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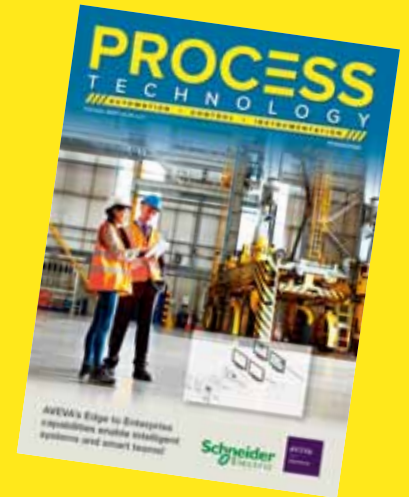
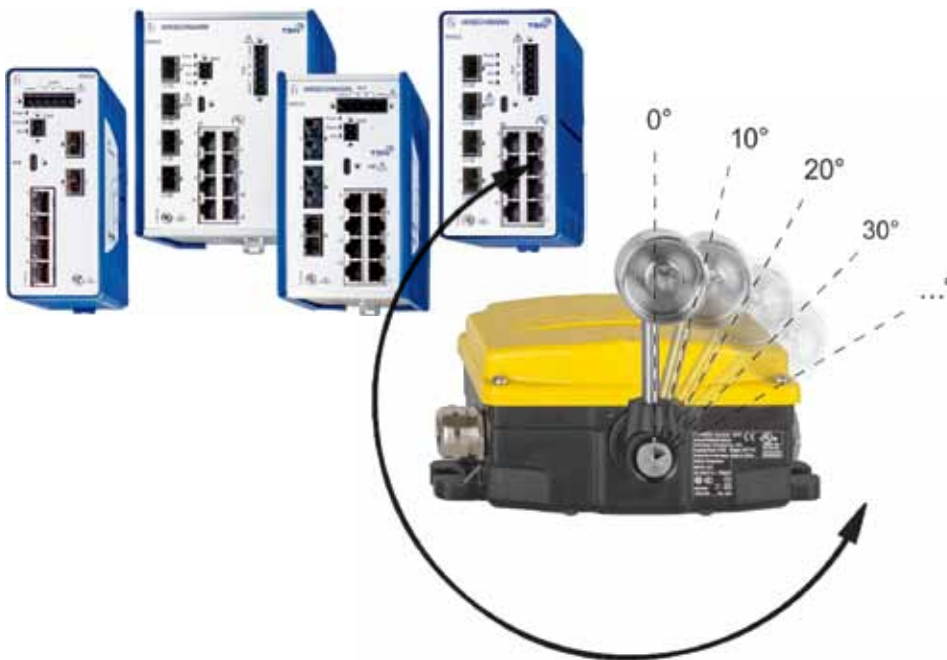
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Engineering the Future

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AVEVA's Edge to Enterprise monitoring and control approach enables next-level real-time decision-making and optimisation from previously siloed and inaccessible data. The portfolio includes six software solutions.

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Unified Operations Center — which offers a command-and-control solution that gives end-to-end operational visibility across facilities, helping to improve safety, operational efficiency, and profit margins.

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COTS HARDWARE

IN OIL WELL PRODUCTION
AND MONITORING

Jim Shaw, Executive Vice President of Engineering, Crystal Group*



No longer is a laptop with a four-port switch a viable engineering toolset for compliance and monitoring at the well site.

Optimal oil production and the necessary environmental safety have been tied to effectively monitoring down-hole parameters of producing wells. Current trends in technology allow for mapping a large array of parameters in order to optimise the equipment utilisation and anticipate or mitigate revenue-impacting issues. With the advent of advanced fibre-optic measurements, Raman Distributed Temperature Sensing (DTS) and Brillouin Distributed Temperature and Strain Sensing (DTTS), precision down-hole measurements are possible and practical.

The base system is comprised of a series of fibre-optic cables, usually double steel encased, with a reflective mirror attached to the end of each of the fibre cables. Light energy travels to the bottom of the hole and is reflected back to a photodiode acting as an optical receiver. Pressures, temperatures, flow rates and proximal changes in the hole can be monitored along the depth of the hole through Bragg, Raman and Brillouin photopic (optical time domain reflectometer) modifications on the signal. An analog-to-digital convertor circuit creates a digital profile that is processed through a signal analyser. Data is passed via Ethernet to the server, which is used to process the data using several advanced Fast Fourier Transform (FFT) algorithms.

The resulting data, which is now easily interpreted as temperature, pressure, flow and position, is stored in a RAID array to monitor the well production performance as trend information. These servers and switches are typically powered through a UPS system that is supplied by a conventional on-site generator set.

A rugged 750 W UPS with a 10-port 10/100MHz Ethernet switch and a 2U server can be packaged in a 40 kg 4U transit case to provide the in-field data processing. Data can be stored onsite or uplinked to a central monitoring station by the extraction team.

Industry challenges

The unique problem with monitoring oil wells with this technology is that the level of computing necessary to process the data into meaningful parameters is daunting. The effort is not possible with a Toughbook or laptop-class appliance. Furthermore, standard servers are not made for this type of application. Rig sites are dirty, dusty, inclement places where the electrical power is typically unreliable. Fracking chemicals are highly caustic to electronics and cause premature failures in untreated commercial off-the-shelf (COTS) servers. The site monitoring schedule is typically a few weeks to a month at one site, then off to the next well via the back of a truck. Transportation to the next well site is often via unmaintained roadways. The equipment needs to be small enough to be manually carried and set up on a platform or well head but tough enough to be transported from site to site without being damaged. This situation defines a challenge for a new breed of rugged COTS computing, networking and integration. Using COTS allows for leading-edge computation at a reasonable cost, and integrating and hardening the package provides a highly reliable system in a small form factor. Performing at this level for the oil industry has been an unmet challenge.

Starting point: transit case enclosure

When selecting an enclosure, we must keep in mind a few considerations that may pay great dividends. First, it is tempting to over-size the transit case for future expansion. Unless it is certain additional or deeper components are required later, one should resist the temptation to pick a 6U case when a 4U will solve the problem. The case is a large portion of the weight, and weight is the focus in this application.

Consider selecting a case that uses a removable inner frame. While this seems

like an unnecessary luxury, the first time maintenance is required, the feature will have paid for itself. Being able to get around the rack, perform wiring, assemble the system and perform troubleshooting is beneficial when the case is not in the way.

The style and durability of the transit case is also important. Consider a thermal formed or carbon fibre case that has been designed to be stacked, locked and dropped. Cases designed for the music industry are lightweight but not designed for this type of environment or service life. The material needs to be rigid enough as well as tough enough to carry the load without damaging the internal equipment or failing in an unanticipated incident.

