

W N I P T

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WHAT'S NEW IN
PROCESS TECHNOLOGY

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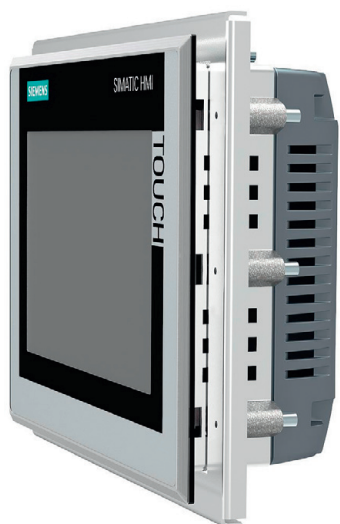
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WHAT'S NEW IN
PROCESS TECHNOLOGY
JULY 2016

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ON THE COVER



The intrinsically safe DPI 620 Genii IS Advanced Modular Calibrator and HART/Foundation Fieldbus communicator is GE's next-generation instrument for the calibration, configuration and maintenance of electrical, frequency, pressure and temperature devices in measurement and control applications. DPI 620 Genii IS can measure and source a wide range of parameters simultaneously including mA, mV, V, Ohms, frequency, RTDs, T/Cs, and HART/Foundation digital signals. It includes a loop power supply to energise devices and control loops and a stabilised DC voltage supply for ratio metric transducers. It has an improved easy-to-detach battery pack that allows hot swapping in hazardous areas.

While being compact and lightweight, the DPI 620 Genii IS is designed with field applications in mind. Its large, high-visibility display can be easily read in direct sunlight and its robust, weatherproof design means it handles the toughest jobs on-site.

The Druck DPI 620 Genii IS Multifunction Calibrator handheld unit forms the heart of a modular test and calibration system that can be tailored by the user on-site to particular tasks or upgraded on-site as new tasks become necessary. Optional accessories include a choice of three interchangeable pressure stations providing -1 to 100 bar pneumatic or 0 to 1000 bar hydraulic pressure generation. Coupled with a choice of 31 interchangeable pressure reference modules, the Druck DPI 620 Genii IS offers a complete pressure calibration solution as well.

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ALARMING DISCOVERIES

IMPROVING OPERATOR EFFECTIVENESS
THROUGH ALARM LIFE CYCLE SUPPORT

Martin Hollender, Joan Evans, Thomas-Christian Skovholt and Roy Tanner

Alarm management standards such as IEC 62682 and ISA 18.2 emphasise the importance of life cycle support in alarm management.

Ahead of a recent simulation exercise at Star City in Moscow, British astronaut Tim Peak was asked what the greatest challenges are during the simulation. He replied, "The most difficult thing to deal with is multiple failures"¹. Likewise for industrial facilities using distributed control systems, alarm floods remain one of the biggest challenges. To get alarm floods under control, alarm-related design knowledge from early life cycle phases needs to be easily accessible in the operational phase when additional information becomes available, so that decisions about advanced alarming methods like alarm suppression can be made with confidence. Having good management-of-change and life cycle support in place makes it possible to keep the alarm system consistent with the changing reality in the plant and allows continuous improvement. To help, alarm management standards such as IEC 62682 and ISA 18.2 emphasise the importance of life cycle support in alarm management.

Although the need for effective alarm management is now generally recognised, accidents like one in 2010 in the DuPont plant in Belle, West Virginia² show that even well known safety leaders like DuPont still have deficiencies. Since software-configurable distributed control systems (DCSs) came into the mainstream, multiple alarms could be added at little or no cost to the end user. Unfortunately, this has led to control systems that include a low alarm system quality due to too many alarms being configured. A classic example is the explosion in the Texaco Milford Haven refinery in 1994³, where the two operators received 275 alarms in the last 11 minutes before the explosion. This is now seen as a characteristic of an overloaded alarm system, which makes it impossible for an operator to be properly aware of a situation and to diagnose and correct it. These types of alarm systems are neither useful nor acceptable and resulted in the development of systematic alarm

management approaches first documented in the EEMUA 191 guideline published in 1999.

Ten years later, the ISA 18.2 standard added a life cycle approach to alarm management similar to the life cycle approach already well established in the safety community with ISA 84 and IEC 61511. Simply put: ensuring safe operation and useful alarms needs ongoing effort.

IEC standard 62682 (published in 2014)⁴ — the first international standard for alarm management — is based on ISA 18.2 (Table 1). It emphasises the importance of systematic life cycle management. IEC 62682 requires, for example, that all information used to design alarms (safety studies, equipment specifications, etc) should be systematically captured and documented. Later, during plant operations, additional information can supplement or revise the original design decisions. Such a revision requires that all information upon which the original decision was based is available and fully understood, to deter any potentially hazardous side effects from the changes.

Figure 1 captures the essence of IEC 62682 and can be used to develop and maintain an alarm system compliant with the requirements of IEC 62682 and good industry practice.

Alarm philosophy

The first step in the project life cycle is the alarm philosophy. The alarm philosophy is the plan for how alarms are to be managed for the site. It defines:

- roles and responsibilities
- alarm requirements
- work processes and procedures to deliver agreed requirements

IEC 62682, among others, provides useful guidance on the content and structure of an appropriate alarm philosophy.

However, the challenge is not in the authoring of the document, but in its application to the project life cycle. It is necessary to focus on the translation of alarm management principles into concrete project activities

Functional safety		Alarm management	
1996	ANSI/ISA 84.01	2009	ANSI/ISA 18.02
2003	IEC 61511	2014	IEC 62682

Table 1

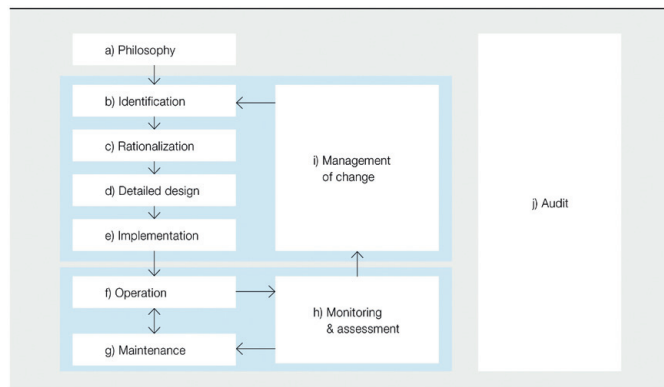


Figure 1: Life cycle of IEC 62682.

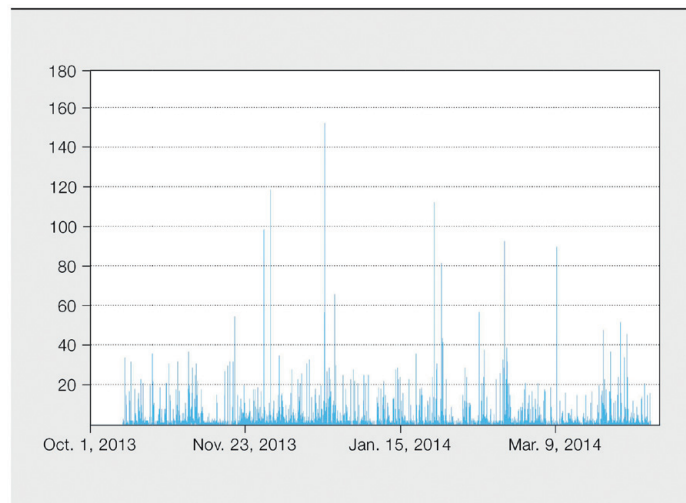


Figure 2: 10-minute alarm rate of a petrochemical plant over six months.

and deliverables while communicating the impact of alarm requirements to the extended project team.

This is crucial in ensuring that the purpose and design intent of alarms are identified and documented during project reviews such as hazard and operability studies (HAZOP), layer of protection analysis (LOPA) and piping and instrumentation diagram (P&ID) reviews.

As this alarm design information becomes available, the project continues by deciding how and where alarm-related data will be stored and managed. For this purpose, IEC 62682 has confirmed the concept of having a master alarm database, which is defined as 'an authorised list of rationalised alarms and associated attributes'.

Rationalisation

IEC 62682⁵ reminds us that in the rationalisation phase of the alarm life cycle, the following need to be identified for every alarm:

- recommended operator action
- consequence of inaction or incorrect action
- probable cause of alarm

Having this information available during operation leads to more consistent operator actions and helps inexperienced operators build up their knowledge base and confidence. Where existing facilities

are being revamped, operations staff are the most reliable source of this information. For new plants, the full definition of required alarms is more challenging, relying heavily on design and vendor data to define the required alarm configuration.

As well as capturing alarm requirements and design data, a key feature of an effective alarm database system should be the ability to export operator response data.

Ready access to this data in an online help facility is seen as particularly important for critical (in IEC terms, highly managed⁶) alarms and is increasingly expected by safety regulators. Plants already using such a system also report that it is a very effective operator support tool.

Continuous efforts

Moving into the operations phase, life cycle management is a central part of IEC 62682 and ISA 18.2 and has also been integrated into the third edition of EEMUA 191. Alarm management requires continuous efforts to maintain good practice and ensure consistency.

Today, many plants have their average alarm rate well under control, with low average alarm rates during normal operation. However, alarm floods are frequently still a challenge.

Figure 2 shows the alarm rate of a petrochemical plant over half a year. Although the average alarm rate is below one alarm

every 10 minutes and is therefore well under control, sometimes floods of more than 100 alarms every 10 minutes exist and smaller floods of about 20 alarms every 10 minutes occur quite regularly.

Unfortunately, these floods often occur during the most demanding phases when operators most need support (during start-up or shutdown, for example). Alarm flood scenarios include:

- alarms floods generated because process sections are shut down (such as low-flow alarms after pump stops), operating in different operating modes (eg, cleaning) or instruments being calibrated. These alarms can become a problem if they occur together with a process problem and important alarms are buried inside a flood of unnecessary alarms.
- alarm floods along the causal chain following a process upset. A single root cause can generate many consequential alarms. The first alarm in the alarm list might not be the alarm closest to the root cause — depending on the process dynamics and how thresholds are configured, secondary and misleading alarms might show up first.

Such alarm floods cannot be avoided just by choosing good configuration values for limits, hysteresis or delay timers. Advanced alarming techniques like hiding (called suppression by design



ALARM FLOODS CANNOT BE AVOIDED JUST BY CHOOSING GOOD CONFIGURATION VALUES FOR LIMITS, HYSTERESIS OR DELAY TIMERS.

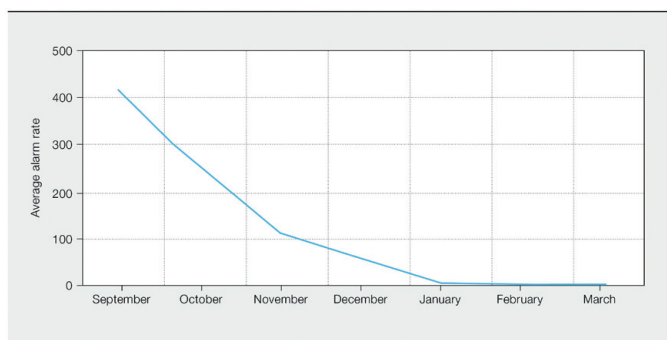


Figure 3: Reducing the alarm rate at the Rashpetco offshore gas plant.



in IEC 62682) and grouping come into play. Modern distributed control systems can provide advanced alarming, including alarm grouping, hiding (dynamic suppression) and alarm shelving (time-limited, operator-driven suppression).

Balanced risk

When addressing alarm floods, the challenge is to strike a balance between the potential risks associated with suppressing an alarm during a particular scenario versus the need to address peaks in the alarm rate during abnormal conditions. These risks are best mitigated via a combination of an effective alarm management toolset and a robust management of change (MOC) process to include the appropriate level of review and approval.

Initial (prospective) rationalisation reviews may have identified candidates for basic alarm suppression such as alarm grouping for alarms to be masked when equipment is out of service. Later alarm flood studies during the operations phase will seek to go further and draw on a full range of alarm system functionality, such as:

- operator comments on alarm responses
- detailed alarm analysis data
- current alarm attributes from the alarm database

Combining all this in a single toolset facilitates the identification of potential alarm suppression scenarios based on

analysis of actual plant data. With the need for manual, ad hoc analysis removed, the potential for human error in deducing cause and effect is greatly reduced and conclusions can be based on much larger data sets — extending over several years if appropriate. Once a particular scenario has been identified, reviewed and confirmed, the toolset can then be used to explore whether there are other instances in which the same logic can be applied. Integration between the alarm database and the DCS enables continuous alarm optimisation, enforcement and monitoring over time.

This approach has been of proven value in a number of cases, including:

- identification of consequential alarms following a particular shutdown
- critical event analysis, highlighting event triggers with potential for early operator response (intervention) and mitigation of equipment shutdown/plant upset

The main benefits are achieved through a life cycle toolset providing a framework for continuous improvement and include:

- reduced production trips
- reduced legislative risk — safer, more environmentally robust operations
- improved operator effectiveness

Figure 3 shows how it was possible to reduce the average alarm rate in a Rashid Petroleum Company (Rashpetco) offshore gas production plant. This resulted in a

reduction of plant trips from 25 down to six per year. As each trip is associated with significant costs, the overall savings are substantial.

Insight achieved

Alarm management is an area of increasing concern to regulators, other public bodies and the public at large who are pushing for evidence of a life cycle approach and continuous improvement, resulting in safer plant operations. With IEC 62682, the best practice in alarm management is finally available as an international standard.

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4. International Electrotechnical Commission 2014, *IEC 62682 - Management of Alarm Systems for the Process Industries*
5. *ibid*, section 6.2.1, Table 3, p36.
6. *ibid*, section 6.2.9, p38.

ABB Australia Pty Ltd
www.abbaustralia.com.au

MID-RANGE GIGABIT SWITCH

The Hirschmann GREYHOUND 1040 is a full Gigabit Ethernet switch designed to provide the high bandwidth and data speed needs of industrial networks and offers a 2.5 Gigabit Ethernet fibre port option.

The switch supports up to 28 Gigabit ports and can operate as a backbone switch. For networks with strict uptime requirements, the GREYHOUND 1040 enables system updates, modifications and expansions without taking the network offline through the use of redundant power supplies that can be easily changed out in the field, as well as interchangeable media modules that enable the addition of new ports or changing existing port types.



The GREYHOUND 1040 is suitable for applications in many industries, including power transmission and distribution, transportation and physical security.

Belden Australia Pty Ltd

www.belden.com

BUTTON LOAD CELL

The FUTEK LLB130 is an accurate subminiature, lightweight load button load cell. It has a capacity range from 1000 g to 22.6 kg, is made from a robust 17-4 PH stainless steel, is RoHS compliant and weighs 8.5 g with a 3.3 mm profile height. It is suitable for press or inline compression applications.

Miniature load buttons are traditionally not known for their high accuracy; however, the LLB130 offers a non-linearity of $\pm 0.5\%$ and deflection of 0.05 mm nominal.

