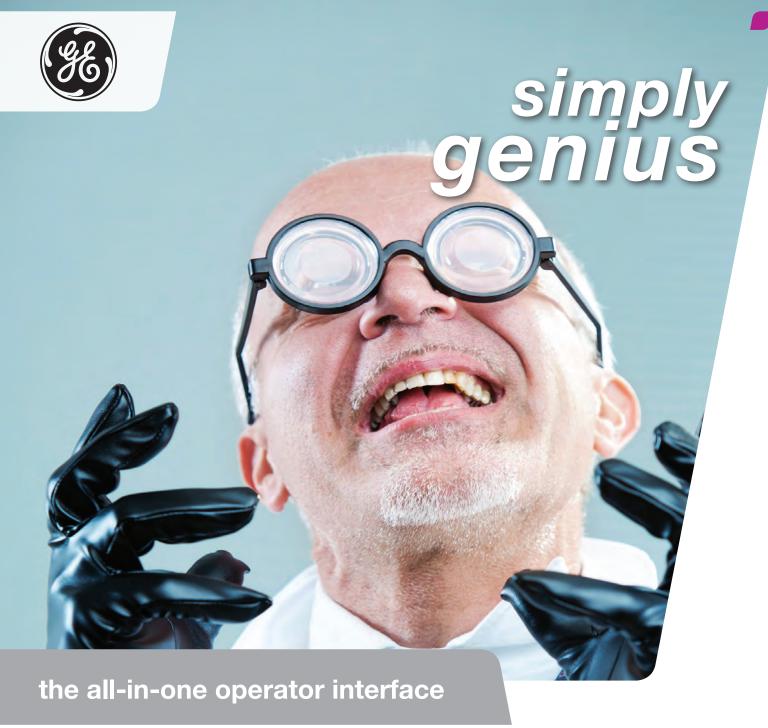




VEGAPULS 64

Radar level sensor for liquids with 80 GHz









range of sizes 6" to 15" combines both PLC & HMI

5 IEC programming language support multi-touch for optimum response

Control Logic brings you the all-in-one Quickpanel+ from GE Automation & Controls. It's a compact controller that combines the features and capabilities of a typical programmable logic controller with an operator interface.

The Quickpanel+ can be used with controllers and I/O from multiple vendors for swift and smooth integration even in complex systems. Featuring built-in HMI functions and support for 5 IEC programming languages, its easy configuration saves on development time.

Streamline your system, simplify development and maintenance by relying on one powerful device for your operator interface and control requirements.

SMARTER, FASTER & EASIER.



WHAT'S NEW IN PROCESS TECHNOLOGY MAY 2016

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ON THE COVER



The VEGAPULS 64 is the first radar level sensor for liquids that measures at a frequency of 80 GHz, allowing considerably better focusing of the radar beam.

Until now, a radar sensor with a transmission frequency of 26 GHz and an 80 mm-diameter antenna had a beam angle of approximately 10°. With the same size of antenna, the VEGAPULS 64 has a beam angle of only 3°. This allows the sensor to be used even in vessels with internal installations or heavy build-up on the walls, as its focused microwave beam can avoid these obstacles.

The larger the dynamic range of a radar sensor, the higher the measurement certainty and the wider the range of application. Media with a low dielectric constant can now be measured with more certainty than previous radar sensors. Even foam, turbulent product surfaces, condensation or build-up on the antenna are no problem — VEGAPULS 64 measures more reliably due to its greater measurement certainty. It has an accuracy of ± 2 mm, even with a measuring range of 30 m.

The new radar level sensor VEGAPULS 64 is not only suitable for wide use in the chemical industry, but also in the pharmaceutical and food industries due to its hygienic materials and design. Due to its small antenna — the diameter of the smallest version is no larger than a \$1 coin — it results in very compact process fittings, which means the sensor can offer an interesting alternative for confined spaces in small vessels, pilot plants and even laboratories.

VEGA Australia Pty Ltd www.vega.com/home_au







The much discussed IIoT is not so much a revolution, as an evolution of existing technologies and systems.

he Industrial Internet of Things (IIoT) is often described as a revolution that is changing the face of the manufacturing industry in a profound manner. However, in reality it is more of an evolution that has its origins in technologies and functionalities developed by visionary automation suppliers more than 15 years ago. As the industry and necessary global standards further mature, it may well take another 15 years to realise its full potential.

With over two billion connected internet users today and an expected 507.5 ZB of information produced by IoT devices by 2019 alone, changes to the industry will certainly be far-reaching. The potential lies in using the correct solutions to link automation systems with enterprise planning, scheduling and product lifecycle systems. The good news is that end users and machine builders can now leverage their existing investments in technology and people while taking advantage of available new technologies. This means introducing IIoT solutions using a 'wrap and re-use' approach, rather than a 'rip and replace' approach, is the best way for Australian companies to adapt to significant changes and avoid complete overhauls of systems.

The emergence of the IIoT megatrend has created both hope and confusion among stakeholders responsible for operating industrial plants. Some changes can be implemented in the short to medium term — others will require a gradual evolution with end users and OEMs incrementally adding functionality to their existing legacy systems as new international IIoT standards are established.

Barriers such as standardisation, cybersecurity and worker competencies may challenge companies looking to adopt the technology but can be overcome with a full understanding of two key aspects:

- The operational environments that will set the stage for smart manufacturing.
- The impact on automation architectures.

Smart manufacturing

A significant enabling factor for the potential to wrap and re-use existing control assets is that the emerging technologies underpinning the IIoT evolution are fundamentally based on the same IT standards and technologies that have driven a convergence of IT and OT systems over the past 10 years, the most significant of which has been the adoption of both wired and wireless IP technologies by operational systems.

This has allowed systems to evolve at a rate required by businesses in a sustainable and secure way. When considering smart manufacturing enterprise there are three main considerations: smart enterprise control, asset performance management and augmented operators.

Smart enterprise control

One of the biggest potential benefits of nextgeneration IIoT systems is the breakdown of enterprise silos. The technologies will allow for closer integration of production systems and ERP systems, product lifecycle management systems (PLM), supply chain management and customer relationship management (CRM) systems. Today these systems are managed somewhat independently of each other, which prohibits a holistic view of the enterprise. It is believed such a holistic approach could facilitate an enormous efficiency gain of up to 26% for enterprises.

Tighter integration will allow enterprises to not only be more efficient, but also more profitable thanks to greater flexibility and responsiveness to volatile market conditions. The notion of control will expand from the real-time control of a physical parameter to the right-time control of the whole business, including both physical and non-physical parameters. Benefits will include the ability to enhance protection against cyber threats, to increase innovation and to better manage safety, performance and environmental impacts.

Examples of real-time business control include enabling 'batch size 1' produc-



tion systems; improving product quality outcomes; and changing supply chain and production schedules on the fly to optimise commercial results based on environmental, raw material, equipment availability and market considerations.

For companies looking to adopt IIoT technology, smart enterprise control does not mean replacing current automation systems with completely new systems. Instead, it is possible to connect current automation systems with enterprise, lifecycle and value chain systems. This optimises the entire manufacturing enterprise and enables a much greater degree of business control.

Asset performance management

Asset performance management applications such as energy management and predictive maintenance are not new to industry, but have had limited uptake due to the cost of implementation. Physical connectivity — such as the cost of cabling to the sensors — and logical connectivity - like integration with existing systems - have been the most cost-prohibitive. Wireless IP connectivity and cloud-based architectures now overcome these cost barriers. In addition, a new generation of simple, small and low-cost sensors is emerging. As a result, next-generation IIoT systems will deliver innovative solutions in the area of asset performance.

The legacy of limited connectivity and closed proprietary industrial systems has traditionally made it difficult and expensive for companies to access the data required to implement these types of asset management and optimisation systems. However, these new technological approaches and lower costs allow manufacturing companies to build on pre-existing systems and connect them in a way that could not have been achieved previously. Most industrial automation suppliers have built sophisticated tools and techniques to upgrade systems and products in a staged way.

Consider the example of condition-based monitoring and predictive maintenance. A lot of money can be wasted maintaining equipment that doesn't really require it, or by neglecting equipment that subsequently fails and causes unanticipated production downtime. Solutions such as condition-based monitoring do exist today, but uptake has been limited by these aforementioned costs. These tools allow data to be easily gathered from the field and converted into actionable information in real time. This will result in better business decisions and forward-looking decision-making processes.

Augmented operators

Future employees will use mobile devices, data analytics, augmented reality and transparent connectivity to increase productivity. As fewer skilled workers are left behind to man core operations due to a rapid increase in baby-boomer retirement, younger replacement plant workers will need information at their fingertips. That information will be delivered in a real-time format that is familiar to them. Thus the manufacturing plant evolves to be more user-centric and less machine-centric.

The use of mobile HMI technologies such as smartphones, tablets and wearables, combined with IP access to data and information (analytics and augmented reality), will transform the way operators work. Portable wireless devices will expand their capabilities and technologies such as dynamic QR codes will improve the operator experience and render the 'augmented' operator more productive.

Today, operators only have access to information from automation systems. Tomorrow, augmented operators will access information from all of the needed enterprise systems and will manage not just process performance and efficiency, but also process profitability.

We've already seen the 'bring your own device' (BYOD) trend emerge in Australia, transforming the way we share information and how we approach work overall. These connections already exist — the task now is putting in place the right framework to ensure we are sharing such information to and from worker devices effectively.



ASSET PERFORMANCE MANAGEMENT APPLICATIONS SUCH AS ENERGY MANAGEMENT AND PREDICTIVE MAINTENANCE ARE NOT NEW TO INDUSTRY. BUT HAVE HAD LIMITED UPTAKE DUE TO THE COST OF IMPLEMENTATION.

Impact on automation architectures

Once the possibilities of a wrap and re-use approach have been considered for the elements of a smart manufacturing enterprise, it is time to switch up thinking to its impact on automation architectures.

Of these impacts, information-driven architectures, centralised versus distributed control, and networked automation architectures stand out as the most significant factors for consideration in a wrap and re-use approach.

Information-driven architectures

As forward-thinking manufacturing enterprises start implementing smart manufacturing, automation vendors will respond by helping to build connectivity among preexisting technology and implementing IIoT at all levels of the automation hierarchy. This will allow easy integration with nextgeneration IIoT systems.

In addition, with the increasing power of embedded electronics, connected intelligence will migrate down to the lower levels of the automation hierarchy - to the control level and to the sensors and actuators. As a result, OT systems will merge with IT systems and the automation hierarchy will evolve to be a much flatter and more information-driven architecture. Since the future implications of this are still unclear. the technologies and architectures employed must be flexible and adaptable to change.

Low-cost, highly connected instrumentation and actuation systems that enable decentralised control of individual equipment function are driving assets to be aware of their operational function. They are also responsible for their individual control and optimisation of local operational parameters.

Sounds like the revolutionary future of control? Perhaps not. Consider the pump curve optimisation functions found in modern drive systems. They effectively transform a simple mechanical device into a highly optimised, highly connected asset ready for integration into an IIoT cloud through a wrap and re-use model.

More examples of this type of IIoT evolution will become available as the market integrates increased process capability and network connectivity into low-cost instruments and actuators.

Centralised versus distributed control

The arguments for highly centralised redundant control systems versus highly distributed control systems have gone on for many years. The advent of IIoT does not resolve this long-standing debate. On the one hand, the use of cost-effective embedded electronics in field devices argues for more distribution of intelligence and control. On the other hand, the high-speed IP connectivity of field devices enables a more centralised architecture where all the sensors and actuators are connected to a highly redundant and powerful multicore processor located in a secure on-premise data centre.

Today, an application is programmed with a particular hardware target in mind: for example, a PLC. Tomorrow, an application will be programmed independently of the underlying automation hardware, and the system will distribute the application transparently to the hardware, configuring all communication mechanisms automatically. This approach will allow users to choose either a highly centralised or distributed architecture, or a hybrid approach based on their specific requirements and concerns.

From this, architectures will likely split into a hybrid centralised or decentralised model. Low costs along with highly connected instrumentation and actuation systems enable decentralised control of individual equipment function. At the same time, centralised automation systems provide supervisory coordination and process safety control across multiple assets.

So while we can expect the distribution of control responsibility to change, the control strategies and methodologies that have worked in the past do not necessarily have to be rewritten. For example, the overall control algorithm for running an aeration system at a wastewater treatment plant will not fundamentally change, but will instead wrap smart connected assets such as blowers and instruments into an existing control philosophy.

Networked automation architectures

Networks will see an exponential increase in the number of smart connected devices. These devices will exploit a time-sensitive IIoT/Ethernet backbone to interoperate with each other and with devices residing in other enterprise systems.

Implementing such large networked systems with today's classical automation techniques is complex. Tomorrow's IIoTbased automation systems will require a new approach to simplify the design, the management and the maintenance of networked automation architectures. Starting from scratch could be the most straightforward way to achieve complete operational efficiency, but as this is not possible for many companies, clever solutions that work across new and older machinery become vital.

Conclusion

While the interest in IIoT has reached fever pitch, there are several reasons IIoT should be seen as an evolution rather than a revolution. End users have invested hundreds of millions in industrial automation and control systems, and aren't always willing to invest hundreds of millions more to replace those systems with new technologies. Even if a valid business case could be made for a ripand-replace system due to the benefits of IIoT, end users would still resist the change because of the increased risk of downtime and associated costs.

The good news is that we have substantial technological maturity that allows businesses and enterprises to introduce IIoT solutions by phasing in new technologies that shift their physical infrastructure base over time. This is where the wrap and re-use approach is of the most value. The cost of connected sensors is dropping rapidly, open IP-based protocols are gaining traction at an accelerating rate and the adoption of cloud-based solutions is becoming a reality.

Schneider Electric Industry Business www.schneider-electric.com





SCANNING LINE SENSOR

Traditional sensor solutions for the detection of flat or misshapen objects, or objects of varying height, can be complex and expensive. The Ax20 scanning array sensor has a high-resolution line array with which a wide variety of objects can be detected with a repeat accuracy of up to 35 μ m.

The measurement area can be up to 30 mm wide, with easy adjustment due to the visible white light. In addition, the sensor is highly immune to ambient light and always supplies precise and reliable results regardless of the reflectivity properties of material surfaces, and without any need for teach-in.

With its compact housing and appropriate mounting accessories, the Ax20 offers a high level of installation flexibility. This is as important for applications in packaging machines, in the print and paper sector or in metal processing, for example, as the numerous ways in which the measurement values can be used. Typical areas of use for the scanning line sensor include the provision of measurement values for controlling the sides of webs of endless materials such as foils, paper or fleeces, whose passage through a machine can be regulated according to the signals transmitted via the analog 4-20 mA output. Detection can take place both via the edge of the web and on the basis of a line on the material. The Ax20 also offers opportunities in the area of position detection, eg, sheets of paper, flat workpieces or electronic cards.