Keep in mind the cases can be 'dynamically tuned' for the load by the manufacturer making isolation a variable by working with the transit case company. It is important that multi-axis isolation techniques are used for this class of equipment, and to be effective, the correct dampening characteristics need to be matched to the mass being protected. This isolation mass information is usually in the manufacturer's specification sheets, but contact the case manufacturer for your unique situation.

The computing challenge

Gone are the days of industrial or military-grade screened parts used in the manufacture of rugged computers. The challenge today is to adapt what is provided for the server class computing industry to harsh environments like those found in well-head monitoring or oil exploration.

The key trends that have dominated the COTS packaging for more than 10 years are:

1. Regulatory pressure to substitute tin-lead solders for tin-silver-copper alternatives has altered the fatigue life curve for cyclic temperature-induced

failure, which can create latent reliability issues and 'tin whiskers' (spontaneous dendritic growth of pure tin columns). While the consumer electronics industry is unencumbered by the change in these materials, the lower ductility solder fails under higher loads but fewer cycles for SnAgCu based solder¹.

2. Integrated circuit technology continues to advance, allowing for smaller features in the microprocessor silicon, which is in turn impacting the connection density on the printed circuit boards' ball grid array size and pitch. Finer-pitched features fracture more readily under a set strain or deflection. Intel and AMD are integrating more of the circuitry on the microprocessor substrate (video, memory controller, interrupt control hub, platform controller hub, etc) making the silicon substrate larger. This is chiefly because of the technology improvement mentioned above. Larger silicon packages create a need for less deflection in the boards and therefore the chassis in order to maintain reliable performance.

These factors conspire to make adapting COTS architectures even more difficult, although not unmanageable. Creating a server package that can withstand shock or impact loading and vibration or cyclic deflection is a critical factor in designing a well monitoring system. The heart — and arguably the most sensitive aspect — of the integrated product is the compute capability. Numerous enhancements are required to utilise a COTS motherboard in this application.

The key to making a rugged system lies in constructing a chassis that has such extreme stiffness that deflections in the solder joints are entirely avoided. Standard sheet metal construction for the computer chassis provides insufficient

rigidity. An alternative to this approach is a billet-machined chassis. This type of milled box construction does an excellent job of limiting deflection; however, there is a weight penalty. Since this is intended to be a portable application, weight is critical.

Another approach is weight reduction through the use of composite materials such as cross-weave carbon fibre laminates for the enclosures. Weight savings of 20–30% are readily achievable using these materials. Additionally, the stiffness of the enclosures rivals those of traditional material selection making a viable option at roughly a 15% cost premium.

The protection of the electronics and the need for a lightweight structure drive the design considerations for the computer. Staking components for vibration and shock, protecting the electronics from humidity intrusion and using stainless steel hardware are good measures to take in creating rugged, durable systems.

Many of these monitoring systems also require the support of virtualisation software to accommodate a larger number of sensor applications running on a single computer. It is difficult to find, and expensive to develop, an embedded computer architecture that is capable of accepting a server-grade virtualisation operating system (such as VMware or Windows with Hyper V) as most small embedded platforms are not server-grade hardware and lack the compute power needed for virtualisation.

An economical alternative is to use platforms that have already been certified to be compatible with your OS of choice. This tends to be a system level challenge. Included in the mix is the choice of a network switch and its management capability. The same challenges faced on the compute side of the system are seen in the network side.



Figure 1: A rugged portable data collection system. Source: Crystal Group.

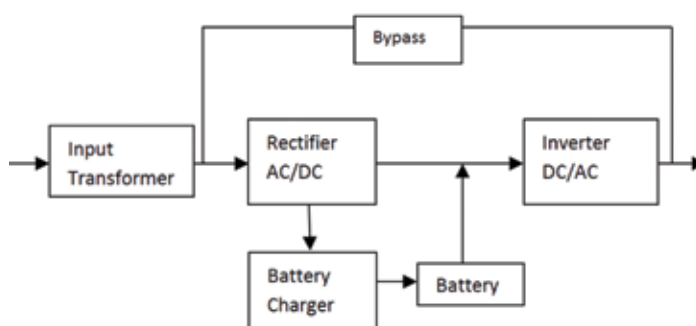


Figure 2: Double conversion UPS block diagram.



Clean power is a key issue onsite

Oil production sites are not typically known for having clean power. This was never an issue until high-end computing entered the equation. A month's worth of monitoring could be lost with a single power spike. The use of a UPS is essential in maintaining the integrity of the data collected at the well site.

Ruggedness and weight are significant factors in UPS selection for well sites. Ruggedness because of the environmental extremes and weight because these systems are expected to be portable. But these are not the only parameters that should be examined when selecting a UPS. Other concerns relate to the use of generators and the ability to provide galvanic isolation. The use of generators and the poor quality they can provide can result in the loss of data or a break in the communication link. Generators can cause frequency instability and notching of the sine wave input to any unprotected load resulting in damaged equipment and downtime onsite reducing the productivity of the well site.

Most commercial UPS systems do not provide the ruggedness to cope with the extreme temperatures or the environment and fail very quickly. Most commercial line-interactive UPSs do not provide galvanic isolation or provide frequency stability to the load and have to utilise the batteries to cope with the voltage fluctuations or the frequency instability. This results in battery failure or a dramatic reduction in battery life. The extreme temperatures also affect line-interactive UPS as the UPS and batteries are designed to operate in a typical ambient temperature of 20–24°C environment.

The solution is to utilise a rugged design with a double conversion online UPS with input isolation. Double conversion online UPSs provide frequency stability, voltage stabilisation and complete galvanic isolation to the load without utilising battery power. Batteries

are only used when power totally fails or exceeds $-15/+25\%$ on the input voltage. This utilisation rate results in longer battery life, less maintenance cost, reduced site downtime and a more productive well site.

A true online UPS has the following characteristics:

- There is no transfer time or interruption of power to the load if a blackout or brownout occurs because the inverter is already online, supplying 100% of the load.
- The true online UPS provides full-time conditioned clean power because the UPS is creating a new clean sine wave after converting or rectifying from AC from the utility to DC and then back to AC. The double conversion online topology fully protects the computer load from all ongoing and often transparent power problems on the utility line.
- Backup AC generators have severely distorted waveforms when supplying non-linear loads such as computers as a result of their relatively high output impedance. All of the standby-type UPSs interpret the voltage distortion as bad power quality causing the UPS to go to battery and back cyclically as generator load changes. Eventually the battery is exhausted, which shuts down the load. Only a double-conversion online UPS will solve these compatibility problems.
- An online UPS can provide tightly regulated output voltage, usually $+3\%$, to the load even if the input voltage varies widely. Many online UPS products can provide this tight regulation without any battery drain.
- An online UPS provides longer run time from its batteries when needed because the battery will not be partially drained during a brownout.
- Overall battery life will be longer for an online UPS compared to standby and standby with boost (line interactive) types.