The LLB130 Uses Metal Foil Strain Gauge Technology and features full internal temperature compensation, so that no external conditioning circuitry is required. It is also available with a TEDS/IEEE1451.4 option.

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CONTINUOUS GAS ANALYSER

Emerson has announced the release of the Rosemount CT5100 continuous gas analyser — a hybrid analyser that combines tunable diode laser (TDL) and quantum cascade laser (QCL) measurement technologies for process gas analysis and emissions monitoring. The CT5100 can detect down to sub ppm level for a range of components, while simplifying operation and reducing costs.

The CT5100 can measure up to 12 critical component gases and potential pollutants simultaneously within a single system, meeting local, state, national and international regulatory requirements.

The CT5100 operates with no consumables, no in-field enclosure and a simplified sampling system that does not require any gas conditioning to remove moisture. The analyser is suitable for process gas analysis, continuous emissions monitoring and ammonia slip applications.

The CT5100 is a combination of advanced technology, high reliability and rugged design. Its 'laser chirp' technique expands gas analysis in both the near- and mid-infrared range, enhancing process insight, improving overall gas analysis sensitivity and selectivity, removing cross interference and reducing response time. The laser chirp technique produces sharp, well-defined peaks from high-resolution spectroscopy that enable specificity of identified components with minimum interference and without filtration, reference cells or chemometric manipulations.

Solid-state components and a modular design with up to six lasers inside a single enclosure simplify start-up and commissioning and reduce field maintenance costs.

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FLOW SENSOR UPGRADE

Elettta has released simple methods for upgrading its existing orifice plate, differential pressure flow sensors.

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PANEL PCS

The PPC-3100S and the PPC-3120S panel PCs use the latest Intel Atom processor and have an easy-to-read diagnostics display.

Advantech Australia Pty Ltd

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RFID SYSTEM

The RFU65x RFID system detects tags at long range, recording the direction in which objects are moving at the same time.

SICK Pty Ltd

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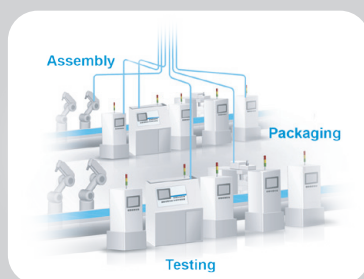
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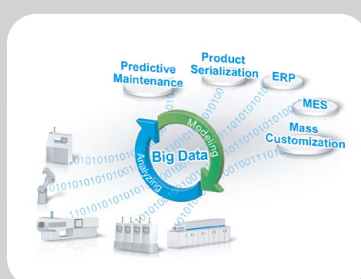
Enabling an Intelligent Planet

Advantech offers a spectrum of hardware and software to facilitate gathering information from the lowest level sensor and routing it over a network to higher level automation, visualization, and information systems.



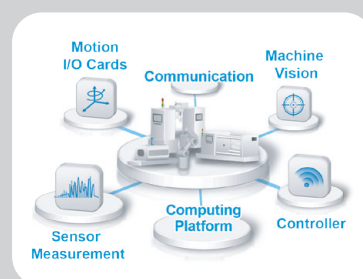
Connected Factories

Advantech's WebAccess Software together with products such as gateways can connect machines, robots and equipment to the factory network and integrate with MES and ERP systems.



Intelligent Services

Advantech's DAQ products allows users to configure the model for failure occurrence helping to develop a predictive maintenance system.



Smart Machines

Advantech offers a full range of products to make machines smarter including; motion control, machine vision, automation computing, sensor measurement, and integrated controllers.



Integrated drives for Zambian SAG mills



Kalumbila Minerals Ltd., a subsidiary of First Quantum Minerals Ltd., had ambitious output goals for Sentinel, its copper mine development project in north-west Zambia, and needed to recruit an entire workforce to build the infrastructure from scratch all while minimising costs.

Harsh environments, rising energy costs and water scarcity are just a few of the challenges facing the world's mines. Kalumbila Minerals was not only confronted by these challenges but also had more to grapple with when building two mines in an isolated area 150 km west of Solwezi, Zambia.

The region had practically no infrastructure for transportation or energy supply, and no workforce with the skills to build one. The local population worked in farming and ranching and had no experience with large construction projects. But having committed to source at least half of its workers locally, Kalumbila Minerals needed to find and train at least 4000 people to lay roads, weld pipes, erect pylons and even construct a new airstrip. A further challenge was Kalumbila Minerals' ambitious production targets: 300,000 tons of copper and 38,000 tons of nickel concentrate per year within the first six years of operation. Meeting this output target would demand advanced drive technology that could power all the mining machinery around the clock with minimal downtime.

To overcome the challenges and make the project a success, Kalumbila Minerals recognised the need for a partner that could offer a solution for both training new workers and providing high-performance integrated drives. End-to-end process optimisation was the only way the company could hope to overcome its production challenges while minimising operational and extraction costs. "For projects involving limited local skills and complex equipment, what we look for in a technology provider is a robust product and a skilled team with the ability to transfer knowledge to our local expert teams," said Nevin Scagliotta, commissioning manager for First Quantum Minerals' Projects Division. "With mills of this size, reliable and high-efficiency drives are top priority and crucial to project economics."

Kalumbila Minerals chose Siemens to provide the drive technology that would give it the power and the cost optimisation it needed. Siemens also knew what steps to take to successfully source and train the new workforce. Kalumbila Minerals recruited 4000 workers from the surrounding towns and hired 4000 indirectly through on-site contractors. Siemens' project team, comprising professional engineers, assembly

supervisors and on-site start-up engineers, then transferred its expert knowledge to the local teams.

Siemens provided the motor and drive systems for two 12 m semi-autogenous grinding (SAG) mills powered by 28 MW gearless mill drives (GMDs) and two 8.5 m ball mills powered by 22 MW GMDs. The integrated GMDs from Siemens provide Kalumbila Minerals with the end-to-end process optimisation essential to maximise efficiency and minimise cost. The drives also provide higher reliability due to the advantages of their gearless design — with no moving gears, there is no variance in the motor and no vibration. This vastly reduces energy loss, as all the force is transferred touch-free via a magnetic field. The lack of moving parts also virtually eliminates wear and tear and the risk of downtime. In the event that maintenance is required, the drives maintain high availability due to their dedicated maintenance modes, such as creeping or inching with rollback of the mill.

"Torque and speed control, and especially the frozen charge protection, keep the mill operating in the safe range, minimise downtime and keep production high," said Axel Fuchs, project manager at Siemens Process Industries and Drives. "The Siemens GMD offers 28 MW and a 150% overload at 9.1 rpm."

The integrated drive train came with Simatic PCS 7 and Sinamics SL150 cycloconverter technology. The Simatic PCS 7 controller for the mill drive and Kalumbila Minerals' existing DCS could be seamlessly integrated due to their common platform, while the Sinamics SL150 offers high overload capacity and efficiency through direct energy transformation, which results in availability of more than 99.5%.

Siemens proved itself to be a trusted partner with the provision of a quality service. This included the professionalism with which its team managed the project and the engineering expertise demonstrated by its gearless drive technology. "For a critical and complex piece of equipment like the mill drives, it is vital to have a self-managing and professional vendor. This is what Siemens has provided with its gearless mill drives and the commissioning team," said Scagliotta.

Siemens Ltd
www.siemens.com.au



CORROSION MONITORING SYSTEM

Emerson Process Management has launched a non-intrusive wireless-based corrosion monitoring system for refineries. The Roxar corrosion monitoring system, consisting of wireless-based probes, will provide refineries with flexible, responsive, integrated and highly accurate corrosion monitoring.

The system will also help identify and track opportunity/high TAN crudes and their corrosive elements. Such crudes are less expensive but more corrosive than others with the system enabling the maximum amount of such crudes to be blended into the mix without increasing corrosion risk.

The Roxar corrosion monitoring system consists of electrical resistance (ER) and linear polarisation resistance (LPR) probes and weight loss coupons — all with high temperature ratings, high resolution (10–100 nm) and fast response times. The ER and LPR monitoring functions are also available on the same instrument and a 20 m cable provides added flexibility with respect to positioning, optimised signal routing, easier maintenance and probe replacement.

The system also comes with advanced wireless capabilities and is compatible with the WirelessHART protocol as well as Emerson's broad product refinery range. The system is part of a complete asset integrity solution and works alongside the Roxar Field Signature Method (FSM) and Rosemount pressure and temperature transmitters and repeaters.

The system can be installed in a number of refinery applications, including side streams, cooling systems and in addressing naphthenic acid corrosion in high-temperature distillation processes. It can also tackle increased corrosion triggered by high velocity and temperatures, malfunctioning desalting units and high sulfur content.

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

SURGE SUPPRESSOR KIT

A surge suppressor kit is now available for use with Moore Industries' field-installed instruments enclosed in its BH and SB housings. The kit is approved for use in explosion-proof applications in the United States/Canada (sCSAus) and Australia/New Zealand (ANZEx).

The surge suppressor exceeds Severity Level 4 of IEC 61000-4-4, providing 3 kA (8/20 μ s) of surge protection stopping failures due to lightning, spikes and overvoltage surges while minimising other electrical noise. This suppressor allows HART signals to pass through and therefore can be used to suppress or protect both analog and HART digital/analog signal lines.

This surge suppressor can be used with Moore Industries' temperature and signal transmitters, signal isolators and signal converters and is easy to install and wire.

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MULTIFUNCTION PROCESS INDICATOR

The Model IQ200 is a multifunction 48 x 96 mm panel indicator for process inputs with six red LED high-brightness digits. The 14-segment alphanumeric displays and plain-language menu prompts make for quick and easy set-up and programming.

Input types include mA, V, counts, frequency and potentiometer, plus an event timer mode. RS232 serial communication with Modbus is included as standard, as are the three user-programmable push-buttons, two digital inputs and 16-point lineariser.

Analog process variables may be calibrated either by direct sensor injection or by user-entered display ranges. The minimum and maximum value recording, moving average digital filter time and filter band are also user-programmable.

Options include up to four set-point relays, 16-bit analog retransmission, a real-time clock and a second RS485 serial interface. When an analog output is added, the product may be used as a manual set-point station to transmit an output without any input. Standard or special firmware may be uploaded in the field via the RS232 communications interface.

The unit fits standard 1/8 DIN 45 x 92 mm cut-outs with an overall depth behind the panel of only 106 mm, including the plug-in cable connectors. Auxiliary power supply variants are 85–264 VAC, 10–30 VDC or 25–70 VDC, while the sensor excitation of 24, 12, 5 or 2.048 VDC is user-selectable.

With a display range of -199,999 to 999,999 counts and 24-bit ADC resolution, the product is a simple-to-use multifunction process panel indicator.

Instrotech Australia Pty Ltd

www.instrotech.com.au



PHOTOELECTRIC SENSORS

Banner Engineering has announced that its next-generation S18-2 compact photoelectric sensor series is now available in fixed-field background suppression mode configurations. The compact, self-contained sensors provide up to six factory-calibrated detection ranges from 30 to 200 mm to satisfy diverse and high-volume applications.

The background suppression sensors are resistant to fluorescent light and offer a high level of cross-talk avoidance. With a small, bright red LED emitter beam, the sensors are easy to align to the target and ensure very small shifts in the detection range caused by target colour variation.

For ease of use, the sensors feature a highly visible output as well as dual-function power and stability indicators. The indicators comprise one green and two yellow LED lights. Solid green indicates power is applied and the sensor is ready, while green flashing specifies a marginal sensing signal. The two bright yellow LEDs, visible from both sides of the sensor, indicate the output is conducting.

Designed with a rugged ABS plastic housing, the sensors are well sealed against water ingress. A wide operating temperature range of -40°C to +70°C ensures optimal performance for diverse applications.

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HYGIENIC SELF-PRIMING PUMP

The Alfa Laval LKH Prime is a self-priming pump that meets the requirements of a range of hygienic industries, including food, dairy, beverages and home personal care.

Using the combination of airscrew technology, an optimised impeller and casing geometry, the pump provides efficient operation with reduced energy consumption and a low CO₂ footprint. It is EHEDG certified and authorised to carry the 3-A symbol.

Designed for cleaning-in-place (CIP) duties containing entrained air, the device can also pump product, potentially reducing the capital investment when designing process systems.

Quiet in operation, the pump reduces sound pressure levels by 80% when compared to products using traditional pump technologies for CIP/entrained air applications.

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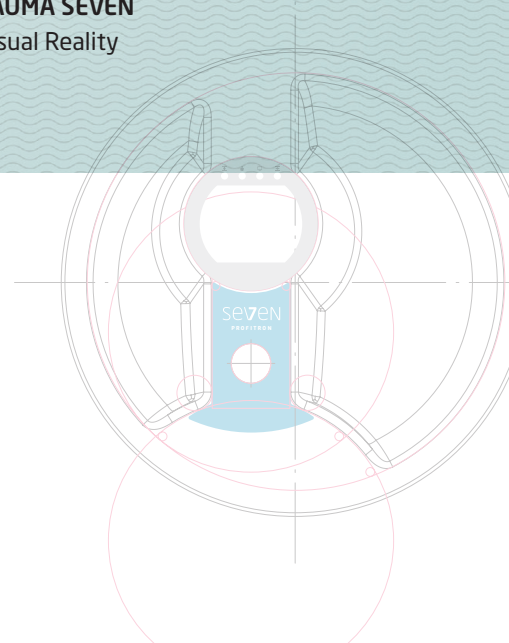
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IP69K VALVE MANIFOLD

SMC has launched an addition to the SY series of valve manifolds with an IP69K rating, targeted at the food and packing market.

The IP69K manifold is available as part of the SY 5000 range and was developed with food industry users in mind. The unit is suitable for wet areas and can withstand washdown and cleaning. Users have the ability to install valves outside of a protective box and close to the actuators for better control. The device is lightweight and comes in a small package, is corrosion

resistant, and easy to clean and maintain.

The manifold is available from 2 to 16 stations with a variety of valve styles offered. The manifold valves are available with options of rubber or metal seal valves. Pressures from 100 to 700 kPa are achievable in the rubber seal, with the metal seal operating at up to 1000 kPa.

The compact unit also comes with an optional power saving coil that draws as little as 100 mW.

SMC Pneumatics (Aust) Pty Ltd

www.smcaus.com.au

MODULAR SAFETY FENCING

Satech offers a perimeter guarding solution that meets the required international standards for correct implementation of a fixed or removable safety guard. With special attention given to the design of the guard itself and the patented mounting and fixing hardware, installation is made as quick and simple as possible using specially designed captive fasteners and pre-punched holes. All aspects of AS and ISO standards are taken into consideration in every aspect of the guarding range ensuring a fully compliant end result with minimal intrusion to the surrounding environment.



Uneven ground surfaces are covered through innovative adjustable mounting brackets, and the patented 'clip' system allows users to fix or remove fence panels in seconds. The clips are simply positioned over the post and fastened in place, another is then installed over the top once the guard has been put into place. Removal is as simple as undoing two captive bolts and sliding out the guard.

For unique machine layouts, custom shapes and sizes can be made to suit allowing for a complete tailored solution for specific machine guarding requirements.