SICK Ptv Ltd

www.sick.com.au

POE+ SWITCHES

The Hirschmann OCTOPUS OS24/34 switch offers Power over Ethernet Plus (PoE+) functionality. Belden's open ordering system allows for tailor-made PoE+ switches to meet specific application requirements, giving users options for fibre or copper ports, port counts up to 28 and power supplies for multiple input voltage ranges, including 24-110 VDC and 100-230 VAC. With IP65 and IP67 ratings, the switches meet the requirements of routing functions in waterproof and dust-tight housings for mounting outside of cabinets, and can operate in temperatures ranging from -40°C to +70°C.

These features make the OCTOPUS OS24/34 well equipped for transportation, automotive, machine building and manufacturing environments, including onboard train networks, passenger information systems in train stations, conveyer systems and traffic surveillance on highways and bridges as well as in tunnels.

Belden Australia Pty Ltd www.belden.com



MODULAR IPC PLATFORM

The Advantech MIC-7500 is a compact modular inter-process communication (IPC) platform. The system's fanless, ruggedised design supports a wide input power range, ensuring the durability to withstand harsh industrial environments. Advantech i-modules are designed to be integrated with MIC-7500 and provide economical and flexible expansion on demand.

The MIC-7500 supports diverse communication requirements and devices. including external sensors, controllers and displays. Currently, Advantech's i-modules comprise two slots, four slots, and two slots with a 2 x 2.5" hotswappable tray. Advantech has plans to develop additional modules in the near future. Advantech's i-modules are easy to assemble and have a simple upgrade path.



The MIC-7500 is powered by an Intel Core i processor that delivers up to 10% additional CPU performance and 30% faster graphics compared to the previous generation. The MIC-7500 series is also compatible with a wide range of CPU platforms, including the Intel Xeon (for server applications) and Intel Atom (for entry-level operations).

MIC-7500 supports a wide operating temperature range of -20 to 60°C. The ruggedised design and cast aluminium case offer vibration and shock protection, as well as a passive thermal solution that ensures silent operation. Designed for the industrial automation market and to withstand harsh environments and 24/7 operation, all electronic components are rugged and satisfy certification standards for environmental protection, EMI/ESD tolerance and high-voltage surge requirements (2 kV). Finally, MIC-7500 supports the Microsoft Windows 7/8/10 and Linux operating systems, and is equipped with Advantech's SUSIAccess remote management software utility for convenient management and system protection.

Advantech Australia Pty Ltd www.advantech.net.au

Customer Value



Increase Asset Utilization up to 10%

- Reduce unplanned downtime by predicting failures and providing pro-active response
- Minimize rate and efficiency losses



Reduce Maintenance Costs up to 10%

- Pro-active response to minimize equipment damage and emergencies
- Optimize maintenance based on real asset conditions
- Improve reliability and extend equipment life



Increase Operating Efficiency up to 10%

- Monitor energy usage to achieve up to 10% reduction in costs
- Improve engineering effectiveness with continuous monitoring, remote collaboration, and ready access to required information
- Increase engineering efficiency with an integrated decision support environment



Increase Safety

- Minimize risks by ensuring normal and stable operations
- Eliminate production stops for safety system verification

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Designed to meet the needs of Honeywell customers worldwide, **Uniformance Asset Sentinel** works across industries — on a varied set of monitoring applications — and across a broad set of asset types.

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Refining & Chemicals

Mining

Pipelines

Power

Monitoring Applications



Process



Health



Efficiency





Type of Equipment / Complexity



Software



Pump



Instrument



Heat Exchanger



Valve



Compressor





Haul Truck







HOT PRODUCTS

WWW.PROCESSONLINE.COM.AU THIS MONTH

IOT GATEWAY STARTER KIT

The Advantech IoT Gateway Starter Kit includes a ready-to-run system, an IoT software platform service, a software development kit and support services.

Advantech Australia Pty Ltd

http://bit.ly/22yC5oM





CONTROLLERS

Siemens has added a range of modules and functions to the Simatic S7-1200 Basic Controllers.

Siemens Ltd

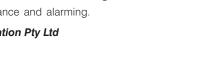
http://bit.ly/1Wv4Wuv



The SIL 2 rated FS10i flow switch/monitor is designed for industrial processes requiring flow assurance and alarming.

AMS Instrumentation & Calibration Pty Ltd

http://bit.ly/1V5JEEp











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Emerson has expanded customers' application options by adding Profinet capabilities to the DeltaV distributed control system.

Emerson Process Management Aust P/L

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Learn more at www.emersonprocess.com/projectcertainty



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SERVO CABLE SYSTEM

Kollmorgen's third-generation 'Smart Feedback Device' (SFD3) single servo cable system is claimed to have many advantages, beyond the obvious one that one cable is half the cost of two.

Its digital resolver technology can simultaneously transfer motor ID and temperature data, and it only requires two wires instead of the customary four wires for resolver feedback. One cable and feedback combination is now suitable and economical for all applications both conventional and high-end.

It is suitable for use with Kollmorgen's AKMH IP69K food-grade-compliant servo motors. Due to the high interference resistance, data can be transferred safely within one cable without EMC problems.

Motion Technologies Pty Ltd www.motiontech.com.au

NON-INTRUSIVE TEMPERATURE MEASUREMENT

Rosemount X-well Technology is a surface-sensing temperature measurement solution that eliminates the need for thermowell process penetration when measuring process temperatures in pipe applications. It provides process temperature measurement while eliminating possible leak points and simplifying installation and maintenance.

The product is available via the Rosemount 648 wireless temperature transmitter and Rosemount 0085 pipe clamp sensor assembly, working together to calculate process temperature via the transmitter's thermal conductivity algorithm. The technology works by measuring the pipe surface temperature and ambient temperature and combining this information with an understanding of the thermal conductivity properties of the installation and process piping.

An advantage of the technology is process temperature measurement without requiring any intrusions or penetrations into the process, allowing for quick and easy installation along with simplified long-term maintenance. Users do not have to design, size or maintain thermowells. Wake frequency calculations are eliminated, as well as time spent determining material compatibility, the right insertion length and the necessary profile.

With Rosemount X-well Technology, users can add temperature measurement points without having to shut down a process. The technology can be installed with a standard pipe clamp procedure and ordinary hand tools and does not require a skilled contractor.

Applications that can benefit from the technology include pipelines, high-velocity flows, slurries, heavy particulate fluids, wellheads, clean-in-place processes, high-viscosity fluids and harsh processes in the oil and gas, chemical, refining, food and beverage, metals and mining, and pulp and paper industries.

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



Westermo's rugged Wolverine family of SHDSL routers, switches and modems has been enhanced with additional models that now include sophisticated but easy-to-use cybersecurity functionality, higher bandwidth and cable quality monitoring.

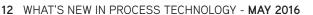
They provide network designers the capability to create or extend industrial ethernet networks beyond the 100 m segment limit using any existing twisted-pair copper cables. They are also suited to applications where it's not possible to install fibre-optic cable due to cost or logistics.

The DDW-242 and DDW-242-485 enable ethernet networks to be connected over distances of up to 15 km at data rates up to 15.3 Mbps on a single twisted-pair cable. Using two pairs bonded, the rate can be doubled to support applications requiring larger bandwidths. An integral switch allows two ethernet devices to be attached, and a choice of either RS232 or RS485 serial port enables legacy equipment to be incorporated into the IP network.

To help improve cybersecurity, the DDW-242 and DDW-242-485 include full layer 3 functionality and IP security provided by the Westermo WeOS operating system. The devices include a built-in, port-based firewall securing data between trusted and untrusted networks, as well as NAT rules and VPN tunnels for encrypting data on the 'last mile' section of the network, which is particularly susceptible to security risk.

The devices offer a wide operating temperature range of -40°C to $+70^{\circ}\text{C}$ and have been tested to meet electromagnetic compatibility (EMC), isolation, vibration and shock standards.

Westermo Teleindustri AB



CASTING SIMULATION SOFTWARE

CD-adapco has announced the availability of STAR-Cast v11.02, the casting simulation add-on for STAR-CCM+. STAR-Cast features a high-pressure die-casting module, providing casting engineers with a user-friendly tool for designing strong, light and high-quality casted parts.

High-pressure die casting is a fast and inexpensive process for the mass manufacturing of precision components, resulting in good dimensional accuracy and requiring minimal machining. However, defects such as gas inclusions and misruns are hard to control and remain a challenge. This process has traditionally also been difficult to simulate due to the complexity of the physical processes, including multiphase flows consisting of both melt and gas.

STAR-Cast is a casting simulation software resulting from a partnership between Access eV and CD-adapco. Drawing on CD-adapco's expertise in thermal fluid simulation and Access's experience in casting and metallurgy, STAR-Cast integrates CAE technology with the detailed models required for casting, enabling accurate simulation of interactions between molten metal and air. By resolving all the physics at once, engineers can now get a better understanding of the complete high-pressure die-casting process using STAR-Cast v11.02 and discover better designs, faster.

In addition to the high-pressure die-casting module, STAR-Cast v11.02 incorporates enhancements that streamline simulation workflow and increase productivity for casting simulations in general, including overall improvement of the user experience, streamlining the set-up of casting processes. Star-Cast v11.02 now also offers easier material handling and manipulation, including a material database builder for the integration of proprietary materials.

CD-adapco Australia

www.cd-adapco.com.au



LINEAR DRIVE WITH MOTOR

The igus drylin E is a maintenance-free linear system with a stepper motor, attached to a lubrication-free lead screw drive or toothed belt. It comes ready to use with a motor, cables and limit switches.

The product can be used in extreme environments for format adjustments and for positioning small to medium loads. It is suitable for a range of applications, such as camera adjustments, the adjustment of inspection equipment, sensor adjustment, pick-and-place or handling systems.

The ready-to-install linear actuators and drive units can be equipped with a lead screw drive, toothed belt, rack-and-pinion drives or trapezoidal/high helix threads. They are ready for assembly with a NEMA motor flange and coupling and are optionally available with adjustable linear bearings and a clearance-free, preloaded carriage.

The robust linear system offers a lightweight and compact design with high stability. It ensures quiet, clean operation and is insensitive to dirt. It is easy to calibrate and configure with online tools and offers a large range of accessories.

Treotham Automation Pty Ltd

www.treotham.com.au







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For information, contact AMS Instrumentation & Calibration Pty Ltd www.ams-ic.com.au

Unit 20, 51 Kalman Drive, Boronia VIC 3155, Australia Tel: 03 9017 8225, Fax: 03 9729 9604





HIGH-DENSITY DC MOTOR COMBINATION



maxon motor has introduced a combination of a 4-pole brushless DC motor with a sealed planetary gearhead and an inductive encoder for demanding subsea applications.

Constructed with a single tube stainless steel housing with laser welded flanges, this 4-pole brushless DC motor offers high levels of robustness and can deliver 90 W of power but has a diameter of only 22 mm.

High end rare earth magnets and maxon's winding technology

give the brushless motor the advantage of being powerful and also highly controllable. The winding gives zero magnetic cogging and the low rotor inertia allows for rapid acceleration. The motor also includes maxon's EASY 16 mm inductive encoder that is also sealed and therefore suitable for use in harsh electrical or environmental conditions.

Reducing the motor speed and increasing the torque is a 26 mm planetary gearhead with rubber seals fitted to the bearing for increased protection. The entire combination of parts forms a powerful, controllable brushless DC servo drive.

maxon motor Australia Pty Ltd

www.maxonmotor.com.au

HIGH-DENSITY I/O MODULES

Red Lion's E3 I/O module platform is a high-density I/O system with hardened metal enclosures and multiple communication options.

The Crimson-enabled E3 I/O modules feature robust networking capabilities with redundant ethernet ports and built-in serial communication. With one RS-485 terminal block and dual ethernet ports that include user-selectable ethernet modes for ring, pass-through and dual net-



works, the modules can eliminate the need for additional switching devices. In addition, the modules offer up to 34 mixed I/O points including input/output, analog/discrete and temperature I/O for complex industrial applications.

Available in DIN-rail and panel-mount form factors, the I/O modules support wide environmental tolerances. With a -40°C to 75°C operating temperature, high shock and vibration ratings and industry certifications that include UL Class I, Division 2 listing, ATEX and IECEx approvals, each I/O module is safe for use with industrial control equipment in hazardous locations.

Control Logic Pty Ltd www.control-logic.com.au



PROCESS CALIBRATOR

The Fluke 725 multifunction process calibrator is claimed to be an easy-to-use field calibrator. The device is used to measure and source functions to test and calibrate almost any process parameter. It is available to rent from TechRentals.

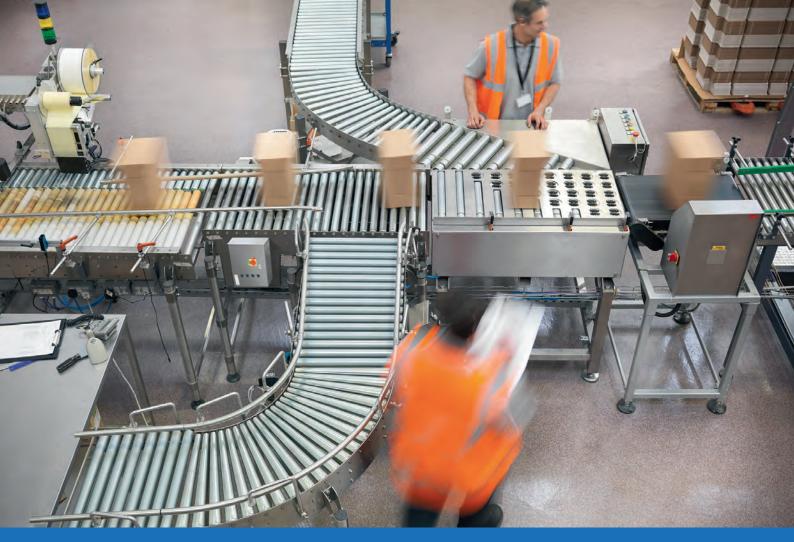
The calibrator's split display allows users to view input and output values simultaneously. For valve and I/P tests, users can source mA while measuring pressure.

The calibrator has auto-stepping and auto-ramping for remote testing, plus 25% stepping for fast linearity tests. Using the optional pressure modules, users can measure and source mA, volts, temperature (RTDs and thermocouples), frequency, ohms and pressure.

