

# PROCESS

TECHNOLOGY

AUTOMATION + CONTROL + INSTRUMENTATION

May 2019 vol.32 no.11

PP100007403



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Looking Forward

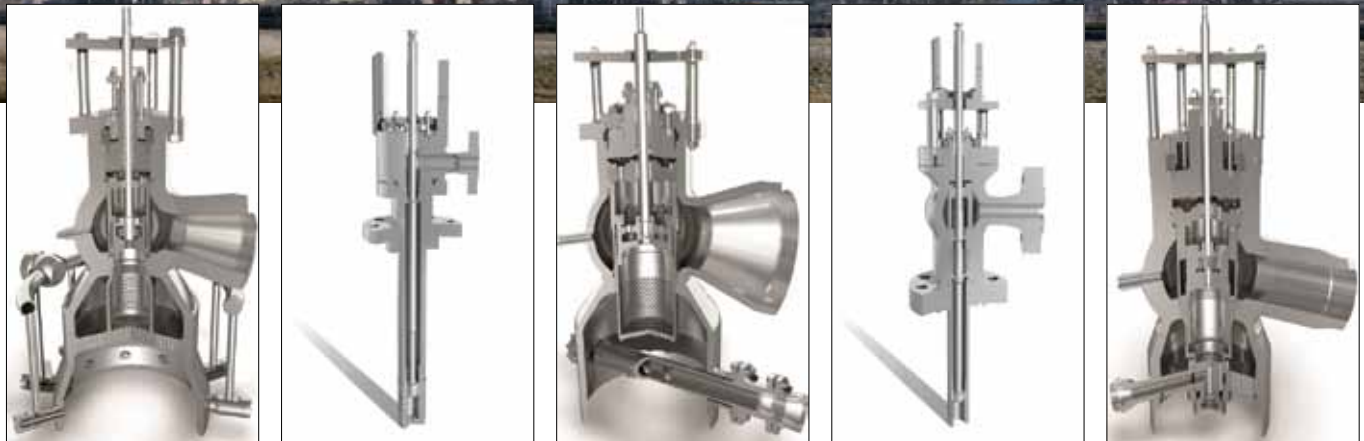
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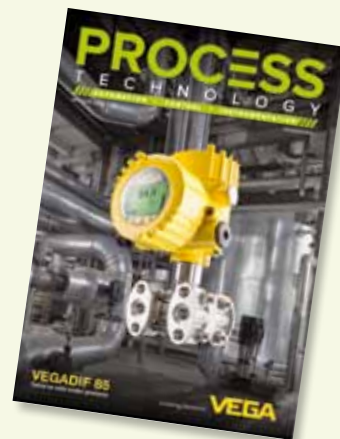
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Looking Forward

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A man with grey hair and glasses, wearing a yellow safety vest over a grey shirt, is looking directly at the camera. He is in a factory or industrial setting, with other workers in yellow vests and blue hard hats visible in the background. The scene is brightly lit, and the man has a slight smile.

# IT/OT CONVERGENCE

## MOVING DIGITAL MANUFACTURING FORWARD

Although they may have different approaches, backgrounds and KPIs, both the IT and OT teams are heavily invested in achieving their company's success.



**H**istorically, the information technology (IT) and operational technology (OT) departments within an industrial manufacturing company could function fairly independently. Operations kept the plant running smoothly and IT managed business applications from the front office.

The two teams occasionally collaborated on successful projects, such as implementing printers on the factory floor or servicing industrial PCs. Unfortunately, those opportunities were rare. Too often, it was a problem, not an opportunity, that brought IT and operations together. Whether it was a security incident, a system failure or unplanned downtime, those encounters did little to breed trust and collaboration between the two teams.

But the world of manufacturing is changing. To keep up, IT/OT relationships must change with it.

The research suggests that executives are equally worried about established companies and start-ups, both within and outside their industry, deploying new technology and business models that will negatively affect their position in the market. To outpace that potential disruption, manufacturing companies are working to adapt their processes, technologies and business models. The most forward-thinking companies aren't just trying to survive the changes. They're working to be the ones that lead it — gaining a competitive advantage, improving operational efficiency and maximising profitability. They are leading digital business transformation in manufacturing.

Clearly, this shift is bringing new and challenging projects to the IT and operations professionals working within the industry. And the savviest IT and operations leaders also know that success in this new climate means working more closely together.

According to the Global Center for Digital Business Transformation, manufacturing is one of the 10 industries that are most ripe for business disruption<sup>1</sup>.

Visionary operations leaders recognise that the reams of operational data they use to support real-time decision-making could

create additional value for the company. But they need the support of their IT colleagues to make the data meaningful and accessible for use across the organisation. Their IT colleagues can also help them better align with business systems, such as enterprise resource planning (ERP) tools and manufacturing execution systems (MES).

At the same time, IT teams want to achieve the vision and potential of a connected factory — from improving the supply chain to driving innovation and minimising downtime. However, to get there they need the knowledge and support of the operations professionals who understand and control the equipment. Both groups have seen glimpses of how their efforts might enhance the future of their companies and industries, but to take full advantage of this opportunity they must work together.

That's why the forced IT/OT interactions that often characterised security and Ethernet projects of the past are being replaced with more powerful, collaborative alliances. Together, IT and operations teams go beyond merely responding to problems. Instead, they're playing a key role in their companies' transformations, helping to seize new business opportunities that make them more competitive, more efficient and more secure. In this article, we take a closer look at some of the key ways IT/OT convergence is enabling digital manufacturing transformation, including:

1. Enabling real-time decision-making through fog computing.
2. Eliminating unplanned downtime through predictive maintenance.
3. Deploying wireless technology on the factory floor.
4. Ensuring cybersecurity for a new world of connected machines.

### Enabling real-time decision-making through fog computing

Thanks to the Industrial Internet of Things, manufacturers are collecting more data than ever before. However, that data is only as valuable as the decisions it can support. That's why traditional cloud computing alone isn't always the best solution for manufac-



IT AND OT CONVERGENCE IS TRANSFORMING MANUFACTURING IN WAYS NEITHER FUNCTION COULD HAVE IMAGINED, WHILE MAKING BOTH ENTITIES EVEN MORE EFFECTIVE AT THEIR JOBS.

turing. Extremely time-sensitive decisions should be made closer to the things producing and acting on the data, to minimise latency and address potential issues.

For years, manufacturers have relied on industrial control systems to achieve real-time decision-making. However, those systems don't typically allow for the same enterprise-wide data sharing expected in the world of smart manufacturing.

That's why operations teams are turning to fog computing, which gives them real-time access to mission-critical data at the plant level, while also sharing that knowledge throughout the enterprise. This enables rapid decision-making that improves safety and prevents costly downtime while also sharing information across different plants in different geographies, helping operations leaders see enterprise-wide trends that can contribute to safety and operational effectiveness.

And here's the beautiful part: IT likes the fog as much as operations does. With fog computing, IT gains a veritable data triage:

- Time-sensitive data can be analysed on the fog node closest to the device generating the data.
- Data that can wait seconds or minutes can be passed on to an intermediary node that keeps an eye on operational data.
- The least time-sensitive data is sent to the cloud for historical analysis and storage.

This approach conserves bandwidth, refining when and how data centre resources are used. It creates a more scalable system, making room for a flood of new digitised devices and complexity on the factory floor. And because it also makes it possible to analyse sensitive data at its source, it improves overall system security.

### Eliminating unplanned downtime through predictive maintenance

IT/OT convergence is also creating a paradigm shift in factory maintenance.

Planned preventive maintenance schedules rule the day in most manufacturing settings. Operations teams perform preventive maintenance on a regular schedule to lessen the likelihood of equipment breakdowns. This approach requires a plant to maintain a database of its assets, track their condition and rely on manufacturers' recommendations to determine when and how to maintain them.

While preventive maintenance is clearly better than just waiting until something breaks, it's not perfect. These methods are time-consuming and costly — and don't always account for special conditions. Since the maintenance schedules are based on best practices, not actual data from the machine being serviced, this approach almost inevitably leads to some amount of unplanned downtime and waste.

And unplanned downtime, in today's world, is simply unacceptable. In most manufacturing environments, profit margins are already slim. The costs associated with unplanned downtime — from production losses to wasted materials and replacement parts — all erode the thin cushion between a profit and a loss. This means that eliminating unplanned downtime is a critical business imperative.

Unlike preventive maintenance procedures, predictive maintenance technologies allow manufacturers to collect real-time data from the actual machines affected, monitor for any situation that might indicate a potential equipment failure and then schedule repairs during planned downtime, while also extending the machine's useful life and dramatically reducing repair costs. Instead of using estimates or best guesses, these systems use real data intelligence from the factory floor.

Shifting to a predictive maintenance approach significantly improves uptime, and it's supported by IT/OT convergence. Operations does its part by collecting key data from PLCs, machines and sensors, while IT provides the data analytics and other tools



that give the data meaning. By digitising the maintenance process, IT/OT teams make it possible to predict when any given device might fail, and intercede accordingly. Fewer resources are used, and it creates a more scalable system, making room for a flood of new digitised devices and complexity on the factory floor. And because it also makes it possible to analyse sensitive data at its source, it improves overall system security.

### Deploying wireless technology on the factory floor

It's hard to imagine a smart factory without wireless. The numerous machines, sensors and PLCs, plus the analytics platforms and ancillary technologies running alongside, all become more efficient and practical with wireless technology.

But until recently, deploying wireless across the plant floor was not always a viable option.

Industrial environments vary greatly, from challenging building layouts to harsh environmental conditions such as dust, excessive humidity, temperature and vibration. Plant managers were also sceptical about whether wireless could support the number of devices, bandwidth, latency and security required for mission-critical applications. So plants deployed miles of cable everywhere, which was expensive and time-consuming to deploy.



erations is a potential downtime disaster waiting to happen. Operations must have a seat at the table to determine when to deploy those updates, ideally in line with planned maintenance schedules, and to evaluate any potential production system impact.

IT and OT must work together to make cybersecurity work for manufacturing, while avoiding unintentional downtime and preserving the company's profit margin.

## Conclusion

IT and OT convergence is transforming manufacturing in ways neither function could have imagined, while making both entities even more effective at their jobs.

According to the 'Smart Manufacturing and the Internet of Things 2015' survey of 418 manufacturing line-of-business executives and plant managers by SCM World and Cisco, smart manufacturing can foster tremendous business outcomes.<sup>2</sup>

At the same time, with OT's insight on the factory floor, IT is staying a step ahead of those who seek to compromise security and confidentiality.

As these two groups work more closely together, they're unlocking new opportunities for manufacturing. Although they may have different approaches, backgrounds and key performance indicators, both are heavily invested in achieving their companies' overarching goals.

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2. Manenti P 2015, *Becoming a Smarter Manufacturer: How the Internet of Things Will Change Industry*, SCM World, <<http://www.cisco.com/c/dam/assets/docs/becoming-smarter-manufacturer.pdf>>

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However, over the last several years there have been great strides in wireless technology. This increased resiliency makes wireless more affordable and practical for industrial environments than ever before, and it is also quicker to deploy.

And wireless can be a game changer for any factory. It enables more flexibility and adaptability for remote monitoring, assembly line changeovers, and quality or supply chain initiatives. At the same time, it can lead to significant cost savings. IT and operations can work together to successfully deploy wireless on the factory floor, and doing this well benefits both groups. IT loves the cost savings, reduced troubleshooting and increased bandwidth, while operations teams enjoy the benefits of additional agility, increased quality and reduced downtime.

## Ensuring cybersecurity for a new world of connected machines

Cybersecurity is mission critical for manufacturing. Protecting intellectual property and customer information is paramount to a company's long-term viability and corporate reputation. At the same time, compromised production systems could affect quality, profitability and even safety.

Not long ago, manufacturers could feel generally comfortable with the security of the machines on the factory floor. Their

proprietary systems and likely lack of enterprise connectivity created a sense of safety. However, linking the machines on the factory floor to the network has countless benefits. For instance, the data collected can be analysed to reduce downtime and to increase operational efficiency, and can lead to improved safety and product quality. However, this new change, combined with an increased prevalence of cybersecurity threats in general, requires a new approach to security. The old 'security by obscurity' approach is no longer valid.

Today's solutions must connect networks and enable monitoring and secure data flow. It must be possible to deploy them in existing environments and on legacy equipment. And they must deliver defence-in-depth features to organise, harden, defend and respond to threats.

Implementing this new approach to cybersecurity in manufacturing requires collaboration from both IT and operations. IT brings a deep understanding of cybersecurity protocols and policies, as well as experience in managing implementation and ensuring compliance.

But to make cybersecurity work for manufacturing, operations teams must also play a critical role in the process. For instance, a diligent approach to cybersecurity generally requires regular system updates, but deploying them without consulting op-

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## Conveyor system optimised by EtherCAT

tna Australia is one of the world's leading manufacturers of turnkey, integrated packaging and processing solutions for the food industry. The tna horizontal and vibrating conveyors distribute and transport products such as snacks, confections, nuts, pasta, fresh produce or pet foods and feed them to the packaging system. The most recently developed horizontal conveyor system, the tna roflo 3, is an innovative solution for the transport and distribution of food products.

"It was specially developed with a view toward simple integration in upstream or downstream seasoning, weighing and packaging modules, and enables the development of customer-specific solutions," explained Kerryn Ball of tna Packaging Systems. "With the tna roflo 3, different products can be conveyed at the same time on a single line and moved in different directions."

The tna roflo 3 horizontal conveyor gives the operator complete control over the speed and direction of movement of the conveyed food products by implementing control commands virtually in real time. With a view to performance optimisation, tna's aim in developing the tna roflo 3 was to implement a distributed control system with real-time Ethernet as the basis for communication. "Prior to the start, tna had considered a range of communication options. Ultimately, EtherCAT was the only system that is proven to work efficiently on standard hardware without having to install a processor board especially for the communication," Ball said. "Since EtherCAT is an open standard protocol, we were able to develop our own EtherCAT master for real-time communication with the horizontal distribution system. The openness of the EtherCAT platform also gives us the option to use devices from different vendors. That offers both us and our customers valuable flexibility."

tna has now installed EtherCAT into all non-standalone tna roflo 3 systems worldwide. Currently, the most extensive system of this type is located in France: 21 servo axes for three production lines are controlled by just one computer. There are further large-scale installations in Korea, with 18 axes, and in Mexico, with 19 axes. A single communication network can be used for several tna roflo 3 systems.