Control Logic Pty Ltd

www.control-logic.com.au



DIAGNOSTIC KIT FOR DEWPOINT TRANSMITTERS

Michell Instruments has upgraded its Universal Communications Kit diagnostic tool to enable users of its Easidew and Pura ranges to carry out on-site checks and reconfigure their dewpoint transmitters simply and easily.

The upgraded tool comes with updated application software that is backwards compatible with previous versions. This means users can use the upgraded tool with older transmitters, making it easier for service engineers who will not need to carry different pieces of kit.

The communications kit allows users to check and configure transmitters via application software installed on a PC. This allows maintenance engineers to digitally measure and display moisture and temperature readings for on-site transmitter spot-checking and also to reconfigure the transmitter output units, range and fault settings to match requirements of the process.

The complete diagnostic tool is packaged in a convenient carry case and includes the software, USB cable and transmitter docking station. It is powered from a PC USB port, which, in turn, powers and receives a digital signal from the Michell dewpoint transmitter.

AMS Instrumentation & Calibration Pty Ltd

www.ams-ic.com.au



DENSITY METERS

Thermo Sarasota FD950 density meters detect any density variation of process constituents or final product quality in near real time. These online continuous meters provide key information for process monitoring and control, quality control and product interface detection.

Compact and lightweight, the density meters tolerate significant plant vibration and can be installed directly into existing pipework. A choice of sensor materials is offered for wetted parts, including Hastelloy C276 for improved corrosion resistance. With hazardous area approvals and secondary containment on all models, these instruments withstand tough industrial environments. Users are able to improve productivity, minimise product waste and reduce costs.

They feature the ability to measure at process conditions and offer a straight-through flow path. Applications include blending, product identification, interface detection, dilution measurement, process/quality control, SG measurement, process efficiency and product consistency.

Thermo Fisher Scientific

www.thermofisher.com.au

DRY WELL CALIBRATOR

The portable Fluke 9170 dry well calibrator achieves low temperatures, reaching -45°C in normal room conditions. It is available to rent from TechRentals.

The product has a large LCD display, a numeric keypad and an onscreen menu which allows the user experience to be easy and intuitive. The display shows the block temperature, cut-out temperature, stability criteria and ramp rate.

The calibrator comes with software that enables completely automated calibrations of RTDs, thermocouples and thermistors. Metrology wells have four different preprogrammed calibration tasks that allow up to eight temperature set points with 'ramp and soak' times between each. Along with a calibration range of -45°C to 140°C, with stability of $\pm 0.005^\circ\text{C}$, the unit has a display accuracy $\pm 0.1^\circ\text{C}$ full range. Immersion depth is 160 mm.



TechRentals

www.techrentals.com.au

ERNTEC

FAULHABER Drive Systems for Electrical Grippers

Today, the productivity rate for pick & place units and precision movement in advance manufacturing is measured in cycle times ranging below one second.

Electrical gripper systems are characterised by acutely attuned, flexible gripping-force control and precise, synchronised movement, often in a small space - with maximum dynamic response.

To drive such a solution, leading companies rely on the technologies and know how of FAULHABER

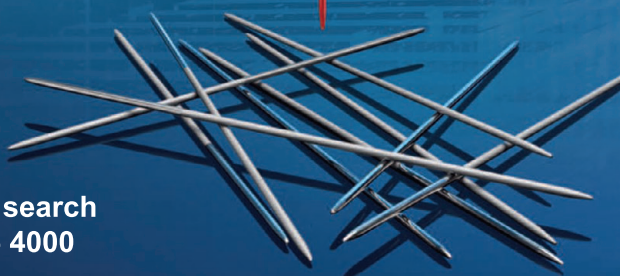
The BX4 Brushless, 4-pole servo motor series is a great solution for precision gripping and dynamic movement in advanced manufacturing operations.

FAULHABER



FAULHABER BX4.

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For further information web search
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Metal fabrication on the path to the IoT

Under the umbrella of SMS Holding GmbH, the SMS group is a group of international companies devoted to systems and machine building for the steel and non-ferrous metal industry. The business units include continuous casting plants and rolling mills, as well as equipment for steelworks, and tube and pipe and forging technology. Over 14,000 employees worldwide generate sales of around 3.4 billion Euros.

SMS initiated its strategic project for complete modernisation of production even long before the term the Internet of Things (IoT) reached the ears of the public. The goals are a sustained increase in productivity and shortening of delivery times as well as long-term job security at its Mönchengladbach plant. Behind these objectives is an investment volume of over 60 million euros. In addition to modernising the infrastructure, well over half of this investment was in highly modern equipment for producing system components for the heavy machines that SMS builds. In just over three years' time all the machines were replaced with a new pool of machines — all without interrupting production. Today, boring mills, a double boring mill with two operator's platforms, gantry machines, vertical lathes and flatbed lathes with up to 21 m of travel are producing complex parts made of tempered steel weighing up to 200 t. These are generally one-off parts or small series of maximum 10 pieces, which often run many hours or even weeks on a machine without interruption.

"We are taking a variety of small and larger steps on the path to the IoT," said Alexander Goebels, head of production planning at the Mönchengladbach plant. One of these steps is greater flexibility in production, which is to say production planning with respect to flexible machine utilisation. Overall tool management based on tool identification using Tool-ID from Balluff is a key component in the new organisation and automation concept.

"Our tool management is today neither economically justifiable without the RFID data carriers, nor is it conceivable for reasons of process reliability with respect to error prevention such as incorrect matching, or typing mistakes when manually entering tool parameters," added Judith Schmitt, plant manager for mechanical production.

"All the machines are incorporated into an integrated framework organisation with central NC programming in the work preparation and decentralised PC stations for production data acquisition and NC program simulation using EXAPT," explained Schmitt. In addition, a host production



controller computes the greatest possible machine utilisation. Also part of the overall system is a central tool presetter that supplies all the machines.

Tools are provided to the machining centres for the most part fully automatically, such as in the heart of production with four machining centres and an associated high-bay warehouse for the workpiece pallet automation system.

"On average, the machining time for components in this production area is two hours per fixture, with often 70 to 80 different tools required," added Goebels. A particular highlight of the high-bay warehouses is the integrated shuttle system for fully automatic supplying of the machining centres with tools. The prepared tools are brought to intermediate storage stations/provision areas at the machining centres. From there a second shuttle takes the individual tools and delivers them in a manner synchronised with the movement of the respective platform machine, so that the tool handler of the machine can take the tools on the fly during the main work phase. The tools are returned in the same manner. Goebels notes that in this area alone, including the 120 magazine slots in the four machines, around 1000 actively job-specific tools are circulating.

"In the entire plant we manage around 10,000 technologically and geometrically different tools, each of which is available either singly or if needed as multiples," added Peter Sosnitzka, who is responsible for the tool setters. In his area all the tool components are maintained and in general all tools prepared. Here the relevant tool parameters are sent to the Balluff RFID data carriers without contact at the same time they are measured. The data is passed along to the EXAPT tool and production management program, which handles the entire process chain from tool identification to management to actual production use. The system ensures consistent processes, greater transparency and all-in-all increased production efficiency. The Tool-ID system from Balluff further ensures that all the required tool data including the tool life written back on the machines is available, correct and up to date, at every place the tools are used.

"The tool identification system from Balluff contributes in many ways to sustained increase in productivity and shortened delivery times," said Goebels, who sees the overall halving of delivery times as achieving the goals of the modernisation project.

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CLOUD-BASED SCADA AS AN IIoT GATEWAY



Consumer media is awash with articles concerning the Internet of Things (IoT) and how smarter devices — the things in the IoT — are changing the world. Another hot tech topic is the cloud in all of its forms: cloud storage, cloud-based apps, cloud-powered mobile devices, cloud-hosted virtual machines and other applications.

While there may be much talk about the IoT and cloud services, they have much more to offer than consumer-grade conveniences. A fusion of IoT and cloud technologies has specific applications in the industrial automation sector, creating the Industrial IoT (IIoT). Unquestionably, cloud-based SCADA software provides an ideal gateway to deliver practical and actionable IIoT information to those who need it.

Most IoT discussions to date have focused more on commercial than industrial implementations, but according to a GE/Accenture white paper, this focus should be changed to favour the IIoT because “data created by industrial equipment such as wind turbines, jet engines and MRI machines ... holds more potential business value on a size-adjusted basis than other types of Big Data associated with the social Web, consumer Internet and other sources”.¹

Consumer-focused discussions about the IoT often revolve around refrigerators and coffee pots chattering with each other, or maybe reporting some details to their users. However, for IoT applications

to move beyond curiosities and parlour tricks and into the realm of usefulness, the bits and bytes of available data must be served up within a pertinent context and formed into actionable information.

Harnessing cloud capabilities to harvest IIoT factory data and then distribute it to users is a powerful combination. Cloud-based SCADA software is an ideal platform to act as an IIoT gateway, empowering customers to use information and reap significant benefits.

Interfacing to existing automation systems

One overlooked reality is that factories, process plants, OEM equipment, materials handling systems and remote facilities are often actually quite a bit smarter than often realised. Most of these systems are automated by various types and vintages of computer-based control and monitoring systems. This means the foundations are in place for large amounts of data to be provided to cloud-based systems.



Sometimes the biggest challenge is geographic, when a facility is fragmented into many islands of automation that are not yet integrated with each other or with higher level computing systems. Other times, a site has legacy or proprietary control and monitoring systems which are not readily tapped for data. Fortunately, there are many solutions available to address each of these situations in a cost-effective and scalable manner.

The good news is that the data available from automation systems is of the very best type for IIoT implementations. IIoT data can concisely define a system's throughput and performance, and show where it is working well and where it is breaking down. And this is the kind of information that can be acted on to expose unexpected inefficiencies, enable improvements that make a factory work better and generate significant savings.

Crunching numbers or making connections

Perhaps it is important at this point to develop a distinction between

a 'data concentrator' and a 'cloud-based IIoT gateway', since the two functions are related but distinct. Both are typically incorporated in a complete IIoT solution — data concentrators are closest to the data sources, while the gateway is closer to the data consumers.

Any factory-located automation or data acquisition system, however large or small, can act as a data concentrator. These distributed systems — whether they are PLCs, proprietary controllers or even HMI's — can touch a large number of I/O points. However, not every limit switch status needs to be reported to the outside world, even though such information might be critical to automation system operation.

Instead, what makes the most sense is for the local automation or data acquisition system to crunch the numbers and perform real-time control, and to consolidate only the most useful information. Sometimes this information is an actual field signal like a pressure or temperature, while in other cases this information is derived from calculations, alarming logic or other algorithms. Raw field signals are conditioned to remove noise and scaled into proper engineering units to make them most useful. Equipment operating modes and conditions also provide important information, but are not usually based strictly on I/O signals, and thus require some data preparation by the local automation system. Data concentrator sources can reside in a single facility, or be distributed over multiple geographical locations.

The resulting serviceable information is really what needs to be communicated to supervisory systems so that humans or higher level software can act accordingly. A cloud-based IIoT SCADA gateway is the connection system that aggregates one or more data concentrators and other data sources to perform the communication function from the concentrators to the data consumers.

In a sense, the SCADA gateway is also a concentrator of sorts. While the data concentrator pre-processes and refines various data streams locally, the gateway consolidates various data concentrator streams into a single, common accessibility platform.

For example, cloud-based SCADA systems can add intelligence to data by executing pre-programmed routines to show patterns and predict incidents before they occur. This can be done by applying certain business intelligence rules to the data.

Fourth time's a charm

Why are data concentrators and cloud-based IIoT SCADA gateways more relevant than ever? The quick answer is 'Industry 4.0', which is concerned with IIoT power and with increasing communications among devices, machines and humans via internet connectivity.

Creating true value is the goal of Industry 4.0, but how is this achieved? Deutsche Bank Research finds that factories, logistics and even products become smarter to support the required functionality. The concept encompasses "not only value creation per se, but also work organization, business models and downstream services. It does this by using information technology to link up production, marketing and logistics and thereby captures all resources, produc-

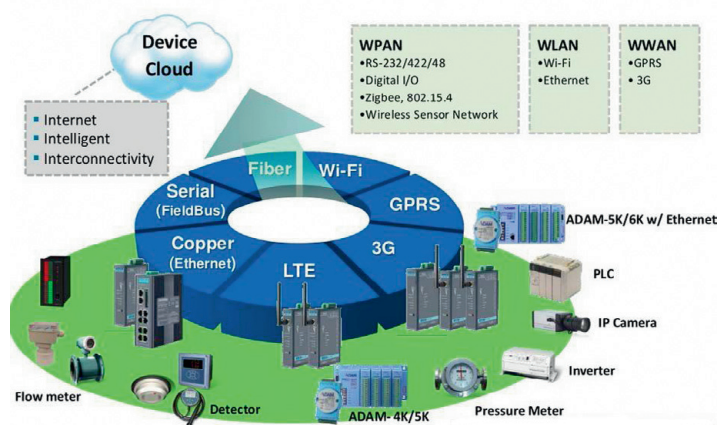


Figure 1: Cloud-based interconnectivity.

tion facilities and warehousing systems. The reorganization thus extends from the energy supply and smart power grids through to advanced mobility concepts ...".²

A cloud-based IIoT SCADA gateway occupies a space in the middle of the requisite Industry 4.0 technologies. Data is generated at IIoT devices, and it is consumed by mobile users and business applications. The gateway is what gathers all of the pre-processed information and makes it effectively available for end users or data consumers.

Another aspect to consider is who will be integrating the IIoT with the cloud. Traditionally, operations technology (OT) automation engineers have handled the control systems and related equipment, while information technology (IT) professionals have handled business computers and networks. The nature of data concentrators and cloud-based IIoT gateways is that the two disciplines now interact and actually overlap. Therefore, for effective IIoT implementations, the relationship between OT and IT must be carefully cultured and managed. The first step is to identify the data.

It's all about the data

When it comes to smart manufacturing information, 'more is better' sometimes but 'better is best' all the time. This means that even though it is possible to transmit every possible signal, a better strategy is to make good decisions about what is provided to the gateway. It is important to remember that excessive data may become an intractable mass, blurring effective use of the valuable information buried within. Good data pre-processing choices will transform disorganised data into targeted and useful information.

Key characteristics of IIoT data are:

- Industrial systems can create a multitude of raw real-time field data.
- Automation systems can pre-process raw data to put this information into context.
- Data can be continuous, scheduled or event-driven.
- Established control systems are powerful enough to process and network field data, while IT systems handle processed data.
- Databases or other applications are needed to bridge the two systems.

The most straightforward data sources consist of process signals like flows, levels, pressures and temperatures. But what constitutes a 'good' value and what defines a 'bad' situation that requires attention? The system designer must provide enough information to put these types of signals into context.



THE GOOD NEWS IS THAT THE DATA AVAILABLE FROM AUTOMATION SYSTEMS IS OF THE VERY BEST TYPE FOR IIOT IMPLEMENTATIONS.