It can source or simulate 10 VDC, 24 mA, 3200Ω, 12 types of thermocouple and seven types of RTD, as well as power transmitters with an internal loop supply.

TechRentals

www.techrentals.com.au



Simply reliable. Simply available.



Discover OsiSense™ XCKW, a powerful new wireless and battery-less limit switch.

OsiSense™ XCKW brings easy connectivity to machine configurations where cabling is difficult, expensive, or unwanted. The range of wireless, battery-less limit switches is designed to serve a vast number of industries, from hoisting, elevators and escalators to mills, foundries, process machinery, and handling & packaging.

OsiSense XCKW switches come in a plug-and-play kit, so only electromechanical skills are needed to install it. It's equally easy to replace an earlier-generation limit switch because the OsiSense XCKW is 100% compatible with XCKS & XCKM switches.

Discover our special offer today!

tesensors.com.au

Simply easy!™





Tony Foster, Regional Sales Manager, Intelligent Energy Management Systems, Power Parameters Pty Ltd

Modern high-efficiency motors have the drawback of higher inrush and starting currents, which means protection equipment must be specified differently.

ther than for legacy installations, or special cases, it is generally mandatory to install high-efficiency induction motors in new installations. The current high-efficiency IE3 standard is being adopted globally but is not yet an enforceable standard in Australia. However, it will not indefinitely 'stay away' and the current-MEPS imposed top limit of 185 kW in Australia can also be expected to broaden. As for the idea that variable speed drives improve efficiency regardless of the efficiency of the motor, an argument can be made that there may well be an excessive use of this form of control, and that for many applications there is both an engineering case — as well as overall efficiency case — to be made for DOL or star-delta control. As will be explained in more detail, the challenge of providing effective control without spurious interruption because of initial high current (inrush and locked rotor current) must be met with appropriate control gear.

High-efficiency motors

There are many techniques employed in the physical construction of high-efficiency motors, but the overall aim is to reduce stator iron and copper losses, windage losses and rotor copper losses. In our $\rm CO_2$ -conscious world, the aim is worthy, although in terms of many practical applications it can be argued that notwithstanding improved efficiency of a motor, the effect of the attached drive

chain may well bring to nought the efficiency dividend of the prime mover. One often sees this reasoning used as a counter argument.

On a practical note, manufacturers supplying international markets are increasingly locked into IE3 standards, and these motors are making their way into the Australian market and the even higher efficiency IE4 motors are, so to speak, just around the corner. As is the case in so many other fields of engineering, there are no silver bullet solutions — and high-efficiency motors are no exception. Thus engineering considerations have to take into account lowered starting torques and high inrush currents that can pose problems for adequate motor protection. The performance characteristics in terms of starting current (locked rotor) and inrush current relative to IE1 motors are shown in Figure 1.

Back to school

A basic understanding of induction motor physics is helpful in understanding how the requirement of higher efficiency has its effect on motor operational parameters. In Figure 2, the basic equivalent circuit of an induction motor is presented. The circuit is shown on a per-phase basis. In essence an induction motor can be considered a rotary transformer, and under locked rotor conditions it is in fact a transformer with a shorted secondary (the squir-rel cage). In the case of a wound-rotor induction motor, external



resistance connected via slip rings approximates a transformer with an electrical rather than a mechanical load.

Let's consider a motor under full load condition. Input power is given by:

$$P_1 = V_1 I_1 \cos \varphi$$

where:

 P_1 is the watts per phase

 V_{1} is the phase voltage

 I_1 is the phase current ϕ is the phase angle.

The output mechanical power is given by:

$$P_m = T\omega$$

where:

T is the torque (Nm)

 ω is the angular speed (rad/s).

The efficiency, η is therefore given by:

$$\eta = \frac{T\omega}{mV_1I_1cos\varphi}$$

where m is the number of phases.

If we assume that V_1 and $\cos \phi$ (power factor) are constants, then for a higher efficiency motor, I_1 is reduced when compared with a lower efficiency motor. The $\cos \phi$ constancy assumption is a little brave, as it is essentially determined by the ratio of load current to magnetising current. However, bear in mind that in higherficiency motors, iron losses are also reduced, and therefore this can easily account for any differential in $\cos \phi$.

So far things look good for higher efficiency motors. However, the question of locked rotor torque arises. This is a very important parameter — particularly for high inertia loads — as it determines initial angular acceleration. At the locked rotor condition, slip is 100%, and therefore doesn't figure in the torque equation. In Figure 2 the parameters to pay particular attention to are the leakage inductance and resistance per phase of the rotor.

The slip ratio is σ (equal to $(\omega_{_{s}}\text{-}\omega_{_{l}})/\omega_{_{s}})$

where:

 $\omega_{\rm s}$ is the synchronous speed (rad/s) and determined by $2 {\rm nf}/{\rm p},$

where p is the number of pole pairs, and f the supply frequency $\omega_{\rm l}$ is the load speed (rad/s).

The general torque equation is given by:

$$T = \frac{\alpha \sigma V_1^2 R_2}{R_2^2 + \sigma^2 X_{2L}^2}$$

where

 $\boldsymbol{\alpha}$ is a constant for a given motor, taking the number of phases into account

 V_{i} is the phase voltage

 $R_{\scriptscriptstyle 2}$ is the resistance per phase

 $X_{\rm 2L}$ is the rotor leakage reactance per phase under locked rotor conditions.

We can now examine the locked rotor torque, while assuming phase voltage to be constant. This yields a proportionality:

$$T \propto \frac{1}{R_2 + \frac{X_{2L}^2}{R_2}}$$

Note that the slip σ is 1 under the locked rotor condition. In order to maximise torque:

$$R_2 = \frac{X_{2L}^2}{R_2}$$

or:

$$R_2 = X_{2L}$$

The above relationship is very important because by reducing the rotor resistance in order to limit I^2R losses, we negatively affect the starting torque.

The rotor current, I_2 is given by the following relationship:

$$I_2 = \frac{\alpha \sigma V_1}{\sqrt{R_2^2 + \sigma^2 X_{2L}^2}}$$

The locked rotor current therefore is:

$$I_2 = \frac{\alpha V_1}{\sqrt{R_2^2 + X_{2L}^2}}$$

Reducing rotor resistance therefore *increases* locked rotor current, although in practice not greatly depending on the particular motor design.

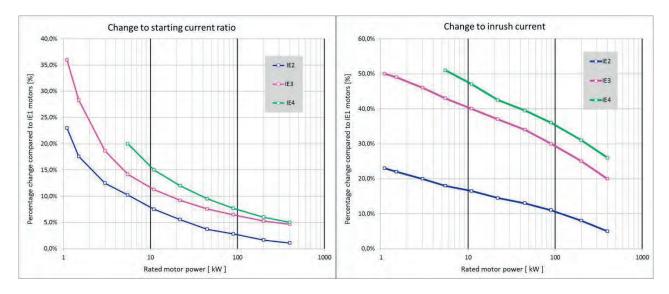


Figure 1: Starting current and locked rotor current relative to an IE1 motor.

Inrush current

The notion that the locked rotor current represents inrush current must be dispelled. It is in fact a quasi-steady state of operation. Inrush current, on the other hand is only partially determined by motor parameters — chiefly the effective leakage inductance and resistance. It should also be noted that under locked rotor conditions the mechanical load, represented by an equivalent resistor (R_l) , becomes zero in value. Note: its value at a slip ratio of σ is given by the formula:

$$R_L = \frac{1 - \sigma}{\sigma} R_2$$

Up till now we have concerned ourselves with the rotor, and locked rotor current. The rotor current is of course reflected into the stator circuit by virtue of the mutual inductance between them.

Thus with locked rotor conditions applying we have an equivalent impedance of:

$$Z_M = \sqrt{(X_{1L} + X_{2L})^2 + (R_1 + R_2)^2}$$

The effective motor impedance at the start, $Z_{M'}$ should be considered as the per phase value. Unsurprisingly the inrush current depends on the phase angle of the supply voltage when connection is being made — and there are three phases. To keep things mathematically consistent, we will write for V_{f} .

$$v_1 = V_{1p}\cos(\omega t - \delta)$$

where

 v_i is the instantaneous voltage, at ωt

 $\boldsymbol{\delta}$ is the phase angle of the voltage when connected.

The angle δ is also related to time, ie, ωt_o where t_o is an initial time. However, δ is an initial condition, whereas ωt is the variable.

The general expression for the current after connection of voltage to an inductive circuit is of the form:

$$v = Ri + L\frac{di}{dt}$$

where:

v is instantaneous voltage,

R is lumped resistance and

L, lumped inductance.

This all looks unfamiliar to the motor equivalent circuit and its equations. Solving this equation, yields the expression below.

$$i = \frac{V_{1p}}{Z_M} \cos(\omega t - \delta - \theta_1) - \frac{V_{1p}}{Z_M} e^{\frac{-R\omega t}{X}} \cos(\delta + \theta_1)$$

where.

 V_{1n} is the peak voltage

 Z_{M} is the motor impedance under locked rotor conditions (startup) δ is the phase lag of the voltage at the moment of connection θ , is the arctangent of R/X.

The second term in the above equation is an exponentially decaying baseline on which the oscillating (at power frequency) current rests. The bigger in value R is, and the smaller in value X is, the sooner the decay takes place. This is shown graphically in Figure 3.

Back to the practical world

The above theory might explain why motors with a low resistance are subject to higher inrush currents than those with higher effective resistance, but the challenge really is to have effective control and protection gear. The ratio of resistance to reactance (R/X) is of importance but in practice what we are dealing with is the short-circuit impedance of the supply circuit as well, since this adds to the motor impedance, Z_{M} . For mission-critical applications, using a high sampling rate waveform recorder to measure inrush current is strongly suggested. The advantage is that it is a site test and therefore takes into account supply circuit impedance. Not only can the maximum amplitude of starting current be gauged, but also the duration. This is equally important as we now know that a combination of low supply and motor impedance, and a low R/X ratio, will result in a high inrush current. In addition the exponential decay component will take longer to return to zero (the steady state).

Motor control gear for high-efficiency motors needs to meet appropriate electromechanical parameters. Electrodynamic attraction on contact sets can cause welding, particularly on a frequent start regime subject to starting currents in excess of 20 times full load current. The overload protection curve for the motor and motor circuit should be carefully selected so that the extreme inverse

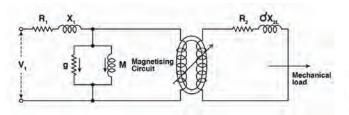


Figure 2: Induction motor per-phase equivalent circuit.

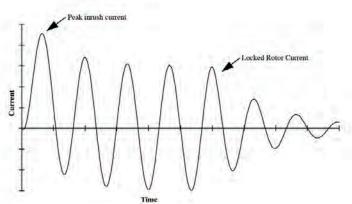


Figure 3: Instantaneous per-phase startup current waveform for an induction motor.



... ENGINEERING CONSIDERATIONS HAVE TO TAKE INTO ACCOUNT LOWERED STARTING TORQUES AND HIGH INRUSH CURRENTS THAT CAN POSE PROBLEMS FOR ADEQUATE MOTOR PROTECTION.

characteristic of the protection caters for the very high inrush current possible, present for up to two cycles. The current-time envelope usually controlled by a magnetic trip should be such as to accommodate the run-up time for the mechanical load.

In view of reduced staring torques, the run-up time is important, because if too long, the thermal inverse protection region may be reached causing early tripping. A first estimation can be made on the basis of full load power and starting torque. Full load power equals:

$$P_m = T_{fl}\omega_{fl}$$

where:

 $T_{_{/\!\!f}}$ is full load torque in Nm required by the load $\omega_{_{/\!\!f}}$ is full load speed in rad/s.

Initial acceleration is determined by:

$$\frac{d\omega}{dt} = \frac{T_s}{I}$$

where:

 $d\omega/dt$ is angular acceleration in rads-2

 T_{ϵ} is starting torque in Nm

J is the moment of inertia of the load in kgm 2 .

A first approximation of the run-up time is to divide the full load speed by the acceleration. More accurate estimates can be made by consulting the torque-speed curve of the motor, and dividing this up into smaller linear portions, calculating time increments for each in order to arrive at a total run-up time.

The very important points being made here can be summarised as follows:

Irrespective of a contractor's or designer's point of view for the necessity or otherwise for high-efficiency motors — or for that matter whether IE3 is to be preferred over the current MEPS classifications — the reality is that many motors now commercially available are subject to IE2 and IE3 classifications (with IE4 around the corner). Consequently high-efficiency motor control is no longer a seldom-occurring situation.

The higher rating DOL-start motors will often be subject to the analytical approach described above. For lower rated motors the task of picking the correct protection current can be simplified given a suitable suite of protective devices to choose from — in short, by allowing the setting of the rated motor current to be placed toward the lower limit of the current rating range. This is best achieved by the availability of overlapping motor-current rating ranges. The designer is therefore able to choose a lower to upper current range whereby the short circuit multiplier used on the upper level current value (yielding the maximum permitted protection current before tripping) falls above the estimated inrush current. A side benefit of the choice of a range where the rated motor current is closer to the lower level current is reduced power loss in the motor starter.

Example

Take the following example of two motor starter protectors for a motor rated at 15 A.

- Motor starter protector A: Setting scale 10–16 A, multiplier of 13.
- Motor starter protector B: Setting scale 14–20 A, multiplier of 13.
 Motor starter protector B (14–20 A) is recommended since it has a 5 A clearance to the top protection setting as opposed to protector A with a 1 A clearance. The power loss of motor starter protector B is approximately 35% lower than that of motor starter protector A.

In the case of motor starter protector A, the response value of the short-circuit release is 208 A (13 x 16 A). With a rated motor current of 15 A, the short-circuit release is 13.86 times the setting current (208/15 = 13.86).

In the case of motor starter protector B, the response value of the short-circuit release is 260 A (13 x 20 A). With a rated motor current of 15 A, the short-circuit release is 17.33 times the setting current (260/15 = 17.33). Because the inrush current to rated current ratio is significantly increased for the B case, it is the better choice for an IE3 motor.

The objective of highlighting the technical aspects of IE3 motors is to alert designers of motor control centres to the necessity of considering anew the field of motor protection and starting. The 'suck it and see' method is likely to bring grief. Proper analysis of motor control parameters is the only way of specifying the technical requirements for the motor control and protection equipment.