The connection to the field level takes place via the EK1100 EtherCAT Coupler. Digital inputs such as level sensors and all universal inputs are connected via standard input terminals. Air-operated doors, warning lamps etc are connected to the digital output terminals. The EK1122 branch terminals increase the topology options of the EtherCAT network in the case of larger systems for which a star topology is suitable.

In the example of the system installed in France, 21 tna roflo modules make up a distribution system that is perfectly tailored to the needs of the customer's application. A single tna 'switcheroo' or 'lifteroo' feed line — a mechanism that separates, tilts and turns the tna roflo pans —



is able to distribute three different products from the processing line to the waiting packaging machines. This innovative function changes the way in which processing lines are interconnected and enables the simultaneous movement of products in several directions on a single packaging line.

"Previously, we needed three conventional feed lines for this — with the corresponding costs and space requirements. With the EtherCAT-based controller, the 21 servo axes distributed throughout the entire factory are controlled by just one powerful computer," Ball said, outlining the advantages. "Thanks to EtherCAT we can build and test the tna roflo modules at our production site. All cables are located in the roflo modules; in addition, information is exchanged over the network so that no 'spaghetti cabling' is created and the system can be designed very simply," Ball explained.

**Beckhoff Automation Pty Ltd**

[www.beckhoff.com](http://www.beckhoff.com)



### NB-IoT WIRELESS SENSOR NODE

The Advantech WISE-4471 wireless sensor node utilises Narrowband IoT (NB-IoT), an international standard defined by the 3rd Generation Partnership Project (3GPP). This wireless communication technology offers lower power consumption in wide-area networks as well as improved remote transmission. With NB-IoT, the WISE-4471 series can expand the data transmission range for wider coverage and stable reception in any environment.

The WISE-4471 wireless sensor node supports the MQTT, CoAP, LWM2M and RESTful open communication protocols. Users can transmit

data to specific public cloud services or existing private cloud platforms. Following the approach of Cat NB1 and Cat M1, the WISE-4471 provides secure, encrypted data transmission. The series supports iSensing MQTT, allowing use of either a public or private broker for publishing data on a cloud platform.

WISE-4471 series nodes are suitable for data collection from widely distributed stations. Using a SIM card for NB-IoT/eMTC configuration, no complicated programming, set-up or registration is required. This allows for rapid IoT application deployment across water and electricity meters, smart cities and remote management facilities.

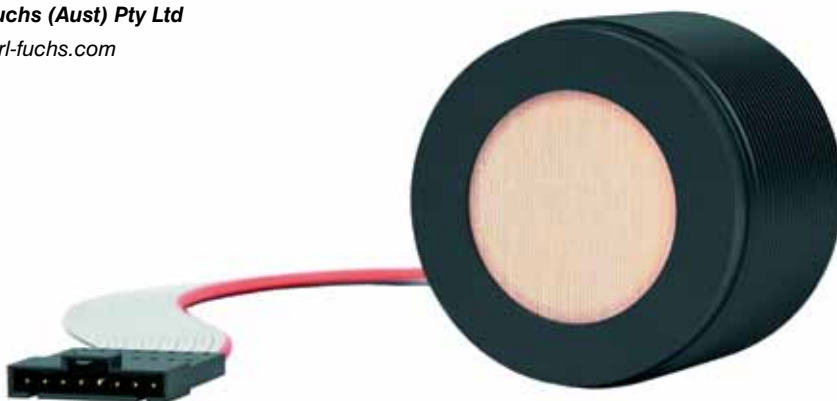
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### ULTRASONIC SENSORS

The Pepperl+Fuchs UCC\*-50GK ultrasonic sensor series is designed to offer maximum flexibility and efficiency to users. Two sensor versions cover most application needs due to their easy configurability. A familiar range of embedded outputs allows for easy controller integration via UART, LIN bus and PWM that eliminates the need for a PLC.

The transducers enable distance measurement in ranges up to 4 m, while adjustable beam widths facilitate precise sensing even in tight spaces, simplifying integration. The sensors are also optimised for solar- and battery-supplied systems, offering a low-power mode and the possibility to be set to standby. Equipped with a power-save mode and optimised for battery operation, the UCC\*-50GK ultrasonic sensor is ready-made for wireless communication where longer operation times are essential.

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### SIMULATION AND DESIGN SOFTWARE UPDATE

MathWorks has introduced Release 2019a of MATLAB and Simulink. The release contains additional products and important enhancements for artificial intelligence (AI), signal processing and static analysis, along with updated capabilities and bug fixes across all product families.

One of the key challenges in moving AI from hype to production is that organisations are hiring AI 'experts' and trying to teach them engineering domain expertise. With R2019a, MathWorks enables engineers to quickly and effectively extend their AI skills, whether it's to develop controllers and decision-making systems using reinforcement learning, training deep learning models on NVIDIA DGX and cloud platforms, or applying deep learning to 3D data.

R2019a introduces Reinforcement Learning Toolbox, further enhancing the MATLAB workflow for AI. The toolbox facilitates a type of machine learning that trains an 'agent' through repeated trial-and-error interactions with an environment to solve controls and decision-making problems. The toolbox reiterates the company's commitment to AI, building on last spring's R2018b introduction of Deep Learning Toolbox, which was enhanced with support for NVIDIA GPU Cloud, Amazon Web Services, and Microsoft Azure, and interoperability through support of the ONNX exchange format. Further support for AI in R2019a includes significant enhancements to Computer Vision Toolbox, Data Acquisition Toolbox and Image Acquisition Toolbox.

R2019a also features several updated signal processing and communications products to support wireless and electronics development, as well as advances in the company's Polyspace static analysis family, including products that support enterprise-scale use for the design and development of safety- and business-critical software.

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# SIX ARTIFICIAL INTELLIGENCE TRENDS FOR ENGINEERS AND SCIENTISTS

Stephane Marouani, Country Manager, MathWorks ANZ

**For those involved in researching, developing and launching AI applications there is still much learning and adapting to new concepts and skills to be done.**

**A**s AI, deep learning, data analytics, IoT and other concepts intersect, applications that once seemed futuristic come closer to reality. However, those tasked with researching, developing and launching these applications are still learning and adapting to new concepts and skills for their evolving job roles.

With AI becoming more prevalent across industries, there is a growing need to make it broadly available, accessible and applicable to engineers and scientists with varying specialisations. The complexity of larger datasets, cloud computing, embedded applications, and bigger development teams will drive solution providers towards interoperability, greater collaboration, reduced reliance on IT departments, and higher productivity workflows.

## 1. AI is not just for data scientists

*Engineers and scientists, not just data scientists, will drive the experimentation and adoption of deep learning.*

Technical curiosity, business imperatives to reap the promise of AI, and automation tools will empower more engineers and scientists to adopt AI. New workflow tools are simplifying and automating data synthesis, labelling, tuning, and deployment, thus making AI accessible beyond data scientists. These tools are also broadening the breadth of applications from image and computer vision to time-series data like audio, signal, and IoT that are common in numerous engineering domains. Example applications range from unmanned aerial vehicles (UAV) using AI for object detection in satellite imagery, to improved pathology diagnosis for early disease detection during cancer screenings.

## 2. Application and domain specialisation

*Industrial applications are becoming a major consumer of AI but bring new demands for specialisation.*

Smart cities, predictive maintenance, Industry 4.0, and other IoT and AI-led applications demand a set of criteria be met to become reality. For example, safety-critical applications that need increased reliability and verifiability; low-power, mass-produced and moving systems that require small form factors; and advanced mechatronics design approaches that integrate mechanical, electrical and other components.

## 3. Interoperability

*Interoperability will be critical to assembling a complete AI solution.*

The reality is, there isn't a single framework that can provide 'best-in-class' for everything in AI. Currently, each deep learning framework tends to focus on a few applications and production platforms, while effective solutions require assembling pieces from several different workflows. This creates friction and reduces

productivity. Organisations like ONNX.ai are focusing on addressing these interoperability challenges, which will enable developers to freely choose the best tool, more easily share their models, and deploy their solutions to a wider set of production platforms.

## 4. Cloud computing

*Public clouds will increasingly be the host platform for AI, will evolve to reduce complexity, and will have reduced reliance on IT departments.*

Powerful GPU instances, flexible storage options, and production-grade container technology are just a few of the reasons that AI applications are increasingly cloud-based. For engineers and scientists, cloud-based development eases collaboration and enables on-demand use of computing resources rather than buying expensive hardware with limited lifespan.

## 5. Edge computing

*Edge computing will enable AI applications in scenarios where processing must be local.*

Advances in sensors and low-power computing architectures will enable edge computing with high-performance, real-time, and increasingly complex AI solutions. Edge computing will be critical to safety in autonomous vehicles that need to understand their local environment and assess driving options in real-time. This has promise to yield huge cost savings for remote locations with limited or expensive Internet connectivity, like deep sea oil platforms.

## 6. Complexity necessitates greater collaboration

*The increased use of machine learning and deep learning in complex systems will necessitate more and greater collaboration.*

Data collection, synthesis and labelling are increasing the scope and complexity of deep learning projects, requiring larger and decentralised teams. Systems and embedded engineers will require flexibility to deploy inference models to data centres, cloud platforms, and embedded architectures such as FPGAs, ASICs, and microcontrollers. These teams will also need expertise in optimisation, power management and component reuse. Engineers at the centre of collaboration, developing deep learning models, will need tools to experiment with and manage the ever-growing volumes of training data and the lifecycle management of the inference models they handoff to system engineers.

To hear about how engineers are taking advantage of AI, *register for MATLAB EXPO*, touring Australia and New Zealand in May: <https://www.mathlabexpo.com/au/2019.html>.

MathWorks

[www.mathworks.com](http://www.mathworks.com)





### VALVE ACTUATOR CONTROL

Rotork has launched the latest generation of its monitoring and control system for valve actuators and plant equipment. Suitable for use in all industries, the Rotork Master Station is capable of operating up to 240 actuators across three separate field networks, allowing the optimum network to be used in different plant areas. It now supports Modbus RTU protocol with third-party device integration and Pakscan Classic, Rotork's standard 2-wire loop system.

The Rotork Master Station has many features to enable the management of the assets connected to it — whether the interest is in condition-based monitoring or predictive maintenance. A large touch-screen interface and webpages share the same menu structure focused on providing quick device set-up, interrogation and issue resolution. Multiple host connectivity is included and the presence of multiple databases enables the Master Station to maximise data transfer efficiency.

The Master Station can be supplied with built-in redundancy support via a hot standby configuration, allowing a replica unit to assume network control in the event of an error in the primary unit.

Installation is simple through the use of a single twisted-pair cable instead of multicore cabling. The wired control loops can operate on long loop lengths up to 20 km without external repeaters, further reducing labour, installation and commissioning costs. The product is available with either 19" rack or panel mounting options and all wiring is easily accessible from the front panels.

**Rotork Australia**  
[www.rotork.com](http://www.rotork.com)

### BENCHTOP LEARNING CENTRE

Opto 22 has announced availability of the groov EPIC Learning Center, a hardware and software benchtop system for learning and development. This fully operational package lets engineers, technicians and developers initialise, configure and program the control, visualisation and communication aspects of their groov EPIC systems. The Learning Center is a companion for Opto 22's free online self-guided groov EPIC learning modules, and it includes two seats for premium on-site training at company headquarters in Temecula, California.

Hardware in the Learning Center includes a groov EPIC processor, power supply, four-position chassis, DC input and output modules, a temperature input module and an analog input module. Hardware is assembled on a desktop operator load panel accessorised with two illuminated push-buttons, a potentiometer, a temperature probe, a Sonalert alarm and a red/blue/green LED indicator. All of this is delivered in a robust Pelican case with a screwdriver for releasing and tightening terminal connectors.

The groov EPIC processor is supplied pre-loaded with software packages enabling a wide range of functionality: groov Manage, to configure, commission and troubleshoot the processor; PAC Control



Engine, a real-time control engine to run flowchart-based control programs; CODESYS Runtime Engine, a real-time control engine to run IEC-61131-3 compatible control programs; and groov View, to build and view mobile and browser-based operator interfaces.

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- Multifunctional process calibrator for pressure, temperature and electrical signals



### UHF RFID READERS

Turck has released its Q300 UHF RFID reader family with an Ethernet interface. Up to four external antennas can be connected directly on the reader, thus simplifying the creation of high-performance gate applications in multiplex operation. The direct connection of triggers and signals via universal I/Os also simplifies the installation. With an output power of up to 2 W the readers can achieve very large read/write ranges. Their selectable antenna polarisation enables read holes to be excluded in any environment, even with a high output.

The integrated Ethernet interface enables all Q300 readers to not only be connected directly to industrial controllers, ERP or other systems, but also to receive a power supply via PoE. Additional interfaces or industrial PCs in the field are not required with the Q300 series. As IP67 readers they support the complete separation of the production level from the corporate IT.

Turck's first variant to be launched is a Codesys variant. The integrated U interface of the Q300-CDS provides the data directly to a controller. The Codesys reader is a multiprotocol device and can thus be integrated directly in all networks with Profinet, EtherNet/IP or a Modbus TCP master.

**Turck Australia Pty Ltd**  
[www.turck.com.au](http://www.turck.com.au)

### SINGLE-USE pH AND DO SENSORS FOR PHARMA

The anticipated rapid shift in the life sciences arena from traditional stainless steel bioreactors to disposable gamma-irradiated plastic bags used for single-batch processing has been delayed by the problem of finding reliable, efficient sensors required for vital liquid analysis.