THE CHALLENGE TODAY IS TO ADAPT WHAT IS PROVIDED FOR THE SERVER CLASS COMPUTING INDUSTRY TO HARSH ENVIRONMENTS

Conclusion

The need for server-class computing on a well site is a recent trend. This trend has provided challenges for companies that need to carefully monitor production for the purposes of regulatory requirements in addition to production optimisation. The oilfield is a relatively inhospitable place for computers, power supplies and network switches. Selecting the right components and protecting them from damage is a key factor in a long and uneventful life. Chassis stiffness and circuit card protection as well as transit case integration and a double conversion UPS power conditioning make well monitoring a viable science in the industry.

**Jim Shaw is the Executive Vice President of Engineering at Crystal Group (www.crystal-rugged.com) and oversees product development and product strategy. Jim has a 30-year history of designing and building rugged electronics for industrial and military applications.*

Reference

1. Kostic AD 2011, *Lead-free Electronics Reliability – an Update*, The Aerospace Corporation, <<http://nepp.nasa.gov/whisker/reference/tech_papers/2011-kostic-Pb-free.pdf>>

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IMAGE PROCESSING SOFTWARE

Wenglor's uniVision image processing software has been updated to release 2.2, which enables smart cameras and control units to be integrated into controls via a Profinet interface.

The results of image and profile evaluations can now be transferred in real time via the established Profinet industrial Ethernet standard, making seamless communication between the sensor, software and control easier.

Another feature of the uniVision update 2.2 is a web-based visualisation function. This enables the results to be displayed as overlays (eg, measurement points or lines) directly in the image or height profile. A 'good/bad' display of the overlays in the signal colours red and green is also available, showing the user whether the test points are OK or not OK. All measurement results can thus be shown quickly and flexibly via a browser-based display.

Update 2.2 also adds an FTP module for saving images, profiles or text files on the uniVision device itself or on an FTP server in the network. This enables image data to be generated and exported for documentation purposes. The additional Count module also enables good and bad parts to be counted to provide an overview of the current production process.

Treotham Automation Pty Ltd

www.treotham.com.au



AIR KNIFE

The compact Super Air Knife provides a uniform, high-volume, high-velocity sheet of laminar airflow across the entire length that is adjustable from a gentle blowing force to a hard-hitting blast of air. The energy-efficient design minimises compressed air use by entraining 40 parts room air to one part compressed air, offering a more efficient way to blowoff, clean, dry or cool parts, webs or conveyors.

The best way to cut energy costs is through proper maintenance and use of the compressed air system, with the most

important factor to dramatically boost efficiency being proper use.

The Super Air Knife uses only one-third of the compressed air of typical blowoffs used in cleaning, cooling and drying operations. It can be instantly cycled on and off, further reducing compressed air usage and costs.

Even at high pressures of 80 psig (5.5 bar), the sound level is surprisingly quiet at 69 dBA for most applications. The Super Air Knife is CE compliant and meets WorkSafe Australia and OSHA dead-end pressure and noise requirements.

EXAIR Super Air Knives are available in many lengths from 3" (76 mm) up to 108" (2743 mm), in a variety of materials that include aluminium, type 303 stainless steel, type 316 stainless steel and PVDF plastic.

Applications include part drying after wash, sheet cleaning in strip mills, conveyor cleaning, drying food products, cooling hot materials and parts, web drying or cleaning, environmental separation, pre-paint blowoff, bag opening/filling operations and scrap removal on converting operations.

Compressed Air Australia Pty Ltd

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COMPACT POWER SUPPLIES

The PIANO series of power supplies from PULS has been designed for users who need easy-to-use DIN rail power supplies, without making compromises in efficiency, life or size. The latest additions include 24 VDC DIN rail power supplies in three models: the PIM36 (36 W), the PIM60 (60 W) and the PIM90 (90 W).

The PIANO Mini (PIM) power supplies create space in systems or machines and allow for flexibility when planning, with the largest 90 W DIN rail power supply coming in a 36 x 90 x 91 mm housing. The width of the 36 W version is only 22.5 mm. There is a high efficiency of 91.8% for the PIM60 and 93.8% for the PIM90 at full load and 40°C ambient temperature for lower heat losses, making the series durable and lowering cooling costs.

The growing PIANO range includes 14 different DIN rail power supplies and is available in 12 to 48 VDC versions, from 36 to 480 W.

Control Logic Pty Ltd

www.controllogic.com.au





Wellhead upgrades help Santos futureproof LNG production

Natural gas is Australia's third-largest energy resource and its export demand is growing. Australian liquefied natural gas (LNG) exports have increased from 15.4 million tonnes in 2009–10 to an estimated 74.8 million tonnes in 2019–20.

Santos is one of the leading independent oil and gas producers in the Asia-Pacific region, supplying the energy needs of homes, businesses and major industries across Australia and Asia. With a large resource base in Queensland and growing demand for LNG in Asia, Santos created the GLNG project in 2007. This pioneering project was to convert natural gas, including coal seam gas from the Bowen and Surat Basins, into LNG for export to Asia.

The project involved the development of gas fields, the construction of a 420 km underground gas transmission pipeline to Gladstone and a two-train liquefaction and storage facility with a nameplate capacity of 7.8 mtpa on Curtis Island in Gladstone.

To assist in futureproofing LNG production, Santos decided to update the standard wellhead design for new wells with an advanced control and automation technology platform.

Progressing cavity pump (PCP) and linear rod pump (LRP) wellhead skids are critical parts of the LNG production process. Their main components include a separator and motor control centre. To improve the next generation of new wellhead skids, Santos called on its longstanding relationship with ATSYS, a Rockwell Automation Recognised System Integrator. Having an accomplished background and expertise in this area, ATSYS produced a wellhead control and monitoring solution for the project with consideration of the arduous environment in which the equipment must operate.

ATSYS was tasked with designing a system that not only improved reliability but would also have the functionality to implement new innovations from Santos on the open system. This would improve the functionality over and above what the previous system could do.

In deciding which technology would provide the best solution for the wellhead skids, ATSYS went through a process exploring a number of options.

"After investigating a number of options, we found that the Rockwell Automation Integrated Architecture solution provided the best performance because it allowed very fast communications between the PLC and the drive, which was critical to this application," explained Andre Tassone, managing director, ATSYS.

A pilot project was conducted and field tested using this solution for both PCP and LRP wells, and as a result of its success, Santos moved forward with the mass rollout of the new design, which involves approximately 400 wellhead skids per year.