Certainly high and low alarm thresholds can be established as identifying good and bad values, but alarming and logging doesn't always tell the whole story in a way that can help to counter developing off-spec conditions. It might be more appropriate to identify process conditions as optimal, average or substandard — even if they are not in a fully alarmed situation. This higher order of pre-processing will flow through the gateway and allow users to make more effective decisions.

Analysing every source of industrial data in an operation can be a daunting task, so the key is to divide and conquer by initially selecting sources expected to provide the best value.

One strategy is to pick a few small and simple data sources and systems as a first project, even if they may not offer the absolute best return. An air compressor system might be a good example. When the test cases are proven, one can focus on more complex data that will help improve high-value product processing.

Consider the best way to elevate useful information to users. For instance, knowing whether a photoelectric sensor is on or off on a conveyor may not be very helpful at a supervisory level, but counting how many items passed a checkpoint during the last rolling hour or during a shipping campaign may describe the operation's efficiency in a useful manner at a glance.

Sometimes it is not necessary to reach all the way down to an automation controller in order to obtain IIoT data. Many systems incorporate HMIs, operator interface terminals (OITs) and control systems which are primarily used to provide automation system visibility to operators, and to allow them to initiate commands. These products may actually be the preferred solution for smaller skid equipment where each package has its own controller and OIT.

As the data harvesting activity proceeds, keep in mind that IT systems are tailored to provide processed data. Common networking protocols and methods are quite good at handling large data blocks such as videos and computer files. This contrasts somewhat with the comparatively smaller-sized blocks of industrial data. OT and IT systems are still a good fit for interconnectivity, but these differences must be understood, and accounted for as required.

Databases are one method of pre-processing data on a larger scale and can represent an effective option for bridging OT systems to the IT level. Similarly, a dedicated application such as a third-party historian may be the right choice to archive large amounts of historical data and then perform calculations or reporting on it so that only the pertinent results are offered to the gateway.

Why look to the cloud?

There are many inherent benefits and features of using a cloud-based IIoT gateway, such as:

- Compatibility with legacy interfaces like RS-232/485 and contemporary fieldbus technologies.
- Ability to handle many common industrial protocols such as Modbus and EtherNet/IP as well as vendor-specific protocols.
- Operating via advanced TCP and UDP connectivity over various established media such as wired Ethernet, Wi-Fi and cellular data networks.

- Providing redundancy, local storage and store-and-forward capability.

Possibly the greatest characteristic is flexibility. Even though cloud-based configurations use the latest internet technology, they are modular enough to incorporate legacy media and communications methods. There are bridging devices available to empower such legacy devices to be useful IIoT data sources, by converting proprietary protocols to standard Ethernet-based outputs.

Although communication media and protocols are moving to standardisation, there are still many technologies in active service. Examples of industrial fieldbus technologies include Profibus, Foundation Fieldbus and DeviceNet — each implemented on a variety of media. Other protocols are somewhat tailored to specific industries, such as BACnet and LonWorks for building automation, and DNP for the power industry. Add to this the fact that some device manufacturers still use vendor-specific protocols and there remains a wide variety of communication methods.

Cloud-based gateways have the ability to roll up all these varied communication methods into a common platform. Each connection is translated as needed, so that the end user is presented with a unified structure. The cloud-based gateway itself uses common web protocols and advanced Ethernet, TCP and UDP connectivity to ensure required levels of performance.

Figure 1 depicts how cloud-based SCADA can act as a centralised pivot point for harvesting IIoT information from industrial automation systems using a wide variety of media and protocols.

Other capabilities expand the effectiveness of a cloud-based gateway. For instance, redundancy capabilities improve system uptime in the event of a failure. Similarly, local storage combined with store-and-forward capability allows information to be buffered during a failure and then transferred when service is restored. Even though IIoT information is less critical than direct local real-time control, users still demand reliable communications performance.

Conclusion

The IIoT is rising in prominence, perhaps even faster than the commercial IoT. Cloud technologies are more than up to the challenge of securely handling manufacturing data.

A cloud-based SCADA system can act as a centralised pivot point for harvesting IIoT information from industrial automation systems. Such a system harnesses all the performance and capabilities of today's powerful internet applications, with enough flexibility to access almost any vintage of data source. Add to this the ability to reach out to connect data over many types of wired and wireless media, and it is evident that cloud-based SCADA is an ideal method to implement Industry 4.0 and fully harness the power of the IIoT.

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Looking Forward

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VALVELESS METERING PUMPS FOR HYDROGEN PEROXIDE

FMI Pumps' valveless, ceramic metering pumps are suitable for metering concentrated hydrogen peroxide (H_2O_2), used in food applications as an effective sterilising agent. Accurate dispensing of H_2O_2 is critical to container sealing during aseptic packaging processes for a variety of food products.

The pumps feature only one moving part, a ceramic piston, in contact with the fluid. Chemically inert and dimensionally stable, ceramics offer good chemical and wear resistance. The pumps also feature the company's CeramPump pumping principle whereby the ceramic piston accomplishes both the pumping and valving functions, eliminating all check valves.

These features make the pumps suitable for OEM sterilisation equipment as they provide maintenance-free operation for millions of cycles, at a precision of 0.5% or better without the need for recalibration.

STAUFF Corporation Pty Ltd
www.stauff.com

SURFACE PASSIVATION FOR TRACE-LEVEL ANALYSIS

For its variable area flow meters DK 32, DK 34 and DK 37, KROHNE now offers the option of surface passivation for trace-level analysis.

Trace-level analysis is used for providing evidence of very small concentrations in the range of ppm (parts per million) to ppb (parts per billion). Here, it is important that none of the particles to be detected are already adsorbed in the sample feed line as this would lead to a delayed or even wrong analysis result. Examples are the measurement of H_2S content in natural gas or oil, mercury, or NO_x/SO_x flue gas analysis in various industries.

To avoid adsorption, sample feed lines, fittings and valves can be surface passivated. This can now also be applied to the DK 32, DK 34 and DK 37 all-metal purgemeters that are used for adjustment and monitoring of the sample flow to the analyser.

Before being assembled and calibrated, all metal components in contact with the medium, such as cone, float, valve components, etc, receive a SilcoNert 2000 inert silicon coating at a temperature of 400°C. The same is possible for wetted metal components of DK 46, DK 47, DK 48 and DK 800 glass devices.

KROHNE Australia Pty Ltd
www.krohne.com.au

MULTILINE OPTICAL SENSOR

The special characteristic of the Sick MultiLine sensor is the two parallel light lines — the compact W4 housing accommodates two photoelectric sensors operating simultaneously. The sensor is therefore suitable for detecting objects such as printed circuit boards that have gaps or openings, as well as exceedingly flat objects such as blister packs or soup packets.

With respect to objects with gaps, using conventional photoelectric sensors involves the risk that the light and thus the reflection to the sensor may disappear through a gap.

The consequence is that the sensor switches off, even though the object is still present. A similar phenomenon can be observed in the case of flat objects with reflective, curved and transparent areas. Here, too, the light may disappear for a short time and switch off the photoelectric sensor.

With the MultiLine sensor, when an item moves into the scanning range, it switches on if the two lines have detected the object. The signal will be active until both light lines no longer signal an object. If, in the meantime, one of the light lines goes missing, the other line maintains the signal.

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SAFETY LIGHT SCREEN

The EZ-SCREEN LS is a rugged, easy-to-use safety light screen that is optimal for machine safeguarding.

The EZ-SCREEN LS features highly visible bi-colour alignment indicators that allow for simplified set-up, easy troubleshooting and streamlined installation. The end-to-end sensing design of the EZ-SCREEN LS eliminates gaps in detection when mounted on top of machine work surfaces and between cascaded segments. For added ease of use, the system requires no PC software, DIP switches or other device for configuration.

To accommodate diverse applications, the EZ-SCREEN LS is available in three resolutions — 14, 23 and 40 mm — with a range of up to 12 m. Sensor lengths range from 280 to 1820 mm in 70 mm increments. Cascade models are also available, which allow users to combine up to four systems of any length, any resolution and any number of beams.

Banner's EZ-SCREEN LS features dual scan technology, which makes it highly immune to EMI, RFI, ambient light, weld flash and strobe lights. The EZ-SCREEN LS is also compliant with the most rigorous worldwide safety standards, including FMEA testing to ensure control reliability, and is third-party certified to Type 4 per IEC 61496, Category 4 PLe per EN ISO 13849-1 and SIL3 per IEC 61508; SIL CL3 per IEC 62061.

The EZ-SCREEN LS emitters and receivers include a 5 mm recessed window and are protected against impact by a 3 mm thick aluminium IEC IP65/IP69 rated housing and metal end caps.

Turck Australia Pty Ltd

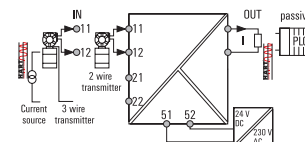
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Weidmüller now offers to market a new member of its well-known ACT20 signal converter series. Consisting of three input/output variants, the ACT20P signal converter delivers reliable protection to controls and PLC modules against voltage peaks and ground loop errors. The ACT20P converters are fully HART transparent to allow easy integration with a HART communication system, in addition to high accuracy and a compact size. These features make the ACT20P signal converter a low-cost, universal solution to all tasks involving the analogue isolation of current signals. Let's connect.

www.weidmuller.com.au

HYGIENIC PANEL CONSOLES

Siemens SIMATIC HMI Comfort INOX panels are suitable for use in food and beverage, pharmaceutical and chemical industries as well as others requiring hygienic production areas.

With food-standard sealing material and shatter protection for the display to prevent contamination of foodstuffs, the panels provide a high standard of hygiene for the food and beverage industry. The panels meet industry criteria that all equipment and components are easy to clean and disinfect so that cross-contamination of food can be avoided.

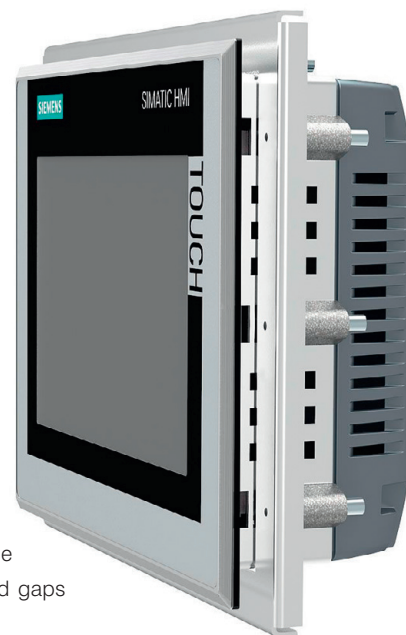
The consoles provide an intuitive local operator interface for machines. Using the SIMATIC WinCC Audit option for panels, operator audit trails can be captured as required to assist FDA validation.

The wide-screen devices are available in 7", 12", 15" and 19" display sizes and are equipped with an analog-resistive touch sensor. Due to a solid membrane, it is possible to obtain the IP66K high degree of protection. Optimised rack design with slight projections to the cabinet allows liquids to run off. The panels have a smooth 240 grit hairline finish. The membrane covering the display cut-out provides shatter protection, is resistant to chemicals and has minimal grooves and gaps in which microorganisms could settle.

The panels come with a food-standard device seal and rear clamping frame that ensures even application pressure of the seal.

Siemens Ltd

www.siemens.com.au



COMPRESSOR

Atlas Copco's Z series of variable speed drive (VSD) compressors, featuring in-built drying systems and Energy Recovery (ER), are suitable for the food processing industry. Oil-free compressed air, with low moisture content from the in-built dryer, helps ensure the quality of the food being produced. With no risk of contamination from machine oil in the compressed air that is used in food processing, the quality of the produced food is guaranteed, the company said.

The VSD is able to reduce the electrical power requirement of the compressor by an average of 35%. Meanwhile, the ER system can recover up to 94% of the remaining input energy to the compressor. This energy is recovered in the form of water heating, which can be used supplement boiler feed for steam etc.

For example, a standard 132 kW oil-injected screw compressor will use over 1000 MWh of electricity in a year. Replacing this compressor with a Z series compressor with VSD technology can save over 350 MWh per year, reducing the electrical input energy to just 650 MWh. Coupling the compressor with the

ER system will recover over 650 MWh of heating energy. This effectively means that the compressor allows the user to use the input energy twice and saves over 1000 MWh of energy every year.

Atlas Copco Compressors Australia

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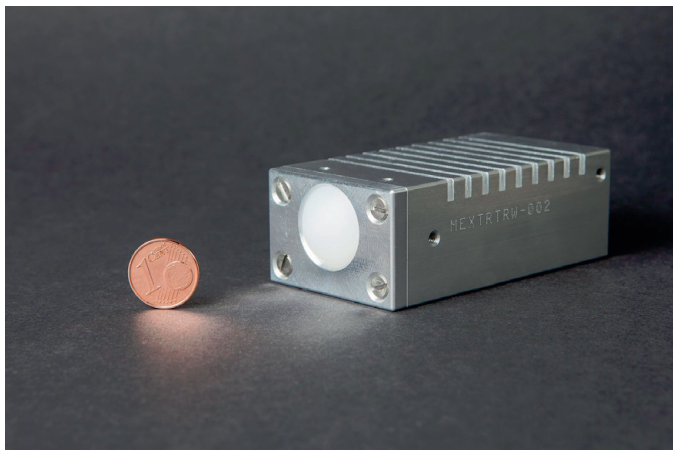
The limitations of optical safety scanners have now been overcome by the use of millimetre-wave radar technology.

Nowadays, it is impossible to imagine industry without robots. Safety laser scanners mostly safeguard dangerous areas and protect people from collisions. But optical sensors have their limitations — for instance, when plastic surfaces, dust or smoke obstruct their line of sight. Fraunhofer researchers have developed a new, high-frequency radar scanner that cuts through these obstacles. It can monitor its environment over a 360° radius, making it ideal for safety applications wherever people and robots work together.

The increasing connectivity of production systems in 'smart' Industry 4.0 operations is driving increased interaction between people and machines, resulting in a trend towards industrial robots

that operate without protective barriers. A prerequisite for this level of co-working is that people must not be endangered at any time — but that is precisely the Achilles' heel of collaboration between people and robots. Currently, laser scanners are used to monitor the danger zone around machinery and to stop the machine as soon as a person enters the zone. However, optical sensors do not always achieve reliable results under changing light conditions. They also do not work if smoke, dust or fog limits visibility.

Researchers at the Fraunhofer Institute for Applied Solid State Physics IAF have developed a compact modular 360° radar scanner that is superior to optical sensors in many respects. This makes it a perfect choice for safety applications for human-machine col-



The radar module is no larger than a pack of cigarettes. ©Fraunhofer IAF.



BASED ON THE CALCULATIONS, IT IS POSSIBLE TO DETERMINE THE DISTANCE, POSITION AND SPEED OF THE OBJECTS.

laboration. The radar works with millimetre waves that are reflected by the objects to be observed, such as people. Transmitted and received signals are processed and evaluated using numerical algorithms. Based on the calculations, it is possible to determine the distance, position and speed of the objects. If several radar units are used, an object's location in the room can also be determined, as can the direction in which it is moving.