Emerson has developed single-use sensor technology that it claims provides up to 10 times greater sensor stability, reducing risk in process quality and yield for biopharmaceutical manufacturers. The Rosemount 550pH single-use sensor and the Rosemount 550DW dissolved oxygen single-use sensor adapter are designed to deliver the same stability and performance as Emerson's stainless steel sensors.

The Rosemount 550pH sensor is an electrochemical, fully disposable device with sensor stability of less than 0.005 pH change per day verified by extensive testing. It is stored wet and is packaged with its own calibration fluid, giving it a two-year shelf life.

The Rosemount 550DW dissolved oxygen (DO) sensor adapter is compatible with standard stainless steel DO sensors and enables placement into the bioreactor single-use bag. Only the gamma-irradiated adapter touches the process solution, meaning the sensor can be re-used for multiple batches. The sensor can be air-calibrated prior to start-up to verify functionality with no fill product needed in the bioreactor.

Both the Rosemount 550pH sensor and the Rosemount 550DW dissolved oxygen sensor adapter operate with the Rosemount 56 liquid analytical transmitter. In addition, the new sensor technologies and the Rosemount 56 transmitter are fully compatible with the Emerson DeltaV control system, which is widely used in the life sciences industry.

**Emerson Automation Solutions**  
[www.emerson.com/au/automation](http://www.emerson.com/au/automation)



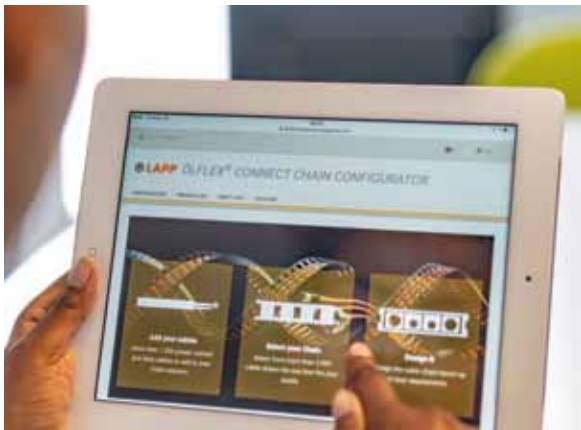
## ENERGY SAVING AIR COMPRESSORS

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**POWER CHAIN CONFIGURATOR**

The ÖLFLEX Connect Chain configurator can be used to digitally engineer a power chain online with a few clicks of the mouse. It is designed to remove the complication from configuring power chains and to make it easy, even for less experienced users. The ÖLFLEX Connect Chain configurator automatically switches off all error sources and finds the best solution.

The online configurator acts as a step-by-step guide through the choice of cable chain, cables and relevant accessories. It makes sure that components are compatible every step of the way, especially when it comes to the cables' minimum bend radius. The cable chain must not have a smaller bend radius than the cable. If this is the case, the configurator will display a warning message and suggest other types of cable chain. Other criteria include the travel length, acceleration, temperature behaviour and shielding. The configurator automatically excludes cables that are not suitable for the application.

When the configuration is complete, users receive a personalised quotation and are then able to choose whether they want to purchase the power chain fully assembled by LAPP or as individual components, with the option of having the cables pre-cut to the appropriate lengths.

**LAPP Australia Pty Ltd**  
lappaustralia.com.au

**IS PRESSURE CALIBRATOR**

The intrinsically safe HPC50 pressure calibrator from Crystal Engineering is the successor to the IS30 series. It offers time-saving features like scaling, % error and flow calculations, as well as integrating both internal and external pressure modules into a single handheld unit. The updated 'advanced simplicity' interface also makes the instrument easy to use without sacrificing features. In addition, intelligent memory slots allow storage of up to five screens, simplifying recall of previously stored settings and user set-ups.

The calibrator offers deadweight tester accuracy along with a range of user-friendly features that allow it to deliver laboratory accuracy in an on-site, field-usable instrument. The HPC50 is suitable for calibrating pressure ranging from vacuum to 15,000 psi (1000 bar) with accuracy up to 0.035% of reading. Units are available in single and dual pressure models, and each can also be equipped with one or two intrinsically safe external pressure or temperature modules for increased flexibility. The APMi pressure modules provide the flexibility to read up to four pressure inputs with a single device, allowing users to either expand the range of their HPC50, view all four pressures simultaneously or to read two separate differential pressures. Alternatively, two ATMi intrinsically safe temperature modules allow both static and ambient temperatures to be read at the same time.

All parameters on the HPC50 series are fully temperature compensated from -20 to 50°C, enabling it to deliver the same accuracy whether measuring pressure, current, voltage or temperature.

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## SERVO CABLES WITH SEPARATE CONTROL PAIR SHIELD

igus has announced a separate control pair shield for the chainflex servo cables of the CF 21, 27 and 29 series. This ensures maximum electromagnetic compatibility of the control pair and a faster shielding of the cable. This enables the user to save up to 30% of the processing time for the pair shield and thus also installation costs.

If a converter and drive need to be connected, servo cables are used. For their assembly, the user must first strip the cable. The CFRIP thread helps to do this – the tear-proof ripcord in the cable jacket makes the pulling easy, like a zipper, providing up to 50% faster cable stripping. The covered shielding increases the electromagnetic compatibility of the control pair and simplifies the connection of the pair shield. This allows users to save up to 30% on the installation of the pair shields and therefore reduce costs.



The UL-approved igus servo cables of the CF21 series are available with a highly flexible, oil-resistant PVC jacket for high stressing capacity and the smallest bend radii in the energy chain of down to 7.5 diameters. The CF27 cable series with an oil-resistant PUR outer jacket is flame retardant and has EAC and CTP certification, while the CF29 cable with a TPE outer jacket is suitable for applications with a bend radius of down to 6.8 diameters, even at extreme temperatures of -35 to +100°C.

**Treotham Automation Pty Ltd**  
[www.treotham.com.au](http://www.treotham.com.au)

## MASS FLOW METER FOR DOSING CONTROL

In industrial applications, especially in the chemical, process and oil and gas industry, corrosion can be a real challenge. These types of industries are coping with demanding environmental and process conditions in production and operation. Prevention or control of corrosion by inhibiting often proves to be an economic solution.

A corrosion inhibitor system will add small concentrations of chemicals into the process. The effectiveness of an inhibitor system greatly depends on the correct injection amount and can be influenced by the environmental and process conditions, so accuracy is crucial.

Using a low-flow control system containing a Bronkhorst CORI-FLOW mass flow meter can help to manage the dosage of corrosion inhibitors more accurately. High accuracy and high turndown ratio are achieved based on pure mass flow measurement with this flow meter. It can directly control valves and pumps by onboard PID control and can be further optimised with PLC and HMI control extending both performance and flexibility.

Bronkhorst's Coriolis dosing system approach enables real-time monitoring, control and logging of injection rates. This allows online checking of flow rates and instantaneous resetting of the required flow rate. Asset management and preventive maintenance are supported with several active diagnostics.

**AMS Instrumentation & Calibration Pty Ltd**  
[www.ams-ic.com.au](http://www.ams-ic.com.au)



## CELLULAR ROUTER

The Digi WR11 XT is a rugged, compact, low-cost 4G/LTE (with 3G fallback) cellular router designed for applications that don't need high bandwidth such as PLCs, SCADA, telemetry, kiosks, ATMs and outdoor signage. It is suitable for use as an entry-level communications gateway for M2M and Industrial IoT applications.

Internally, the Cellular Engine Module used in the WR11 supports all ANZ 3G and 4G frequencies and is Telstra approved. It is capable of an uplink bandwidth of up to 5 Mbps and download speeds of up to 10 Mbps, and supports dual SIM cards. All Digi Routers including the WR11 connect with Digi's web-hosted Remote Device Manager, providing users a high-level view of all their connected devices. Digi's web portal provides easy set-up, configuration and maintenance, which is helpful for keeping track of device location, firmware revisions and configuration storage.

The WR11 features a full metal enclosure with a DIN rail mount option, a wide operating temperature range, and a wide range of antenna and power supply accessories. The router itself supports stateful packet inspection and offers support for VPN, VRRP+ (Virtual Router Redundancy Protocol), SSL and SNMP.

**ETM Pacific Pty Ltd**  
[www.etmpacific.com](http://www.etmpacific.com)



### CLAMP METER

The Fluke 376 true RMS AC/DC clamp meter with iFlex offers improved solutions for a wide range of current measurement situations. It can read up to 1000 V and 1000 A in both AC and DC modes with its true RMS AC voltage and current measurements. It is available to rent from TechRentals.

The iFlex flexible current probe included with the device expands the measurement range to 2500 A AC while providing increased display flexibility for various sized conductors. With both the jaw and iFlex, the Fluke 376 has frequency measurement capability to 500 Hz.

Other features include an integrated low pass filter and signal processing that allows usage in noisy electrical environments while providing stable readings. It also has CAT IV 600 V and CAT III 1000 V safety ratings.

**TechRentals**

[www.techrentals.com.au](http://www.techrentals.com.au)



### PRESSURE REGULATORS WITH LOW-TEMP SEALS

Swagelok has released a low-temperature seal option. The seal, a product expansion for the company's RHPS Series pressure regulators line, is designed to maintain a strong seal in cold climates and applications where significant cooling occurs due to high pressure drop. Comprising low-temperature-resistant nitrile material, these regulator components are suitable for use even in environments with extensive presence of hydrocarbons, such as at large industrial gas suppliers' facilities where climate control may not be an option.


The low-temperature, nitrile-based seal, diaphragm/piston O-ring and seat seal options will be available immediately on all regulator configurations in the RHPS Series pressure regulators product line. These options have a minimum temperature rating of -45°C for configurations rated up to 1015 psig (70.0 bar), -40°C for configurations rated up to 5800 psig (400 bar) and -20°C for configurations rated above 5800 psig (400 bar).

**Swagelok Corporation**

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# REQUIREMENTS FOR IEC 61511 BEST PRACTICE COMPLIANCE

*Sven Grone, Schneider Electric Safety Services Practice Leader\**

Proof testing and a SIL study may no longer be enough during the operate and maintain phase.

**T**he vast majority of companies operating process plants overtly identify safety as a top priority. It would, in fact, be highly unusual if the company for which you work did not identify safety as its number 1 goal.

Operators of these process plants need to assess safety continuously as a routine part of their daily operations. And when they are dealing with functional safety under the IEC 61511 standard, it also means sustaining safety lifecycle requirements for the entire lifetime of the plant. In fact, ensuring that your safety systems are delivering as-designed safety integrity for a plant's operational lifetime is a mandate for anyone that operates, maintains or designs safety systems — as well as for plant managers, risk managers and overall corporate safety leadership.

First promulgated in 2003, international standard IEC 61511 has long been the global process sector's standard for good engineering practice in safety instrumented systems (SIS). After 13 years of evolution and application experience, a second edition was released in 2016.

The 2016 edition<sup>1</sup> contains significant differences across the lifecycle. Many items that were previously designated as "informative" — things you should do — were changed to "normative" — things you must do to remain compliant. Just designing and implementing a safety system in accordance with the standard, and keeping up

regular proof tests on SIS devices, were now no longer sufficient to comply with IEC 61511 and best practice.

One constant in the plant is that things will change. The process may change, the feedstock may change, the way you control and operate may change — and the people you have running the plant will almost certainly change. So the key questions that must be asked are:

1. Will any of those lifetime plant changes affect my safety systems?
2. Are the systems I have in place still providing the protection I need?
3. How would I know if they were or not?

Clauses 16 and 17 of IEC 61511, on the 'operate and maintain' phase of the safety lifecycle, help address these questions. These clauses in the original release provided good guidance as to intent, but did not specify requirements for achieving that intent. As a result, many companies considered regular proof testing of SIS devices sufficient to ensure the safety integrity of their systems — and for some, even doing that testing diligently was a challenge.

Real-world events have shown the folly of relying solely on proof testing. As we know from the 'analyse and assess' phases of the safety lifecycle, the proof test interval is only one of many elements that contribute to the allocation of a safety integrity level (SIL) for a safety function. Many of these design inputs were



based on generic data available at the time, or assumed based on experience. But how do we know if those assumptions are correct today? More importantly, how do we know if they will still be correct 10 years from now?

### Could this happen in your plant?

Let's take the real-world example of a process heater in a small refinery. When the initial SIL design work was done, the low fuel gas feed scenario in the hazard and operability study (HAZOP) led to a requirement for a safety instrumented function (SIF) on the fuel gas pressure for the process heater. At the time, the process hazard analysis (PHA) team decided that this SIF would encounter a demand every 30 years or so, based on past experience and the planned scheduled maintenance of the gas regulator. The resulting SIL target was calculated as SIL 1 (see Figure 1). As a result, a SIL 1 loop was designed and implemented in the field.

During the course of a safety audit, however, a review of maintenance records showed that the fuel gas strainer/filter had been replaced five times. Asked why this was the case, the maintenance supervisor advised that budget cuts had extended the scheduled maintenance period on the strainer/filter from once a quarter to once a year. Poor gas quality meant the filters were clogging more frequently and tripping out the process heater. In fact, over

the previous five years, operators had recorded five heater trips associated with low fuel gas trips.

The safety system design had not changed from the day it was installed — and all SIS devices connected to the system were regularly proof-tested.

Figure 2 shows the same SIL design scenario as Figure 1, except that the demand rate has been replaced with the real-world demand rate of one demand every year (1.0E-01); all other factors are the same. The calculated SIL requirement is now SIL 3. This is two orders of magnitude more risk reduction than the current safety set-up is supplying. The formidable commercial impact on "plant at risk" in this example is in excess of \$50 million!

This example highlights the potential effect of relying solely on regular proof testing to ensure safety system integrity. As shown, one change in the operation and maintenance of a non-SIS-related piece of equipment had significant impact on the safety integrity of the system. If the safety auditor hadn't made the effort to rerun the safety calculation with the revised demand rate, the risk gap would have remained undiscovered.

This type of covert flow-on effect regarding safety is not uncommon, especially as the plant moves into five to 10 years of operation. This is usually the time frame in which personnel involved in the safety design have been reassigned or changed jobs, and the history of decision-making during the safety design phase has begun to dissipate.