Power Parameters Pty Ltd

www.parameters.com.au



EXPLOSION-PROOF CABINETS

Outdoor enclosure specialist Intertec has launched a range of explosion-proof cabinets to protect field instrumentation operating in hazardous areas. Available in a diverse range of standard sizes, as well as in custom shapes up to walk-in shelter size, the cabinets are certified for use in Zone 1 and Zone 2 hazardous areas. They are suitable for housing forwardplaced analyser equipment in industrial process facilities, such as petrochemical/oil refineries and fertiliser production/storage plants, and also provide the possibility to install non-Ex rated analysers and instrumentation inside Zone 1 or 2 classified environments.

Intertec's pressurised explosion proof (Ex p) cabinets are constructed from GRP (glass-reinforced polyester) composite materials. The materials are highly resistant to corrosion and have a similar strength to stainless steel but are about 75% lighter. They are especially suitable when robustness and rigidity need to be combined with low mass — such as on offshore platforms.

GRP composite materials also have a much higher thermal resistance than metal. This simplifies the construction of cabinets that provide good insulation, reducing the energy required to heat or cool the equipment. It also makes it easier to build cabinets without any thermally conductive links between their exterior and interior surfaces, thereby avoiding creating cold spots which can lead to problems with condensation.

GRP composite panels can be chemically bonded to create tight sealing that prevents the ingress of hazardous gas and reduces the consumption of air, which is used to create the slight positive overpressure needed for Ex p protection.

Intertec

www.intertec.info







RTUs WITH DATA LOGGING

Red Lion's Sixnet RAM series of cellular 3G/4G LTE RTUs now offer a data logging ability that includes support for SD card storage. The update adds a capability that is backward compatible but also benefits from easy-to-use data logging via its web interface and CSV file format storing support.

The units offer many connectivity options, including 802.11bgn, onboard WiFi, up to five ethernet ports, RS-232/485 serial ports and onboard GPS positioning for mobile deployment. Together with onboard I/O and support for industrial Modbus/DNP3 protocols, the RTU interfaces with remote I/O, controllers, PLCs and SCADA systems. Users can control connected I/O and operational data in real time utilising the web-based event engine while monitoring mission-critical alerts sent via SMS or email.

The units are suitable for the oil and gas, water/wastewater, utility, transportation and mining industries.

Control Logic Pty Ltd

www.control-logic.com.au

HANDHELD SPECTROMETER

B&WTek's NanoRam is a compact, lightweight, handheld Raman spectrometer and integrated computing system designed for rapid raw material verification.

The handheld Raman spectrometer is used for non-destructive identification and verification of materials such as APIs, excipients, intermediates and finished products. Compact and weighing less than 1 kg, it can be used by non-technical users to rapidly identify samples in the warehouse, loading dock or field, helping to eliminate quarantine areas and expedite materials through the manufacturing lifecycle.

Utilising Raman technology, non-contact analysis can be performed through transparent containers, all while maintaining the volume and integrity of the sample.

At the heart of the product is a 785 nm-wavelength laser excitation source coupled with a thermoelectrically cooled CCD detector and a crossed Czerny-Turner spectrograph, delivering a stable signal with low background noise.

The handheld Raman spectrometer comes with the point-and-shoot, vial holder and bottle adaptor accessories.

The device features a high-brightness touchscreen display and an embedded one- and 2-dimensional

barcode scanner. It has an IP64 dust-tight and splash-proof housing and supports a batch scanning option, along with Wi-Fi and ethernet communication for data synchronisation and management.

SciTech Pty Ltd

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Test Benches



Leakage



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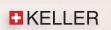
Aviation



Compressors



Explosion Waves







VORTEX FLOWMETERS WITH HART 7

Emerson Process Management's line of Rosemount 8800 vortex flowmeters now offers HART Protocol Revision 7, which allows for easier identification in the field, commissioning and configuration.

Properly identifying devices both in the field and in the control room takes the guesswork out of whether or not the correct device is being



Once connected to the device, or while viewing from the control room, Long Tag allows for a detailed device name to be viewed or loaded into the flowmeter. Long Tag support increases the character limit from the current 8-character tag to 32 characters, allowing the user to create the descriptions necessary to track down each device.

HART 7 also offers greater flexibility for device configuration. For the most up-to-date process information, HART 7 delivers expanded burst mode capabilities to allow the vortex meter to burst up to eight variables and to trigger messages based on process events.

In addition to the latest HART 7 features, the 8800 vortex flowmeter now provides Sensor Signal Strength as a display and output variable. This allows for continuous health monitoring of the flow sensor both at the device and remotely as a HART variable.

Emerson Process Management Aust P/L

www.emersonprocess.com.au

MOTOR STARTERS

Schneider Electric has introduced TeSys H, a 22.5 mm-wide multifunctional, ultracompact starter for electrical motors. The product is designed to save space in control cabinets and can be used in a variety of industries, including food and beverages, logistics and durable goods. It is also a suitable starter solution for machines in material handling and packaging systems.

The unit can provide up to four functions: forward running; reverse running; protection against overload, phase imbalance, phase loss, stall and jam; and safe shutdown up to SIL3 according to IEC61508-1 (available in the Safe Torque Off variant). It provides up to a 75% space reduction — making it suitable for all control cabinets where saving space is a priority — and a 60% reduction in installation time.

The motor starters are available in two models dedicated to different applications. Bearing a green label, the standard TeSys H is meant for standard applications and provides the three functions of forward running, reverse running and protection. It is equipped with a fault auxiliary contact, three reset options (manual, remote and automatic), a wide setting

range (0.18 to 2.4 A and 1.5 to 6.5 A) and control voltage (24 VDC or 110-230 VAC), and four LEDs for easy diagnostics.

The red-labelled TeSys H, the Safe Torque Off model for safety chain applications, includes an additional safe shutdown function. This model meets the requirements of functional safety and is rated SIL3 according to IEC 61508-1.

Schneider Electric Industry Business www.schneider-electric.com



ACCELEROMETERS

The Endevco Model 46AXX POD accelerometer is a general-purpose accelerometer designed for versatility in mounting configuration. The POD accelerometer sensor assemblies are available in five sensitivities and are threaded for easy installation in any of the POD mounts. The POD mounts are available in five configurations - hex mount, cube mount, tri-axial mount, tri-hex mount and cube adhesive mount. The POD accelerometer sensor assemblies may be mixed and matched in any of the POD mounts. For extra safety, the POD sensor assembly and mounting bases have lock wire holes to prevent the POD accelerometer from loosening during vibration.



The hex and cube mounts are for traditional single-axis measurements. The tri-axial mount allows the user to select the same or different sensitivities on each orthogonal axis. For users that do not know the correct accelerometer sensitivity for the test, the tri-hex mount is suitable. The tri-hex mount allows the user to thread three different POD accelerometer sensor assemblies in a single mount.

Sensitivities can be mixed and matched in any configuration (10, 25, 100, 500, 1000 mV/g), and all units are IEEE P1451.4 TEDS capable.

Bestech Australia Pty Ltd www.bestech.com.au







HV PROGRAMMABLE POWER SUPPLIES

TDK Corporation has announced the addition of eight high-voltage models to the TDK-Lambda Genesys 3U Series of AC/DC programmable power supplies. These include 800, 1000, 1250 and 1500 V models with output power levels of 10 and 15 kW. These high-voltage models address the requirements for applications in the industrial, automotive, alternative energy, oil and gas, lighting and semiconductor markets.

These units can operate in either constant-voltage (CV) or constantcurrent (CC) mode and can accept a three-phase AC input of either 400 or 480 VAC (with standard passive power factor correction).

Safety features included are safe/auto restart, last-setting memory and built-in protective functions. With safe start configured, the power supply returns to its last operation settings after a power interruption but with the output disabled, while with auto restart, the power supply returns to the last used operation settings after a power interruption. Built-in protective functions include overvoltage protection (OVP), undervoltage limit (UVL), foldback protection (FOLD) and overtemperature protection (OTP).

Higher power systems can be configured using the master/ slave 'Advanced' parallel operating mode (utilising two-wire current share). This mode configures the Master unit to be the single point for programming, measurement and status of the total current of the paralleled system. Four units can operate as a single 40 or 60 kW power supply.



Using the embedded 16-bit RS232/RS485 multidrop digital communication interface, up to 31 power supplies may be controlled in an addressed RS485 daisy-chain configuration.

Glyn Ltd www.glyn.com.au





Drive automation for bogie changes

When railway maintenance teams need to work on the wheels or other bogie components of a railway vehicle, the bogie needs to be separated from the vehicle. Traditional methods of exchanging bogies require special safety precautions. This is not the case with a new bogie exchange system (BES) manufactured by Andrew Engineering.

According to Neil Boehringer, project manager at Andrew Engineering, the new design halves the changeover time.

He says that when traditional methods are used, it takes a team of maintenance workers an hour and a half for each changeover. Using the new equipment, a single operator can remove and replace a set of bogies and have the train ready to leave the shed within 45 minutes. This makes it easy to carry out maintenance on the wheels or other components away from the train.

The latest exchange system enables faster, safer and more economical turnaround in railway maintenance sheds throughout Australia.



Traditional methods rely on jacking the entire rail wagon up or working from below in specially constructed pits, but due to the precise movements controlled by an SEW-Eurodrive MOVIDRIVE B drive inverter, the car need only be lifted by 50 mm. The bogie is then easily removed from the carriage and brought out sideways. This combination of movements requires a complex set of drives, motors and gears, working in all three axial directions (x, y and z), with some of the lifting and positioning movements requiring great precision.

When equipped with an absolute encoder feedback mechanism, the inverter can be configured for fine or course movements in any direction, says Mauro Castiello, sales/application engineer at SEW-Eurodrive.

"The absolute encoder gives us the ability to lift and position with a tolerance of 0.1 mm, in real time," he said. "In other cases, when we don't need that level of precision, it's more like manually operating a crane. You press the button and the motor runs, and then you release the button to stop it."

During the system design phase, Boehringer and his team at Andrew Engineering enlisted their supplier to assist. "If it's a complex design that you can't do yourself, they support you," he said.

SEW-Eurodrive employed its Workbench software in producing the designs. Castiello says that by feeding in parameters like the speeds of the movements, the weights to be lifted and the type of friction to be encountered, the designers could easily select the appropriate motors and drives. To cater for the range of movements, the system design included a combination of helical bevel and helical worm gearboxes.

"After the equipment selection was made, we reviewed the calculations together with the Andrew Engineering designers. Once approved, a three-dimensional CAD model of the system was provided and then used directly into their own design software," said Castiello. "Their skilled designers could use this input to engineer a complete BES, with no additional information from us."

Because the movements are sequenced when the bogies are changed over, the designers requested a single inverter to control the individual movement of four different motors. This resulted in considerable savings for the overall project.

Lincoln Oxer, senior electrical designer at Andrew Engineering, says another major advantage of the design was the ability to control the motors and drives via a fieldbus, with acceleration times, deceleration times and other parameters easily managed. Similarly, any adjustments that become necessary as conditions change during the life cycle of the machine can be carried out remotely or by the operator at the HMI.

The complete system controls 15 different motors through seven drives. Some of the motors have brakes, while some have absolute encoders for extra precision. Consequently, there are a wide variety of power and current requirements during the bogie changeover and it is essential that all the parameters can be switched simply.

While the cost, speed and labour-saving advantages of the BES are clearly important, improved safety is the number one benefit.

When a traditional pit is installed in a maintenance shed - an expensive civil construction exercise — special work practices must be put in place to maintain the trains. Working in a pit beneath the train means working in a confined space. Occupational health and safety regulations for confined spaces include requirements for a quick and easy exit in case of emergency. At the same time, though, the maintenance crews are working at height to change the bogies, and there is a requirement for scaffolding to ensure their safety. "These two requirements are fighting against each other, and maintenance might be delayed because the issue is too hard to resolve," said Oxer.

The Andrew Engineering BES overcomes this safety dilemma. In railway maintenance sheds around Australia, it is now possible for a single operator to carry out the bogie exchange in a safer, faster and more cost-effective manner.

A longer and more detailed version of this article can be read online at: http://bit.ly/1NBmhju

SEW-Eurodrive Pty Ltd www.sew-eurodrive.com.au



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SPECTROSCOPIC ANALYSERS

The CA-6 UV range of spectroscopic analysers from Electro-Chemical Devices (ECD) can monitor any two selected parameters in separate measurement ranges for ammonia, nitrate or chemical oxygen demand (COD 254 nm).

CA-6 UV analysers provide an accurate, reliable and economical online sampling system to monitor harmful pollutant parameter levels. The analyser's sensors are available in multiple parameter measurement ranges: ammonia from 0-10 mg/L or 0-1000 mg/L; nitrate from 0-30 mg/L, 0-100 mg/L, or 0-250 mg/L and COD 254 nm from 0-200 mg/L or 0-20,000 mg/L.

Each model is ordered precalibrated with either a single parameter or dual parameters. A technician can complete the installation in 15 minutes.

Each parameter is analysed based on the measurement of UV absorption in the sample according to Beer-Lambert's Law. The absorbance of the solution or gas is measured through a quartz flow cell at a specific wavelength using a long-life Xenon lamp and photo detectors.

Accuracy is 5% for the measurement of ammonia, nitrate and COD, based on a sample temperature range of 0 to 80°C, but the sample must be liquid and not frozen. Repeatability varies based on the parameter chosen and the single or dual parameter configuration, ranging from 0.15 to 3%.

The CA-6 analyser is designed with four alarm relays. A single 4–20 mA analog output is included with 12-bit resolution. RS232 communications are provided for data download to a CSV file, with an optional RS485 Modbus communication module available.

AMS Instrumentation & Calibration Pty Ltd

www.ams-ic.com.au

UNINTERRUPTIBLE POWER SUPPLY

The FEAS Accupack LDR40MH24-RS uninterruptible power supply (UPS) has an onboard 24 VDC switchmode power supply, integral batteries and serial communications.



The UPS connects between the line voltage (85-270 VAC or 120-400 VDC) and the field equipment and is capable of supplying full load currents of up to 5 A at 24 VDC. To allow for intermittent high current demands upon the system, the full load current can be exceeded by up to 50% for limited periods of time. Additionally, the output is short-circuit and polarity protected to prevent damage caused by incorrect installation.

During mains operation, the AC/DC converter supplies the load with power while also providing the sealed batteries with an optimal charging voltage. In the event of a mains power failure, the easily replaceable sealed batteries supply the load until the mains power is restored.

Using the LDR's RS-232 or RS-485 interface, status messages relating to input voltage, temperature and battery capacity can be communicated to the upstream control system.

Automated Control Pty Ltd

www.automatedcontrol.com.au



THERMAL IMAGING **CLAMP METER**

FLIR has released what is claimed to be the world's first thermal imaging clamp meter, the CM174 Imaging Clamp Meter with IGM (Infrared Guided Measurement).

