the Intel 6th generation of iCore and Celeron processors. The Celeron version of the AFL3 is the Celeron E3955U processor, while the i5 version is equipped with the i5-6300U processor.

The device has a variety of storage options available, including a 2.5" SATA hard drive bay, an M.2 M PCIe and an mSATA slot. Both the M.2 and mSATA offer a fast method of storage with a data transfer rate of up to 10 GBps.

The optional E-Windows technology is a modular way of adding flexible functions for a variety of devices — these include extra GbE LAN ports, COM ports and 3G capabilities. The E-Windows Technology enables easy replacement of modules so they can be swapped out with different modules, enabling changes to be easily made to meet the needs of a variety of applications.

The product also features a 9–30 VDC power input, selectable AT/ATX power mode, built-in speakers and IEI's One Key Recovery solution, which allows users to create rapid OS back-up and recovery.

ICP Electronics Australia Pty Ltd

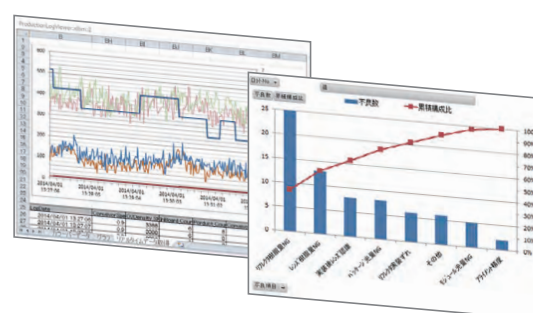
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CIRCUIT PROTECTOR WITH IO-LINK

The E-T-A REX12D electronic circuit protector is a protective element incorporating IO-Link that is suitable for mechanical engineering and process control. It combines system transparency and flexibility with a compact design.



The product is a double-channel electronic circuit protector which is mounted side by side with the EM12D-TIO supply module. Both modules feature push-in technology which requires no tools and saves wiring time. Current ratings 2 x 2, 2 x 4 and 2 x 6 A are available. Loads with a total rating up to 40 A can be protected if required by means of side-by-side rail-mounted circuit protectors, which can be connected with the help of a hinged connector arm. No bridges, jumpers or bus bars are required.

Status indication keeps users informed about the current state of each of the two channels of the device. Signalling shows connection of the load circuits and allows effective troubleshooting. The product offers a wealth of IO-Link communication options and thus enables service personnel to detect faults at an early stage and to react before the actual failure happens.

Faulty circuits will selectively be disconnected after approximately 3 s and after less than 10 ms in the event of a short circuit. Capacitive loads of up to 20,000 μ F can be switched without problems. The internal failsafe element (blade fuse), which is adapted directly to the current rating of the circuit protector, allows easy adjustment to the cable cross-section.

E-T-A ElectroTechnical Applications Pty Ltd

www.e-t-a.com.au

CONTROLLER

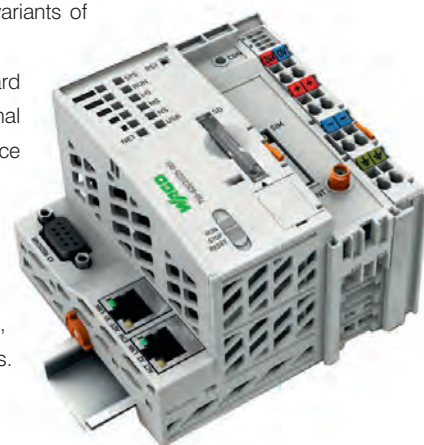
The PFC200 controller users to control machines and systems remotely via wireless technology. Three variants of the PFC200 enable long-distance, wireless control and monitoring via GPRS and SMS.

WAGO's PFC200 controller joins the WAGO-I/O-SYSTEM 750 equipped with a 3G modem with a standard SIM card. The PFC200 3G provides wireless GPRS internet connectivity and allows convenient bidirectional communication via SMS. The PFC200 (750-8207) features two Ethernet ports and an RS-232/RS-485 interface for seamless network integration. An integrated network switch enables easy line topology implementation. Additionally, an integrated web server provides the user with online configuration options and status information from anywhere. Featuring both fan- and battery-free design with SDGC memory, the PFC200 is claimed to be maintenance-free and robust.

The controllers support the following protocols: IEC 60870-5-101, -103 and -104. IEC 61850, IEC 61400-25, as well as DNP3. The PFC200 3G is also compatible with both IPsec and OpenVPN protocols.