Could something like this happen in your plant? If it did, how would you know? If you wanted to check, where would you find the right information to start?

### The objectives of safety instrumented functions

Safety instrumented functions (SIFs) can be considered as automated safety loops being executed by the safety instrumented system (SIS) to:

- respond to a specific, defined hazard
- implement a specific action
- put the equipment under control into (or maintain) a safe state
- provide a specified degree of risk reduction.

A SIF requires operators to maintain this specific level of risk reduction for the entire plant lifetime. So it needs to be monitored and managed in accordance with the safety lifecycle — as defined in Clause 16 of the IEC 61511 standard.

#### 16.1 Objectives

*The objectives of the requirements of Clause 16 are to ensure that:*

- *the required SIL of each SIF is maintained during operation and maintenance;*
- *the SIS is operated and maintained in a way that sustains the required safety integrity.*

### Edition 2 requirements

In Edition 2, Clause 16 now features specific requirements for how these objectives are to be achieved, and specifically states activities

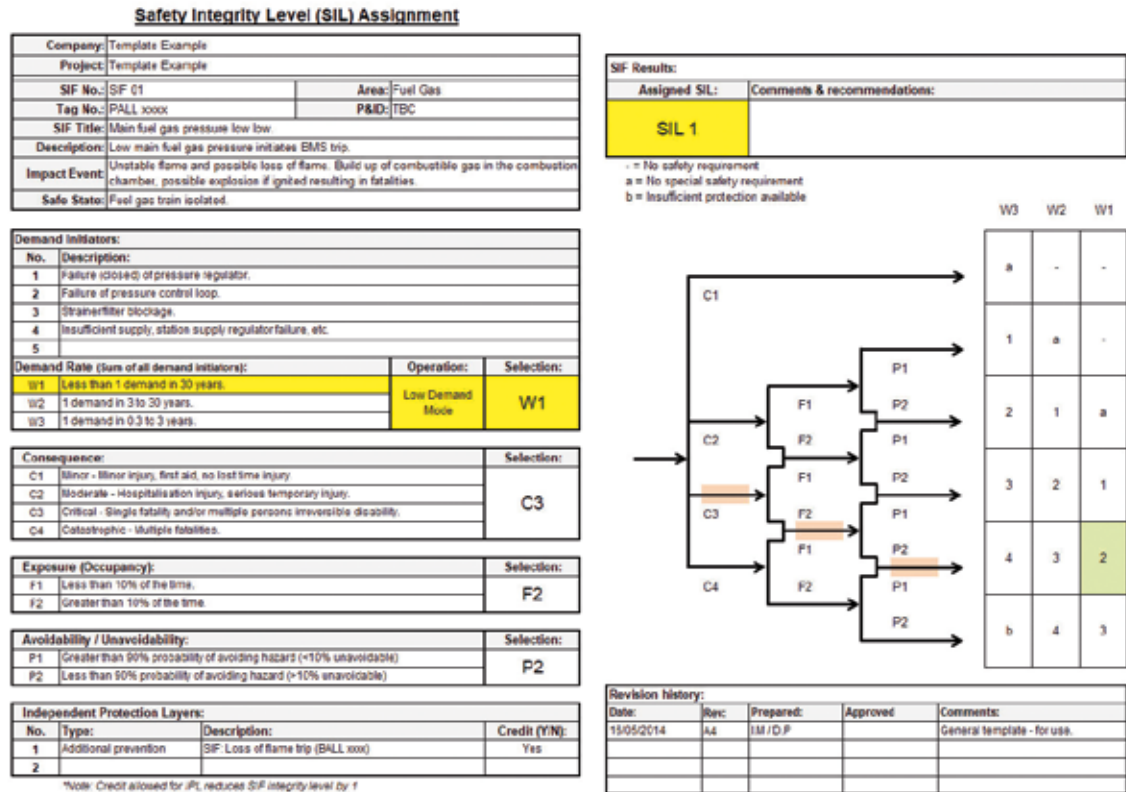


Figure 1: SIL target requirement calculated as SIL 1 based on scheduled maintenance.

that must be undertaken to comply. These can be summarised into several basic categories:

### Planning

16.2.1 Operation and maintenance planning for the SIS shall be carried out. It shall provide the following:

- routine and abnormal operation activities;
- inspection, proof testing, preventive and breakdown maintenance activities;
- the procedures, measures and techniques to be used for operation and maintenance;
- the operational response to faults and failures identified by diagnostics, inspections or proof-tests;
- verification of conformity to operations and maintenance procedures;
- when these activities shall take place;
- the persons, departments and organizations responsible for these activities;
- a SIS maintenance plan.

A specific SIS maintenance plan must treat the SIS as a whole and include all elements, "from pipe to pipe". It's no longer acceptable simply to follow the manufacturer's maintenance procedure for individual SIS elements and claim compliance. The plan must be designed to maintain the system to meet the objectives stated in Clause 16.1.

### Procedures

16.2.2 Operation and maintenance procedures shall be developed in accordance with the relevant safety planning and shall provide:

1. the information which needs to be maintained on SIS failure and the demand rates on the SIS;
2. procedures for collecting data related to the demand rate and SIS reliability parameters;
3. the information which needs to be maintained showing results of audits and tests on the SIS;

4. the maintenance procedures to be followed when faults or failures occur in the SIS, including:

- procedures for fault diagnostics and repair;
- procedures for revalidation;
- maintenance reporting requirements;
- procedures for tracking maintenance performance.

The SIS maintenance plan must be populated with specific procedures, and these procedures now have specific activities outcomes defined — some of which require you to regularly and systematically collect SIS performance data that you may not have previously been collecting or recording.

### Training and competency

16.2.6 Operators shall be trained on the function and operation of the SIS in their area.

16.2.8 Maintenance personnel shall be trained as required to sustain full functional performance of the SIS (hardware and software) to meet the target SIL of each SIF.

Operations and maintenance personnel must receive specific training on the installed safety systems and how to sustain them over the plant lifetime. Apart from the initial training effort required, compliance with these clauses will demand establishment of a training competency program, competency matrix and regular review of the competency of various positions in case of personnel change within those roles.

### SIS specific monitoring, analysis and validation

16.2.9 Discrepancies between expected behaviour and actual behaviour of the SIS shall be analysed and, where necessary, modifications made such that the required safety is maintained. This shall include monitoring the following:

- the demand rate on each SIF (see 5.2.5.3);
- the actions taken following a demand on the system;
- the failures and failure modes of equipment forming part of the SIS, including those identified during normal operation, inspection, testing or demand on a SIF;

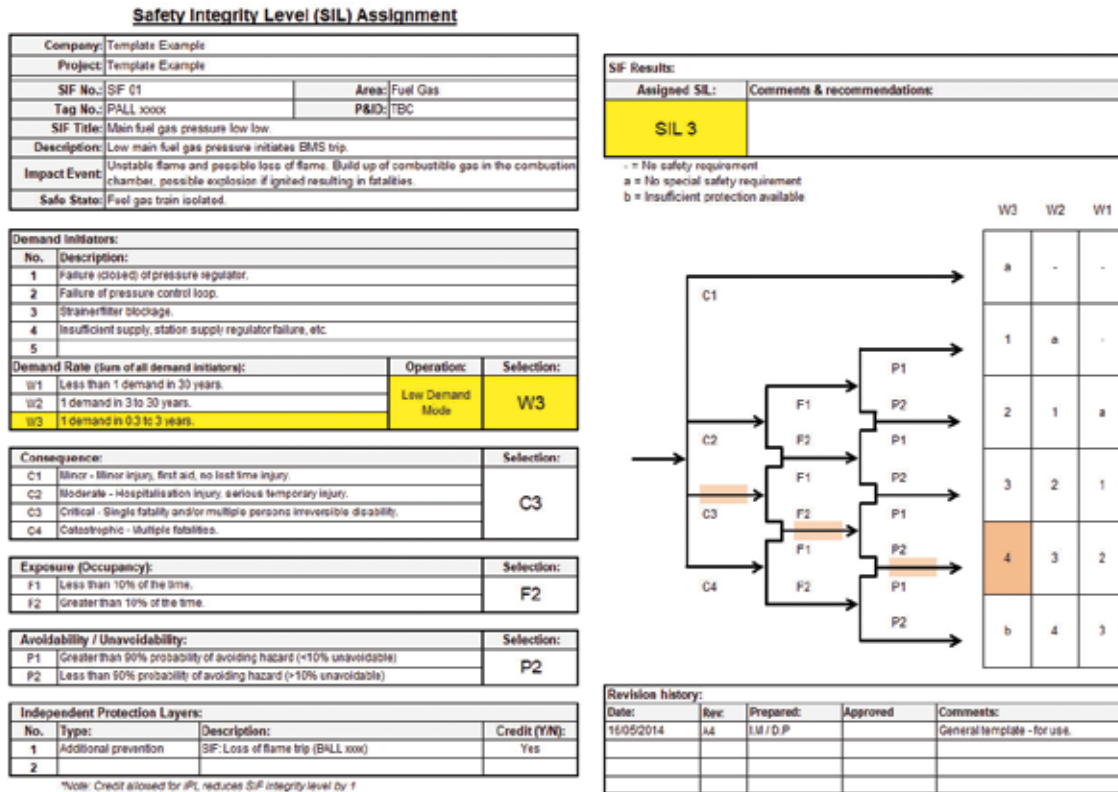


Figure 2: Real SIL target requirement with real-world demand taken into account.

- the cause of the demands;
- the cause and frequency of spurious trips;
- the failure of equipment forming part of any compensating measures.

The requirement for collecting, analysing, reporting and recording SIS performance data is clearly stated. This work often involves a significant effort in labour and administration of information, which may place a strain on organisations with limited resources. It can also lead to uncertainty within the company as to whose job it is to perform some or all of these tasks. This needs to be clearly defined in the SIS maintenance plan.

### Conclusion

The evolution of the IEC 61511 standard has led to changes in requirements for the longest phase of the safety lifecycle – the ‘operate and maintain’ phase. These changes have evolved specifically to help users properly plan and execute the required practices and procedures. The aim is to ensure that their safety instrumented systems continue to provide the same level of risk reduction as they did on the day they were installed – and that they not suffer any degradation in operational safety integrity caused by changes in plant operation not considered in the original design.

The changes also seek to provide clear direction concerning the human element involved in operating and maintaining these systems. The standard now requires you to have a documented and specific SIS maintenance plan – with specific procedures in place to record the real-world performance of your SIS, and then to verify and validate that performance against your original SIS design. It also requires that the operators of these systems be properly trained and aware of the hazards these systems are protecting against, and that maintenance personnel receive sufficient training to know how to maintain full functional performance of the system to meet the target SIL (over the lifetime of the plant).

While these practices were recommendations in the original edition of IEC 61511, in Edition 2 they became requirements, which demands additional consideration and attention when planning a project. They also impact existing facilities where the company wishes to achieve full compliance with the standard, yet does not have systems or procedures in place to meet the new requirements.

Because the ‘operate and maintain’ phase of the lifecycle will usually span several decades, the focus and rigour applied to maintaining compliance is not a ‘once off’ or ‘transactional’ activity. If not planned for at the concept stage, meeting these requirements may incur significant operational cost and labour. It is therefore prudent to implement SIS maintenance planning as early as possible in the project cycle, and to consider ‘designing in’ procedures or automated systems to ensure that SIS performance data is captured and that regular validation against design criteria is performed – and documented.

In short, compliance with IEC 61511 means operators of process facilities need to “recognize that doing a SIL study and keeping up ‘proof testing’ [alone] is no longer sufficient to comply with best practice”.

### Reference

International Electrotechnical Commission 2016, *Functional safety – Safety instrumented systems for the process industry sector - Part 2: Guidelines for the application of IEC 61511-1:2016*.

*\*Sven Grone is a functional safety professional with over 26 years’ experience in industrial automation and controls. He is a TÜV Certified Functional Safety Engineer possessing more than 10 years’ experience with the functional safety lifecycle and implementation of safety-related applications such as emergency shutdown systems, burner management systems, high-integrity pressure protection and rotating machinery safety controls.*

**Schneider Electric**  
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### CORROSION-PROOF WARNING SIGNALS AND BEACONS

The explosion-proof and flameproof STEx range from E2S Warning Signals encompasses audible, visual and combined warning devices and manual call points, all employing 316L stainless steel enclosures. Designed for installation in harsh onshore and offshore environments where corrosion is a particular problem, the units are IECEx and ATEX approved for Zones 1 and 21 for use in hazardous areas containing both gas and dust. Extended

certification and operational temperature ranges enable the range to be employed in arduous applications. Members of the STEx family are also DNV approved for on-deck marine use.

The STExS alarm horn sounders, with a choice of traditional flared or omnidirectional horns, are available with 64 alarm tone frequency patterns and outputs up to 123 dB(A). The STExB beacon light source is available in either a 10, 15 or ultrabright 21 Joule Xenon strobe, halogen rotating or an array of high-output LEDs. STExC combination signals contain both Xenon strobe and audible signals in one compact enclosure. The field-replaceable colour lens filters feature a prismatic design for enhanced light output generating high candela values.

The STExCP8 call points, approved for deployment in SIL 2 complaint systems, are available with the E2S termination unit enabling EOL and series devices to be added in the field without disturbing field wiring. The call point range is available in four operating mechanisms: traditional break glass with plastic-coated safety glass, push-button, push-button with tool reset and momentary action push-button.

**Mechtric Pty Ltd**

[www.mechtric.com.au](http://www.mechtric.com.au)



### DUST-TIGHT DRUM TIPPER

Flexicon has introduced the TIP-TITE drum tipper that is designed for use with poorly flowing or agglomerated materials, allowing rapid transfer of free-flowing and non-free-flowing bulk solid materials dust-free. Similar in performance to open-chute tippers but with total dust containment, the outlet on the downstream end of the tipper is nearly equal in area to that of the drum opening, allowing agglomerated materials and large chunks to be discharged with minimal possibility of material bridging.