The CM174 600A AC/DC clamp meter has a built-in thermal camera that powers FLIR's IGM technology, which visually guides users to temperature differences and pinpoints anomalies. Electricians may even find new issues they didn't expect to see, expanding their scope of work. For instance, they might have a hunch that a faulty motor controller caused an equipment failure, but after using CM174 they discover that an overheating motor or a loose connection was to blame.

If an electrician is facing cluttered wires or scanning complex panels for hazards, they can stay at a safe distance and use IGM to show them the anomalies without reaching into the panel. The narrow-jaw design and builtin work lights make it easier to clamp the meter around wires in tight spaces and in poor lighting conditions. The CM174 validates findings with advanced measurement features to help solve the most complex electrical issues and is useful for checking repairs and ensuring problem areas have returned to normal.

FLIR Systems Australia Pty Ltd www.flir.com.au



3D VISION SENSORS

3vistor-T 3D vision sensors from Sick are designed to offer maximum flexibility for indoor use due to their 3D snapshot technology. The 3vistor-T provides real-time depth information for each pixel based on timeof-flight measurement. This involves transferring all 3D raw data — or application-specific information which has already been preprocessed — in a way that has been customised to suit the respective application. High-performance visualisation tools and 3D information make the 3vistor-T a suitable solution for applications including intralogistics, robotics or industrial vehicles.

The sensors are available in two different product variants. The 3vistor-T CX version is a basic 3D camera that provides high-quality 3D point clouds. The 3vistor-T AG version is a smart 3D camera. It provides both

complete and reduced 3D data, depending on what is needed.

More than 25,000 distance and intensity values are provided in a single recording. As a result, no operator is required and 3D information is also available for stationary applications. What's more, the sensor features a programmable interface that can be used to transmit data to external PCs.

With its 3D time-of-flight technology, the 3vistor-T provides spatial and depth information in real time for each image. Depending on the variant, this process outputs a pure point cloud, appropriately reduced image data, or image data.

The 3vistor-T can therefore be used as a preconfigured variant for automated guided vehicles or as a 3D camera for individualised programming. The 3vistor-T can be installed quickly, is immediately ready for use and features intuitive control

SICK Pty Ltd

www.sick.com.au



DESIGNLINE SERIES

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The attractive industrial PCs in the Designline series are narrow, feature IP65 protection, multi-touch capability, and are always close to the action as they can be installed very easily directly on the machine.

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NEW ENERGY-EFFICIENT MOTOR TECHNOLOGIES

Increased energy efficiency requirements for drive systems have led to alternative motor technologies taking up the competition with traditional induction motors and AC drive applications.



n the quest to improve the energy efficiency of drive systems, much effort has been spent on improving the efficiency of the electric motor. Through the introduction of a classification system for motor energy efficiency in the IEC 60034-30 standard, users are given a clear and easy framework for comparing motor efficiencies.

With new higher efficiency classes being developed, users will have to get used to considering alternatives to the classic induction motor.

Classification of motor efficiencies

Drive systems consume a major share of the electricity produced and used globally.

In order to put more focus on the efficiency of electric motors and drive systems, the working groups of the IEC have created a framework for the measurement and classification of motor efficiencies with the standards IEC 60034-2-1 'Standard methods for determining losses and efficiency from tests' and IEC 60034-30-1 'Efficiency classes of line operated AC motors'. The standard IEC 60034-30-1 (2008) defines the motor-efficiency classes IE1, IE2 and IE3, as well as efficiency limits for each class and motor size.

Additionally, in the latest version of IEC60034-30-1 Ed 1.0, a new class IE4 (super premium efficiency) is introduced.

When classifying the efficiency of motors, it is important to take the size of the motor into account. An efficiency of, say, 90% is poor for a large motor but good for a small one — whereas a motor of class IE4 is always just about as good as it gets. Today there are only standards in place for line-fed motors, whereas requirements for defining the extra motor losses, and thus the change of efficiency, for motors connected to variable speed drives (VSDs) are not yet in place.

Upcoming versions of the IEC 60034 family of standards are set to cover this aspect as well, but currently the efficiencies given by motor manufacturers are not suitable for direct comparison of motor efficiencies in VSD applications.

The European Committee for Electrotechnical Standardization (CENELEC) has also created a framework for the comparison of the efficiency of drive systems in the standard EN 50598 - 2 'Ecodesign for power drive systems, motor starters, power electronics and their driven applications'. This standard also gives methods for defining the efficiency of a drive-plus-motor system (a power drive system or PDS) in a given application. By the end of 2016, the international version will be released as IEC 61800-9.



Motor technology change ahead

There will probably be a need to define higher efficiency classes than the current IE1 to IE4. Higher efficiency classes, such as IE5, could be expected to require at least 15% lower losses over the previous classes. According to data presented by the IEC, the induction motor is competitive up to energy-efficiency class IE3, but it will be difficult to adapt to IE4 and IE5 requirements in a cost-efficient way, as increasing efficiency in essence is achieved by reducing the I2R losses of the rotor by using copper bars and by increasing surface areas. Reducing the I2R losses of the stator is also possible at the cost of a much larger construction.

If the induction motor is hard to adapt to higher efficiency requirements, then what are the alternatives?

The synchronous reluctance motor

The synchronous reluctance motor (SynRM) has been known for almost a century. For reasons related to its lack of direct-on-line starting capability (although hybrid designs with line-start capabilities are available), weak torque behaviour and lack of good solutions for variable frequency control, this motor technology initially did not achieve a wide industrial use. Today it has become interesting

again, due to improvements in rotor designs and modern costeffective and commonly used VSD technology.

Functional principle

A typical SynRM is designed for a three-phase sinusoidal supply voltage with a stator design, which is more or less the same as is used in, and mass-produced for, induction motors.

The main technical difference is in the rotor design, which, instead of a short-circuited squirrel cage, is designed to achieve paths with high and low magnetic reluctance. Reluctance for magnetic flux is analogous to resistance for an electric current.

The path with low magnetic reluctance is normally referred to as the d-axis (direct axis), whereas the corresponding path with high magnetic reluctance is referred to as the q-axis (quadrature axis).

When a magnetic field is applied through the rotor from the motor stator, a torque is created as the rotor tries to align itself in the best flux-conducting angle relative to the stator field. As the magnetic field in the stator is rotating with a rate in proportion to the applied stator frequency, the rotor will follow with a speed synchronised to the speed of the stator field.

The strength of the torque produced by the SynRM is directly proportional to the ratio of the inductance of the q- and d-axis. Most rotor designs available in the market today are rather simple laminated designs with air gaps in the q-axis direction to increase the reluctance.

In static operation, no current is induced in the rotor, which keeps the rotor losses low, improving the motor efficiency compared to the induction motor. However, in order to magnetise the rotor, a reactive current is needed — which in turn reduces the power factor of the motor compared to the induction motor.

Expect a higher nominal current

The lower power factor of the SynRM increases the nominal current. The decrease in power factor is to some extent compensated, however, by the increase in efficiency - but still the motors available in the market today commonly have a higher nominal current than the corresponding induction motor. The reason for the increased current is also partly due to the fact that the motors are designed for VSD operation and thus designed for a slightly lower nominal voltage than the line voltage.

For the motor user, the higher current of the motor has one major impact — the sizing of the VSD. As VSDs available on the market today have current ratings optimised for IMs, an oversizing of the VSD with one step seems to be typically required, which in turn leads to a slight cost increase for the VSD.

High efficiency

Data provided by motor manufacturers suggests that the efficiency of currently available SynRMs is high due to the low rotor losses. In addition, most motors are not run at full load constantly, and research suggests that the efficiency of SynRMs at partial loads can be even better than the efficiency of a corresponding permanent magnet synchronous motor (PMSM).

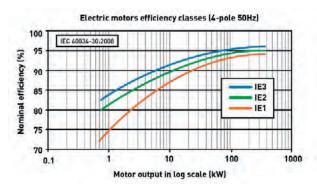


Figure 1: Efficiency classes according to IEC600034-30 for line fed motors.

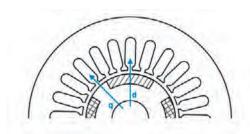


Figure 3: Permanent magnet motor cross-section.

In applications that are run constantly, such as pumps and fans, the energy-saving potential of high-efficiency motors is also typically the greatest. In many of these applications, VSDs are already used for reasons related to process control and the energy efficiency of the system. Due the quadratic torque behaviour of centrifugal pumps and fans, these are commonly used at partial load, which underlines the importance of good motor efficiency at partial loads.

VSD support

As already stated, a SynRM cannot normally be started and run directly from the line. Motors with integrated short circuit bars in the rotor, that allow the motor to be started as an induction motor directly from the line, are available on the market.

For most applications, a VSD will always be needed. Until recently, most general-purpose VSDs lacked the control functionality needed to run SynRMs. This is now changing, however, as some VSD suppliers have added support for SynRMs — users interested in applying SynRMs should be in contact with their VSD supplier for more information about the availability of VSD support.

The permanent magnet motor

The first permanent magnet motors were developed in the 19th century. Due to the lack of good magnetic materials and the need for variable frequency control (although hybrid designs with line start capabilities are available), the motor technology did not initially get any large-scale industrial use. With the availability

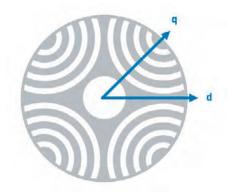


Figure 2: Example of SynRM rotor cross-section.

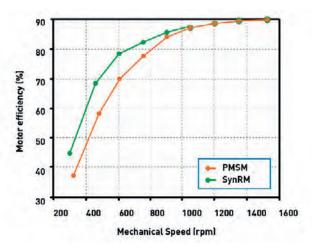


Figure 4: Efficiency comparison PMM vs SynRM as function of speed with quadratic load curve.

of rare-earth magnetic materials, the torque/power density of permanent magnet motors has improved significantly. Today, permanent magnet motors are used in a wide range of industrial applications — both as servo motors and also increasingly in normal VSD applications. A large portion of the motors used in the machine-building sector are special designs that allow the designer to adapt the motor to the requirements of the driven load, for example, to create gearless solutions.

Functional principle

There are several variants of permanent magnet motors, such as brushless DC motors and servo motors, as well as standard motors designed for VSD applications — and thus suitable for three-phase sinusoidal voltage supply. Such motors are often designed around a standard stator having the same characteristics as the stator of an induction motor.

As with SynRMs, the main difference between the induction motor and PMSM is in the design of the rotor. In PMSMs, the rotor contains strong permanent magnets that create a magnetic field that aligns with the magnetic field of the stator, thus creating torque on the motor shaft. As the magnets of the rotor will follow the magnetic field of the stator, the result is a synchronous motor.

High efficiency at all speeds

As the rotor is magnetised with permanent magnets, there is no actual current flow in the rotor and therefore no I2R losses or slip losses. The power factor remains high over the whole



IF THE INDUCTION MOTOR IS HARD TO ADAPT TO HIGHER EFFICIENCY REQUIREMENTS, THEN WHAT ARE THE ALTERNATIVES?

speed range and can, with the help of an adequate drive control, be kept close to unity — which in turn also minimises the I2R losses in the stator windings. A high portion of motors used today are used with partial load or at partial speed - an area where the PM motor efficiency is high compared to the induction motor.

Low-speed, high-pole IMs usually have a rather low power factor and low efficiency due to the less efficient magnetisation of the rotor at lower speeds. Permanent magnet motors do not have this problem and can be designed with a high number of poles without loss of efficiency. In applications where mechanical gears can be saved, both cost and efficiency gains are achieved.

Permanent magnets

The amount of torque that can be produced by a permanent magnet motor is directly proportional to the strength of the magnets. Rare-earth magnetic materials such as neodymium are therefore generally used. In recent years, the price of rareearth metals has greatly fluctuated, which can have an effect on the cost and availability of this technology.

VSD support is largely there

Modern VSDs normally offer at least basic support for permanent magnet motors. This makes it easier to move to this motor technology, as a wide selection of VSDs are available that support at least the less demanding applications such as pumps and fans. For demanding applications and for special high-pole and direct-drive types of applications, the number of VSDs with support for this kind of use is lower.

Comparing motor efficiencies

In order to compare motor efficiencies, there are several parameters that need to be considered. Most significant is that PMSM and SynRM motors require a variable speed drive, which produces a voltage pattern for the motor that is not fully sinusoidal and thus creates additional motor losses. Most IM motor efficiency data is given for fixed sinusoidal 50/60 Hz supplies — the additional losses caused by the voltage pattern are often not quantified. Today, there is not yet a fully standardised framework in place for definition of motor efficiencies at different speed/torque points, which makes the comparison technically quite demanding.

Application-specific efficiencies

When comparing motor or drive + motor efficiencies, it is also important to consider the behaviour of the load in the actual application for which the motor is to be used. For example, in centrifugal pumps and fans, the power need varies in proportion to the third power of the speed, which means that efficiency

at partial load is very strongly linked to the total efficiency of the installation.

PMSM vs SynRM

Laboratory measurements conducted at the University of Beira Interior in Portugal on commercially available 2.2 kW motors indicate that the motor efficiency in quadratic load (pump and fan) applications of both PMSM and SynRM motors reach efficiencies close to 90% in VSD operation — better than the 87% IE3 efficiency limit currently defined for line supply.

As can be seen from Figure 4, the reluctance motor appears to be extremely competitive in the low-speed area.

Is change coming?

SynRM and PMSM motors can already compete both in cost and efficiency with the traditional induction motor, but are apparently still sold in rather small quantities. What is still needed for these motors to get into mainstream use? The points below affect how fast these motors will gain ground and how fast and to what extent the transition away from the induction motor will happen:

- Availability: Many users are tied to a certain supplier, making a change of supplier largely if the existing supplier is not capable of supplying new motor technology.
- VSDs: Both SynRMs and PMSMs requiring a VSD in order to operate.
- Efficiency requirements: Energy-efficiency legislation puts emphasis on energy efficiency as a decision-making criterion. These initiatives can be directly motor-related, but there are also very often machine-specific or application-specific requirements.
- Compatibility: The new motor technologies are interesting motors, but backward compatibility - both mechanical and electrical — with existing installations has to be ensured, requiring a higher level of understanding of their behaviour.

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Danfoss Drives (Australia) Pty Ltd

drives danfoss com au

PRESSURE TRANSMITTER

The HDA 4300 pressure transmitter with a flush membrane has a ceramic measurement cell with a thick film strain gauge for relative pressure measurement in the low pressure range.