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PROGRAMMABLE AUTOMATION CONTROLLERS

The XP-8331-CE6 and XP-8731-CE6 are the latest generation of Windows CE 6.0-based PACs from ICP DAS. They come equipped with an x86 CPU (1 GHz, dual-core), a VGA connector for video output, two USB 2.0 ports, two Ethernet ports, four serial ports and one, three or seven I/O slots for high-performance parallel I/O modules and serial I/O modules.

The series come with expandable I/O ports: the XP-8331-CE6 has three of these ports, while the XP-8731-CE6 has seven ports. These ports allow the expansion of the products' capabilities to include functionality like motion control, frequency input, PWM output, memory and counters.

The benefits of running Windows CE 6.0 on XPAC includes hard real-time capability, small core size, fast boot speed, interrupt handling at a deeper level and achievable deterministic control. The XPAC is also capable of running PC-based control software such as Visual Basic .NET, Visual C#, etc. This series offers features of both traditional PLCs and Windows-capable PCs.

The devices also feature 2 GB DDR3 SDRAM, a built-in 32 GB flash disk, 16 kB EEPROM, 512 kB of non-volatile RAM and an 8 GB CF card.

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Controlling isotropic graphite production

Graphite is a form of carbon that has been used by mankind since as far back as the fourth millennium BCE, when it was used for decorating pottery. Later it found its way into use as a refractory material to line moulds for cannonballs, resulting in rounder, smoother balls that could be fired further, contributing to the strength of the English navy. Today graphite is used in many applications, including batteries, steel production, brake linings, foundry facings and lubricants, pencils and electric motor brushes.

Some of today's graphite applications require a finer-grade graphite, called isotropic graphite, which has more stable properties than the graphite used in applications of the past. This graphite is used primarily in semiconductor and solar panel manufacturing.

One manufacturer focused on delivering isotropic graphite is Oregon-based Toyo Tanso USA. Toyo Tanso USA is a subsidiary of Toyo Tanso Japan, which was the first company to achieve mass production of isotropic graphite. Its products are used in a variety of applications today, including nuclear power, which requires high reliability, electrical discharge processing and the manufacture of semiconductors to support today's massive demand for new technology.

Toyo Tanso USA also offers a variety of services related to graphite, including silicon carbide surface treatments. These surface treatments protect substrates from customer process environments and also control the generation of particles and gas from the substrate. Toyo Tanso's process also ensures excellent blister resistance while improving the abrasion and oxidation resistance of the substrate.

Toyo Tanso performs its surface treatments in a tough industrial setting.

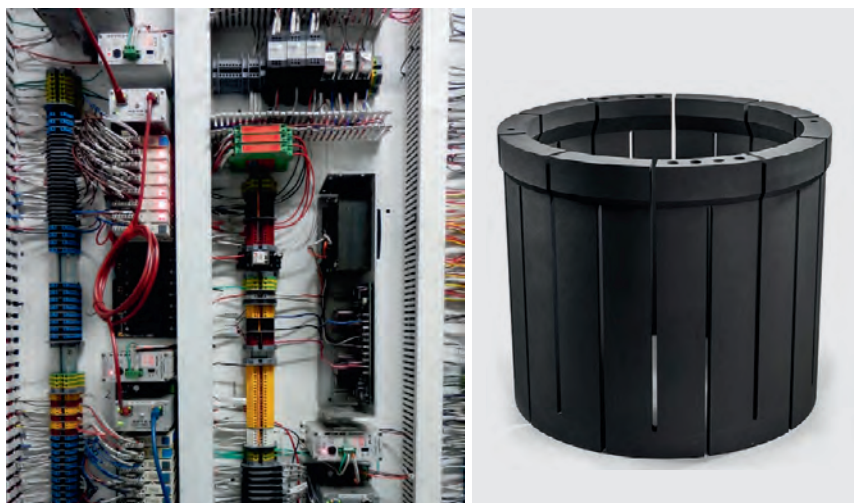
"Our production environment is very busy and physically demanding, yet requires precise control of all the interacting systems," said Peter Souvanna, IT manager for Toyo Tanso USA.

Souvanna is responsible for managing the batch automation process systems that perform the silicon carbide surface treatments. The treatment process is performed in multiple vessels that act as reactors, where the coating process takes place. These multiple vessels have varying specialisations and require careful management to ensure that each process is successful and within specifications.

To automate its batch process, Toyo Tanso needed something rugged and able to survive in its demanding production environments, with many I/O options and controls that could be easily programmed and deployed. The company therefore implemented the Opto 22 SNAP PAC control system to automate its surface coating process.