Drums from 114 to 208 L are positioned on the tipper platform, which is raised by a hydraulic cylinder, seating the rim against the circular end of the discharge transition. A second hydraulic cylinder tips the platform-hood assembly and drum, stopping at dump angles of 45, 60 or 90° with a motion-dampening feature. At full rotation, the transition outlet mates with the gasketed square inlet on the lid of a hopper or downstream process equipment, allowing a pneumatically actuated slide gate valve to be opened and closed for total or partial discharge with no dusting.

The stainless steel transition can be supplied with a square or rectangular outlet, as well as with circular outlets, with corresponding gasketed flanges for installation on downstream hoppers and receiving vessels.

Non-product-contact materials of construction can be specified in carbon steel with durable industrial finishes, or stainless steel finished to industrial or sanitary standards. Other models are available for dumping of boxes, bins, pails and other containers.

**Flexicon Corporation (Aust) Pty Ltd**

[www.flexicon.com.au](http://www.flexicon.com.au)



### DC-UPS SYSTEMS

The DC-UPS power supply systems from Technology Dynamics are designed to provide clean, uninterrupted power to critical DC loads in the event of AC (utility) power loss. They provide backup power for a certain duration of time, depending on the load of the battery capacity, and are available in several power levels and configurations, which are uniquely designed for exact applications.

The CP-RK-BBU Series DC-UPS is designed for harsh environments such as military and industrial applications, while the TCP-RK-BBU Series is a full-function DC-UPS battery backup system complete with internal sealed lead acid batteries. The rackmount system is rugged, efficient and suitable for critical systems where downtime cannot be tolerated. The TCP-RK-BBU Series of DC-UPS contains a primary power supply, batteries and LVBD circuit.

Available in 12, 24 and 48 VDC outputs with power levels to 3 kW, standard run times include 10, 20 and 30 min on battery, depending on load requirements. Extended run times are available with additional battery racks. Options include extended temperature operation, power factor correction, conformal coating, 400 Hz operation, chassis slides, analog or digital meters and MS connectors.

**Metromatics Pty Ltd**

[www.metromatics.com.au](http://www.metromatics.com.au)

## SAFETY PRODUCTS

### SAFETY LASER SCANNER



With the microScan3 Pro, SICK is expanding the product family of the microScan3 safety laser scanners, which are suited for safety and navigation in mobile applications as well as the intelligent protection of complex stationary applications.

The safeHDDM scanning technology increases the reliability of the microScan3. It functions well in dust and ambient light. It increases the productivity and availability of machines. Smart connectivity facilitates safe integration into networks and cuts cabling costs. Using Safety Designer software, the microScan3 can be intuitively configured and commissioned. The operational status can be called up and read on the display or via the network.

**SICK Pty Ltd**  
[www.sick.com.au](http://www.sick.com.au)

### HAZARDOUS LOCATION CABINET COOLER SYSTEMS

Exair's Hazardous Location Cabinet Cooler systems have achieved the UL classified designation for Div1 environments. They have been tested by UL and passed their stringent requirements for use on classified purged and pressurised electrical enclosures within Class I Div 1, Groups A, B, C and D; Class II Div 1, Groups E, F and G – and Class III environments. The cooling capacity of up to 5600 btu/h is suitable for electrical enclosures with problematic overheating. They are CE compliant and available for NEMA 4 and 4X enclosures.

The Exair HazLoc Cabinet Coolers circulate -7°C air inside the enclosure to prevent high-temperature faults. They mount in a standard electrical knockout while keeping the NEMA 4 or 4X rating of the enclosure. Cabinet cooler systems include an auto drain filter separator to ensure no moisture passes to the inside of the electrical enclosure. An optional thermostat control minimises compressed air use and keeps the enclosure at  $\pm 1^\circ\text{C}$  of the setting.

Exair's range of cabinet cooler systems is available for NEMA 12, 4 and 4X enclosures from 275 to 5600 btu/h and UL listed and CE compliant with no moving parts to wear out. Applications include cooling control panels, PLCs, microprocessors, variable frequency drives and robotics.



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## SAFETY PRODUCTS

### SURGE PROTECTION FOR HAZARDOUS AREAS



The Novaris IS range of surge and lightning protection products is designed specifically for hazardous areas. They are certified intrinsically safe according to IEC Ex and ATEX; the group IIC T4 certification makes them acceptable for use with all gas/air mixtures.

Novaris slimline surge protection devices (SPDs) provide surge protection for most twisted pair

signalling schemes. Certified to be intrinsically safe Novaris IS SPDs can be installed in the hazardous zone or the field side of the IS barrier. This not only provides protection for the PLC or RTU I/O, it also provides protection for the IS barrier.

With two different base options the SL protectors offer either direct earthing via DIN rail, for the most effective, low impedance earth connection (-G base), or a connection via GDT to the DIN rail, offering isolation under normal conditions and equipotential bonding during a surge (-EC90 base).

The plug-in design provides simple and rapid replacement and testing with no rewiring needed. This also provides a convenient method of field equipment isolation if required.

**Control Logic Pty Ltd**

[www.controllogic.com.au](http://www.controllogic.com.au)

### SAFETY NETWORK CONTROLLER

Omron has released the latest edition of its NX Series safety network controller, which supports both the CIP Safety and Safety over EtherCAT (FSoE) protocols. It is designed to allow manufacturers the ability to reduce design and maintenance time for efficient global production of various systems.

In conjunction with Omron's NX102 Machine Automation Controller both EtherNet/IP + CIP Safety and EtherCAT + FSoE can be used simultaneously, which makes building safety systems for large production lines using robots from different vendors possible. Various models are available providing up to 254 CIP Safety connections and real-time safety control of up to 12 motors.

Featuring automatic programming and user-defined function blocks reduces safety control programming time. Together with online functional test and offline simulation, safety management can be easily implemented by inexperienced workers leading to maximised productivity.

The unit also features data logging and restore ability to quickly identify the cause of line stoppage and offer easy replacement without use of a software tool.



**Omron Electronics Pty Ltd**

[www.omron.com.au](http://www.omron.com.au)

### MODULAR ACCESS PERMISSION SYSTEM



PITmode fusion is a modular operating mode selection and access permission system. The modular system offers more flexibility for functionally safe operating mode selection and for the control of access permissions to plant and machinery.

PITmode fusion consists of the reader unit, PITreader, with RFID technology and a Safe Evaluation Unit (SEU). Its modular design allows PITmode fusion to be integrated into the design of existing control consoles. PITmode devices are used on plant and machinery in which users switch between a range of control sequences and operating modes.

Authorised users receive the machine access suited to their individual task on a coded RFID transponder key. Up to five safe operating modes can be defined, such as automatic mode, manual intervention under restricted conditions or service mode. The key is inserted into the control console, the SEU detects the specified operating mode and PITreader ensures functionally safe switching. Accidents, misuse and manipulation are prevented, and users benefit from higher availability of their machines.

To increase protection against manipulation, the keys can be coded with company-specific programmed PITreaders: that is, the keys include a password-protected signature. Any keys that do not have company-specific coding will be denied access. In addition, RFID keys and PITreader can be used to implement a group-based permission management. In this case the various enables are transferred to whole groups with the same access permissions instead of individual persons.

PITmode fusion offers functionally safe operating mode selection and access permission up to PL d.

**Pilz Australia Industrial Automation LP**

[www.pilz.com.au](http://www.pilz.com.au)



**TRANSPONDER-CODED DOOR LOCK**

The space available for safety engineering and the time allotted to wiring equipment as diverse as machine tools, packaging machines and food production systems are steadily decreasing. Due to its compact dimensions, the Euchner CTM transponder-coded door locking mechanism is particularly simple to integrate into the machine design. The ball actuator supported on an elastomer bearing can secure doors with extremely small pivoting radii. This type of guard locking offers maximum flexibility to the design engineer.

The bistable guard locking function of the CTM safety switch ensures that guard locking remains in its momentary state if the power fails or the installation is switched off. In other words: a locked door will stay locked if it was locked before, or it can be opened and closed as needed if guard locking was not previously activated. People can therefore no longer be locked in unintentionally if the power should fail.

The CTM's intelligent communication capabilities futureproof it for Industry 4.0. It can simply be connected in series with other Euchner devices, for example. The integrated interface additionally permits connection to the Euchner ESM-CB evaluation unit, which then forwards the data via IO-Link to the higher-level control system.

Euchner has complemented the standard CTM with a hygienic version for use in the food industry. This version consists exclusively of food-safe materials; all plastics are approved according to EU Regulation (EC) No. 10/2011, for example. This version features smooth surfaces, rounded edges and materials resistant to cleaning agents.



**Treotham Automation Pty Ltd**  
[www.treotham.com.au](http://www.treotham.com.au)

**GAS NON-RETURN VALVES**



Gas non-return valves are needed to prevent the dangerous backflow of gases and the formation of unwanted mixtures in plants and pipelines. The Witt NV150 is designed to meet this requirement with a compact 1/2" fitting with minimal pressure loss and high flow capacity.

This device is about the size of a matchbox, at 60 mm long and with a diameter of 35 mm, and meets all the requirements of DIN EN ISO 5175-2 and protects systems featuring town gas, natural gas, acetylene, hydrogen, oxygen and non-flammable gases as well as compressed air.

Supporting low pressure operation, the NV150 offers an ultra-low opening pressure of 4 mbar, and the pressure drop in the line is therefore extremely low. In addition, the spring-loaded valve system has low noise emissions, and a high-quality sealing system with elastomers effectively prevents leaks.

The Model NV150 is designed to operate up to 70°C ambient temperature and 16 bar maximum operating pressure. Weighing in at only 221 g, this brass device can be mounted in any position and offers a very long service life due to its integrated 100-micron dirt filter. Versions in stainless steel and aluminium are also available.

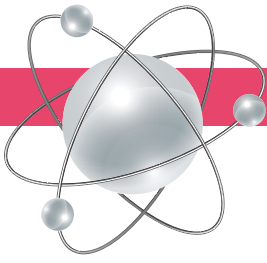
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## Analytics identify production errors and causes in real time



*With smart cameras and a high-performance machine controller connector, Fraunhofer IPA's Smart System Optimization identifies production errors and their causes. (Source: University of Stuttgart IFF/Fraunhofer IPA Photo: Rainer Bez)*

With its Smart System Optimization, Fraunhofer IPA has developed a tool that identifies errors in interlinked manufacturing systems and shows their root causes. In order to do this, high-performance machine control connectors and external sensors such as smart cameras record relevant process characteristics, while an analytical tool interprets the data in real time. This means that fully automated production systems with short cycle times can be optimised while also enabling automated machine benchmarking of comparable machines.

In complex and capital-intensive manufacturing systems, companies must always maximise productivity. However, many manufacturing systems encompass a variety of stations, and work so quickly, that sources of errors can no longer be manually identified. In a survey of 147 participants, Fraunhofer IPA determined that there is a high demand for a solution to optimise interlinked systems.

"The more complex the system, the lower the productivity," said Project Manager Felix Müller. "The pharmaceutical and consumer goods industries are particularly affected by complexity."

With Fraunhofer IPA's Smart System Optimization, data collection and analysis is completely automated. Self-learning algorithms that were developed specifically to analyse fast-acting production lines of discrete goods were a key enabling technology. A high-performance connector is used to collect data from the inside, accessing data from the machine controller (PLC) at a high frequency. If the PLC data is not sufficient,

smart cameras also record the relevant process characteristics from the outside. This creates a continuous data stream that is synchronously transmitted to the big data analytics tool. This can then draw conclusions with the aid of the algorithms, give a feedback in real time to operators and prepare the information in the desired form.

The tool also works out how to link the errors and can prioritise them. It is suitable for automated machine benchmarking too. This means that all machines in a fleet can be brought to the highest possible level.

Fraunhofer IPA has already implemented the tool in industry several times. At SCHOTT Schweiz AG, the overall equipment effectiveness (OEE) was increased by around 10% for a highly automated production system that manufactures syringes.

At Freudenberg Sealing Technologies (FST), the researchers implemented the interlinked machine benchmark, leading to a reduction in cycle time of up to 10% per machine. Currently, Fraunhofer IPA researchers are working on expanding the sensors used in the Smart System Optimization and developing algorithm packages for short-term failure prediction. They also plan to make the connector available for even more machine controllers, allocate currently unrecognisable errors in an automated way and make error images comprehensible for production employees in real time.

**Fraunhofer Institute for Manufacturing Engineering and Automation IPA**

[www.ipa.fraunhofer.de/en.html](http://www.ipa.fraunhofer.de/en.html)

## CONTINUOUS GAS ANALYSER

Emerson's Rosemount CT4400 continuous gas analyser is a purpose-built quantum cascade laser (QCL) and tunable diode laser (TDL) analyser designed to help plants reduce ownership costs and report emissions accurately in environmental monitoring applications measuring standard components, such as nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>).

Optimised for cold and dry applications running at ambient pressure, the Rosemount CT4400 analyser offers the benefits of QCL/TDL technology, including high sensitivity, accuracy, improved stability and low-drift performance in a configuration that allows fast, easy integration into existing plant infrastructure.

Because the system can hold up to four laser modules, it can measure up to seven application-specific gas components simultaneously, providing flexibility in continuous emissions monitoring applications. This simultaneous, multi-component analysis within a single analyser reduces the need for multiple analysers, and thus the cost.

At the heart of the Rosemount CT4400 is Emerson's QCL technology, which detects gas molecules in both the near- and mid-infrared wavelength range. The system employs a laser chirp technique that enables detection of individual gas species, free from the cross-interference effects of other gas components in the stream, making the measurement highly accurate and stable down to sub-ppm concentrations. This high performance ensures operators meet increasingly demanding regulatory requirements, while real-time reporting provides critical insight into process performance.

**Emerson Automation Solutions**  
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## COMPRESSORS WITH INTEGRATED DRYERS

Kaeser has announced the FSG series of its dry running rotary screw compressors featuring an integrated i.HOC rotary dryer.