The pressure connection is achieved with a fully sealed stainless steel front membrane filled internally with a pressure transfer fluid. The process pressure is transmitted hydrostatically to the measurement cell via the pressure transfer fluid. Connections to other equipment are possible via 4-20 mA or 0-10 V.

This device has been designed specifically for applications in which a standard pressure connection could become blocked, clogged or frozen by the particular medium used. It is also used for processes where the medium changes regularly and any residues could cause mixing or contamination of the media.

The HDA 4300 offers an accuracy of ≤0.5% FS and low temperature error in a compact design.

HYDAC International

www.hydac.com.au





COMMAND ENCLOSURES

The design of the ROLEC multiPANEL command enclosure offers an attractive visual appearance for modern, high-value machinery in a wide variety of industries.

The profile enclosure, with dimensions of between 150 and 800 mm in length and width, can be produced to meet customer requirements. Decorative inlays in brushed stainless steel fully encircle the enclosure body of extruded aluminium profiles. The enclosure can be powder-coated in any RAL colour to adapt the visual appearance to customer-specific requirements. An optional ergonomic handle improves the handling of the command enclosure.

The enclosure also offers flexibility for the internal mounting of controls, with three available enclosure depths of 70, 85 and 130 mm that are achieved through the choice of the corresponding door. All common designs of system controls can be easily integrated into the multiPANEL — from glass fronts with touch applications and front plates with cutouts for switches to the direct internal mounting of panel PCs.

There are two basic variants. The multiPANEL display has been designed almost borderless and facilitates the full surface installation of front plates or glass fronts, eg, with touch functionality. The multiPANEL Kommando has a 22 mm-wide framework and has been designed to accommodate a panel PC or a front plate.

Both basic variants have ingress protection IP65/DIN 60529. They have variable depths when combined with 15 or 60 mm-deep doors. The slimmest multiPANEL version (70 mm) is available with a flush rear wall that can be chosen with a lock and hinge or bolted option.

ROLEC OKW Australia New Zealand P/L

www.rolec-okw.com.au



MOBILE DRUM TIPPER

The TIP-TITE mobile drum tipper allows dust-free transfer of bulk materials from drums into process equipment and storage vessels. Ready to plug in and run, it is mounted on a mobile frame with quick-action floor jacks for stable operation anywhere in the plant.

A hydraulic cylinder raises the drum carriage, which seals the drum rim against a discharge cone, after which a second hydraulic cylinder tips the carriage-hood assembly and drum, stopping at a predetermined dump angle of either 45°, 60° or 90° with a motiondampening feature. As the assembly approaches its fully tipped position, the outlet of the discharge cone mates with a gasketed receiving-ring inlet fitted to existing process equipment or to the lid of an optional hopper with integral pneumatic, tubular cable or flexible screw conveyor, creating a dust-tight seal.

Once the discharge cone is seated against the gasket, a pneumatically actuated slide gate valve opens, allowing material to enter the receiving vessel.

The unit accommodates drums from 114 to 208 L, weighing up to 340 kg and measuring 91 to 122 cm in height. An optional pneumatically actuated vibrator on the discharge cone promotes complete evacuation of non-free-flowing materials.

The drum tipper is available constructed of mild steel with durable industrial finishes, with material contact surfaces of stainless steel or in all-stainless steel finished to food, dairy, pharmaceutical or industrial standards.







MOTION CONTROL WITH SAFETY

The Allen-Bradley Compact GuardLogix 5370 controller allows users to combine safety and motion applications with up to 16 axes without the need for separate networks.

The Compact GuardLogix 5370 controller has the same performance capabilities as Rockwell's CompactLogix 5370 controller, while also providing integrated safety and motion on a single EtherNet/IP network.

The controller helps users meet global safety standards. It achieves Safety Integrity Level 3, Performance Level e and Category 4 — the highest ratings for machine safety. When used in combination with the Allen-Bradley Kinetix 5500 servo drive or the Allen-Bradley PowerFlex 527 AC drive, users have integrated safe torque off on EtherNet/IP.

Engineers use the Rockwell Software Studio 5000 software to configure the Compact GuardLogix 5370 controller and develop all elements of their control system. Data can be defined once and then easily accessed and re-used across different machine types to speed up system development and commissioning.

Rockwell Automation Australia

www.rockwellautomation.com.au



INFRARED CAMERA

An out-of-focus thermal image can be off by 20° or more with no way to correct it once it has been captured — short of retaking new images. The Fluke Ti450 infrared camera is designed to solve this problem by delivering in-focus images of everything in the field of view.

MultiSharp Focus is a technology that rapidly takes multiple images focused from near to far and combines them to produce one image with all objects in focus. The focusing system lets users capture an automated, in-focus image of all potential targets, delivering the image clarity needed by professional thermographers and maintenance managers to provide better images and avoid costly rework.

MultiSharp Focus is also available as a free upgrade to Fluke's TiX500, TiX520 and TiX560 infrared cameras when owners update the camera's firmware.

For instant focus on a single target, the camera features 320x240 resolution and LaserSharp Auto Focus that uses a built-in laser distance meter to calculate and display the distance to the designated target with high accuracy.

The SuperResolution mode increases image resolution to 640x480. This delivers images with four times more pixel data than normal resolution. The higher resolution lets users see more detail for greater analysis capability and better reporting.

The wireless Ti450 is part of Fluke Connect — a system of wireless test tools that communicate via the Fluke Connect app. The app is a cloud-based solution that gathers measurements to provide a comprehensive view of critical equipment status.

Fluke Australia Pty Ltd

www.fluke.com.au





PNG showcases world-class technology at Monier's Nebiri quarry

Monier Limited is Papua New Guinea's largest producer of construction materials and building products. When the company upgraded its Nebiri Quarry to increase annual output capacity from 300,000 to 1 million tonnes, PNG's government publicly commended Monier for its contribution to the country's ability to deliver significant infrastructure improvements.

Currently employing 350 people, Monier supplies ready-mix concrete, quarry products, prestressed and precast concrete products, masonry products and reinforced concrete pipes.

The Nebiri Quarry, which is located in PNG's National Capital District, supplies the key ingredients that are required for developing infrastructure, including aggregates, road base, armour rock, sand and select fill. In upgrading the quarry, the company aspired to build a highly advanced plant that would be seen by the country's construction industry as 'the plant of the future'.

In July 2013 Monier chose Metso as a strategic partner, awarding the company a €10.5 million contract for the upgrade. The contract included design, fabrication, installation and commissioning of the new plant.

Campbell Johnston, Metso's director - systems sales and support systems, explained Metso's approach to the project:

"The plant configuration requested by Monier was not typical. Before attempting any design work for our tender submission, we needed to clearly understand Monier's space constraints and their operational requirements. We decided that the best way to achieve that was for our engineers to visit site," he said.

"While sending our engineers over to PNG was a costly exercise, it proved to be a very good move. Based on our team's firsthand appreciation of site conditions and an exchange of ideas with Monier's management, they were able to propose an optimised solution."

Locating the new plant close to the existing plants was a logistical necessity. Land adjacent to the existing plants was allocated, but it didn't offer the ideal amount of space for a plant that matched Monier's production requirements. Metso's proposal was based on an innovative design, which ensured that the new plant would be compact enough to fit into the allocated area.

Delivering the project involved teamwork across three countries: Papua New Guinea, Australia and France. The design and supply of equipment was undertaken by Metso's team in France. Plant safety had to be in line with Australian OHS regulations and all electrical work was to comply with Australian electrical standards. To best cater for these requirements, Metso Australia took the lead on OHS as well as the plant's electrical design, installation and commissioning. In order to comply with Papua New Guinea's laws, Metso also had to set up a local subsidiary.

The new plant includes four stages of aggregate crushing and screening. The first three stages consist of three crushers in series, each followed by a triple deck screen. In the final stage, there is the option to send all or part of the product for shaping through a vertical shaft impact crusher. A bonus from this stage is a fine aggregate byproduct that can be used as an additive in road base.

The plant simultaneously produces up to nine different products at a rate of 350 tonnes per hour. 'Made to order' products have no impact on production rates or quality. To achieve this result, Metso worked closely with Monier's management to develop a design that offers a unique level of flexibility.

Metso's design allowed for extra capacity and so Monier was delighted when final tests showed that the plant is capable of delivering the nine different products at a rate of 450 tonnes per hour; 100 tonnes per hour more than the contractual requirement.

During precontract discussions, Monier's management had expressed concerns about intermittent power cuts that they experience from time to time, caused by unexpected demands on Port Moresby's electricity grid. Metso addressed these concerns with an electrical design that allows the plant to be run on either mains power or by diesel generator sets.



The system incorporates an uninterruptible power supply which provides backup power for the PLC and SCADA system. A signal appears on the SCADA screen to let the operator know when mains power is lost. The system also lets the operator know when the generators are in operation.

In operation the plant has proven to be highly efficient, using 40% less power per tonne than the older plants and delivering three times the output of both the existing plants put together.

Anthony Grimmer, Monier's quarry manager, commented, "In my 35plus years of mining and quarrying experience throughout Australia and PNG, I have not yet come across the level of sophistication as provided by Metso in the total crushing package at the Nebiri Quarry.

"In my opinion, we can easily claim to have a true 'plant of the future',"

A longer and more detailed version of this article can be read online at: http://bit.ly/244o8Fa

Metso Australia Limited www.metso.com



PRESSURE SWITCH

The EDS 3300 electronic pressure switch with a flush membrane has a ceramic measurement cell with a thick film strain gauge for relative pressure measurement in a low pressure range.

The pressure connection is achieved with a fully sealed stainless steel front membrane filled internally with a pressure transfer fluid. The process pressure is transmitted hydrostatically to the measurement cell via the pressure transfer fluid. Depending on the type, the instrument can have up to two switching outputs and a switchable analog output (4-20 mA or 0-10 V).

It has been designed specifically for applications in which a standard pressure connection could become blocked, clogged or frozen by the particular medium used. Further applications include processes where the medium changes frequently and any residues could cause mixing or contamination of the medium.

The EDS 3300 features an accuracy ≤1%FS, and the PNP switching output supports up to 1.2 A load per output. The 4-digit digital display is rotatable in two planes for optimum alignment, and the measured value can be displayed in bar, psi or MPa. Operation is via simple key programming — switching points and switch-back hysteresis can be adjusted independently.

HYDAC International

www.hydac.com.au





CONSTANT CURRENT SUPPLIES

The TDK-Lambda EVS series constant current power supplies offer a simple function set, designed for electrical energy storage and water processing applications. The new products will be marketed under the TDK-Lambda brand. In addition to a 300 W board-type fanless model and a 600 W unit model, a dedicated backflow prevention module will also be offered.

In recent years, the demand for electrical energy storage systems for peak shift and peak cut applications as well as for emergency use is rapidly increasing. The EVS series has been designed as a constant current power supply optimal for integration in such systems, providing the required constant current, constant voltage charging capability. The upper output voltage limit as well as the constant current value can be set by the user using equipped trimmers.

The 300 W model realises silent operation through a fanless design. Available output voltage ratings are 18 V (300 W model only), 36 V and 57 V, to suit the requirements of 12 V (300 W model only), 24 V and 48 V storage systems. Parallel operation is also supported, to enable charging of high-capacity storage systems.

Glyn Ltd

www.glyn.com.au



IIoT GATEWAYS

HMS Industrial Networks has introduced a gateway range for the Industrial Internet of Things. The Anybus .NET gateways enable real-time data from industrial machinery to be presented to .NET-based IT applications. This means that .NET programmers can get data directly from a PLC system on the other side of the gateway for use in applications for statistics, analysis or maintenance. The first .NET gateways released support Profibus and Profinet.

The basic prerequisite for Industrial IoT is that industrial applications are able to communicate with IT systems. However, the operational technology (OT) on the factory floor uses fieldbus and industrial ethernet networks, which are designed for real-time communication — by default separated from the IT infrastructure. The gateways address this situation by acting as translators that send and receive data between Profibus or Profinet networks and IT platforms using .NET as a framework.

The result is that IT systems get unprecedented access to real-time data from the factory floor, which enables predictive maintenance, KPI follow-up, machine analytics, data mining, big data processing and production statistics without interfering with the industrial processes.

The information exchange between the OT side and the IT side is defined in a spreadsheet template that defines how the data is mapped, tagged and presented to IT applications. The spreadsheet is uploaded to the HMS code generator, which

automatically creates a customised high-level C# API that is easy to integrate directly into a .NET application. It also generates a customised GSDML file for the PLC.



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LEVEL SWITCH

The HYDAC ENS 3000 with IO-Link communication interface is an electronic level switch with integrated 4-digit display.

The instrument has a switching output and additional output that can be configured as switching (PNP) or analog (4-20 mA or 0-10 V). The ENS 3000 can be used not only for oil but also for water and is available with or without temperature sensor.

Compared with the standard version, the IO-Link interface enables bidirectional communication between the device and the control. Parameterisation and cyclical transmission of process and service data is therefore possible.

The IO-Link interface is compliant with specification V1.1, and the display is rotatable in two axes for optimal alignment.

Typical fields of application are machine tools, handling and assembly automation, intralogistics or the packaging industry.

HYDAC International

www.hydac.com.au





TANK SAFETY VALVES

Emerson Process Management has introduced the Enardo 850/950 series of wirelessly monitored pressure vacuum relief valves (PVRVs) that provide safety and emissions control by managing the pressure in storage tanks in the oil and gas. chemical, petrochemical, and pharmaceutical industries.

The pressure in storage tanks fluctuates due to changes in temperature, liquid level or both. A PVRV opens and closes in response to these pressure fluctuations to ensure that safe pressure levels are maintained. However, because these PVRVs are located on the top of storage tanks, they are difficult to monitor and often remain unmonitored, with no feedback loops commonly seen in other pressure control devices.

Site managers are increasingly looking for ways to increase safety and efficiencies. A wireless solution enables immediate response to prevent problems related to safety, emissions, and the quality of a tank's content.

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

OXYGEN MEASUREMENT GUIDE

Mettler Toledo has produced a guide for the process industries that explains the measurement theory, sensor technology and practice of measuring dissolved and gaseous oxygen with in-line sensors.

Oxygen measurement and control plays an important role in many chemical, pharmaceutical, biotechnology, power and food and beverage processes. In biofermentation, oxygen control leads to increased yield and decreased production of unwanted by-products. Oxygen management in the chemical industry helps to avoid the formation of explosive gas mixtures, and oxidation control in the brewing industry results in increased quality and shelf life of products. The in-line measurement of oxygen in liquid and gaseous mixtures is vital in these and many other processes for providing continuous, real-time data on oxygen levels.