The human eye and optical sensors cannot see through wood, paper or plastic. In contrast, millimetre waves (W band: 75–110 GHz) penetrate all dielectric materials and, therefore, optically non-transparent materials, such as clothing, plastics surfaces and paper, as well as dust, rain, snow and fog.

"Our radar is not focused on one point. Instead, it sends out millimetre waves in a club shape. Unlike a laser scanner, the signals are reflected even when visibility is obstructed by an object," explained IAF scientist Christian Zech. The laser scanner can reliably measure the distance and the position of a target — a person, for instance — only if the target is working in an unobstructed line of sight. However, IAF's 360° radar can penetrate optically opaque material, which means it can identify the employee even if there are boxes, cardboard walls or other obstacles in the way.

Previous millimetre-wave radar systems — based on waveguides — were bulky and expensive. IAF's scanner has a diameter of only 20 cm and is 70 cm high. The high-frequency module, featuring indium gallium arsenide semiconductor technology, is no larger than a pack of cigarettes and is located in the base of the scanner.

"These days, millimetre-wave applications are dominated by waveguides that are extremely expensive to produce. Thanks to a cost-effective mounting and interconnection technology, as well as specially developed circuit boards, we can replace the waveguides with our high-frequency module that has been integrated onto a board measuring just 78 x 42 x 28 mm," said Zech.



The complete radar scanner: the radar module is located in the lower silver area; the mirror is attached on the top. ©Fraunhofer IAF.

The high-frequency module, which is the key component of the radar scanner, was developed by IAF researchers in close collaboration with the Fraunhofer Institutes for Reliability and Microintegration IZM and for Manufacturing Engineering and Automation IPA.

In addition to the signal processor, the complete system comprises a transmitting and receiving antenna with a dielectric lens. A self-turning mirror affixed at a 45° angle deflects the millimetre waves, guides them and evaluates the entire room. Thanks to the use of a dielectric antenna, the angle of aperture can be freely selected. That means nearby objects as small as a centimetre in size can be detected as easily as large surfaces that are far away. The system's range of operation is dependent on the application and can be up to several hundred metres. The scanner includes an ethernet interface and is therefore suitable for Industry 4.0 applications.

In order to evaluate the measurement accuracy and reliability of the 360° radar, the researchers carried out hundreds of measurements in the lab. Maximum deviation from the mean was less than 1 µm; standard deviation was 0.3 µm.

Fraunhofer Institute for Applied Solid State Physics IAF
www.iaf.fraunhofer.de/en.html

RUGGED SERVERS

The RS4104 and RS4198L24 are two high-performance, configurable rugged servers from Crystal Group. They are rackmounted servers designed to feature Dual Intel Haswell or Broadwell E5 Xeon processors paired with high-performance co-processors like the Xeon Phi or nVidia's Tesla products.

Crystal Group has designed these units to accept GP/GPU engines such as the Xeon Phi, AMD FirePro or the nVidia Tesla platforms. The combination of the processing power of the server-class motherboard and the parallel processing capability of dedicated co-processors make these devices suitable for data-intensive applications including radar signal processing, training and oil and gas exploration.

The RS4104 and RS4198L24 can be configured with up to 1.5 TB of DDR4 memory.

The RS4104 also supports up to 10 PCIe 3.0 x8 or five PCIe 3.0 x16 expansion slots for add-in cards and is powered by a 1780 W power supply. The unit is 20" in depth, 17.5" in width and fits onto an EIA-310 rack with options for Crystal Glides, fixed-mount or Jonathan rails.

The RS4198L24 supports up to 10 PCIe 3.0 x16 expansion slots (eight of which can support double width cards) for add-in cards and is powered by 3200 W 2+2 power supplies. The unit also fits onto an EIA-310 rack with Crystal Glides.

The RS4104 and RS4198L24 4U are compatible with industry-standard operating systems such as Windows 7, Windows 10, Windows Server 2008, Windows Server 2012, VMware and Linux operating systems.



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ANALYSER SYSTEM FOR EDIBLE OILS AND FATS

Krohne has introduced OPTIQUAD-EOF 4050 W for the continuous inline measurement of free fatty acids (FFA), total polar material (TPM), peroxide value (POV), moisture or dirt. The optical spectroscopic analyser system is aimed at frying and other edible oil as well as fat applications.

The system measures directly in the pipe: analysis is achieved via an optical window mounted in a standard VARINLINE measuring section. The readings are provided instantly for process control or dynamic control loops via four 4–20 mA outputs. Depending on the application, measurement of anisidine value (AV) and iodine value (IV) are possible. Compared to conventional laboratory methods used to obtain these values, the system reduces the need for sampling, sample transport and handling, and the associated sources of error and costs.

The optical spectroscopy analysing method allows for a range of uses in edible oil applications, such as oil extraction, oil refinement and frying processes up to oil recycling, as well as fat processing. It provides a measuring range of 0–98% for FFA and an accuracy of RMSEp: $\pm 0.03\%$ up to $\pm 1\%$ FFA, depending on the measurement range.

The system consists of the analyser unit (protection rating IP65/NEMA4X) and the operating unit, an industrial PC with touchscreen display for parameterisation and automatic calibration in a stainless steel housing (IP65/NEMA4X), optionally built into a switch cabinet. It uses up to four measuring methods (transmission, scattering, fluorescence and refraction) with up to 12 wavelengths from ultraviolet to infrared. The underlying calibration is calculated automatically from reference data specific to the application.

KROHNE Australia Pty Ltd

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CONTRAST SENSOR

The KTM Inox contrast sensor from SICK features high greyscale resolution and is integrated into a rugged stainless steel housing. The optimised OES4 ASIC technology, combined with a response time of 35 μ s, ensures good detection of contrast marks, even on glossy materials.

The various teach-in methods (dynamic, static and switching threshold close to mark) ensure flexibility during commissioning. The integrated IO-Link interface can be used to access the parameter settings. This speeds up and simplifies format changes.

The unit has a sensing distance of 11 mm (± 3 mm) and a switching frequency of 15 kHz. Featuring an RGB light source, it is Ecolab-certified and tested to IP67 and IP69K enclosure ratings.

The product detects marks even in conditions with weak contrast ratios. It is therefore suitable for use in a wide range of applications, even in harsh environments during intensive cleaning.

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RH AND TEMPERATURE SENSOR

Michell Instruments has launched an improved version of its interchangeable relative humidity sensor — the HygroSmart I7000XP — which enables users to carry out maintenance on industrial relative humidity and temperature transmitters in as few as 30 s. The updated unit has been developed by Michell's research department and features the latest polymer capacitive technology to give an accuracy of 1% RH.

The main benefit of the I7000XP is its modular format, which makes maintenance of compatible transmitters and probes fast, easy and cost-effective. The calibration data is stored in the electronics of the unit. To recalibrate a transmitter or probe, all that is needed is to replace the I7000XP sensor. No specialist training is needed and the process is as simple as changing a light bulb, with routine maintenance taking as few as 30 s in most cases. No instrumentation needs to be sent away or dismantled, which keeps processes running more efficiently.

The HygroSmart I7000XP forms the heart of Michell's range of RH probes and transmitters, including the recently launched HygroSmart 280/290 series of RH transmitters and probes for industrial processes. Typical applications include environmental control in pharmaceutical production, engine and environmental test cells.

AMS Instrumentation & Calibration Pty Ltd

www.ams-ic.com.au



SCREW BLOWERS

The DBS series screw blowers from Kaeser Compressors are designed to offer energy savings for wastewater treatment plants. They are available with power ratings from 15 to 37 kW and flow rates from 4 to 22.5 m³/min.

The DBS series are claimed to be up to 35% more efficient than conventional rotary blowers and to also provide energy savings in the double-digit range compared with many commonly available screw and turbo blowers.

These benefits are made possible by the Sigma Profile rotor technology used in Kaeser rotary screw compressors. Another key factor is the non-slip direct drive with speed transmission integrated into the screw compressor block, which delivers maximum speed with minimal transmission losses.

These screw blowers are especially well suited to municipal and industrial water treatment applications. Two different versions are available to meet the needs of water treatment plants requiring pressures of 400 or 650 mbar. The DBS blowers are quiet, with sound levels in primary applications not exceeding 72 dB, which is equivalent to a modern vacuum cleaner.

The low energy consumption of Kaeser screw blowers makes them suitable for supplying compressed air to water treatment plants. They are designed for use over long duty cycles, including continuous operation; require little maintenance; and can be installed side by side. Upon request they can be delivered with an integrated frequency converter or a star-delta starter.

Kaeser Compressors Australia

www.kaeser.com



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MACHINERY HEALTH SYSTEM

The Ovation Machinery Health Monitor leverages the power of the Ovation platform through an I/O module dedicated to machinery health functions. With installation as simple as inserting the module into a spare I/O slot, the health monitor eliminates the risks, wasted time and increased costs typically associated with configuring and integrating two separate systems by removing the need to integrate stand-alone vibration and health monitoring systems.

With the Ovation Machinery Health Monitor, operators receive alerts from a single set of common plant HMIs and no longer need to manually check machinery functions through a separate system, enhancing their awareness of potential plant or safety issues. By eliminating synchronisation across multiple systems and using familiar Ovation tools, configuration and upgrades are faster and far less complex. The ability to troubleshoot and analyse data is also enhanced through the use of familiar Ovation alarming, trending, historical data collection and sequence-of-events monitoring functions.

The health monitor also reduces the risk of cyber attack by eliminating links to stand-alone systems and isolating process information — all of which can help facilities meet NERC CIP and other security regulations.

The Ovation Machinery Health Monitor incorporates Emerson's PeakVue technology to predict early failures of rolling element bearings and delivers standard API 670 machinery protection for critical plant assets, including turbines, pumps, motors, compressors and centrifuges. The module is designed to be scalable and can be implemented online in phases so that protection and prediction strategies can be easily added as needs evolve.

For more information: www.emersonprocess.com/OvationMachineryHealth.

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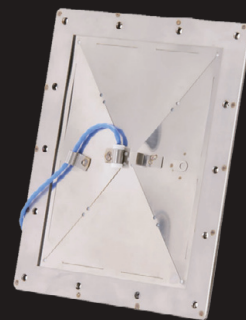


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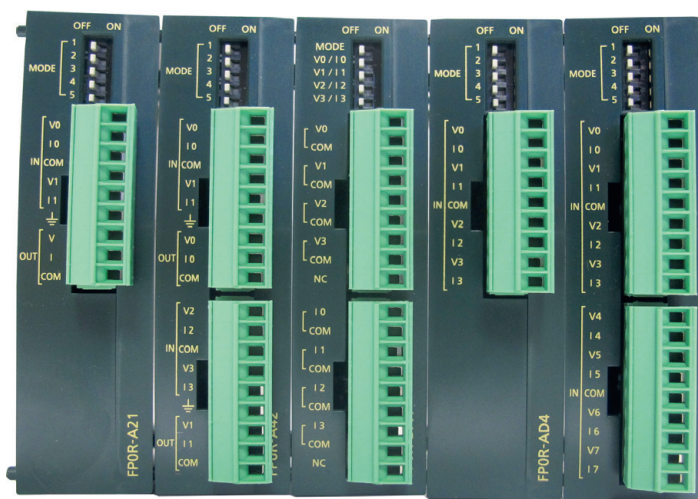
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ANALOG EXPANSION UNITS

The Panasonic FP0R analog expansion units offer improved performance, extended functions and a higher resolution for improved control in plant and machine applications.

There are now five analog units available in the range, two dedicated input units, one dedicated output unit and two combination input/output units. All units are capable of being set as either 12-bit resolution for compatibility with existing applications or as 14-bit resolution, giving an accuracy of 1/16,000 count across the selected range, thus allowing for better, more accurate, control of analog systems.



There are five selectable voltage and current input ranges and six selectable voltage and current output ranges. In 12-bit compatibility mode, the range is selectable as a group, via the DIP switch on the front of the unit. When running in 14-bit mode, each input or output range is independently selectable within the user program. All of the FP0R analog units are compatible with FP0R, FP2 and FP-X model PLCs.

Control Logic Pty Ltd

www.control-logic.com.au



PRESSURE AND TEMPERATURE TRANSDUCER

Emerson has introduced the Paine 310-38-0050 Series transducer to provide increased reliability when making pressure and temperature measurements in downhole oil and gas drilling and production operations. The transducer has an ultras-small footprint with an outside diameter of just 9.4 mm to save critical downhole tool space.

Downhole drilling operations must measure pressure, temperature and other variables to optimise the drilling process and ensure safety. These measurements are typically made with a variety of downhole tools, either mounted just above the drill bit to provide continuous measurement while drilling or as separate tools inserted into the drill hole on a periodic basis. Once drilling is complete and production begins, these measurements are needed to optimise throughput, maximise uptime and ensure safety.

In all of these applications, space is at a premium and high reliability is required. The environment is extremely harsh with high temperatures and pressures, corrosive drilling fluids and high vibration. Rugged components with small form factors are required to support smaller tool sizes, along with increased pressures and temperatures as holes become deeper.

The Paine 310-38-0050 transducer provides both temperature and pressure measurements in the smallest and most rugged form factor possible. It supports measurements up to 25 kpsi (1723 bar) and temperature up to 218°C to cover the wide range of downhole operating environments.

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POLYMER ENERGY CHAINS

In many industries there is a huge demand for roller energy chains for high fill weights and speeds that can travel long distances, while operating quietly.

The low-maintenance P4 system, originally developed for high-speed container cranes, can travel very long distances up to 800 m and carry high additional loads of up to 30 kg/m. They are used for high speeds of up to 10 m/s and the autoglide crossbars ensure safe guidance on very long travel distances. The energy chains offer a long service life and are abrasion resistant.

They are suitable for indoor and outdoor crane technology, automated storage and retrieval systems, plant construction, portal robots, materials handling technology, mining and steel works.

The smaller sizes P4.32 and P4.42 in particular are suitable for green machining processes and storage systems. Compared to sliding friction, rolling friction comes out 75% less, which means they use up to 57% less drive power. Plant and machinery manufacturers have great benefits on loading gantries for automated production processes from 3 m/s, and especially from 3.5 m/s. On travel distances of 40–50 m, the electricity and operating costs are significantly reduced and higher speeds and accelerations are enabled without increasing the noise level.

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The Argon ARD21 21.3" rugged display is designed for command and control applications where maximum viewable surface area is needed in the smallest mounting possible. The ARD21's small bezel size, flexible mounting configurations, configurable I/O and universal AC/DC power supply make it a

suitable solution for many mission-critical applications.

The ARD21's 21.3" display is suitable for combat and tactical vehicles, mobile shelters and close-in spaces. Argon Corp offers the customer a variety of standard options and is ready to customise to ensure that the product meets particular requirements.

The display features low power consumption (65 W at 450 nits), LED backlighting, 19" rack mount (8U/9U high, 7.1 cm depth). It is MIL-STD-810 compliant and is a fully enclosed unit with no fans.