The i.HOC integrated rotary dryer for screw compressors provides a steady supply of oil-free compressed air with pressure dewpoints of up to -30°C, even under unfavourable conditions.

The dryer utilises 100% of the available hot compressed air from the second compression stage to directly regenerate its desiccant. The advantages of this full-flow regeneration make the i.HOC particularly efficient and ensure stable pressure dewpoints, even in harsh conditions such as low final discharge pressure, high ambient temperatures or reduced utilisation.

For particularly sensitive compressed air applications, Kaeser offers optional pressure dewpoint regulation for all FSG series, oil-free rotary screw compressors with an integrated i.HOC. Should the cooling conditions deteriorate, perhaps due to rising ambient temperatures, the dewpoint regulation registers the resulting pressure dewpoint increase and boosts the dryer's regeneration potential accordingly. This ensures that the pressure dewpoint is optimised. This offsets the daily and seasonal fluctuations in the cooling air temperature, thereby achieving constant pressure dewpoints.

The standard FSG series of dry running rotary screw compressors with integrated i.HOC dryer models are available with drive powers of 160 to 355 kW and produce flow rates from 29.30–50.20 m<sup>3</sup>/min, designed for pressures 4 to 10 bar.

**Kaeser Compressors Australia**  
[www.kaeser.com.au](http://www.kaeser.com.au)

## ZIGBEE ISOLATED I/O MODULE

The ICP DAS tZT-P4C4 is a wireless 4-channel isolated digital input and 4-channel isolated digital output module.

Each channel features photo-coupler isolation. It supports sink-type output with protection against short-circuiting, and source-type input. All input channels can be used as 16-bit counters. Further, there are options for configuring power-on and safe digital output values, with 4 kV ESD protection and 3750 VDC intra-module isolation also provided.

ICP DAS's tZT series products have the advantage of both low cost and the low power consumption of ZigBee modules. They have the capability for wireless communication up to 300 m (LOS). Coupled with the tZT's dynamic mesh network, users can easily catch DIO data in difficult-to-wire environments.

**ICP Electronics Australia Pty Ltd**  
[www.icp-australia.com.au](http://www.icp-australia.com.au)



## AIR-COOLED OIL-FREE COMPRESSOR

Gardner Denver has released an air-cooled version of its Ultima compressor technology, claiming to be the first air-cooled oil-free compressor to offer heat recovery for process water.

The technology's closed package cooling system means the heat energy captured when compressing air (up to 95%) can be used to provide process water heating, delivering usable water temperatures of up to 85°C.

Its hybrid cooling capabilities offer extra flexibility for the user too. Operators can choose between either air cooling, water cooling or both, depending on the most economic means of cooling at the time. For example, air cooling might be more cost-effective to use during the winter period, as the heated cooling air can then be repurposed for space heating in a facility. On the other hand, during summer months, when there is no demand for space heating, a water-cooled operating mode might be more economical.

The air-cooled Ultima compressor is said to offer cost savings of up to 13% when compared with industry standards, even without the additional application of heat recovery. Due to speed-regulated fans, the power consumption in standard ambient conditions or at partial load is reduced even further.

**Gardner Denver Industries Pty Ltd**  
[www.compair.com](http://www.compair.com)





### AI EMBEDDED PCs

The Sintrones ABOX-5200G4 and ABOX-5200G1 are AI box PCs that can support autonomous vehicles, deep learning AI and factory automation, as well as other applications.

They are powered by Intel's 8th Generation 6-Core i7-8700T CPU with NVIDIA GeForce GTX technology: the ABOX-5200G4 is powered by a GTX 1060 GPU and the ABOX-5200G1 is powered by a GTX 1050Ti. They can provide high computing performance on a broad range of computational workloads. The ABOX-5200G4 supports 1280 CUDA Cores and the ABOX-5200G1 supports 768 CUDA Cores.

In regards to expansion capabilities, the ABOX-5200G4 and ABOX-5200G1 both have eight GPI, four GPO and three RS-232/422/485 ports to connect, and 10 GbE LAN (optional eight PoE) with dual hot-swappable SATA storage

RAID 0, 1 and 5. As for operation in extreme weather conditions, the ABOX-5200G4 has a wide operating temperature range of -40 to 60°C while the ABOX-5200G1's range is -40 to 70°C.

Overall, the ABOX-5200G4 and ABOX-5200G1 fanless AI box computers can effectively process deep learning operations with NVIDIA CUDA technology and support end-to-end deep learning solutions which play a vital role in autonomous vehicles and factory automation.

**Backplane Systems Technology Pty Ltd**

[www.backplane.com.au](http://www.backplane.com.au)



### FOOD SAFE MOTORS AND BEARINGS

ABB has launched a full range of stainless steel IEC Food Safe motors and mounted ball bearings designed

for the harsh washdown conditions in the food industry. These motors and bearings are part of ABB's Food Safe range that already includes stainless steel NEMA motors and gearing.

To reduce the risk of contamination and the amount of water and chemicals required to sanitise equipment, all Food Safe products are easy to clean. They feature smooth rounded housings to eliminate crevices that could trap food particles and harbour bacteria. The nameplates on the motors and gearing are laser etched to avoid channels and ridges where contaminants could accumulate.

IEC Food Safe motors feature encapsulated windings that last longer in harsh washdown conditions versus general-purpose motors. These motors also eliminate the need for motor shrouds, which can harbour food particles and allow bacteria to breed. IEC Food Safe motors feature IE3 premium efficiency to reduce energy consumption and emissions, and are available in the power range 0.18 to 7.5 kW, in 2- to 6-pole versions for 230–690 V at 50 or 60 Hz.

ABB's Dodge Food Safe mounted ball bearings also achieve the IP69 water protection rating without the use of an end cover, and carry a warranty against failure due to water ingress. The bearings' 100% stainless steel insert design combined with a KleanTec top coat offers protection against corrosion. Food Safe bearings are available in a variety of housing styles in sizes from 20 up to 50 mm.

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## TAKING MANAGEMENT BY STORM: HOW TO MAKE THE LEAP FROM TECHNICIAN TO LEADER

Transitioning from a technical role to a leadership role is a common progression in an engineer's career, but it is one of the biggest and most challenging leaps you can make in the workplace.

The chances are you have spent years mastering your specialisation, whether it is in automation, oil and gas, utilities or even mining. You've been recognised for your hard work, and now the expectation is that you step up and hand over your place to somebody else. It's no longer your job to do the 'hands on' work. Instead, it's your job to help technical engineers reach the company goal.

In this situation, simply changing your title to 'Manager' or 'Director' does not necessarily mean you are truly acting like a leader. Leadership requires a different set of behaviours and a different way of thinking, so it's now your job to grow and evolve.

At my culture firm, Corporate Edge, we understand the struggles some of us have with this transition, which is why we have put together four key changes you need to make in order to transition from technician to a leader.

### Change 1: Get comfortable spending more time with people, rather than on the tasks

One of the core differences between a leader and a technician is that leaders are required to focus more of their energy on people and strategy, as opposed to implementation and execution.

Many new managers find it difficult to move their focus from technical work, like the design, to people. This is particularly hard if you are introverted, as you have likely received more energy from your project rather than from your colleagues in the past.

Often the challenge people face as they step away from the factories, machinery and processes into an office space is the

feeling that they aren't getting anything done. The key here is to change how you view what is most important (good productive use of your time). Spending a day in one-on-ones with your technical team, empowering them to do their work for the week, is actually far more important (and productive) than you attempting to do all of that work yourself.

### Change 2: Let go of the day-to-day tasks and learn to delegate

In order to step up, there will be practical tasks you were doing that you now need to stop doing. This is often hard to do as we have become famous for our ability to do them. The reality is, those tasks are no longer relevant to our position and we need to become famous for being a leader if we are to succeed in a leadership role.

One of the barriers that prevent new managers from focusing on the bigger picture is the feeling that they don't 'have the time' to do so or they're worried about losing control. Who will fill the void leftover if we stop focusing on day-to-day activity and start focusing on macro planning?

There is one very simple solution to this problem: delegation.

Underneath you, there might be multiple direct reports who are looking to grow and progress within the organisation. By handing over certain elements of your work to them, you free yourself up to focus on long-term work and help your technical team to thrive.

At first, you'll need to accept the fact that the work they do might not be the same quality you are used to achieving. However, with the right training and feedback from you, in time, it might even be better. Seeing your technical team progress and improve is what being a manager is really all about.

### Change 3: Rethink how you use your time

We make our habits, and then our habits make us. After years of working in the industry, it's only natural that you become used to doing things a certain way.

Perhaps you are very experienced in installing new equipment for increased efficiency in manufacturing. As a technical engineer, working on a project was often quicker and easier when you did the tasks yourself rather than training someone else to do them.

However, using this approach as a manager is short-sighted. While it might help you move things along more quickly in the short term, in the long term the 'I'll just do it myself' mentality will not serve you.

Whilst you may feel that you can do anything, you cannot do everything. When stepping into a leadership role you need to essentially retrain yourself on how you are spending your time. Rather than spending time installing equipment, troubleshooting for maintenance or micromanaging the design process, you should be spending it empowering others to do those tasks so you can focus on higher-level work.

#### **Change 4: Focus on higher-level thinking**

As leaders, we should be aiming to focus on higher-level thinking that will ultimately lead to higher-level work. Only this will truly have an impact on the organisation as a whole. This is a sign of true leadership, as it requires you to take yourself out of the day-to-day practical work and think on a larger scale. The first three key changes lead to this one. When you become a leader, you move from Technician to Visionary, from doing to thinking. This is a decision you consciously need to make. You will not succeed as a leader if you can't transition to higher-level thinking. This is what will create your ability to provide higher-value work; the ability to make a difference at an organisational (or divisional) level.

Some questions that create higher-level thinking are:

*What is it that we do best?*

- How do we maximise our ability to do that?
- How do we create a culture that delivers that every day?

*How do we get greater levels of innovation?*

- What do we have in place that gets the team involved?
- What do we as leaders need to do differently to get the team to cooperate?

*What development is needed in the organisation that will enable future growth?*

- What capability growth is required?
- What capacity growth is required?
- Where do we need to invest our time and resources?

*What do I need to do differently to add even more value?*

- How am I currently spending my time?
- How should I be spending my time?
- What example am I role modelling to the team?

Change is all about switching up your thinking and mindset in relation to the transition of your role from technician to leader. Follow the above as a guide and we promise you, you'll be well on your way.



*Phil Allison understands that success doesn't just look like a well-paying job. It looks like satisfaction, health and development. As the founder and Managing Director of Corporate Edge, Phil has dedicated his career to the holistic betterment of people and the places they work. This father of six is driven by values of genuine relationships and life balance.*

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## AUTOMATION COMPUTER

The UNO-3285C is a fanless control cabinet PC with a 6th generation Intel Core i7-6822EQ quad-core processor and an Intel QM170 PCH chipset. It is designed to deliver high-performance computing and maximum flexibility for industrial automation, vision and motion control applications. The provision of up to five expansion slots supports the integration of modular peripherals and ensures flexible installation in diverse cabinet configurations. In addition to an exchangeable RTC battery that can be accessed via the removable top cover for convenient maintenance, the system has dual power inputs designed to ensure a stable power supply.

Features include six USB 3.0 ports, two Gigabit LAN, two RS-232/422/485 serial ports, as well as DVI-I and HDMI display interfaces. With two internal HDD/SSD bays and up to five expansion slots (two PCIe x8, two PCI and an iDoor slot) the UNO-2385C supports flexible PCI/PCIe expansion cards.

With the integration of various iDoor modules, such as an industrial fieldbus communication, PoE, COM or digital I/O module, system integrators can extend or customise the system features to provide purpose-built, futureproof solutions for diverse machine automation, machine vision, motion control and automatic optical inspection.

**Advantech Australia Pty Ltd**  
[www.advantech.net.au](http://www.advantech.net.au)



## ISOLATED SIGNAL SPLITTER AND DUPLICATOR

Acromag's SP330 series of isolated signal splitter/duplicators are designed to accommodate a broad variety of applications. Very similar to the company's SP230 loop-powered 2-wire series, these 4-wire DC-powered models are also software configurable for precise conditioning of current, voltage or temperature input signals.

The SP330 splitters provide two isolated outputs, proportional to a single input, with a choice of process control signal formats (0–20 mA, 4–20 mA, 0–5 V, 0–10 V,  $\pm 5$  V or  $\pm 10$  V).

A standard USB port connects the splitter to a PC or Android device with Acromag's free software for easy selection and scaling of I/O ranges. Power sources from 6–32 VDC are supported and can connect at the terminals, to a power bus along the DIN rail, or at both locations for redundancy.

The SP330 Series modules are designed to operate reliably from -40 to 75°C with high immunity to electrical noise and surge protection. UI/cUL Class 1 Division 2, ATEX Zone 2 and IECEx hazardous location approvals are pending.

**Metromatics Pty Ltd**  
[www.metromatics.com.au](http://www.metromatics.com.au)



## SMART SENSOR FOR BEARINGS

ABB has launched the ABB Ability Smart Sensor for Dodge mounted bearings, part of the ABB Ability Digital Powertrain, which enables health checks for bearings. The smart sensor technology provides an early indicator of any potential problems by assessing the condition of bearings from vibration and temperature information. This helps to prevent downtime on applications such as bulk material handling conveyors typically found in the mining, aggregate and cement industries, as well as applications in the food and beverage and air handling sectors.

ABB Ability Smart Sensor for mounted bearings uses the latest algorithms to assess, manage and ensure performance of components. Since 80% of bearing failures are lubrication related, a bearing 'running hot' can indicate that proper lubrication procedures are not in place. Monitoring a bearing's vibration can indicate potential system problems.

The smart sensor easily mounts on the bearing and communicates wirelessly via a smartphone or other device. This capability keeps employees safe, enabling easy access to the health data of bearings in locations that may be difficult or dangerous to reach.

**ABB Australia Pty Ltd**  
[www.abbaustralia.com.au](http://www.abbaustralia.com.au)







**HEAVY-DUTY CONNECTOR HOUSINGS**

Heavycon standard housings from Phoenix Contact are made using high-grade, corrosion-resistant aluminium, and due to their conductive surface and seals, they are also suitable for EMC applications.