The new system was designed around efficient commissioning. Commissioning of the old system took days and now just takes hours per wellhead. The systems are built and tested off-site utilising automatic



PLC and drive set-up via SD cards. The skids arrive onsite already configured and tested, meaning commissioning is a seamless process.

The speed of communications between the Allen-Bradley CompactLogix controllers and PowerFlex 753 drives allows for very precise real-time measurements of torque and position of the pumps. "While the pump is operating, we need a high-speed sampling rate to ensure the accuracy of the dynacards," said Alex Gibson, principal control systems engineer, ATSYS. "The dynacard plots the pump load against position, allowing us to perform some advanced control functions. The high-speed communications and processing power of the Rockwell Automation system provided the capability to use a PLC instead of an RTU for this application when a lot of people in the industry thought this would not be possible. It provided maximum flexibility and the ability to perform AGA3 gas flow calculations in this complex control application."

Given the remote location of the sites, having access to diagnostic information was a key requirement for the project to avoid people having to go to site unnecessarily. There are diagnostic features built into the system using analog I/O with HART connectivity from Spectrum Controls. The new system provides improved reliability, simplified set-up and commissioning, fast fault diagnosis and the simplicity of a single standardised design for multiple wells.

"The Rockwell Automation Integrated Architecture solution is flexible, scalable and futureproof to allow for additional innovations. It provides a technology platform for Santos to not only meet today's requirements but to also expand the future possibilities of gas production," Tassone said.

The collaboration between Santos, ATSYS and Rockwell Automation has been a key component of this project.

"The project teams and engineers from all companies involved were able to work together to effectively solve complex problems which culminated in the ongoing success of this project," concluded Greg Schultz, channel account manager, Rockwell Automation.

Rockwell Automation Australia
www.rockwellautomation.com/en_au

MODULAR PYROMETER

The Impac 600 series from Advanced Energy is a digital, modular pyrometer that provides a highly customisable design with easy installation and maintenance. It is a long wavelength digital pyrometer best suited for non-contact temperature measurement on non-metallic or coated metallic objects.

The modular concept allows for various combinations of system components including a converter box, sensor heads and a multi-sensor box. The standard configuration includes an electronic converter box and a removable sensor head to allow for easy exchange. Each converter box can connect up to two sensor heads or up to two optional multi-sensor boxes that connect up to four sensor heads each.

The Impac 600 is suitable for measuring temperature ranges between -40 and 700°C. Three different optics are available with a field of view 2:1, 10:1 or 20:1.

The converter box is available with or without a display and communications supported are analog or RS-232/RS-485.

W&B Instruments Pty Ltd

www.wandbinstruments.com.au



REED CHAIN LEVEL INSTRUMENT FOR FOOD APPLICATIONS

WIKA has expanded its range of level transmitters with reed measuring chain by adding the model FLR-F for food applications. The instrument has an electropolished surface with a roughness of less than 0.8 μm Ra and is available with application-specific process connections such as TriClamp.

The level transmitter works on the float principle with magnetic transmission. It measures the level correctly, even with foaming, and can additionally output a temperature value. The reed contacts in the guide tube (up to 6 m long) can be arranged as a quasi-continuous level measurement.

The model FLR-F is also available in a version with a head-mounted transmitter for different output signals and communication protocols. Furthermore, the instrument can be supplied with a removable float limitation and FDA-compliant sealing or in an ATEX variant for applications in which pipes are cleaned with flammable media.

WIKI Australia

www.wika.com.au



VORTEX FLOWMETER

KROHNE has introduced the OPTISWIRL 2100 vortex flowmeter, aimed at basic utility applications in the process industries and as a solution for the measurement of liquids, (wet) gases, saturated and superheated steam where high accuracy is not required.

The product features the vortex technology of the OPTISWIRL series and is also equipped with Advanced Vortex Frequency Detection (AVFD) technology for signal filtering. It provides stable measurements under demanding process conditions with medium temperatures from -40 to 240°C.

The 2-wire, 4-20 mA HART 7 device is available as a flanged version DN15-300 or sandwich (wafer) version DN15-DN100. For a large measurement span even in pipelines with large diameters, a version with integrated nominal diameter reduction is available. For convenient onsite parameterisation and measurement reading, a remote option makes it possible to install the signal converter up to 50 m away from the sensor. Approvals for use in hazardous areas are in preparation.

The device adds to the OPTISWIRL vortex series as an economical alternative to the OPTISWIRL 4200.

KROHNE Australia Pty Ltd

www.krohne.com.au

LONG-DISTANCE LASER RANGEFINDERS

Many industries use large overhead cranes to move heavy products. These cranes can be automated and monitored using long-distance laser rangefinders. Acuity long-distance lasers are designed to help improve crash avoidance and automated retrieval, and maintain equipment more proactively and efficiently.

Common examples of laser rangefinders used in crane positioning include overhead crane position monitoring at steel mills during the transportation of heavy coils, crane monitoring during the hoisting of large equipment and bridge crane positioning for many industries including the ship docking/cargo transportation industry during the unloading of pallets and containers.

Acuity long-distance rangefinders are suitable for crane positioning applications in many environments. The sensors have a rugged package with NEMA-4, IP65 and IP67 ratings that can be used both indoors and outdoors, allowing sensor versatility to meet application needs. The Acuity AR3000 laser distance sensor is commonly used to measure the position of the crane's trolley along the longest stretches at ranges up to 3000 m. The Acuity AR1000 laser distance sensor commonly monitors the side-to-side position and vertical position of cranes.

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2D LIDAR SENSOR

SICK has expanded its 2D LiDAR sensor range for localisation and anti-collision applications with the compact TiM2xx series.

The e-commerce sector continues to experience strong growth. This has also led to an increase in demand for automation solutions to support the growing logistics infrastructure and the transport of goods and products. Autonomous mobile robots (AMRs) are handling more logistics tasks of varying kinds. The latest AMR designs are becoming increasingly compact. 2D LiDAR sensor solutions need to keep pace with these new types of applications in terms of functionality, size and cost.

The TiM240 is the first variant in the TiM2xx series and has an enclosure rating of IP65 for indoor use. The TiM240 scans an area of up to 200 m² at 15 times/s. This allows the user to cover a relatively large space with one scanner, to detect the smallest changes in the space due to the high scan rate and to quickly transmit these changes to the controller via Ethernet. The HDDM+ technology provides a stable output of measurement data. The low power consumption of 2.9 W becomes a particular advantage when used in battery-operated vehicles.

At only 150 g the TiM240 is lightweight and takes up very little space with its compact dimensions of 75.8 x 79.7 x 60 mm, enabling it to be integrated into ever-shrinking AMRs.