Today, both electrochemical and optical technologies are available for the measurement of oxygen in aqueous and gas-phase media. Amperometric technology has been successfully used for decades in a variety of applications and is based on electrochemical reactions. Optical technology, which exploits the phenomenon of fluorescence quenching, is a relatively recent innovation that has gained wide acceptance in the biotech and beverage industries due to its ease of use.

Mettler Toledo's quide provides an overview of oxygen measurement theories, an explanation of amperometric and optical sensor technologies and an outline of how sensors should be calibrated and maintained in order to provide reliable measurements. The guide is available to download from www.mt.com/pro-oxygen-guide.

Mettler-Toledo Ltd

www.mt.com





FREE-CHLORINE ANALYSER

Sigrist has released a free-chlorine analyser that self-cleans to ensure a consistently accurate reading of chlorine levels.

Suitable for the treatment of drinking water, water in beverage and food production and process water in various industries, the Sigrist AquaDMS Disinfection Measuring System helps technicians effectively optimise the chlorination of water.

The Sigrist AquaDMS Disinfection Measuring System can precisely measure chlorine levels over long periods of time because all sensors are equipped with an automatic sensor cleaning function. This function ensures that all the sensors are automatically cleaned at least once within a 24-hour cycle to deliver a precise reading of chlorine levels every time. The process removes coatings of organic and inorganic material from the sensors to provide zero point stability and no drift.

The AquaDMS analyser allows users to directly measure chlorine levels in real time, and includes an intelligent control system and flow regulator. The operator touch screen, sensor, assembly and wiring are pre-mounted on a panel. The control system features an easy-to-use touch screen and colour display that clearly illustrates values, alarm and status messages. The flow regulator ensures a stable flow of water through the system for the continuous accurate measurement of disinfectants.



As free chlorine measurements are affected by pH and temperature, an optional pH electrode can be integrated into the Sigrist AquaDMS. An input is also available for temperature as well as digital in and out.

Prodetec Pty Ltd

www.prodetec.com.au





n Part 1 of this article reviewing some of the currently published literature on the subject of ICS cyber threats, the types of advanced threats to Australian industrial businesses were reviewed and explored in the light of current industry trends, and the concept of the intrusion kill chain was introduced.

The intrusion kill chain

To recap, it is important to understand in a general sense the process an adversary may take to achieve their goal. In Part 1, the military concept of a kill chain was defined as follows¹:

"A kill chain is a systematic process to target and engage an adversary to create desired effects. US military targeting doctrine defines the steps of this process as find, fix, track, target, engage, assess (F2T2EA): find adversary targets suitable for engagement; fix their location; track and observe; target with suitable weapon or asset to create desired effects; engage adversary; assess effects..."

The reason it is called a chain is because it is an end-to-end process — a failure at any point in the chain interrupts the process. Hutchins et al (2010)¹ proposed a six-step kill chain model specifically for explaining the methodology for cyber intrusions, defined as reconnaissance, weaponisation, delivery, exploitation, installation, command and control (C2), and actions on objectives:

• Reconnaissance: At this point the intruder is researching, identifying and selecting targets. The steps involved can be relatively

difficult to detect because they may involve steps as simple as crawling websites, mailing lists, forms and blogs, or exploiting social relationships and researching relevant technologies.

- Weaponisation: Today this often involves developing a remoteaccess bot to be delivered as a payload via some tool. The tool for delivery (the weaponiser) may be as simple as a PDF, a Word document or malicious code behind a URL link.
- Delivery: This is the delivery of the 'weapon' to the target environment. Currently the three most common forms of delivery are email attachments, website links and USB removable media.
- Exploitation and installation: After the weapon has been delivered, its code is triggered. It may exploit a target system vulnerability or simply deploy itself and connect back to the adversary for further commands, allowing the adversary to establish a presence inside the target environment.
- Command and control (C2): Once the adversary has established a presence, they can exploit the remote access they have given themselves. They then have effective 'control'.
- Actions on objectives: Once this step has been reached, the
 adversary can now take action on their original objectives.
 In most cases this involves covert data exfiltration (theft),
 but may alternatively simply as act as a hop to compromise
 other systems laterally inside the network or through to a
 partner network.



The ICS kill chain

The aforementioned intrusion kill chain is a theoretical model used by IT cybersecurity experts to model the general process of IT infrastructure intrusion by a cyber adversary. Understanding the process that an advanced cyber adversary may take to effect an intrusion allows cybersecurity experts to evaluate the necessary response depending on where the intruder is in the chain when the breach is discovered.

In its paper *The Industrial Control System Cyber Kill Chain*, the SANS Institute² describes the above model as not directly applicable to ICS cyber attacks, but is it useful as a foundation to understand the process. The authors recommend a two-stage model — the first stage being the cyber espionage step, which is modelled very closely on the Lockheed Martin model. Stage 2 is the process for an actual attack on an ICS. The reason for this is the inherently greater difficulty for the adversary in accomplishing an ICS breach (if the ICS is well designed).

"The authors believe ICS networks are more defensible than enterprise information technology (IT) systems. By understanding the inherent advantages of well-architected ICS networks and by understanding adversary attack campaigns against ICS, security personnel can see how defense is doable."²

The problem for the cyber adversary, in relation to attacking an ICS with significant effect, is that they must become well versed

in the process being automated and the engineering design of the ICS and safety system. This is necessary in order to have a predictable and controllable effect on the target system. They also need to become familiar with the specific hardware and software technologies being used. This gives defenders more time to study and predict the nature of the attack:

"The multiple stages, or exaggerated kill chain, provide additional opportunities for defenders to increase the adversary's cost of an attack and to position themselves to detect and disrupt attackers before they reach their goal."²

Where this assumption of lower vulnerability breaks down is in systems where the ICS has some form of remote access or internet connectivity independent of the organisation's IT infrastructure. These are historically not generally as well protected as those that go through various other protective mechanisms when traversing via the IT network and internal firewalls. Backup connections to remote SCADA sites have been known to have been exploited in the past, for example. Plant wireless networks that are not well secured may also be a potential attack vector in some cases.

Stage 1 — Intrusion

Similar in form to Lockheed Martin's Cyber Kill Chain model, stage 1 of an ICS attack involves a cyber espionage intrusion to gain information about the ICS (see Figure 1).

The planning phase involves mostly passive reconnaissance, also known as 'footprinting'. The techniques used involve taking advantage of the large amounts of information that can be found via the internet and other sources (including social engineering) to build up information about the target organisation. The information your company makes publicly available about itself, both deliberately and inadvertently, can often be a rich source of (at least initial) information for further investigation. Hiding within the noise of common internet activity, attackers can map the target's network entry points, patterns of activity, protocols used, etc.

The preparation phase involves weaponising and targeting, usually involving the development of a remote-access bot or some other form of code to be delivered as a payload via some tool. The tool for delivery (the weaponiser) may be as simple as a PDF, a Word document or malicious code behind a URL link. Delivery may be in the usual ways, via phishing emails and USB devices, but if the preparation phase has revealed excessive information, an attacker may be able to compromise a VPN or gain entry via a partner network (supply chain, vendor, etc) that has previously been compromised. If direct entry has been achieved, weaponisation may not be necessary. In any case, the preparation phase mainly involves preparing the weapon and identifying the target to be exploited to deliver the weapon.

The cyber intrusion phase involves the actual delivery of the software weapon, if necessary, by one of the well-known mechanisms. The weapon is then utilised in the 'exploit' step to perform initial malicious actions, such as deployment of the code.

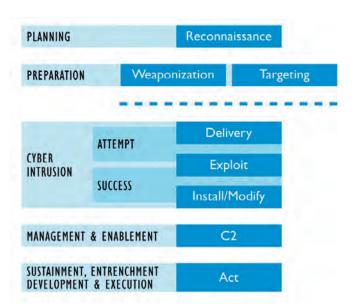


Figure 1: Stage 1 cyber intrusion preparation and execution. Source: SANS Institute.

For example, an employee opens a compromised PDF document, which initiates the exploit. The exploit itself may install a malware bot or remote-access Trojan, or may take advantage of operating system scripting capabilities such as PowerShell. While antivirus and malware detection are important, the following points should be remembered:

- A high-level adversary specifically targeting an organisation may create new code not known to antivirus software.
- Defenders should not assume that malware is the only way it can be done, and that inherent operating system capabilities can also be directly exploited.
- More than one intrusion path may be developed over time to reduce the risk to the adversary, should one path be detected and closed down.

Once the intrusion has been established, the adversary now has the opportunity to command and control, using a deployed agent or via compromised direct access. This does not always imply two-way real-time communication, but can be a slow step-by-step one way communication 'from the inside out', hiding in normal internet traffic.

The final stage is open-ended. Once command and control has been achieved, an attacker has the freedom to perform any number of acts. If they are a skilled adversary, they will be very careful to attempt not to be discovered and hide their tracks.

So far, this first stage has involved IT system cyber espionage. However, once a covert presence is established — and while it remains undetected — the intruder enjoys ample opportunity to perform espionage and traverse the network at will, including using it as a launching point to attack other networks.

Stage 2 — Attacking the ICS

As stated above, in most cases it is not really feasible for a cyber attacker to skilfully attack an ICS without site- and equipment-specific knowledge, making industrial control systems inherently more defensible if designed well.

They also need to be very careful not to unintentionally initiate an attack when they are only at the information gathering stage, as

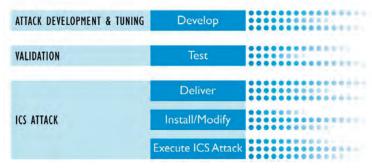


Figure 2: Stage 2 ICS attack development and execution. Source: SANS Institute.

it may have unforeseen consequences. The SANS Institute uses the following example:

"For example, an attempt to actively discover hosts on an ICS network may disrupt necessary communications or cause communication cards to fail. Simple interactions with ICS applications and infrastructure elements may result in unintentional outcomes."²

For this reason, the stage 2 process is considerably different from stage 1 (see Figure 2).

It would be a very foolish attacker that would just dive in and attack an ICS and expect not to be detected. This is why stage 2 begins with a development step, to develop a capability specifically targeted at the specific ICS in question. This will involve data collected in stage 1, and there will therefore be generally a long delay between stage 1 and any explicit action occurring in stage 2.

The obvious benefit for defenders here is that if the intruder has been detected in stage 1, there should be ample opportunity to take actions to defend against stage 2 — either by eliminating the initial intrusion (removing the adversary's control) or by studying the adversary's actions in order to 'track them down' and take some other form of retaliatory action through law enforcement or other actions.

The validation step for the adversary will involve testing their attack capability against an offline test system, as it would be foolhardy to test on the real target. Even network scanning needs to be tested against an equivalently configured test system before attempting it on the target.

In order to validate, an advanced adversary will need to acquire equivalent technology as the target system — physical hardware and software components — in order to test properly. It may be possible, through government agencies, to determine if unusual automation system purchases are being made, especially if information about the attacker is discovered in stage 1.

The ultimate end goal — the actual cyber attack — will only be possible after the above steps have occurred. In this step the adversary will deliver and install the capability developed in the development and testing phases, which will allow them to modify existing control system functionality and execute an actual attack.



A KILL CHAIN IS A SYSTEMATIC PROCESS TO TARGET AND ENGAGE AN ADVERSARY TO CREATE DESIRED EFFECTS.

It may involve triggering conditions to manipulate the process, changing process set points and spoofing state information to fool plant operators.

Conclusion

Obviously, the end goal of a sophisticated external cyber attack on an industrial control system could be devastating and potentially terrifying. It should be clear from the above that while many in industry are concerned that this may occur, it is nevertheless the domain of well-equipped and sophisticated adversaries.

Because the attacker ultimately needs to be able to manipulate the process (except for the option of simple disruption through a denial-of-service attack), the attacker's goal is significantly difficult to achieve if the system is well designed.

The current trend towards implementing the interconnection of industrial control systems with business IT systems and the internet, along with cloud services and remote access, creates cybersecurity challenges for businesses — particularly for those

industries of national interest that may be more likely to be targets for sophisticated attackers. In a rapidly changing and more unstable world, with an increasing speed of technological development, it is necessary for industrial organisations to look to making sure that network designs - both OT and IT - fully take into account the threats and risks that greater connectivity implies, and that companies at the highest levels of management acknowledge the risk and invest in the appropriate skills and technology to protect their businesses.

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- 1. Hutchins EM, Cloppert MJ & Amin RH 2010, Intelligence-Driven Computer Network Defense Informed by Analysis of Adversary Campaigns and Intrusion Kill Chains, Proc 6th Int'l Conf. Information Warfare and Security (ICIW 11), Academic Conferences and Publishing Ltd 2011, pp 113-125.
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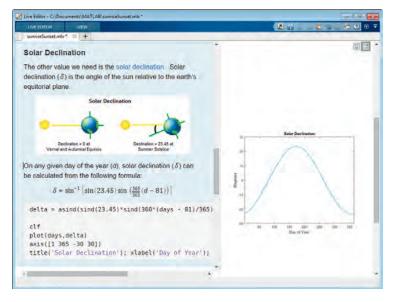
SIMULATION SOFTWARE

MathWorks has introduced Release 2016a (R2016a). This release includes the MATLAB Live Editor, which offers the ability to write, run and modify code in a single interactive environment to accelerate exploratory analysis, and App Designer, an environment that simplifies the

> process of building MATLAB apps. R2016a also includes a number of features in Simulink to help speed up model development and simulation, as well as updates and bug fixes to all other products.

The Live Editor offers a different way to create, edit and run MATLAB code. Results and graphics are displayed together with the code that produced them in a single interactive environment. Scientists and engineers can add formatted text, mathematical equations, images and hyperlinks to create an interactive narrative that can be shared with others.

App Designer provides an enhanced design environment and UI component set for building MATLAB apps. It integrates the two primary tasks of creating an interactive application - laying out the visual components and programming the behavior of the app. The generated code is object oriented, which makes it easier to share data between the different elements of the app, and the compact structure makes it easier to understand and maintain.



MathWorks Australia www.mathworks.com.au



STABINGER VISCOMETER

Anton Paar's SVM 3001 Stabinger Viscometer is a precise kinematic viscometer with an integrated density-measuring cell. A single measuring cycle on a small sample volume

yields kinematic viscosity, density, dynamic viscosity, viscosity index and more.

As the density cell is integrated, the density measurement does not need to be carried out separately. One combined measuring cell covers the entire measuring range for viscosity, density and temperature. Due to its measuring principle, the measurement duration is independent of the sample's viscosity. A minimum sample amount of only 1.5 mL is sufficient for the multiparameter results, including calculation of API degrees.