Metromatics Pty Ltd

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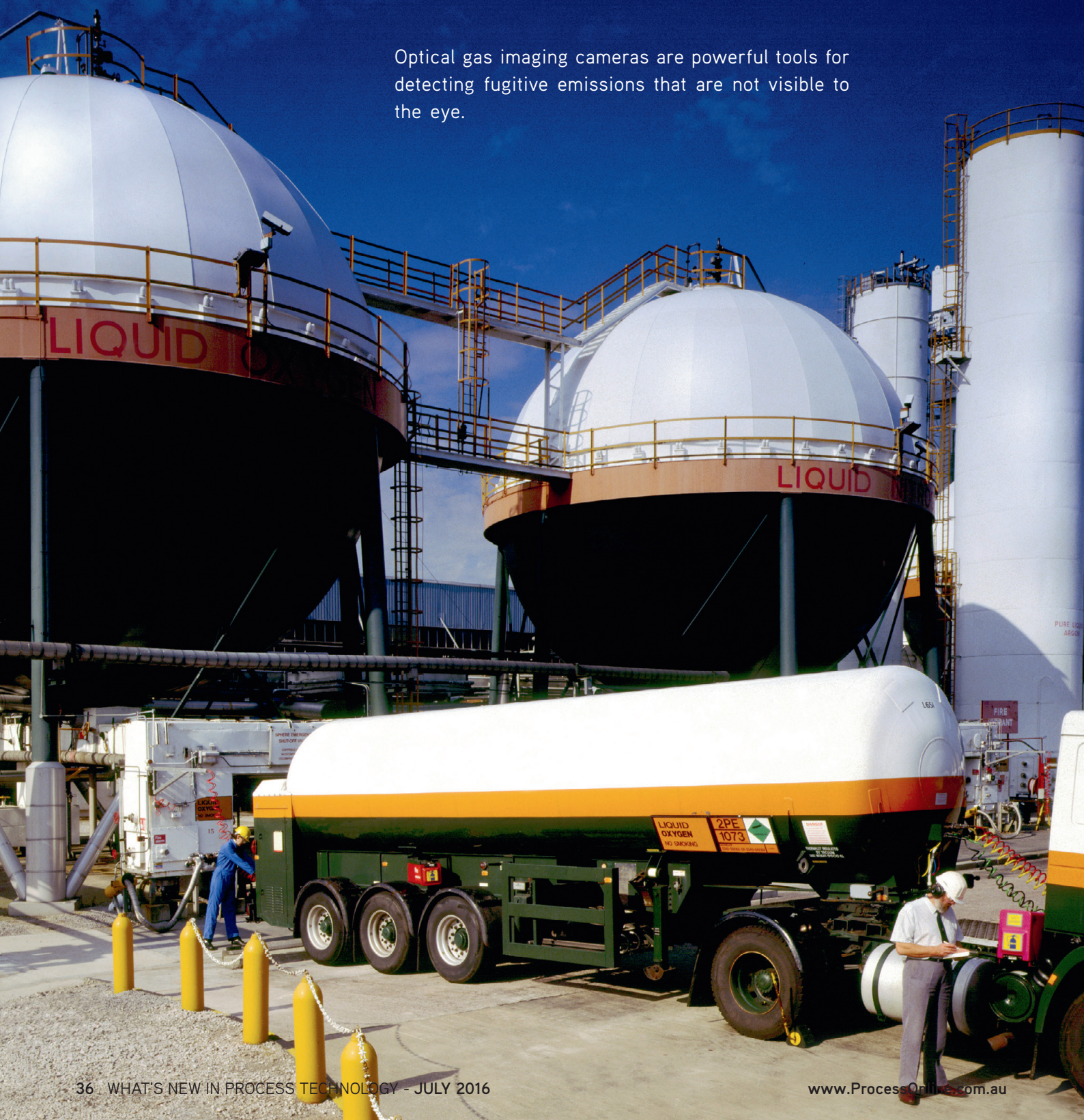
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TEN TIPS TO GET THE MOST OUT OF OPTICAL GAS IMAGING

Optical gas imaging cameras are powerful tools for detecting fugitive emissions that are not visible to the eye.



Optical gas imaging (OGI) cameras use spectral wavelength filtering and sterling cooler cold filtering technology to visualise the infrared absorption of VOC/hydrocarbon, sulfur hexafluoride (SF₆), refrigerants, carbon monoxide and other gases whose spectral absorption matches the response of the camera.

By using OGI technology, the industry is able to incorporate a 'Smart LDAR' (leak detection and repair) program that allows operators to safely and efficiently visualise gas leaks. OGI has allowed the industry to reduce industrial emissions and operators to conform to future regulations. In addition, OGI saves money, as part of a much more efficient process, but most importantly, it improves the safety of their assets and their personnel.

To get the most out of your OGI equipment, you should consider the following 10 tips.

1. Understand the application and needs

Different applications require different cameras. In other words: one camera may not see all the gases, so you need to understand which type of gas you are dealing with. For example, a VOC/hydrocarbon OGI camera will not see SF₆ and a CO camera will not see refrigerants.

2. Take into account the environmental conditions

The success of passive optical gas imaging depends on environmental conditions. The greater the background energy differential, the easier the camera will be able to visualise the gas leak and pinpoint its source. Active optical gas imaging (ie, using a laser-based backscattering technique) relies on a reflective surface in the background. This presents a significant challenge when you are looking at components high up and pointing the camera at the sky. Also, rain and strong winds need to be taken into account. Rain can make detection very difficult, but wind can actually help visualise the gas because it makes the gas move.

3. Keep in mind that optical gas imaging is qualitative, not quantitative

Due to the environmental variants, background energy differential and variations, an OGI camera will not be able to tell which amount of gas is leaking or what gas it is. An OGI camera will, however, pinpoint the source of the leak in the most efficient and effective way.

4. Combine an optical gas imaging camera with a sniffer probe

Use an OGI camera to visualise the leak and trace its source. Then, use a sniffer probe — a toxic vapour analyser (TVA) or organic vapour analyser (OVA) — to quantify the leak. Combining an OGI camera with a sniffer probe is referred to as Smart LDAR.

5. Use all the features and functions on your OGI camera

Certain OGI cameras are dual-use systems. They can also be used for industrial maintenance inspections, including high- and low-voltage electrical installations, mechanical installations, pipework and insulation, ovens and many more. The thermographic function on your OGI camera will also help you determine the background temperature or energy the gas is absorbing. Unlike with other thermographic applications, your object of detection (gas) has no visual representation and it is moving constantly. Therefore, a continuous focus is most important and so is the thermographic capability to determine the temperature range settings. An OGI camera also al-



Figure 1: SF₆ leak from a high voltage insulator.

lows you to record a movie to capture the movement and pinpoint the leak. It is always advised to take a visual image.

6. Keep it safe

A gas imaging camera is a quick, non-contact measuring instrument that can also be used in hard-to-access locations. It can detect small leaks from several metres away and big leaks from hundreds of metres away. It can even show leaks on moving transport vehicles, thereby greatly improving the safety of both the inspector and the plant. Thanks to their great performance, sensitivity and, with some cameras, also a high sensitivity mode (HSM), you can scan for leaks from a safe zone or even from a greater distance, compared to traditional gas detection methods.

7. Consider future industrial emissions regulations

Fugitive gas emissions contribute to global warming and pose deadly risks to both workers and people living close to these facilities. Optical gas imaging cameras detect dozens of volatile organic compounds, including the greenhouse gas SF₆, efficiently contributing to a better environment. Optical gas imaging cameras also allow you to comply with new industrial emissions regulations and procedures as set by the new EU Industrial Emissions Directive (IED) and by some EPA regulations in the United States.

8. Keep track of your return on investment

In many cases, the cost of the camera is paid for within its very first survey and in some cases with the finding of the very first leak.

9. Work with permits

OGI cameras in general are not Zone 1 ATEX certified. Therefore, you will need to apply for a 'hot work permit' or use it under a 'permit to work scheme'. Remember, you can see significant and dangerous leaks with the right camera from a safe zone, even outside of the facility's perimeter.

10. Follow training

Learn from experienced and qualified OGI users to get the most out of your camera. You might follow a training course by quality organisations such as the Infrared Training Center (www.infraredtraining.com).

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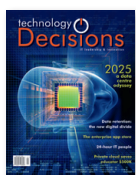


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Worldwide coordination supports safe Ichthys start-up

The Ichthys LNG project is currently under construction and is ranked among the most significant oil and gas projects in the world. The project is a joint venture between INPEX group companies (the operator), major partner Total, CPC Corporation Taiwan and the Australian subsidiaries of Tokyo Gas, Osaka Gas, Kansai Electric Power, Chubu Electric Power and Toho Gas.

The final investment decision for the Ichthys LNG Project was reached in 2012 and first production is scheduled to commence towards the end of September 2017.

The Ichthys oil and gas field, in the Browse Basin, off the coast of Western Australia, is estimated to contain 360 billion cubic metres of gas and 527 million barrels of condensate, and have an operational life of more than 40 years. Located about 220 km offshore Western Australia, it covers an area of around 800 km² in water averaging depths of around 250 m.

Gas from the field will undergo preliminary processing at the offshore CPF to remove water and raw liquids, including a large proportion of the condensate.

The project is expected to produce 8.9 million tonnes of LNG and 1.6 million tonnes of LPG per annum, along with more than 100,000 barrels of condensate per day at peak.

Gas and condensate from the Ichthys field will be exported to onshore facilities for processing near Darwin via an 890 km pipeline. Most condensate will be directly shipped to global markets from a floating production, storage and offloading facility permanently moored near the Ichthys field in the Browse Basin.

Safety specialist HIMA recently opened a new regional headquarters in Singapore, and Ichthys is one of its most significant ongoing assignments.

Energy companies around the world rely on automated safety systems from HIMA. "But our scope on Ichthys is much more than just safety systems," said Dieter Specht, project director for HIMA. "We have worked for several years to synchronise all the steps necessary to ensure safe operations and a successful start-up. In the process, we've functioned on a tight time schedule with multiple companies across national borders and cultural differences."

Global coordination and local collaboration are crucial for huge energy projects. To meet that demand, HIMA offices in Singapore, China (Shanghai), South Korea (Geoje), Dubai (UAE), Australia (Perth) and Germany (Bruehl) have collaborated closely. Project management is coordinated from Bruehl, while most day-to-day work with fellow



project suppliers takes place in Singapore. That's also where function tests have been conducted on more than 1200 cabinets supplied by the basic process control system (BPCS) supplier HIMA and project partners.

At Ichthys, HIMA is working closely with the project's three engineering procurement contractors and the BPCS supplier. At one point, all five companies examined the details of each of 25,000 safety I/Os. That brought forward additional requirements that typically would have been identified during commissioning. That up-front work helped to minimise subsequent plan corrections and related time delays.

Functional safety expertise is an important factor in HIMA's project approach. The company is applying the principles of IEC 61511 in designing and testing the systems. "We have the expertise and project coordination skills that are valued by operators of all sizes of energy projects," said Specht.

Along with safety instrumented systems (SIS), fire and gas (F&G) systems and high-integrity pressure protection systems (HIPPS), HIMA is providing 430 control cabinets and related connections. A pre-FID project for developing standard applications, design and testing was supplied in advance to the main contract. Additionally, cybersecurity and network management for associated hardware and components such as smoke detectors in employee living accommodations are part of the scope.

HIMA Australia
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UNDERGROUND COMMUNICATIONS

Craig Stratton, Market Manager – Industrial Market

In underground mining, communications infrastructure is a vital component of the operation. Fibre optic networks offer a reliable, high-speed, low-latency, intrinsically safe, interference-proof, flexible and modular option for evolving underground mine communication systems.

Underground communication networks are the critical link between operations underground and personnel at the surface. Mines are constantly changing and the mining process is highly mobile. As the operation has advanced, equipment and people are constantly moving. The potential for explosive gases, rock falls, wet locations, temperature extremes, confined spaces, high voltage and electromagnetic interference are a few of the hazards the underground network must survive. Furthermore, the demands on the network have increased through convergence of data. By adding surveillance video feeds, sensor data, miner tracking data, machine control signals, mine phones and production data to a singular network, the need for bandwidth over a distance which grows daily has become paramount to effective underground operations. Fibre optic networks offer a reliable solution for underground mine communications. Optical fibre systems are also capable of handling the convergence of data over long distances. Designed to be modular for ease of maintenance and expansion, and portable to facilitate changes in

the network infrastructure, optical fibre systems enhance safety by eliminating spark hazards found in conventional copper cabling solutions. Optical fibre systems are readily available and easy to deploy and maintain. In this article, we will review the basics of optical fibre, cable and connection systems for use in underground mines and show how these elements are specified and deployed in an underground installation.

Fibre optic communication systems use pulses of light to transmit data. First developed in the 1970s, fibre optic systems have revolutionised communications in our modern world. Massive amounts of data are successfully transmitted via fibre optics every day. From online transactions and internet searches to live HD video feeds transmitted around the globe, fibre optic communication systems are at the core of the modern information age. The process of communicating over fibre optics involves only a few basic steps. First, the data must be converted to light. Second, the encoded light pulse is transmitted over the fibre optic network. Finally, the light pulse is converted back into a conventional electronic digital



signal. Transmitting and receiving optical signals is accomplished through readily available transceivers that use devices such as light emitting diodes (LEDs) and vertical cavity surface emitting lasers (VCSELs), a form of laser diode commonly used in fibre optic transmission systems.

The fibre optic network consists of several components including optical fibre, optical cable and optical connecting systems. Optical fibre is a very thin strand of glass that is used to carry the light pulses from the transmitter on the sending side to the detector on the receiving side. Optical fibre consists of three basic layers — the core which is the glass region where the signal travels; the cladding which is a glass region that traps the signal in the core; and a polymeric coating or primary buffer that provides a basic level of protection to the fibre while it is being further processed. Transmission of light through an optical fibre works through the principle of total internal reflection. By changing the index of refraction of the glass in the core compared to the index of refraction of the glass in the cladding, the transmission path the light takes as it travels

through the fibre is prescribed. By controlling the angle at which the light is coupled into the fibre, the cladding can effectively act as a mirror and completely reflect any light that tries to escape through the cladding. Figure 1 illustrates this phenomenon.

Traditionally, underground mining networks have used multimode optical fibre. Multimode fibre, as the name implies, allows multiple modes of light to travel along its length. This type of optical fibre has a larger core diameter and accepts light coupled from a larger angle and from a broader spectral source, such as an LED. Multimode fibre offers plenty of bandwidth to support Ethernet protocols over short distances and is more than adequate for signalling for machine control and miner tracking over short distances. The core size of multimode fibre is commonly 62.5 micron or 50 micron versus approximately 9 micron for singlemode optical fibres. The ability to transmit data over distance is commonly referred to as the bandwidth distance product. Because of the larger core size in a multimode optical fibre, the bandwidth distance product can present a limitation for very large underground networks. Additionally, multimode fibre has significantly higher intrinsic light attenuation, or the loss of the optical power, which is another limiting factor in large underground networks.