SICK Pty Ltd

www.sick.com.au

ULTRASONIC FLOW METER



Bronkhorst has released an updated generation of ES-FLOW ultrasonic flow meters for low flow rates of water, additives and other liquid substances. The improved flow meters measure volume flow from 2 up to 1500 mL/min with higher precision, high linearity and low pressure drop, using ultrasound in a small-bore tube.

The instruments are liquid-independent, due to a measuring principle in which the actual sound velocity is accounted for in the flow calculations. The combination of a straight sensor tube with zero dead volume means that the flow meter is self-draining. Having orbital TIG-welded flanges, the meter is CIP or SIP cleanable, and now meets 3-A sanitary standards for hygienic applications. Wetted parts are made of stainless steel, and the exterior design is rated to IP66 or IP67.

The local user interface is a capacitive touchscreen with a TFT display. For remote operation, Bronkhorst added a variety of Ethernet-based fieldbuses to the already available range of analog and digital communication options. The onboard PID controller can be used to drive a control valve or pump, enabling users to establish a complete, compact control loop.

Typical applications can be found in food, beverage and pharmaceuticals (eg, additives, sterilisation of packages), medical and chemical (eg, catalysts, reagents) and many other markets that require precision fluid handling, such as fuel consumption measurement and dosing of hydrocarbons, demineralised water, colourants or lubricants.

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THERMAL MASS FLOWMETERS

Endress+Hauser has launched the Proline t-mass F/I 300/500 thermal mass flowmeters, designed for measuring pure gases and gas mixtures, each with numerous alarm functions, as well as bidirectional measurement capability and reverse flow detection.

When process and ambient conditions significantly fluctuate, t-mass is said to provide high measurement accuracy ($\pm 1.0\%$) and repeatability ($\pm 0.25\%$). Gas flows with low pressure and a low flow velocity can also be measured due to a high turndown ratio. The t-mass F and I models can operate at process temperatures up to 180°C and pressures up to 580 psi.

The t-mass 300/500 measuring system is equipped as standard with 'Gas Engine' software to enable, among other things, calculation of the mass flow of a gas under current process conditions. The Gas Engine also calculates flow velocity, reference density, corrected volume, and energy flow for current operating conditions, and measurement of pure gases and gas mixtures by selecting from up to 22 standard gases, as well as gas mixtures created by combining up to 8 of these 22 gases (special gases on request).

The t-mass 300/500 measuring system has been developed in accordance with IEC 61508, SIL 2 and can serve safety-related applications. Any device or process errors that may occur are indicated to NAMUR NE107 standards. It is also equipped with alarm functions used for detecting unwanted condensate drops on the sensor or pulsating flow, and it can measure and account for gas flows in both flow directions and detect reverse gas flows.

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SANITARY TEMPERATURE SENSOR CALIBRATION

Sanitary temperature sensors are commonly used in many industries, but their calibration is different and more difficult than for normal temperature sensors.



Temperature is one of the critical process parameters in many industries and the accuracy of the temperature measurement in processes is a crucial consideration.

The food and beverage, dairy, pharmaceuticals and life science industries have additional requirements for temperature measurement sensors because of their processes. They require temperature sensors that are sanitary, meaning that these sensors need to be suitable to be installed in hygienic and aseptic process environments. These sensors need to be hygienic and designed to be easy to clean, often supporting clean-in-place (CIP) processes. The mechanical design needs to be free from any cavities, dead pockets, gaps or anything that would complicate the hygienic cleaning.

Surface finishes of these sensors are hygienically graded and need to meet the strict standards in these industries, such as the 3-AR (<https://www.3-a.org/>) or EHEDG (European Hygienic Engineering & Design Group) <https://www.ehedg.org/>.

The material of the wetted parts in these sensors is often high-grade stainless steel, suitable for these applications, and for easy installation, the sanitary sensors are often provided with the clamp installation.



The temperature ranges typically go up to around 150°C, or in some cases up to 200°C, which in itself is not very challenging.

The role of calibration

In any industry, it is vital that the process measurements measure correctly and as accurately as designed. This can be achieved with the help of suitable process instruments and with a proper calibration program.

Within the food and beverage, pharmaceutical and life science industries, calibration plays an even more important role than most other industries. In these industries, the consequences of a bad or a failed calibration can have a dramatic effect, as we are talking about consumer and patient health and safety. As failed calibration can be very costly in these industries, it has to be avoided by all means possible.

These industries also have dedicated strict regulations concerning calibration.

Why are sanitary sensors difficult to calibrate?

Sanitary sensors are very short

Sanitary temperature sensors are typically very short. Most often less

than 100 mm and typically around 50 mm, but can also be as short as 25 mm. The diameter of the sensor typically is 3 mm or 6 mm.

The commonly used practice in temperature calibration (and a Euramet guideline recommendation) is that a temperature sensor should be immersed deep enough in a temperature bath to achieve sufficient accuracy. The recommendation is to immerse to a depth that is 15 times the sensor diameter (plus the length of the sensor element). But with these short sanitary sensors, it is simply impossible to immerse the sensor to sufficient depth during the calibration. For example, a typical sanitary sensor with a diameter of 6 mm should be immersed to at least 90 mm (15 x 6 mm) depth during the calibration to ensure accurate results. But if that 6 mm sensor has a length of only 50 mm, sufficient immersion is simply not possible.

Some rules of thumb for the immersion depth when calibrating in a liquid bath are:

- 1% accuracy: immerse five diameters plus the length of the actual sensing element inside the sensor
- 0.01% accuracy: immerse 10 diameters plus the length of the sensing element
- 0.0001% accuracy: immerse 15 diameters plus the length of the sensing element



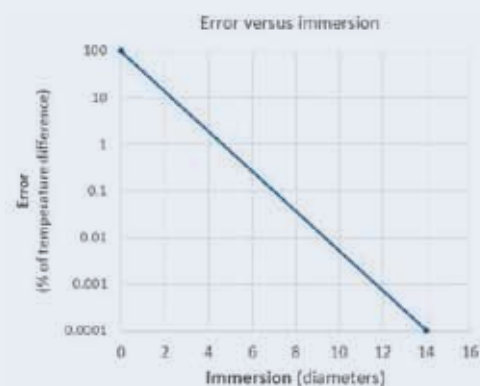


Figure 1: Error versus immersion.

The accuracy in the above rule is to be calculated from the temperature difference between the block temperature and the ambient temperature.

For example, if the ambient temperature is 20°C and the block temperature is 120°C, there is a 100°C difference. If you then immerse the probe only five times the dimension (plus the sensing element length) — say you have a 6 mm probe with a 10 mm sensing element inside of it and you immerse it 40 mm (5 x diameter + sensing element) — you can expect about 1°C error due to the low immersion (1% of 100°C).