Peltier elements allow for heating rates of up to 20°C/min. As the heating is electrical, no thermal transfer liquids are needed. By using the special VI method, temperature changes are performed automatically and the viscosity index is calculated in compliance with ASTM D2270.

Multiple parameters are shown on the 10.4" touch screen. An intuitive display widget shows measurement precision and repeat deviation for both viscosity and density at a glance. FillingCheck allows for monitoring of the filling quality in real time. This feature saves valuable operating time.

The unit offers user management including an audit trail option for full traceability. The storage capacity is 1000 data points and data export can be performed via USB storage device, printer or ethernet.

MEP Instruments Pty Limited

www.mep.net.au









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Wireless steam trap monitoring improves productivity

A major food manufacturer in the United States drives innovation in all areas of its business while maintaining the highest quality in its products, services and relationships. For the food product's plant in the south-east, innovation extends to process instrumentation and control.

"We are always looking to improve energy use," said the project engineer who provides project and maintenance services in the utility area of this plant. "This is a large plant with multiple product lines which are run as individual business units from a cost perspective. We want to know the energy use for each business unit over time and compare them. In that way, we can make continuous improvements to the areas that need it the most."

Steam traps were identified as one culprit of energy loss. When a steam trap fails open, steam is not completely consumed and is blown directly into the condensate return system, where it may be lost to the atmosphere in an 'open system'. It can also raise the pressure in the condensate system, inhibiting the discharge of other traps and causing system-wide inefficiencies. If it fails closed, the system will flood, causing a loss of heat transfer and subsequent loss of production.

Steam trap failures also increase the potential for water hammer, which may lead to equipment damage and downtime.

In an effort to prevent steam trap failures, a preventative maintenance (PM) schedule was developed. With close to 100 traps in the plant, PM could only be performed once per year. It takes the maintenance crew at least one hour per unit to check the steam traps, when done properly, so maintenance labour on the traps was $% \left(1\right) =\left(1\right) \left(1\right) \left$ 100 hours annually.

"When I heard about the acoustic transmitter from Emerson, I wanted to try it out," the customer said. "We were looking for automatic, online monitoring of steam trap performance and realtime alerts to minimise preventative maintenance requirements and minimise energy losses. This new transmitter from Emerson seemed like a good fit and we were glad to test it."

A self-organising, wireless network with wireless 3051S DP flowmeters had already been installed to monitor compressed airflow to the various business units in the plant, to understand the electrical energy use. Adding the non-intrusive wireless acoustic measurement device was easy and saved a significant amount of money in installation cost. "Wireless greatly reduces installation cost," said the customer, "and we use those savings to purchase more instrumentation to extend utility monitoring in our plant."

For steam trap monitoring, nine 708 Rosemount Wireless Acoustic Transmitters (with integrated sensors that mount externally) were installed on steam lines throughout the plant and integrated into the existing Smart Wireless Gateway, which communicates to a plant host. The steam traps range from thermostatic (TT) and float and thermostatic (FT) to simple bucket traps. The customer found that the acoustic transmitters work equally well on all of them. One application is even a steam-driven pump, where the acoustics of the pump are being monitored to give an early indication of problems. The

> network was easy to expand and the new transmitters also strengthened the mesh network. Even though there is a large amount of concrete between the transmitters and the gateway, and high EMF, the wireless communications are strong and reliable.

> The 708 transmitter, with a combination of temperature measurement and acoustic 'listening', gives high visibility into steam trap states.

> "Manual monitoring of temperature did not give us enough information to

conclusively target a steam trap for replacement when we saw water hammering," the project engineer continued. "But when we installed the wireless acoustic transmitter, we could tell immediately which steam trap was stuck." It was quickly fixed, and a trend of the new trap showed normal acoustics and temperature.

Now the plant has real-time alerts for each of the nine steam traps with wireless acoustic transmitters. Some are in washdown areas and one is in a high-humidity environment. All are communicating reliably. Because of the design of the device, the customer can 'set and forget' each of the acoustic transmitters and eliminate manual PM activities.

"We found 22% of our traps needed to be replaced during our last PM check. By installing wireless acoustic transmitters, the plant will prevent steam loss with early detection of steam trap failure. Not only will this minimise energy loss, but it will free up maintenance to focus their time and attention on things that need to be fixed, to further improve our productivity," concluded the customer.

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





VPN ROUTER

The Wieland Wienet VPN industrial router allows the user to perform remote management, remote maintenance and alarming from a distance.

The routers can be used for many applications, including energy systems such as wind turbines, solar farms, biogas cogeneration systems and heat pumps. They can be used for water and wastewater management and for system monitoring in machine building such as washing machines, packaging machines and compressors. They are also suitable for external surveillance cameras, vending, smart metering and mobile fleet management.

The router is user-friendly with the arrangement of ports on the front panel and a standard USB port. It features a robust aluminium housing and DIN rail assembly. It has an operating temperature range of -30°C to 70°C and supports all popular mobile systems.

The router will always access the fastest available connection and offers download speeds of up to 100 Mbps and upload speeds of up to 50 Mbps. It can be used for industrial applications in conjunction with VPN service portals, such as Wie-Service24.

The devices are also available with a second SIM card slot, additional I/O, RS-232, RS-422/RS-485, M-Bus, a second ethernet interface, a WiFi module or an integrated 3-port switch.





PARTICULATE TRANSMITTER

The Dwyer Series PMT2 particulate transmitter is designed to measure particulate emission levels from dust collector discharge.

Using DC-coupled, electrostatic, induction-sensing technology, the transmitter monitors a pA current that is generated as particulate passes near the probe and transmits a 4-20 mA signal that will vary based on the particulate level. The product offers six sensitivity ranges, allowing the user to choose the range that will best fit the application.

The range and test selector switch can also be set to output a 4 or 20 mA signal to assist with set-up or troubleshooting. Averaging time setting can be used to dampen the signal if desired.

Applications include emissions monitoring; broken bag detection in dust collectors; filter leak or wear detection; and bin vent monitoring.

Dwyer Instruments (Aust) Pty Ltd www.dwyer-inst.com.au







LOW-PROFILE BULK BAG DISCHARGER

Flexicon's updated series of BULK-OUT half-frame bulk bag dischargers features frames of variable heights and offsets to fit restricted areas previously utilised for the dumping of smaller containers such as sacks, pails, drums, boxes and bins.

The low-profile dischargers are engineered to straddle downstream blenders, feeders, tanks or other equipment in areas with limited headroom, restricted floor space and/or obstacles that would preclude the use of conventional discharger frames.

Lacking an upper frame, the discharger provides overhead space for the suspending of bulk bags using a forklift or plant hoist. It can also be configured to support new or existing bulk bag lifting frames that can be connected to bags at floor level and then forklifted onto the half frame within centimetres of the ceiling.

The bag-to-discharger interface consists of a SPOUT-LOCK clamp ring positioned atop a pneumatically actuated TELE-TUBE telescoping tube, allowing dust-tight connections.

The high-integrity, dust-tight seal between bag spout and clamp ring enables full-open discharge from bag spouts of all popular diameters, eliminating the need for iris valves.

The discharger is also equipped with FLOW-FLEXER bag activators that raise and lower opposite bottom edges of the bag at timed intervals, loosening compacted materials and promoting material flow through the bag discharge spout.

Product contact surfaces are of stainless steel, with frame construction of carbon steel, or stainless steel finished to industrial, food, dairy or pharmaceutical standards.

Flexicon Corporation (Aust) Pty Ltd www.flexicon.com.au



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NEW PRODUCTS

PRE-ENGINEERED SIS

Rockwell Automation has introduced its OptiSIS solution, a pre-engineered safety instrumented system that can help ease deployment and reduce lead times for small and mid-sized process applications.

The OptiSIS solution is suitable for oil and gas, chemical and petrochemical producers with ageing process safety systems that are either non-compliant or can no longer be maintained.



The OptiSIS solution is designed for safety instrumented system applications of 50 or 100 I/O points, including emergency shutdown (ESD) systems, burner management systems (BMS) and high-integrity pressure protection systems (HIPPS). The version for applications of up to 100 I/O points will be available in the fourth quarter of 2015.

The pre-engineered OptiSIS solution is delivered ready to install, wire and configure, shortening the overall engineering time and eliminating the need for any programming. Users need only enter their logic scenarios into the system's cause-and-effect graphical interface. The configurations are tested and can then be stored for verification against original safety function requirements — or used at a later date to restore the system to a known state.

The system accommodates a varying mix of digital and analog I/O types. Additionally, simplex I/O and fault-tolerant (dual) I/O versions are available to address different redundancy needs.

The system meets requirements up to SIL 3 and is compliant with IEC 61511/ISA 84.00.01. It uses ready-to-install, TUV-certified hardware and validated application software.

Rockwell Automation Australia

www.rockwellautomation.com.au

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LINEAR WIRE ENCODER

The ELAP HLS linear wire encoder provides a number of pulses proportional to the linear displacement of the wire. An internal spring controls the return of the wire to the starting position.

The transducer consists of a bidirectional incremental rotary encoder operated by means of a wire-reel mechanism; the wire is made of stainless steel covered with nylon. It is rugged and easy to install, with a highly IP rating against environmental agents.

The HLS encoder is available with strokes ranging from 1 to 12 m and resolutions ranging from 0.04 to 1 mm, with a push-pull or line driver output signal. Three available types — HLS-S, HLS-M and HLS-L — differ in mechanical size and measuring stroke.

Typical applications include X-Y tables, oil- or air-pressure cylinders, packaging equipment, woodworking machines, marble and sheet working machinery.

Motion Technologies Pty Ltd www.motiontech.com.au

WATER-IN-OIL SENSOR

The AquaSensor AS 1000 is designed for the online detection of water in oils, in particular as an OEM sensor for fluid conditioning monitoring. It measures the degree of saturation and the temperature of the fluid and enables hydraulic and lubrication oils to be monitored continuously and online.

In the analog output version, the AS 1000 transmits the values for the degree of saturation and the temperature as a 4-20 mA signal. In the version with two switched outputs, the product can be configured individually using the HYDAC service instrument HMG 3010, the condition monitoring unit CMU 1000 and the interface module CSI-B-2.

The parameters that can be adjusted are saturation level/temperature, switch points, mode of the switched outputs, switching direction and switch delay times.

The unit features a compact and robust design, a sensor and wide fluid temperature range.

HYDAC International

www.hydac.com.au



ow can government and industry work together to ensure our continuing competitiveness in a globalised world? What can companies do to embrace new ideas in industry automation from global sources — and make them work in their local operations?

These questions and more will be answered at the Profibus & Profinet Global Forum and the Automation Innovation Summit taking place alongside one another on 25 May 2016 in Sydney.

The manufacturing and resources industries are essential components within a balanced and diversified economy. But these sectors, having weathered the downturn of the past few years, now face a myriad of challenges — challenges that can only be resolved through decisive and effective implementation of innovation.

The forum's morning session therefore will offer technical updates, news on IIoT and practical knowledge about how to implement Fieldbus and Industrial Ethernet technologies in manufacturing and process plants. In addition to experiencing the PROFIBUS & PROFINET Technical Exhibition, attendees can hear from a line-up of technical experts from around the world who will present global best practices and case studies on how they applied automation technology in innovative ways to boost productivity and reduce costs.

The event will transition to the Automation Innovation Summit in the afternoon, where industry and government representatives will exchange information and engage in debate about innovation and its impact on productivity.

With the Australian Government's Productivity Commission noting productivity growth witnessed in 2013-14 "remained well below what is required to maintain our historical growth in living standards", the summit will hear from diverse speakers as they present a practical plan of action to turbo-boost the next decade of innovation and productivity growth in Australia.

Major stakeholders from industry, business, academia and government will also discuss the Innovation Statement — what it means, how it will be implemented, and how industry and manufacturing will likely benefit from it.

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EFFECTIVE USE OF TIME

ne of my colleagues has '1440' printed in huge numbers on the wall next to his desk. This is his reminder that there are only 1440 minutes in the day and that, to be successful, he aims to use every single minute deliberately. A moment is used effectively if it forwards his career, allows him to learn, improves his health or strengthens his relationships with friends and family. It is an attitude towards being mindful about tasks undertaken.

To run a successful operation, particularly with the suppressed commodities market, we should adopt this same attitude and ensure that every minute of our working week is used effectively. There are only 2100 minutes in a 40-hour week (less rest breaks) and each one should be used in the most effective manner. As my mentor once told me, "Work smarter, not harder".

An effective task is one that improves the productivity, efficiency, reliability or safety of a plant, or improves your ability to work effectively, like training. The killers, for effective use of time, are tasks that are required to be done but should not be done manually.

A good operator would walk about the plant at the beginning of a shift and perform a quick visual inspection in a matter of minutes. This task improves safety awareness and is therefore an effective task. Unfortunately, operators commonly stop to read gauges, scrawl values onto pieces of paper and then transcribe them to spreadsheets later, which are all ineffective minutes.

Manually dipping a tank to verify that a SIL3 rated system is operating correctly is critical to continued safe operation of a tank farm. It is a task that takes about 60 minutes each day and requires permits to be raised and safety equipment to be prepared and tested. Given that it could be automated, manual dipping should now be considered a risk to personnel safety and an ineffective use of time.

Condition monitoring staff spend as much as 60% of their time - about 1260 minutes each week — collecting vibration spectra, and only 40% analysing and acting upon the data. Automated vibration monitoring can significantly reduce collection times and be used to identify problematic devices. It would also reduce the time spent reviewing spectra from healthy equipment, allowing key staff to spend more time on effective tasks and giving full and undivided attention to devices that need detailed analysis.

When I talk to people about productivity, I am looking for solutions that will help them remove ineffective minutes from their schedule and focus their efforts on productive tasks. It will always come down to accessing data they need but currently spend countless minutes collecting, because the cables and junction boxes are not available to install new instruments.

For each of the examples above, WirelessHART instruments have been used to replace gauges, perform level measurement and collect vibration data. In every case, it was just faster, easier and cheaper to install a wireless transmitter, rather than wired, to perform the rudimentary data collection task.

There are only 2100 minutes in each week. Each one of those minutes should be spent analysing and acting upon data, using our skills effectively. Reading a gauge is an ineffective use of time.



Craig Abbott has a BSc in CS and IT and has worked as a software engineer on projects for over 20

years. He enjoys using his IT background and extensive OT experience to help customers develop solutions to improve business metrics. Craig works as a Wireless Specialist at Emerson Process Management.



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