The B32 and B48 housings can accommodate two fixed-position contact inserts side by side, saving a great deal of space when wiring. The B32 housings can accept two B16 inserts and can be interlocked with double-locking latches. Two B24 contact inserts can be installed in the single-locking latch-equipped B48 housings. The housings are available with side-exit or straight cable outlet. Matching covers are also available. The housings are designed for high mechanical stresses and vibration. The standards-compliant sizes of these sleeve, panel mounting and surface mounting housings ensure that they are fully compatible with the industry standard.

**Phoenix Contact Pty Ltd**  
[www.phoenixcontact.com.au](http://www.phoenixcontact.com.au)



**HANDHELD PARTICLE COUNTER**

The TSI Aerotrak 9306 is a handheld particle monitor that offers features and flexibility that enable versatile particle contamination monitoring. The ergonomic handle and thumb controls mean the unit can be operated with one hand, while the 3.5" colour touch screen displays the easy-to-use interface. It is

available to rent from TechRentals.

The product generates pass/fail reports for ISO 14644-1, EU GMP Annex1 and FS209E. The data can be easily viewed using the device's touch screen, and can be downloaded using TrakPro Lite Secure Software. It can also be printed to an external printer.

The device is compliant with the stringent requirements of ISO 21501-4 and can be used in various applications, including tracking down particle contamination sources, classifying clean areas, finding filter leaks and conducting IAQ investigations.

Capable of measuring up to six channels of data simultaneously, the product also features a removable and rechargeable Li-ion battery, long-life laser diode and data storage.

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### REACTION TORQUE SENSOR

Futek has introduced a redesigned TFF400 reaction torque sensor. The sensor features a flange-to-flange mounting solution with torque measurements ranging from 0.04 to 56 Nm and an improved (doubled) torsional stiffness, making the sensor stiffer and faster.

The updated design features a lower deflection and robust flexure, and is made from anodised aluminium for optimum durability.

The through-hole counter-bore design allows the assembly to be kept concentric

and limits the chances of offsetting the torque. With the recommended mounting plate, a full range of mounting options becomes available.

The product also features up to 300% overload protection on lower capacities, integrates into OEM applications and has an easy cable disconnect.

**Metromatics Pty Ltd**  
[www.metromatics.com.au](http://www.metromatics.com.au)



### PANEL PC

Interworld Electronics has released the FABS-921AP food-grade stainless steel panel computer.

The FABS-921AP is housed in a fanless aluminium enclosure with a 304 or optional 316 grade stainless steel bezel that provides IP66/IP69K front panel protection. Part of the FABS series, the panel PC has been optimised to meet the hygienic design requirements of DIN EN 1672-2 and DIN 42115, Part 2. These European standards establish high standards for food and beverage processing equipment.

The FABS-921AP is powered by an Intel 6th/7th generation Core I Processor with DDR4 memory. A full HD 21.5" 1920x1080 resolution LCD and 7H anti-scratch durable projected capacitive touch screen make it suitable for operator panel and HMI control applications. The standard 250 cd/m<sup>2</sup> or an optional 1000 cd/m<sup>2</sup> high brightness screen is available.

It provides two COM ports, two GbE LAN ports and two USB 3.0 ports as well as support for internal Mini-PCIe expansion modules. Communication and network options include 3G/4G, Wi-Fi/BT, GPS and RFID. The internal 2.5" SATA3 HDD is easy to access allowing the operating system and data storage to be upgraded at any time.

The FABS-921AP supports DC 9-36 V power input and an operating temperature range of 0-50°C. Operating system support includes Windows 10/IoT. The panel computer is 60 mm deep. Panel and VESA mounting make the FAB series convenient to install.

**Interworld Electronics and  
Computer Industries**  
[www.ieci.com.au](http://www.ieci.com.au)



### ENTRY-LEVEL PoE+ SWITCHES

Belden has released the SPIDER III PoE Standard Line entry-level rail switches. Flexible and configurable, the switches provide PoE+, enabling industrial engineers to supply greater power to more network devices and ensure high-quality communication.

The entry-level rail switches are shock, vibration and interference resistant, making them suitable for a variety of harsh industrial applications, such as automated systems in factories, processing plants, traffic control, video surveillance and building technology. Industrial engineers working in the manufacturing, machine building, automotive, mechanical and plant engineering industries will benefit from the devices as they reduce the amount of cabling needed in tight operating spaces.

**Belden Australia Pty Ltd**  
[www.belden.com](http://www.belden.com)



## Crisp manufacturer doubles packing speed and reduces wastage

UK gourmet chip manufacturer Pipers Crisps has doubled its packaging capacity and reduced waste due to the installation of high-speed packaging solutions. The new installation has enabled Pipers Crisps to increase productivity, while maintaining the highest level of product quality through enhanced seal integrity.

Based in Brigg, Lincolnshire, the company was established in 2004 by three farmers who joined forces to produce great-tasting, quality chips using local potatoes. Today, its award-winning products, recognised nationally for their unique and bright packaging design, are distributed throughout the UK, as well as exported to Europe and the US. Following a period of impressive growth in the past two years and rising popularity of its products, Pipers Crisps needed to add new packaging lines to its existing packaging fleet to cope with the additional demand.

With existing equipment achieving throughput speeds of only 80 bags per minute (bpm) for its smaller bags, Pipers Crisps needed to substantially increase bagging speed. The premium chips manufacturer opted for two tna robag FX 3ci vertical, form, fill and seal (VFFS) packaging solutions. These high-speed baggers feature a very short vertical product transfer from the scale to the pack, helping to maximise packaging performance. The new set-up allows Pipers Crisps to package a variety of bag sizes at speeds of up to 140 bpm, resulting in a 75% increase, in line with the company's capacity uplift.

Catering for a variety of snacking occasions, the chips manufacturer needed a packaging solution that could switch between two different pack sizes — 40 and 150 g — of high-quality pillow bags, without lengthy changeover times that would slow down or even stop production. With its lightweight formers, unload assist and twin film spindle, the flexibility of the tna robag FX 3ci makes changeovers fast and easy, enabling operators to easily switch from one bag size to another on the same packaging line.

The Pipers Crisps brand is renowned for its premium positioning. In such a highly competitive market, quality is crucial to help differentiate brands on retail shelves. It was therefore important that the chosen packaging solution could maintain seal integrity and reliably produce high-quality bags that do not compromise the shelf life of the product within it.

"During the packaging process, pieces of chips can get caught in the bag seal, compromising seal integrity and reducing the shelf life of the product. When this occurs, it can often lead to product rejects and waste," explained Simon Hill, Regional Sales Manager at tna.

With its innovative rotary jaw design and advanced sealing technology that offers improved seal performance at high speeds, the tna robag FX 3ci proved to be the perfect solution. Featuring patented stripper tube closures, the completely integrated packaging system allows for better control of the product through the packaging and filling cycle, therefore helping to control dust generation and minimising crumbs in the end seal of the bag.

The tna robag FX 3ci was also customised with product-in-seal-detection (PISD) software that monitors product in the seal and jaw



area. If seal integrity is compromised, the system immediately alerts the operator so that bags can be quickly removed from the line for further inspection. That way Pipers Crisps is able to ensure that each bag meets the highest quality standards while keeping waste to an absolute minimum.

Richard Mottram, Factory Manager at Pipers Crisps, commented: "Before the installation, we experienced 3% wastage at 80 bpm, as we had to manually detect and remove any bags with compromised end seals or pleats before they entered the packaging area. Now, our wastage is down to 1% at 140 bpm, which has surpassed our expectations. As a result, it has helped us gain better control over product losses and achieve operational cost savings, while contributing to quality assurance."

**tna solutions Pty Ltd**  
[www.tnasolutions.com](http://www.tnasolutions.com)

## COMPACT WIRELESS GATEWAY

The Artila Matrix-750 wireless gateway is designed to make it easier for process industry users with remote operations to set up and run wireless networks. Remote operations often have challenges with difficult installations, high expense and insufficient field personnel to keep pace with aggressive schedules. As a result, they are constantly one step behind — juggling equipment, crews, schedules and data, with limited insight into what is really needed where.

The compact Matrix-750 is a simple remote monitoring solution, offering a device-to-cloud service with long range, good signal coverage and data transmission, and rapid deployment for optimal performance and ease of use. It was specifically designed to meet the needs of smaller networks required for remote applications; the small size and DIN rail mount capability means the Matrix-750 is suitable for the limited cabinet space requirements of most remote operations. Built-in layered security functionality ensures that the network stays protected at all times. Additional devices can be added quickly and easily without the need to configure the communication paths.

**Micromax Pty Ltd**

[www.micromax.com.au](http://www.micromax.com.au)



## TWIN SCREW PUMP

Designed for handling fluids that are sensitive, abrasive and either high or low viscosity, the Alfa Laval Twin Screw Pump is suitable for use in hygienic applications in the dairy, food and beverage, and personal care industries.

Additional benefits claimed for the Alfa Laval Twin Screw Pump are that it is quiet and virtually pulse-free, as well as being smooth and gentle during operation.

Built on a robust, reliable platform that meets stringent hygienic standards, the pump is capable of handling both product transfer and CIP applications. Its low pulsation characteristics and good solids handling capabilities reduce the risk of product damage, thereby improving product quality. Maintenance is simplified and process uptime increased.

Two-in-one operation provides easy handling of process media of varying viscosities as well as CIP fluids. This simplifies piping and pump control, cutting costs and minimising contamination risks. High suction performance and lift capability with low NPSHR provides installation flexibility and increases product recovery.

Quick, easy seal replacement with the pump in place is made possible, due to a cartridge seal with a front-loading, self-setting design. This maximises process uptime and minimises maintenance costs. An optional seal service kit program adds maintenance flexibility and cuts operating costs.

The Alfa Laval Twin Screw Pump features a clean, external stainless steel finish with profiled elastomers and fully surrounded mechanical seals. Designed for maximum cleanliness using FDA-conforming materials, the pump is both EHEDG and 3-A certified. An optional ATEX version enables use in hazardous zones.

**Alfa Laval Pty Ltd**

[www.alfalaval.com.au](http://www.alfalaval.com.au)

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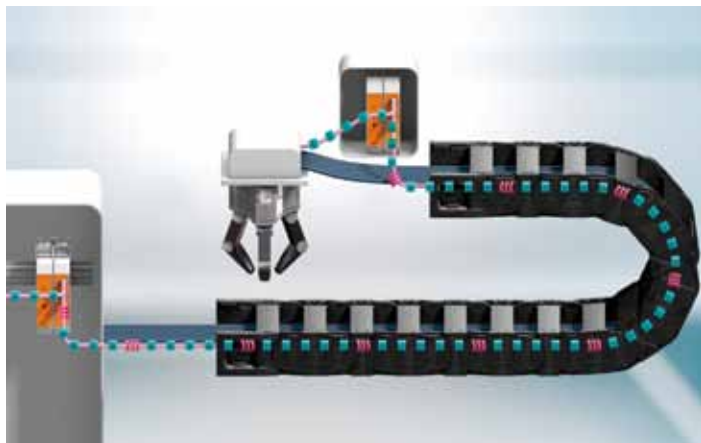
The Camille Bauer DM5S is a DIN rail instrument for measuring in single- and three-phase 3- and 4-wire systems. It can be equipped with a Modbus RTU interface and up to four analog outputs. Parameters can be queried via the Modbus and via the analog outputs (bipolar, unipolar or live-zero, 4–20 mA).

Parameters include real, reactive and apparent power, frequency, cos phi, current and voltage in one instrument. Programming is achieved via USB connector to a PC or laptop and the connection can be left in place when powering the DM5S from the mains. The English-language CB-Manager makes the configuration of the DM5S self-explanatory. The DM5F (fast) version with a 15 ms response has 32 built-in energy meters that can be read via the Modbus.

**Power Parameters Pty Ltd**

[www.parameters.com.au](http://www.parameters.com.au)





## BUS CABLE MONITORING

The mechanical loads in energy chains eventually change the transmission characteristics of bus cables. As well as linear travel, this also applies to three-dimensional movements, eg, in the case of dress packs on robots. The result is disruptions in data transmission or even unforeseen plant failures.

The igus CF.D system detects the impairment of the chainflex bus cable in advance. The intelligent system consists of an evaluation unit and a response module that are installed at the beginning and end of the moving bus cable. The evaluation unit is usually placed in the switch cabinet on the fixed-end side, and the response module in the distribution box on the moving-end side. Special data is transmitted between the two for measurement purposes and the cable quality is permanently evaluated by means of the increasing amount of lost or damaged data. If a predefined value is exceeded, the user is alerted via a yellow LED and the switching of a contact. Exceeding a second alert threshold is signalled via red LED and indicates a failure of the bus transmission, so that the error can be quickly located.

The system enables the monitoring of a cable in dynamic operation, without additional measuring wires or sacrificial cables. CF.D integrates itself into the igus isense environment for predictive maintenance. By networking using the igus communication module (icom), the online status and alert display — via a PC, tablet or smartphone — are as visible as they would be via direct integration into the user's infrastructure.

**Treotham Automation Pty Ltd**

[www.treotham.com.au](http://www.treotham.com.au)

## CONTINUOUS INKJET PRINTERS

Designed to combine speed, accuracy and the ability to withstand demanding industrial manufacturing environments, the Domino Ax-Series continuous inkjet printer is the outcome of research revisiting the underlying science behind CIJ technology.

Updated technology includes the i-Pulse printhead and inks; the i-Techx electronics and software platform; and Domino Design, for easy integration and maximised productivity.

The i-Pulse printhead optimises print quality and readability by using smaller ink drops, delivering higher resolution text and 2D codes. The smaller ink drops reduce ink consumption, and better drop management equals a cleaner print head and a significant reduction in wash solvent.

The i-Techx electronics and software, as well as Domino Design provide control to the end user through a simple, easy-to-use remote touchscreen interface. Being cloud connective, the Ax-Series can be used in conjunction with Domino Cloud so users can ensure the printer maximises uptime through planned downtime.