Measured in decibels, attenuation is described by the equation: $-10 \log (\text{Power Out/Power In})$. In a typical multimode system using 62.5 micron fibre with an LED light source operating at 850 nm, the intrinsic attenuation of the fibre is approximately 3 dB per kilometre. Since attenuation is measured on a logarithmic scale, 3 dB equates to an optical power loss of about 50%. On the other hand, by using a VCSEL-based transceiver operating at 1300 nm, the intrinsic attenuation of the fibre is typically around 1 dB per kilometre. Singlemode fibre attenuation is typically less than 0.5 dB per kilometre. So far, the discussion of attenuation has been limited to intrinsic attenuation due to absorption and scattering of light within the optical fibre itself. It is important to understand that attenuation in optical systems can be exacerbated by external factors. Transmission loss in an optical fibre can be severely affected by improper handling, extreme stressors during installation or the operating condition of the cable.

For example, bending cables in a radius that is smaller than the specified value can result in macro bending attenuation. In this instance, light is allowed to escape through the cladding region of the optical fibre due to a change in the angle of incidence of the light ray travelling through the fibre. Additional sources of attenuation include micro bending of the optical fibre. This occurs when a lateral force is applied to an optical fibre such that the waveguide is deformed microscopically. The effect on the transmission path of light travelling within the glass is similar to that of a macro bend whereby the deformation causes a change in the geometry of the fibre structure allowing light to escape through the cladding.

In recent years, optical fibres have improved significantly, exhibiting lower intrinsic attenuation, higher bandwidth distance product and greater performance in bending. However, it is important for the



Image supplied by AFL

network operator to understand the basic tenets of these issues in order to get the most out of the underground network. Since underground mines are growing daily and networks are extending further and further underground, maintaining head room in the optical power budget is important. To work properly in extreme environmental conditions found in underground mines, optical fibres should be packaged in robust cables that are capable of preserving these critical transmission properties.

Effective optical cable designs incorporate features proven to protect and preserve the optical budget for extended durations in extreme conditions. Factors affecting the cable such as tensile loading, bending, crushing, impact forces, moisture, chemical exposure, vibration and hot or cold temperature extremes need to be considered. Multiple test methods have been developed by a variety of industry standards groups to help determine appropriate performance specifications for cables. Many of these industry groups have focused on specific applications or installation environments such as typical telecommunications closets or structured cabling within commercial buildings. While these groups have developed standards that are excellent for qualifying cables for these applications, it is important to recognise that optical cables going into harsh environments, such as underground mines, may need additional performance attributes. Some in the industry have looked to military specifications as the ultimate in ruggedness. While these are certainly high-performing cables, in many instances a combination of specifications is more relevant. For example, as robust as military cables may seem, one important criterion that is

commonly omitted from these cables is that of optical fibre strain.

In this article we've investigated the issues around transmission properties of optical fibre and discussed how cable systems can protect and preserve the optical budget used in underground networks. However, we have yet to touch on a key parameter affecting long-term reliability of optical fibre cable systems. Since optical fibre is made of glass, optical fibre strain must be considered in order to avoid premature failure due to static or dynamic fatigue. Strain is the word used to describe the deformation that occurs when an object is stressed. In this case, the optical cable may be stressed during both installation and operating conditions. Examples of cable stress include pulling under tension during installation, bending, self-supporting cable installations, wind load, ice build-up and even thermal stress caused by extreme temperatures. In these situations, the cable design must isolate the optical fibre such that the fibre strain is limited to specific values. In most cases, the recommended fibre strain threshold is less than 0.2% for residual loading of 100 kpsi proof tested fibre. Multiple studies have been conducted dating back to the 1990s demonstrating that long-term reliability of optical fibre can be achieved with this performance attribute designed into the system.

Above and beyond all considerations in underground confined spaces where explosive gases may be present is that of human safety. Cable systems should meet the local safety requirements for flame spread, smoke generation and toxicity. In the United States, Mine Safety and Health Administration, or MSHA, approved cables have been validated by a third party to comply with these requirements. In many international locations, the International Electrotechnical Commission, or IEC, has established similar requirements.

Pre-terminated cable assemblies that have gas-blocked connectors are commonly used in underground mines due to the concern of explosive gas migration. In addition to safety, pre-terminated cable assemblies offer the added advantage of a plug-and-play modular network approach. Since mines are growing by the minute, plug-and-play modularity allows the network operator to easily and safely extend the cabling system to allow growth with the operation.

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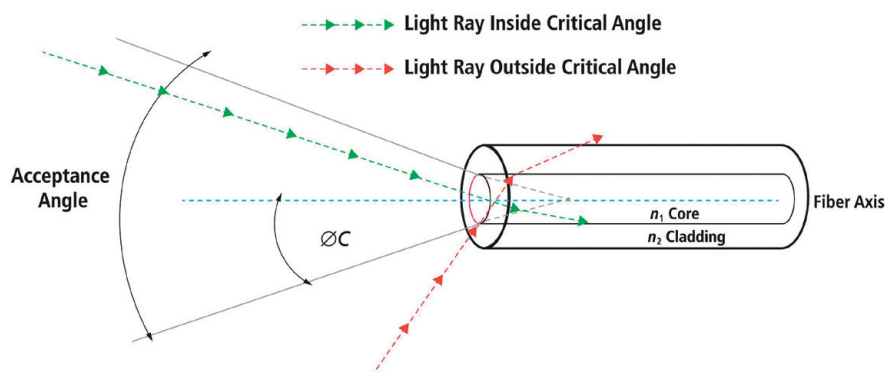


Figure 1: Make-up of optical fibre showing total internal reflection.

MANUAL DUMP STATION WITH CONVEYOR

Flexicon has released a manual dumping station with integral FLEXI-DISC tubular cable conveyor that collects dust created during manual dumping from bags, boxes, pails and other containers, and gently conveys the material at any angle over short or long distances.

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Filters are readily accessed by removing the interior baffle and replaced using quick-disconnect fittings.

The conveyor moves material using high-strength polymer discs affixed to a stainless steel or galvanised cable that slide fragile materials within smooth stainless steel tubing, gently, quietly and dust-free, horizontally, vertically or at any incline.

The modular system can have single or multiple inlets and outlets, and convey over short distances or hundreds of metres.

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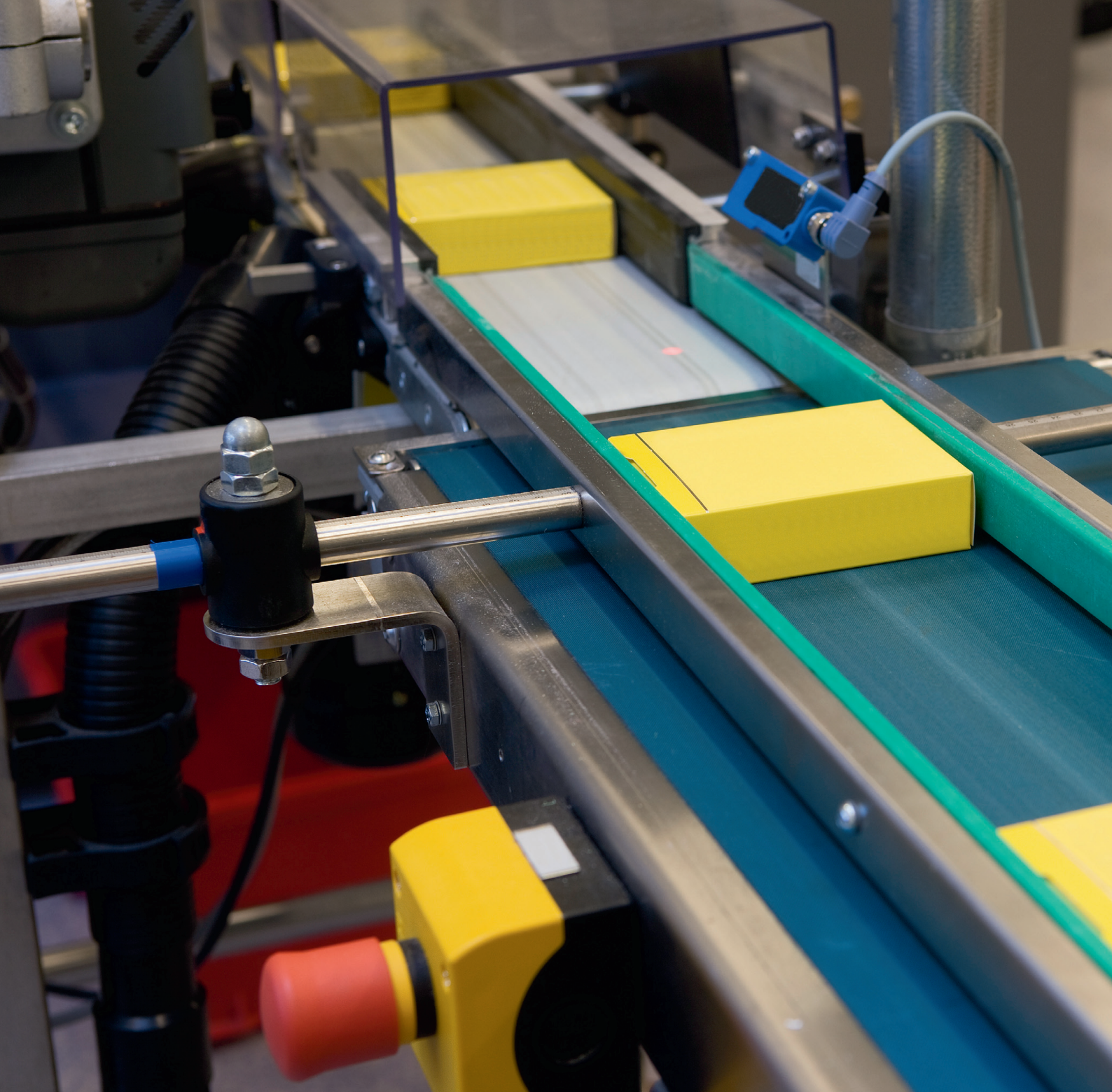
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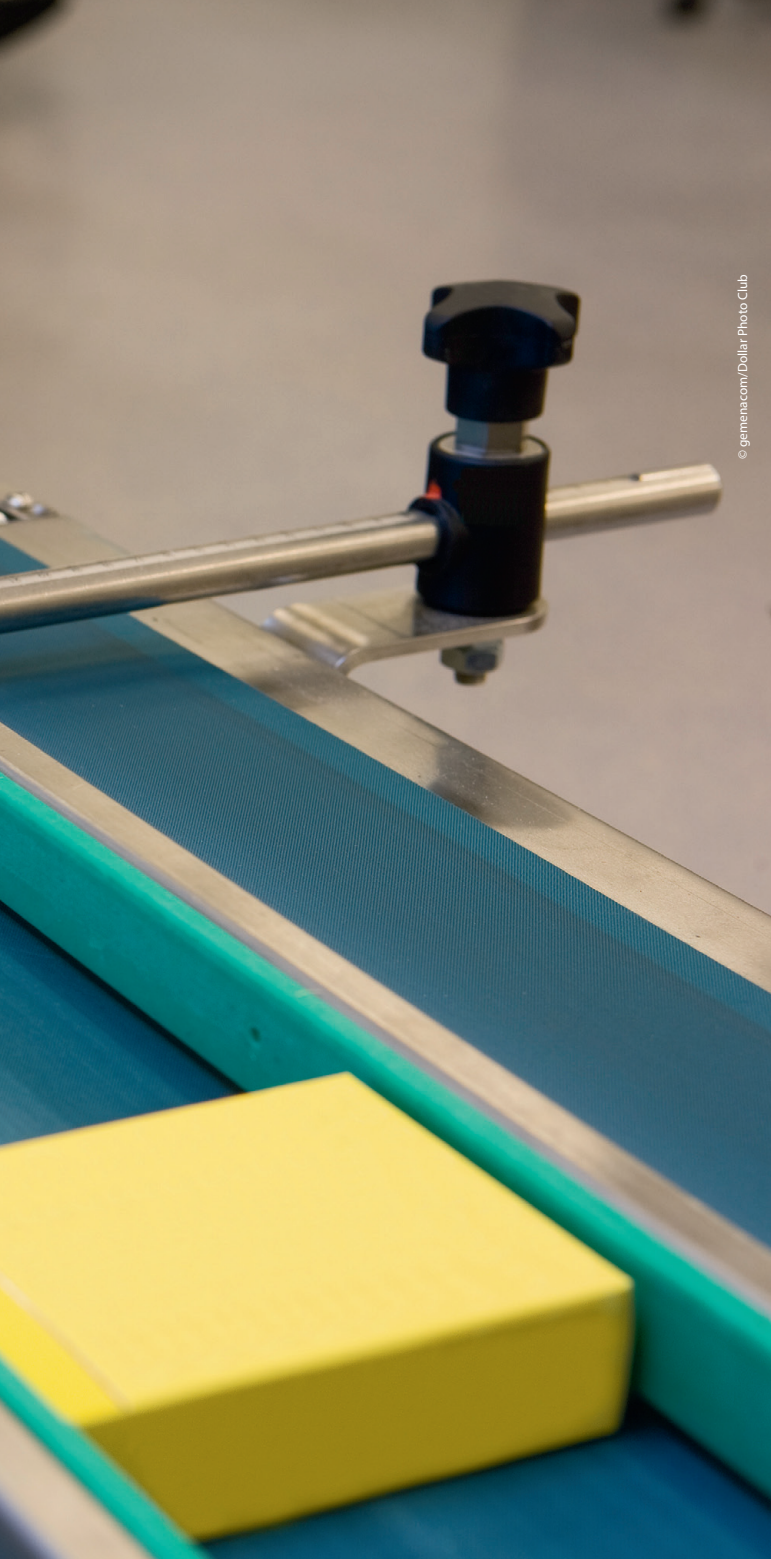
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INTELLIGENT SENSOR TECHNOLOGY AND THE CLOUD

Glenn Johnson

Big data analytics will play an important role in the realisation of Industry 4.0, and the most efficient way to achieve it will be by the effective use of cloud computing technologies. Smart sensor technologies will therefore also play a leading role in ensuring the efficiency and accuracy of the source data.



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process efficiency, 'zero unplanned downtime' of machinery, and the ability to manufacture 'batch size 1' — highly customised products produced at reasonable cost to the consumer."¹

Batch size 1

Perhaps the 'holy grail' of Industry 4.0 is the concept of a single unit batch. Smart sensor technology, coupled with adaptive automation systems, will be key to achieving this goal, in which manufacturing plants are flexible enough to adapt to individual customer requirements. Enabling high product variance in ever-smaller quantities, intelligent components (smart sensors) must be able to adapt and control themselves.

An example of a step in this direction in packaging is that it will be possible to pack items of differing sizes (such as different sized beverage bottles) on one system using smart sensor detection with automatic format adjustment. The sensors detect the change in product and signal the control system to reset itself so that the right box can be set up, the bottles can be placed inside and the box can be labelled accordingly. The system continues running automatically and does not require line shutdowns to change batches.

Smart sensor solutions, in which state-of-the-art sensor technologies are used in conjunction with integration at the control level, will provide decentralisation of certain automation functions directly in the sensor, relieving pressure on the control system and increasing machine productivity.