A total of eight separate programmable automation controllers (PACs) are used to manage the batch automation process. Each controller is configured to communicate with other controllers to leverage the distributed control and intelligence features of the Opto 22 PACs and ensure system uptime.

The I/O modules and PACs are responsible for everything: controlling pumps and motors, temperatures, and power and pressure to the vessels;



heating the vessels; and supplying cooling water during the coating process.

Pressure and temperature are both controlled using PID loops that run on the PAC's built-in processor. Other dynamics inside the vessel are also controlled using the SNAP PAC system, including dozens of valves in each vessel.

The PAC and I/O monitor pH and pressure during the coating process while maintaining critical set points using PID loops and a variety of other control points to manage Toyo Tanso's proprietary coating process. In total, the vessels use over 1000 I/O points for control and monitoring during batch process runs.

Souvanna found the flowchart programming style of the PAC Project programming tools to be very easy to use.

"The scratch pad features of the controller make it easy to move data in and out of the controller," he noted. "Ladder logic is useful for basic on/off procedures and control, but... ladder logic can be difficult to troubleshoot. The ability to step in and out of a control block to pinpoint exactly what's happening in the process makes troubleshooting much easier.

"And the HMI tools that come with the product offer many standard features built directly into the software that allowed us to build rich HMI screens to know exactly what's going on with our process at all times."

Toyo Tanso USA also implemented the groov mobile interface tool to develop a gas monitoring system that can be accessed directly from operators' mobile devices. During the coating process, a number of potentially dangerous gases are used. groov acts as a backup to the standard control system HMI. Wherever operators are, they have access to alert notifications and system status directly from the mobile device using an interface served from an industrially hardened groov Box.

"The groov Box also supports unlimited concurrent connections and user accounts, allowing the entire plant to use a single groov Box for all of our operators," said Souvanna.

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CONVEYOR ROLLER SENSORS

Wenglor sensors for roller conveyor systems offer everything required for modern warehousing and transport technology. Equipped with a near field communication interface (NFC), the sensors can be conveniently configured via an Android app or with a PC.

They are available as a reflex sensor with background suppression or retroreflex sensor or logic unit, and can be supplied with or without accumulation logic and with valve (for pneumatics) or without valve (for motorised rollers).



The sensors are easy to mount using a fast-clip system and quick wiring. Due to intelligent accumulation logic functions and energy-saving modes, power consumption at the solenoid valves is reduced by 75% with the help of the integrated EcoMode.

Automatic roller shut-down, intelligent jam monitoring, dynamic accumulation zones, individual and

block forwarding, as well as time functions allow many logistics processes to be easily implemented and optimised. Users benefit from significantly reduced energy consumption, lower noise levels, a large decrease in the number of errors, increased throughput rates and up to 60% more capacity for the conveyor system.

Treotham Automation Pty Ltd

www.treotham.com.au



FACTOR 1 SENSORS WITH IO-LINK

Turck is now offering its Uprox3 sensor in a version with IO-Link capability. In addition to long sensing distances, IO-Link allows for more flexibility and intelligence for integration into sensing applications.

Easy configuration allows users to flexibly adapt the sensors to needs. Users can not only set the output functions and the sensing distances, but special functions are included and can be used whenever needed. Additionally, each adjustable switching distance can be run sequentially in combination with an IO-Link master. The sensors include all standard Uprox3 benefits such as Factor 1 with long sensing distances and high magnetic field strength. The reduction of variants streamlines the ordering of the product, and also minimises storage and administrative costs.

In IO-Link mode, the sensor is operated on an IO-Link master. This enables access to all parameter and evaluation functions. The intelligent data retention with IO-Link 1.1 allows a sensor to be exchanged without having to reset parameters. The process data Uprox3 IO-Link offers provides further analysis options, such as application-specific switch points, temperature limits or an identification number. These can be used to identify 256 different nodes. The sensing of targets and their simultaneous identification can then be implemented with a single sensor.

Turck is initially offering four variants of Uprox3 IO-Link: an M12, M18 and M30 barrel style, all in a chrome brass housing, as well as PTFE-coated variants for welding applications. Additionally, a rectangular CK40 style is also included in the series.

Turck Australia Pty Ltd

www.turck.com.au

MOTORISED PRESSURE REGULATORS

Rotork has introduced the Fairchild PAX1 range of motorised pressure regulators. The design, based on the Fairchild MP2400 range, offers a flexible, low-power and field-convertible unit representing the next generation of motorised pressure regulation. The PAX1 is suitable for midstream and downstream natural gas systems demanding precision.