Figure 1 illustrates the relationship between thermometer immersion depth (in diameters) and the relative error of the temperature difference (of the temperature block and ambient temperatures). So if you don't immerse at all, you naturally get a 100% error, and if you immerse deep enough the error caused by immersion becomes insignificant.

This rule of thumb can become quite significant at higher temperatures or for extremely short sensor lengths, and so this should be kept in mind with sensors less than 40 mm.

It is not always easy to know the length of the actual sensing element inside the probe. If that is not mentioned in the datasheet, you can ask the manufacturer.

Sanitary sensors often have a clamp connection with a flange

As mentioned previously, sanitary sensors also often have a so-called clamp connection (Tri-clamp, ISO 2852, DIN 11851, DIN 32676, BS 4825, Varivent, etc), so there is a relatively large metallic flange that causes heat to conduct away and leak from the sensor to the flange. In practice this means that the flange causes the sensor to read a slightly lower temperature when calibrating to a temperature higher than ambient temperature.

Liquid bath or a dry block?

Generally you can calibrate temperature sensors in a liquid bath or in a dry block.

Pros and cons of a liquid bath

A liquid bath makes it easier to insert any shape of sensors and you can also use a reference probe inserted at the same time. Depend-

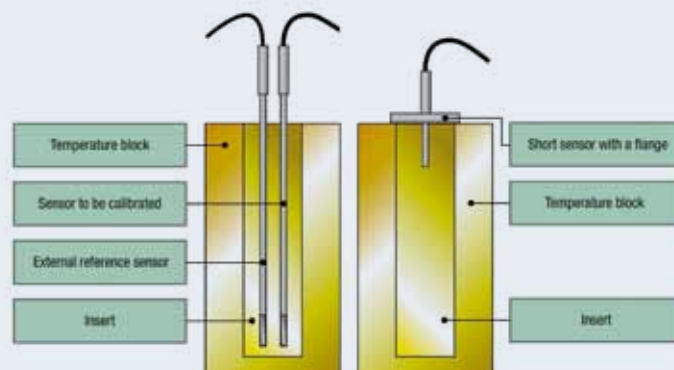


Figure 2: Calibrating normal temperature sensors versus a sanitary sensor with a flange.

ing on the size of the liquid bath, you may be able to insert several sensors to be calibrated at the same time. In case the sensor to be calibrated is an odd shape, a benefit is that it will still fit inside the liquid bath. A liquid bath often enables better uniformity and accuracy than a dry block due to better heat transfer via the liquid.

Even though this sounds like a favourable option, a liquid bath also has several drawbacks:

- A liquid bath always includes some sort of liquid, such as silicone oil, and often you don't want to contaminate the sanitary sensor in such a liquid. Cleaning is necessary after the calibration to ensure that the sensor is clean when installed back into the process.
- Handling of hot oil is dangerous and any spills may cause injuries.
- Liquid baths are very slow. Even fitting several sensors in at the same time, it is often several times slower than a dry block, so overall effectiveness is not really any better. Sometimes several baths are used, each set to a different temperature, but this is a very expensive way to calibrate.
- The sanitary sensor should be placed so that the surface of the liquid touches the bottom of the flange, but in practice this is not always that easy to do. For example, silicone oil has a large thermal expansion, which means that the surface level is changing slightly as the temperature changes. So, you may need to adjust the height of the sanitary sensor during the calibration.
- Liquid baths are often large, heavy and expensive pieces of equipment.

Pros and cons of a dry block

The main pros of calibrating the sanitary sensor in a dry block are:

- Because it is a dry, it is also clean and does not contaminate the sanitary sensor to be calibrated.
- A dry block is very fast to change temperature.
- When using a dedicated insert with proper drillings, it is easy to insert the sanitary sensor the same way each time, and the calibration is repeatable every time and with different users.
- A dry block is light and easy to carry compared to a liquid bath.
- Typically, a dry block is also cheaper than a liquid bath.

On the downside, a dry block is a less accurate than a liquid bath, which typically only calibrates one sanitary sensor at a time and needs different inserts drilled for different diameter sensors.

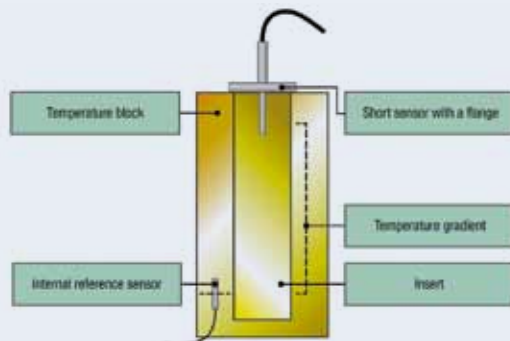


Figure 3: The internal reference sensor is usually too low to be accurate with sanitary sensors.

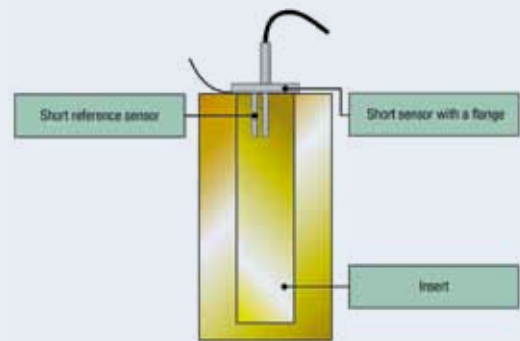


Figure 4: Using a dedicated short reference sensor.

Despite these downsides, customers often prefer to make the calibration of their short sanitary sensors in a dry block.

How to calibrate in a temperature dry block

To calibrate these short sanitary sensors in a temperature dry block, there are a few considerations to take into account.

Using a reference sensor

Firstly, when you do the calibration in a dry block, the flange of the sanitary sensor makes it impossible to use a normal external reference sensor in the same insert.

Comparing the calibration of a normal (long, no flange) temperature sensor using a reference probe with a short sanitary sensor with a flange (Figure 2), we can see that the short sensor flange covers all the holes in the insert, so it is not possible to insert a normal reference temperature probe.

Using an internal reference sensor

The dry block always includes an internal reference sensor. Trying to use the internal reference sensor in the dry block does not work with short sensors, because the internal reference sensor is located close to the bottom of the temperature block, and the short sensor to be calibrated is located in the very top part of the insert (Figure 3). Dry blocks typically control the temperature gradient on a limited range in the bottom of the insert. The top part of the insert typically has a larger temperature gradient, so the top of the insert does not have the same temperature as the bottom of the insert. The size of the gradient depends on the temperature difference between the insert and environment, and how deep you insert the sensor.

Using a dedicated short reference sensor

As the internal reference sensor in the bottom of the dry block is not suitable, we need to use a dedicated external reference temperature sensor. The aim is to use a dedicated reference sensor that is short enough so that it can be immersed to the same depth as the sanitary sensor to be calibrated. Optimally, the middle of the sensor elements should be aligned to the same depth.