Perhaps the most common exemplar of the aim for batch size 1 production is an automotive production line. The sensor technology detects which assembly steps must be taken on the basis of the car body itself — thus ensuring unique identification — and guarantees continuous transparency right through to delivery. Processing steps on the object are updated via rewritable RFID transponders. RFID data cards are attached to components or integrated unseen within them. In these ways, individual vehicles can be customised 'on the fly' to meet a customer's specification.

Track-and-trace transparency

The application of smart sensor technologies such as RFID, as described above, provides other benefits.

The traceability of products during complex manufacturing and logistics processes is another area of great advancement. A transparent material flow is required in production and logistics so that production decisions can be made more quickly — such as supply of parts and raw materials.

At the delivery stage, the completed product — customised for a customer — can then be identified automatically for delivery, allowing transparency and traceability monitoring right through to the customer. Future identified faults or production flaws can be traced back to individual components or production processes at a single point in time for root cause analysis, improved quality control and enhanced customer service.

Data and the cloud

Much has been said about the explosion of data that Industry 4.0 and the Internet of Things (IoT) will produce. Cloud technologies hold the promise of making the data more accessible from multiple locations, and centralising analytics.

In reality, the quantity of data generated by any given production process will depend on the nature of the process itself. In the examples above, a single car with all its RFID-identified parts may imply hundreds of data points per product, while for the bottle packaging example, there may be only one data element per product, or a few per batch.

Today we are constantly reading and hearing that the future of industrial production will be in the form of the Industrial Internet, Industry 4.0 or cyber-physical systems. The opportunity to use larger quantities of data to produce and supply goods in a more efficient and flexible way, while also saving resources and achieving better quality, ultimately depends on the reliability of the data input for the process chain — and the sensors that record real-time situations and convert these into useful data.

Of course, the management and usage of the data collected from sensors is the other large element of Industry 4.0 that needs to be considered. According to Dr Michael Gerstlauer of Teradata, we are entering "an era where sensor technology and the interconnectivity of machines — the Internet of Things — is driving the industry forward. This is an evolutionary journey of analytics capabilities that begins with today's Agile Data Warehouse and culminates in a future state where you have a Sentient Enterprise and manufacturing processes at optimal capacity. Industry 4.0 promises new levels of

Depending on how the data is to be used, the data may be stored and used locally, or stored and processed by a cloud service. In the case of cloud applications, local consolidation of data at the source can improve data efficiency. For example, if a particular sensor output changes only slowly or rarely, only changes need to be stored, so local consolidation comes into play. When large amounts of data are involved, local consolidation and compression can enhance efficiency significantly.

Smart sensors that incorporate their own smart logic can reduce the data demand by providing only necessary information as desired. In the bottle packaging example, the smart sensors also assist in automatically reconfiguring the process, keeping the running production data within the packaging line for best efficiency. Only final production data should need to be forwarded on for batch track-and-trace.

The cloud and intralogistics

One application where the convergence of smart sensor data and the cloud comes into its own is in the field of intralogistics. By now we all will have experienced the simple example of parcel tracking, in which we receive emails providing access to data by which we can trace the delivery of products we have purchased online. At each step of the delivery we can see where the package is, via our computers, tablets or smartphones.

In today's intralogistics, goods are transported with a high degree of variance in content, size and weight, and at various points are weighed and measured, while having their location detected. Sensor technology identifies the goods with machine vision systems and laser-based code readers, while the volume is determined with laser scanners, light grids and encoders. Data relating to the items is scanned and uploaded to services in the cloud so that the items can be identified and compared. For example: is the parcel damaged? Is the code complete? Are the weight and volume correct?

Any defects can be tracked from all sites and any trouble spot can be identified. In addition, quality defects in the process can be identified and resolved. As the speeds on conveyors are further

increased, maximum productivity is guaranteed — not just within one site, but potentially all over the world.

Smart sensor technology in this context is used to ensure high performance levels for sorting and transportation. As well as the object data, additional performance data relating to the status of the sensors, the speed of conveyors or the quality of the labels is constantly being generated.

The presentation of data at a local level can be condensed at system or factory level if necessary before being transferred to the cloud. The data delivered to the cloud by the sensors can be evaluated according to different user criteria. As described above, apps can be developed which allow the end customers to track the individual goods during the transport process on their smartphones. But it is also possible that alarm workflows can be triggered in the event of performance problems or faults, and that changes in the status of the goods will be detected in the logistics chain.

Big data that is reliable

Reliable and unambiguous identification of goods in the production process and supply chain is a vital prerequisite for efficient, autonomous control. Whether it's a single product on a conveyor or data about millions of parcels that are transported every day, the status of all recorded data must be easy to retrieve and analyse. This is where the cloud comes into play, allowing data to be collected from multiple locations, analysed and further read and shared from still other locations.

While this data offers great opportunities, the process of preparing it in a way that allows companies to make the right decisions presents a significant challenge. This seamless flow of data and information from the sensor to the control and back again is the cornerstone of Industry 4.0.

References

1. Gerstlauer M, 2015, 'Why You Need a Data Strategy To Succeed in Industry 4.0', Teradata, <<http://blogs.teradata.com/international/need-data-strategy-succeed-industry-4-0/>>.

NEW PRODUCTS

PROCESS INSIGHT SOFTWARE

Aspen Technology recently announced the introduction of aspenONE Engineering and aspenONE Manufacturing and Supply Chain V9 software. This latest release is designed to give businesses in the oil, gas, refining, mining, chemicals, engineering and construction, and other process industries, insights into their processes to help them significantly reduce OPEX and CAPEX costs.

Features of the aspenONE V9 release are said to help push the limits of asset performance, empowering users to design and troubleshoot with confidence, improve reliability by enabling greater insights into process constraints, onboard new users faster and make process safety consistent and continuous throughout the entire asset life cycle.

The enhancements to Aspen HYSYS V9 include updated distillation column analysis, BLOWDOWN technology, improved integration and workflow in the refinery planning model, Sulsim (Sulphur Plant Simulator) Sulphur Recovery, custom modelling enhancements and mercury partitioning capabilities.

Schlumberger and AspenTech have also collaborated to provide the latest link between OLGA software and Aspen HYSYS, expanding asset-wide modelling to maximise production without compromising safety in the upstream.

The aspenONE Manufacturing and Supply Chain V9 updates include the Aspen DMC3 Builder that can increase efficiency by up to 30% by building and deploying all AspenTech APC controllers from start to finish on one intuitive tool.

The Map Monitor in Aspen Fleet Optimizer (AFO) improves scheduler visualisation with an interactive web-based mapping application, providing real-time, accurate information that streamlines fuel distribution.

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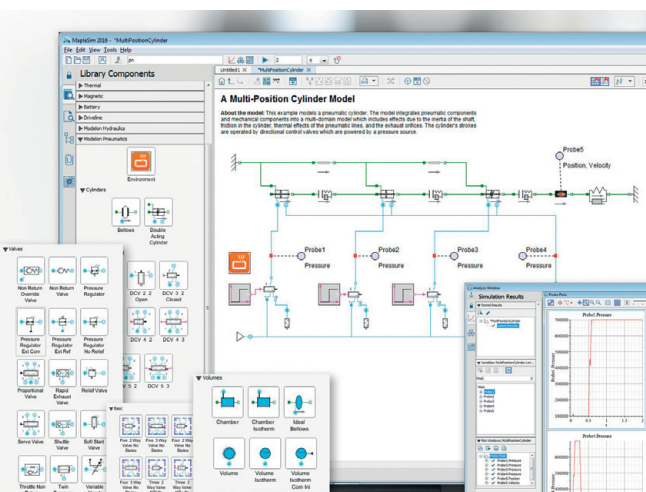


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MODELLING OF PNEUMATICS SYSTEMS

Maplesoft has announced the release of the MapleSim Pneumatics Library from Modelon, an add-on component library to MapleSim, the system-level modelling and simulation platform. This library can be used in the modelling and simulation of pneumatic systems for system design, component sizing and control design, with applications that include construction equipment, machine design and commercial vehicle design.

With the MapleSim Pneumatics Library from Modelon, engineers can access the component library from Modelon in the MapleSim environment, allowing them to take advantage of MapleSim's approach to physical modelling and simulation. Using MapleSim and the pneumatics library, engineers can dramatically reduce model development and analysis time and produce fast, high-fidelity simulations of their system-level models involving pneumatics.

Engineers can choose from over 100 components to model cylinders, motors, valves, nozzles, lumped volumes, lines and sensors. For advanced applications, they can customise and extend components as needed. Because this library is fully integrated into MapleSim, engineers can also access the underlying system equations for advanced analysis, parameter optimisation and visualisation, and generate highly efficient, royalty-free simulation code suitable for real-time and in-the-loop simulations.

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POWER SUPPLIES

Phoenix Contact has released its next-generation TRIO 2 power supply range, designed for machine building as well as water operations, industrial and manufacturing plants, building services, renewable energy, shipbuilding and process technology.

The devices feature a high MTBF value of more than 1 million hours at 40°C because of the quality components inherent in the smart design of the TRIO 2 range.

The TRIO 2 series also provides for the reliable starting of heavy loads with an overload capability of 150% for 5 s, due to its dynamic boost feature. This securely absorbs starting currents and short overload situations during operation without a drop in output voltage. The rugged electrical and mechanical design also ensures that they can withstand high shock and vibration. The devices can endure high electrical transient surges due to increased isolation between the input and output connections.

The TRIO 2 range features a wide operating temperature range of -25 to +70°C and device start-up as low as -40°C.

Push-in connection technology on the front of the TRIO 2 range enables fast and easy connection, making the wiring of the devices tool-free. In addition, the TRIO 2 power supplies feature a slim design. Highly compact, the single phase 20 A unit is 68 mm wide.

Also available in a three-phase model that can operate in two-phase with no degradation, the next-generation TRIO 2 Power Supplies deliver increased performance for those requiring reliable power for long-term applications.

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OPERATING DEVICE FOR SMARTPAT SENSORS

SMARTMAC 200 W is a 2-wire loop powered operating device with HART 7 communication to Krohne's SMARTPAT series process analysis sensors. The target industries for SMARTMAC include all industries that use SMARTPAT sensors or accessories: the chemical, petrochemical, pharmaceutical and food and beverage sectors as well as power plants, semiconductor and water/wastewater applications.

SMARTPAT is a series of process analytical sensors with integrated transmitter technology: each sensor is directly connected to the process control system via 4–20 mA/HART without the use of an external transmitter. Nevertheless, there is still a demand for a convenient operating device on-site. Therefore, SMARTMAC 200 W was developed as an optional 2-wire loop-powered operating device.

With SMARTMAC 200 W, SMARTPAT sensors can be read, calibrated and configured online at the measuring point. It features HART 7 communication and shows clear and configurable diagnostics according to NAMUR NE 107. With the replacement function, the connected SMARTPAT sensor can easily be exchanged as all sensor settings can be copied for the new sensor, including 4–20 mA parameters and TAG identification.

For convenient use, SMARTMAC 200 W features English, German, French, Spanish and Italian as operating languages. The die-cast aluminium housing (identical to IFC 100 W and MAC 100 W signal converters) offers ingress protection rating IP66/IP67.

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SMART DEVICES RELY ON EVEN SMARTER ENGINEERING

As industrial machines become more sophisticated and connected, the need for 'smart engineering' and detailed application knowledge continues to grow to increase productivity and safety, lower risk and reduce costs of compliance.

As technology continues to advance at a rapid rate, the line between information technology (IT) and operational technology (OT) is also becoming less defined. Smart manufacturing is driving new opportunities for end users as they look to optimise their production and supply chains by bringing together islands of information.

Establishing an information-enabled connected enterprise can help manufacturers become more competitive, flexible and sustainable, which is of paramount importance in the current global market.

Advances in technologies, such as the Industrial Internet of Things, are enabling machines to get smarter and meet end-users' networking, integration, diagnostics and intelligence demands. Motors and drives are gaining improved integration and connectivity, resulting in increased productivity, safety and asset management.

Ethernet communications is now an important part of any application that involves drives because it provides full access to all the diagnostics within the drives, including drive parameters, status and additional features such as automatic device configuration, which eliminates the need for manual reconfiguration.

While supplying the drives is the easy part, applying the correct engineering is critical for the system to run safely and effectively. It is the domain knowledge on the application and how to apply the engineering that really makes the difference. For example, if a drive on a crane has not been selected or engineered correctly the crane could drop its load resulting in safety and productivity risks. Similarly, if a drive on a process line is not sized or engineered appropriately, the process will not run effectively.

Complying with safety standards plays an important role in reducing the risk of injuries and improving productivity. Implementing the

most appropriate standards and technologies also provides major improvements in manufacturing productivity, efficiency and the morale of personnel. However, understanding the current risk level of one machine or an entire plant floor is a challenging task.

Safeguarding a machine or entire plant requires a detailed safety assessment to be undertaken. Following the findings of the safety assessment, a solution can then be designed that meets the operational requirements of the plant or machine and also address any safety risks.

The Industrial Internet of Things continues to bridge the gap between the physical and virtual worlds, generating data that provides visibility into operational issues to help improve profitability and reliability. Connected, smart machinery can enable secure, remote access services that reduce operational costs throughout the life cycle of machinery.

When engineered correctly, smart devices can provide more information and transparency to improve the life span of equipment and drive productivity throughout the enterprise. Smart engineering combined with detailed application knowledge can help increase machine speed for increased production or improve machine control to optimise quality as well as quantity.

We are often awarded contracts that have required our engineers to 'scratch their heads' a little to deliver the best solution. Supplying the smart devices and equipment is the easy part, but the application knowledge required to engineer them correctly to improve productivity, profitability and safety is where the real smarts come into play.



Peter Tomazic has been working in the electrical automation industry for 33 years. In his current role as senior solution consultant for the Global Solutions team at Rockwell Automation South Pacific,

he uses his expertise to help customers meet their unique challenges, specialising in motor and drive applications.



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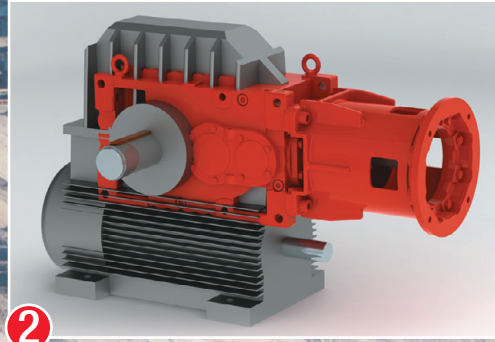
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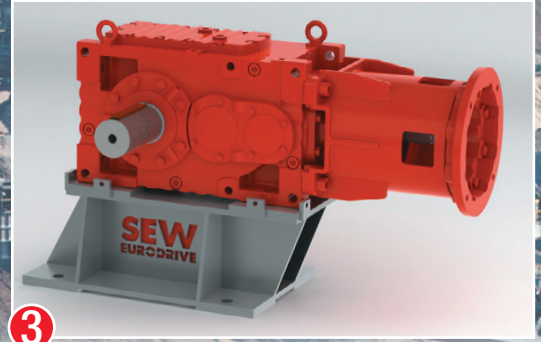
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