Operating from an 11–26 VDC power supply, the PAX1 is capable of controlling pressure ranges of 0–0.5 to 0–3000 psig. The low power consumption is suited to renewable energy sources. The units incorporate isolated 4–20 mA and non-isolated 1–5 VDC analog inputs to provide proportional linear positional control. In both control modes, the regulators lock in place on loss of signal or power supply.

Integrated within the improved human interface, push-buttons enable local control and facilitate the setting of various options. These include limit switches, travel alarms, high and low set points and analog feedback. A female hexagon motor drive interface also enables manual operation.

The IP68 watertight enclosure, combined with explosion-proof certification and an ambient operating temperature range of -40°C to +80°C, optimises potential operating environments, while the NAMUR standard mounting interface maximises suitability for industrial applications.

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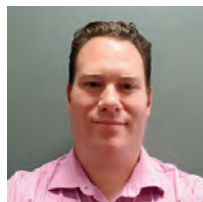
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SERIALISATION TO PROTECT AGAINST TAMPERING OF PHARMACEUTICAL PRODUCTS

Marco Kaiser, Industry Manager Consumer Goods, SICK AG

EU directives on the serialisation of pharmaceutical products come into effect over the next three years and will affect the way manufacturers label and package their products.

Fake medicinal products are a global problem: medications with high sales levels and those that command a high price are particularly vulnerable to forgery. Experts estimate that more than one in 10 preparations worldwide are forged; for medications available online the level is believed to be over 50%. A buyer wishing to keep their online purchases anonymous can even expect up to 95% of all the products to be fakes, according to research studies based on all products available online. The consequences of taking fake medicines can range from the absence of any therapeutic effect to fatalities.

In the fight against the forgery of preparations, imitations and tampering of packaging, the European Union has defined a catalogue of measures in directive 2011/62/EU — typically known as the Falsified Medicines Directive (FMD) — which is intended to prevent fakes entering the legal supply chain of medicines. In 2015, the EU Commission published a number of fundamental technical details concerning the design of safety features. This delegated act was published in February 2016 in the Official Journal of the European Union and is therefore legally binding.

All members of the pharmaceutical logistics process chain — pharmaceutical and commissioned contract manufacturers, contract packagers, wholesalers and pharmacies — are obliged to implement the EU directive within the next three years. In concrete terms, this means two things: every item of pharmaceutical packaging must have an individual serialised code that makes it globally unique; at the same time, every item of packaging must be protected against undetected, premature opening or tampering with the help of appropriate tamper-evidence systems. This is specified in further detail in standard EN 16679:2015-03 'Packaging – Tamper verification features for medicinal product packaging', which supports the application of directive 2011/62/EU.

There is a range of sealing options suitable for preventing packs from being opened and re-closed without leaving evidence, thereby guaranteeing maximum protection against tampering. These include fibre-tear labels, which are irreversibly damaged on opening, or foil 'VOID' stickers that reveal previously invisible text or patterns once they are detached. As a tamper-evident safety feature, transparent, self-adhesive sealing labels with perforations across the opening



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THERE IS A RANGE OF SEALING OPTIONS SUITABLE FOR PREVENTING PACKS FROM BEING OPENED AND RE-CLOSED WITHOUT LEAVING EVIDENCE, THEREBY GUARANTEEING MAXIMUM PROTECTION AGAINST TAMPERING.

the aid of image-based code readers — to check its legibility by a machine on the one hand and to verify the coded contents on the other. To identify additional barcodes, suitable CLV laser scanners can be used.

Folding cartons are usually manufactured from pre-cut and pre-punched blank formats. If these are labelled with fluorescent marks, the authenticity of the packaging can also be checked using luminescence sensors. This can take the form of either a random check before the blank enters the input magazine of the packaging machine or a continuous and 100% check where the sensor scans each blank individually as it is removed from the magazine. The printed pattern, colour and condition of the carrier material do not influence the safety and availability of the packaging authentication.

Following serialisation in line with the Falsified Medicines Directive 2011/62/EU, each item of secondary packaging must be sealed once it has been filled in a way that is so tamper-proof that if it is opened or tampered with, it is detected at the latest by the dispensing pharmacist, and the medication can be removed from the supply chain without causing damage. Numerous manufacturers satisfy the requirement for a tamper-evident safety feature with self-adhesive sealing labels with perforations. These are applied to the opening flaps of folding cartons by machine at high process speeds. Using a sensor, the presence of these safety labels, as well as possible errors in dispensing or attaching them, can be identified immediately. The sensor distinguishes with maximum reliability between clear reflection from the plastic surface of the label and the diffuse reflections from the rougher surface of the packaging material.