Also, the reference sensor needs to have a thin flexible cable so that the cable can fit under the flange of the sanitary sensor.

To help that, we can make a groove in the top of the insert where the reference sensor cable fits and the flange of the sanitary sensor still touches the top of the insert.

Naturally the structure of the temperature dry block needs to be such that the sanitary sensor with the flange fits in its place and touches the insert top end. In some dry-blocks the surroundings prevent the flange from going deep enough to touch the top of the insert.

Locating the reference sensor at the same depth as the short sanitary sensor to be calibrated ensures they are measuring the same temperature. Also, the reference sensor cable is in the groove, so it does not prevent the flange of the sanitary sensor from touching the top of the insert (Figure 4).

Short sensor without a clamp connection

There are also short temperature sensors without the clamp connection and without the flange. With these sensors you should also use an external reference sensor that has been immersed to the same depth as the sensor to be calibrated. The reference sensor should be as similar as possible to the sensor to be calibrated, with a similar diameter, similar response time, etc.

Documentation, metrological traceability and calibration uncertainty

As documentation is included in the formal definition of calibration, it is a vital part of every calibration. This is naturally also valid in sanitary temperature sensor calibration — typically in the form of a calibration certificate.

The calibration equipment used should have a valid metrological traceability to the relevant standards, otherwise the calibration does not ensure traceability in the sensor calibration.

The calibration uncertainty is also a vital part in every calibration. If the calibration equipment (and calibration method and process used) is not accurate enough for the sensor calibration, then the calibration does not make much sense.

AMS Instrumentation & Calibration Pty Ltd
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DIGITAL LOAD MANAGEMENT SYSTEM

TeSys island is a smart, digital multifunctional load management system that can switch, protect and manage motors and other electrical loads of up to 80 A. It is designed to help prevent unplanned stoppage and enables the early detection of abnormal load behaviour. By automating routine tasks, leveraging simulation technologies and having a design that reduces wiring and enables faster mounting to DIN rail, TeSys island can reduce time to market by up to 30%.

With this smart load management system, commissioning and operation are also made easier. TeSys island can be used to integrate machines to IT using open standards and allows users to commission remotely. It also reduces machine downtime, enhancing maintenance efficiency with faster information tracking.

By using TeSys island, users can generate up to 50% time saving on corrective actions. Pumping, packaging and conveying are common applications for TeSys island, but it can also be used in other industrial and commercial applications. It is compatible with third-party PLCs and all industrial fieldbuses.

Schneider Electric

www.se.com/au

RFID SECURITY READERS

IDEC Corporation has announced the KW2D series of smart radio-frequency identification (RFID) readers, which are designed for easy installation into the typical 22 mm panel-mount holes used with machinery and are readily integrated with automation systems.



The RFID readers are compact, UL-listed, all-in-one devices installed into typical 22 mm panel-mount holes right along with other switches, buttons and lights. They maintain IP65/67 water-, dust-, and oil-proof ratings, and feature push-in power supply terminals. A built-in Ethernet port facilitates easy connectivity to host devices like PLCs and HMIs using Modbus TCP. Three-colour white/green/red LED lighting is clearly visible from the front and sides to indicate standby, successful verification or error respectively, while a built-in auxiliary buzzer provides audible feedback of successful and error conditions.

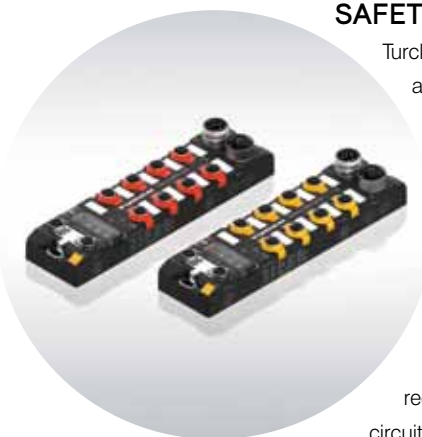
Users can mix and match various RFID tag formats: commercial-style cards, wristbands, stickers, and IDEC-supplied colour-coded key fob or card-style tags. The key fob tags are available in five colours, durable for field conditions, and include enhanced encryption compared with other tag types.

RFID tags are passive devices that respond to a short-range radio signal generated by the RFID reader when the two are in close proximity. The KW2D operates at standard 13.56 MHz high-frequency (HF), providing a reading distance of up to 15 mm depending on the tag style. Several ISO/IEC communication speeds (type V, A or F) are supported.

IDEC Australia Pty Ltd

www.idec.com/australia

SAFETY I/O MODULES



Turck has expanded its range of safety I/O components with the TBPN and TBIP block I/O modules for Profisafe and CIP Safety respectively. The IP67/IP69K modules provide safety input and output signals directly from the field to the safety controller, or they can alternatively be used as decentralised safety controllers in the field. This function optimises modular machinery and also applications in which long bus cycle times to the central controller would require greater safety distances.

Safety functions can also be tested offline with the local safety controller function before the machine or the machine module communicates with a central controller. Commissioning work is considerably faster when the devices are used in combination with a custom web server.

The block I/O devices provide four safety inputs and four universal inputs or outputs (FDX) in the field. The flexibility of the FDX ports in particular enables optimum coverage of the individual safety signal requirements of any application. The modules can be used for applications up to PL e, category 4, in safety circuits up to SIL CL 3. Actuators are provided with 2 A per output, with up to 9 A in total. With protection to

IP65/IP67/IP69K and an extended operating temperature range from -40 to +70°C, the fully potted block modules can withstand harsh environments.

Turck Australia Pty Ltd

www.turck.com.au

PILZ INTRODUCES THE FIRST BATCH SIZE 1 SAFETY RELAY

The myPNOZ safety relay from Pilz monitors safety functions such as E-Stop, safety gates, light curtains, two-hand controls IIIA/C and enabling switches. It consists of a head module with up to a maximum of eight expansion modules that can be freely combined.

In the corresponding online tool myPNOZ Creator, users can assemble a needs-based safety solution from a wide range of options. Users can switch between a logic view and a hardware view. The option for visualisation and extensive documentation is also available via simulation.

Logical, safe engineering

Depending on the safety requirement, users interconnect safety functions such as E-Stop or safety gate using logic AND/OR connections. The myPNOZ Creator online tool uses a symbol to indicate any logic errors in the safety function sequence. Users can add any further safety functions at will and also define details — such as delay-on energisation and delay-on de-energisation for example. Users can check immediately whether a circuit or safety design meets their own requirements in the myPNOZ Creator, using the simulation in the online tool. As a result, errors can be reduced and commissioning accelerated.