With a versatile and durable IP66 rated 316 marine-grade stainless steel cabinet on the Ax550i model, the Ax-Series can withstand washdown environments in the food and pharmaceutical industries.

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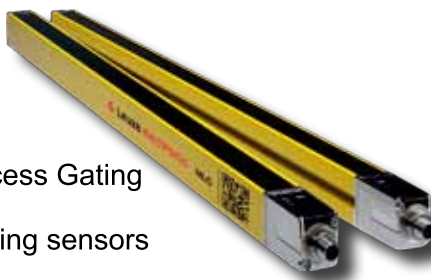


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# INCORPORATING CYBERSECURITY INTO WATER UTILITY MASTER PLANNING

## A STRATEGIC, COST-EFFECTIVE APPROACH TO MITIGATING CONTROL SYSTEM RISK — PART 2

*Umair T Masud, Manager, Consulting Services Portfolio, Rockwell Automation*

Protecting critical infrastructure systems is imperative, but it is necessary to determine how to work within the context of organisational structure and budget.

**B**y now it is well known that the cybersecurity threats are increasing in sophistication for all industries. In Part 1 of this article, the unique cybersecurity issues of water utilities were introduced, and the inadequate nature of traditional cybersecurity countermeasures that are commonly found.

While there is an understandable tendency for utilities to view any initiative related to information infrastructure, metering or process control systems as a 'project', by definition, projects are limited in scope and have well-defined objectives, timelines and budgets. But when it comes to safeguarding a utility's industrial control system, a 'set-it-and-forget-it' project mentality can be dangerously limiting.

As a critical business objective, cybersecurity must be approached as an ongoing process, albeit one where budget projections and public relations are challenging. And where success is measured by what doesn't happen, rather than what does.

### **Building the program: laying the foundation**

Cybersecurity touches every aspect of a typical business. For water utilities — which have a high volume of critical assets

plus complicated constituency and governance — the scope of an ICS Security Program can appear particularly daunting.

However, regardless of size or complexity of the existing infrastructure, all utilities face similar challenges. And when it comes to mitigating risk, all ICS Security Programs can deploy a common, proven methodology. That methodology must:

- begin with an assessment of business needs and the specific operational requirements of the process control system;
- identify critical assets and data that are essential to operation;
- support asynchronous technology and business change — and be adaptable to the evolving landscape and move towards active defence with minimal overhaul;
- recognise that no single product or technology will fully secure industrial networks;
- utilise a defence-in-depth strategy based on multiple countermeasures that disseminate risk over an aggregate of security mitigation techniques.<sup>1</sup>

### **Stakeholders and executive buy-in**

Identifying the right team to support and execute this methodology at the outset is critical. To be effective, this team must be endorsed at the executive level — and include expertise encompassing both



the industrial control system and business-level networks. In utilities with limited ICS and IT expertise, incorporating a trusted third-party consultant is a viable option.

Ultimately, this team will be charged with formalising and executing the policies and procedures that will guide the utility on cybersecurity issues for years to come. And will be instrumental in determining and implementing related technologies and contingency plans.

### Setting strategic priorities: know your environment

An ICS Security Program based on a defence-in-depth strategy begins with a clear understanding of the environment and what needs to be protected. Once the current state is clearly understood, utilities can determine which critical control investments will have the most impact.

#### Security assessment

Assessments are the starting point for any cybersecurity program. An assessment outlines a utility's current security posture — important baselines for system availability, integrity and confidentiality.

Through an assessment, a utility can determine what is 'normal' from the standpoint of data entering and leaving the system. This is a crucial first step to identifying abnormalities and potential security events. In addition, an assessment evaluates the robustness of a utility's security practice architecture — and its ability to protect ICS assets.

Effective security assessments also extend beyond the technology deployed. For example, good security assessments take into account not only networks and industrial control systems, but also existing policies, procedures and typical behaviour. In addition, automation expertise can be leveraged to provide a comprehensive review, including process control application performance within the existing infrastructure.

Specifically, an assessment should include at minimum:

- Inventory of authorised and unauthorised devices and software.
- Detailed observation and documentation of system performance.
- Identification of tolerance thresholds and risk/vulnerability indications.
- Prioritisation of each vulnerability, based on impact and exploitation potential.

The final outcome of any assessment is recommended and prioritised mitigation activities. These recommended activities are often aligned with what are known as *critical security controls*.

### Security controls investment and utility master planning

With the results of a security assessment and prioritised mitigation steps in hand, a utility is positioned to implement a cybersecurity program. However, while the need for a program may be well understood within the utility, justifying funding to implement recommendations can be a significant hurdle — especially when public opinion comes into play.

The following factors pose public relations challenges — both within municipality governance and the broader community — and may forestall funding approval:

- Given finite budgets, funding a new cybersecurity investment generally means diverting funds previously allocated for other more popular purposes.
- In the public sphere, it's usually easier to justify additional costs — and potential rate hikes — for improvements to the system that immediately and directly impact water delivery or quality. The benefits of a cybersecurity program are often invisible.
- Cybersecurity is not a one-time expenditure. Security is a commitment that commands vigilance and an ongoing investment in people, process, product and technology.

Due to these factors, aligning security controls investment closely with the utility master plan is the most effective, publicly palatable and fiscally responsible approach.

#### Ways to align

While not an exhaustive list by any measure, here are some specific ways a utility can implement a strategic, lifecycle approach to cybersecurity investments:

### **What is the NIST Cyber Security Framework (CSF)?<sup>2</sup>**

The NIST Cyber Security Framework was developed by the National Institute of Standards and Technology, in concert with other US agencies and industry experts to address risks in the industrial control environment and the critical infrastructure that are controlled by them. The framework enables any organisation to apply the principles and best practices of risk management to improving the security and resilience of an industrial control infrastructure. The functions and categories that make up the framework are as follows:

#### **Identify**

1. Asset management
2. Business environment
3. Governance
4. Risk assessment
5. Risk management strategy

#### **Protect**

1. Access control
2. Awareness and training
3. Data security
4. Information protection processes and procedures
5. Maintenance
6. Protective technology

#### **Detect**

1. Anomalies and events
2. Security continuous monitoring
3. Detection processes

#### **Respond**

1. Response planning
2. Communications
3. Analysis
4. Mitigation
5. Improvements

#### **Recover**

1. Recovery planning
2. Improvements
3. Communications

The Cyber Security Framework allows for each organisation to align the effort of managing risk with their unique business requirements and priorities.

- **Biggest impact first:** It may go without saying, but follow the initial assessment prioritisation — and allot funds first to those investments that are most critical.
- **Assess all cyber investments for risk:** Most utilities routinely include mechanical risk assessments as an intrinsic part of the selection process for any investments related to the physical infrastructure. Extend this mindset to new investments that impact the IT infrastructure and industrial control system as well. Make it part of the purchasing decision.
- **Invest for a more secure future:** Do not silo cybersecurity. Take a 'future-ready' mindset to all investments — SCADA systems, process control systems, power control and monitoring systems, and software — at every level of the enterprise. Work to confirm new investments incorporate cybersecurity features — even if the utility cannot immediately activate those features. Move towards a more active defence with every investment.



AN ICS SECURITY PROGRAM BASED ON A DEFENCE-IN-DEPTH STRATEGY BEGINS WITH A CLEAR UNDERSTANDING OF THE ENVIRONMENT AND WHAT NEEDS TO BE PROTECTED.

- **Scrutinise and limit system proliferation:** Narrow the scope of system suppliers and SLAs, starting with the procurement process. The fewer disparate systems within an environment, the easier it is to secure them.
- **Consider quality-based selection (QBS):** This pre-selection procurement system focuses on the long-term lifecycle costs of a solution, including overall sustainability — not only upfront capital costs. QBS helps set a technology direction for the future that prioritises an integrated secure environment.
- **Recognise the value of ongoing and annual assessment:** A successful cybersecurity strategy requires an ongoing audit of what exactly is occurring in the system — and an annual assessment to restate or realign priorities.

### **Conclusion**

For years, water utilities have enjoyed the limited protection intrinsic to systems that are isolated from a connected world. The industry, too, has achieved tremendous returns on investment — thanks to the seemingly timeless products that comprise their water systems and the skilled staffs that maintain them.

Although the water systems of the past may not appear very different from the day they were commissioned, the internetworking of many of these systems has changed. Typically, 'islands of automation' have been replaced by hybrid systems with an intermixing of old and new products — and a variety of creative methods to exchange information. Connectivity of even the older systems to business operations and potentially to the outside world has become a norm, not an exception.

Within this environment, understanding even the current system security baseline can be a challenging task for water utilities. However, the need to address cybersecurity issues has never been greater.

By viewing cybersecurity as an ongoing process and aligning critical security controls investment with the utility master plan, utilities can better identify system vulnerabilities and undertake essential mitigation steps.

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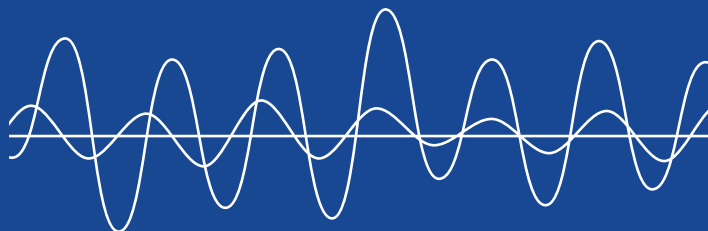


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# AS I SEE IT



## TAKING A PROCESS SAFETY APPROACH TO INDUSTRIAL CYBERSECURITY RISK MANAGEMENT

Over the last decade the industrial sector has been dramatically impacted from the waves of frenzy brought about through big data, the IIoT and Industry 4.0. The latest evolution from these trends includes harnessing the opportunities created from machine learning, augmented/virtual reality and artificial intelligence. These concepts continue to pervade boardrooms and quickly become strategic objectives for organisations to gain an edge and remain competitive. This means that more money is being allocated to IT and OT infrastructure than ever before – a welcome opportunity for many ageing industrial sites.

In the most recent downturn of commodity prices, several final investment decisions on many of these infrastructure projects were delayed. The additional strain on bottom lines caused many companies to also consider the opportunity to consolidate their IT and OT functions to save cost. This consolidation created great opportunities, but as IT and OT infrastructure inevitably merged and monthly news articles about cyber attacks on facilities increased, it became clear that cybersecurity risks needed to be closely managed.

Many companies approached IT consultancy firms to help run risk reviews and develop mitigation strategies – which was a great start; however, in several instances that I have observed, consultants failed to effectively address the operational risk or impact practical site processes. In other cases, the mitigation outcomes only focused on getting similar IT infrastructure into the OT layer, such as firewalls, security information and event management and automated patch management. Critically, they neglected to address the greater lifecycle requirements that a secure OT infrastructure requires.

While every company typically has its own defined risk management process, some specific requirement for industrial cybersecurity should be considered. There are several published guidelines in the various frameworks – for example, NIST – and standards such as IEC 62443 that outlines these requirements clearly, based on the full lifecycle for industrial cybersecurity. It is important that

these be adopted when these cybersecurity risk mitigation projects are executed, since OT has a distinctly different risk profile and lifecycle to that of enterprise IT.

Adopting a lifecycle risk management approach to industrial cybersecurity should not be hard for the industry to grasp because there are very strong parallels between industrial cybersecurity and those of process safety; however, the general pattern I have observed is that a disparity in the focus between them still exists even after a cybersecurity project is delivered.

A good test of a company's maturity in this regard is to review a typical Management of Change (MOC) or Permit-to-Work (PtW) procedure. Does a cybersecurity risk assessment check exist, or is the expectation that this falls under the 'other' risks and left up to the individual to disclose? Would a PtW check of personal protection equipment be considered as 'other'? Neither should the use of a USB device.

More equipment on sites now has the capability today to be networked through the enterprise layers. More contractors connect to site assets, directly and remotely, to complete their work – and the consequences continue to increase as attacks become more sophisticated and targeted. Therefore, effective lifecycle cybersecurity risk management will require a culture change and should utilise similar approaches to process safety relating to risk identification, assessment, mitigation, implementation and measurement, underpinned by continued awareness training.



*Martin Van Der Merwe is passionate about automation, with a degree in Electronic Engineering and IT from the University of Johannesburg and over 17 years' experience in the industry. He thrives on connecting clients' challenges with solutions as the Director for Emerson's Systems and Solutions in Australia and NZ.*



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March 2018 total CAB audited circulation (Aust + NZ)  
4,754 readers (80% personally requested)



Contact the editor

Printed and bound by SOS Print+ Media Group

Print Post Approved PP100007403

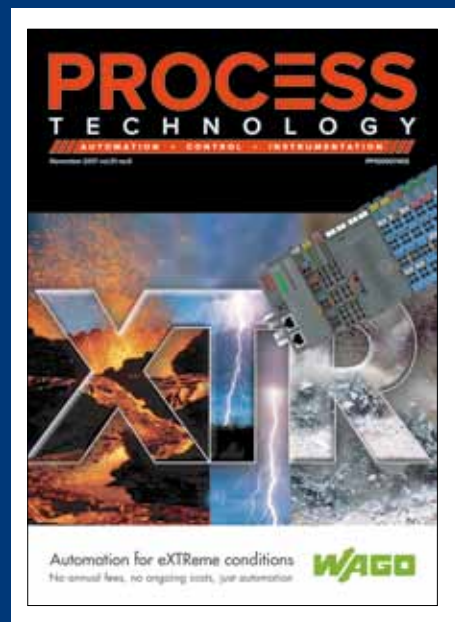
ISSN No. 0819-5447

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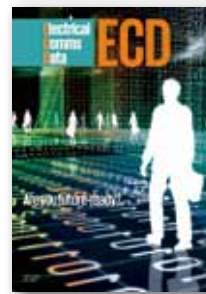
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Pilot Lights  
Motor Controllers  
Panel Meters

Sensors  
E-Stops  
Keypads  
Foot Pedals



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