Once correctly filled and sealed, medication with secondary packaging is then sent on to the tertiary packaging stage. For this aggregation, the packaging must be completely filled and each box identified and assigned to secondary packaging so that it can be traced later on if necessary. An image-based code reader can detect both complete filling 'at a glance' as well as identify the data matrix codes of all boxes simultaneously.

Summary

The EU Falsified Medicines Directive 2011/62/EU, delegated acts, and the EN 16679:2015-03 standard to support implementation, clearly define the details concerning the design of safety features and relevant devices in the fight against the forgery of medicine and tampering of packaging. In complying with these directives, companies involved in the pharmaceutical and packaging-logistics process chain can apply modern sensor and safety systems as a secure investment to ensure compliance.

SICK Pty Ltd
www.sick.com.au

flaps of folding cartons have the advantage that they neither affect the pack design nor cover up required wording or markings.

With directive 2011/62/EU and standard 16679:2015-03, the starting pistol has been fired for the race against product piracy and forgery of medications; nevertheless, not many have heard it yet. Industry insiders report that even global manufacturers are far from hitting the home straight in all aspects of serialisation and tamper evidence, not to mention small and medium-sized market participants, some of whom are still in the starting blocks. This can partly be explained by the large number of directives, the complexity of the requirements they contain and the lack of contact people who can troubleshoot integrated complete safety systems, as well as provide the knowledge required for their practical implementation.

Intelligent sensor solutions needed

In order to serialise individual items of packaging, they are labelled individually with a data matrix code. Before the packaging is filled, for example with tablets that use blister packs as their primary packaging, the coding is captured during the packaging flow with

AS I SEE IT



WORKING WITH MILLENNIALS

One of the biggest challenges in our industries is the ageing workforce. According to a recent report, over 60% of employers in mining and manufacturing believe the ageing workforce would have a large or very large impact on their organisation.¹ Yet many employers are nervous about hiring younger workers.

We've all heard the following statements. As managers, some of us have even said them ourselves:

"My Gen Y staff are difficult to deal with — they want it all and want it now."

"Why are millennials asking for flexible working arrangements? They should be grateful they have a job."

"They don't have the patience to sit down and carefully study and learn something before they act."

Admit it: we've all at least thought it!

We baby boomers, who remember the time when a phone had a rotary dial and was on your desk, can struggle with these ideas. The arguments might sound logical, but is there a double standard here?

What would we would think if the IT department announced they were going to roll out fax machines across the business? And what would you say if someone suggested corresponding by telex instead of email? And in our technology-focused industries, would we accept using 40-year-old standards and technology?

So why do we insist on 1970s-style management thinking when it comes to recruiting and managing people?

We should be embracing these tech-savvy, in-a-hurry 20-somethings. A 'want it all now' attitude often means they will focus on the solution, not just the problem. How often have we been in meetings that discuss at length all the reasons why the issue can't be resolved? Didn't you just wish there was someone in the room with a can-do attitude?

A 'flexible working arrangement' to a millennial doesn't mean working fewer hours; in fact, it's the very opposite. They

are happy (even expect) to be connected to work 24/7, not just 9–5.

Your control engineer found an expert in Russia on LinkedIn while he was preparing the 2-year-old for preschool. By lunchtime he had learned how to calculate the optimum surge line of your compressor. During TV ad breaks last night, your staff collaborated — on their private Facebook group — on the best way to virtualise your servers. And your new project engineer doesn't need you to give her a lesson on how to calculate the net present value on that capital expenditure request: she's got an app for that.

My advice: Find out what motivates your millennials. Hint: It won't be simply 'doing their job well'.

Instead they will probably be wanting to 'make a difference'. Explain how their job fits into the big picture; explain the reasons for your requests; ask their advice. Explain how they are making a difference.

I'll admit that for some, the 'want it all now' attitude comes with an expectation that it will be handed to them. But for the most part the old manager's adage still rings true:

"Find good people, make it clear what you want them to do, then get out of their way."

Reference:

1. Chandler MacLeod 2013, *Coming of Age: The impacts of an ageing workforce on Australian business*.



Andy Kennard has been working with Emerson Automation Solutions in process control and instrumentation for over 35 years. He holds degrees from the University of Sydney in engineering and science.

Andy's current role is senior sales manager for Emerson Automation Solutions' business unit for ANZ. He believes staff development is a key part of any management position.



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