Safety: simply create, simulate safely and order with time to spare

In the myPNOZ Creator it is possible to define the number, type and logic connections between the safety functions, based on what the user needs for their plant. The Creator uses these details to automatically calculate which modules are needed and the sequence in which they must be inserted. The plug-in sequence results from the connection logic for the safety functions. Due to this internal combination logic, the process requires no programming knowledge. The product that is generated can be ordered directly via the online tool, and users can order a previously defined configuration of myPNOZ with just a click of the mouse. The safety relay is delivered pre-assembled and ready to install. Each myPNOZ is given a unique type code, so that if necessary the same system configuration can be reordered at any time.

Comprehensive modularity for greater flexibility

The myPNOZ safety relay monitors consists of a head module with up to a maximum of eight expansion modules, which can be freely combined. The modular myPNOZ offers up to 12 different expansion modules in total: four output modules, four input

modules and four input/output modules. Each input module can monitor two safety functions, which not only minimises hardware costs but also reduces the wiring. Multiple safety sensors can be monitored without the need to wire multiple relays — as was the case previously. With myPNOZ it is also possible to form multiple safety zones, which independently monitor plant sections that operate separately. This helps to increase the availability of the plant because machine parts can be shut down independently from each other.

The slimline 17.5 mm head module already has a higher-level safety function. This works on all outputs, regardless of any other potential safety zones. The output modules either switch immediately or with a time delay and are available with relay or semiconductor outputs. myPNOZ enables safety functions to be AND/OR linked, enabling customised applications.

Fast, simple assembly

The modules on myPNOZ are easily connected using bus connectors, and the whole system is supplied with power via the head module. As a result, only the head module needs to be connected to the power supply, which reduces wiring. The plant can be commissioned quicker and can also be optimised with a view to maintenance costs: if just one module needs to be swapped, individual modules can be exchanged immediately without dismantling the whole system.

myPNOZ also has expanded diagnostics via LED for each module and each safety input. This accelerates troubleshooting and reduces downtimes.

The range of modules and the fact that they are easy to handle mean that users can always assemble the solution that's right for them. That guarantees users maximum flexibility over the whole lifecycle, even when subsequent changes are needed.

Wide-ranging applications

myPNOZ represents an efficient, safe solution for mechanical engineering. What's more the safety relay can be used in various industries. Users benefit with safety applications of simple to average complexity, when two to a maximum of 16 safe input functions are to be monitored, without using engineering software.

For more information, go to www.mypnoz.com.

Pilz Australia Industrial Automation LP
www.pilz.com.au

PILZ
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INDUSTRIAL DATA ACQUISITION SYSTEM

The Dewesoft IOLITEd is an industrial data acquisition system designed for easy-to-use industrial data acquisition and monitoring applications. All signal amplifiers are designed to offer high-end signal conditioning with 24-bit resolution and a high sampling rate of up to 50 kHz/channel.

With its range of input and output slots, the product allows the measurement of a wide range of parameters including voltage, current, strain, stress, vibration, sound, temperature, digital and counters.

High-quality data acquisition hardware combined with Dewesoft X data acquisition software performs data collection without losing a single sample, according to the company. It also provides data visualisation and processing capabilities.

Data can be stored in a time-series database and served to SCADA systems using standard interfaces such as OPC UA or XCP to support Industry 4.0 applications.

A wide variety of amplifiers with different channel counts per module allow suitable channel distribution for monitoring. Systems can be distributed with 100 m distance between the modules and good signal quality due to short sensor cable length.

Units are synchronised with each other and can use external timing sources like GPS for precise synchronisation of dislocated units.

IOLITEd devices are standard EtherCAT slave devices that are compatible with any EtherCAT master controller. When connected to Dewesoft X software, retransmit functionality ensures no samples are lost during measurement.

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HEAVY-DUTY SWITCHGEAR

The Schmersal HDS switchgear series is designed for use in heavy industry. The modular series unites a range of functions into a single platform, making it suitable for a wide range of applications.

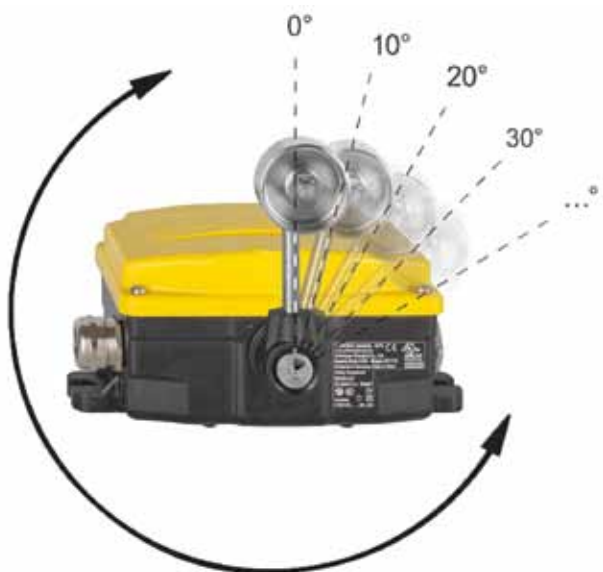
The basis of the platform is the standardised enclosure concept, which is available in two versions: plastic (Duroplast) and grey cast iron. The plastic version is resistant to aggressive media and especially suitable in port logistics applications and loading and unloading operations, as well as in the agricultural industry in the processing of fertilisers, minerals and phosphates. The robust grey cast iron version is suitable for industries such as mining or bulk materials and extraction.

The function range is also divided into two basic versions: the emergency-stop, designed as a pull-wire switch (RS655/RS656), and the position monitoring (BS655/BS656). The basic switch on the position monitoring version can be flexibly combined with a range of actuation elements. Typical application areas include emergency-stop deactivation, belt misalignment monitoring in the transport of bulk materials, end position monitoring in steel-making and level monitoring in material silos. IP66 and IP67 protection make them suitable for use in extreme environmental conditions.

All basic versions can be optionally connected to the Dupline installation bus or AS-I-Safety-at-Work for quick and easy networking, series switching and improved transfer of diagnostics data. Central connecting terminals with CAGE and CLAMP technology also help to reduce installation times.

Control Logic Pty Ltd

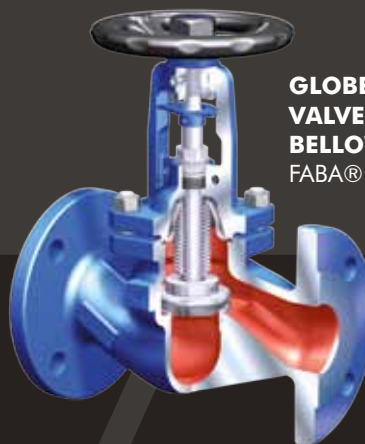
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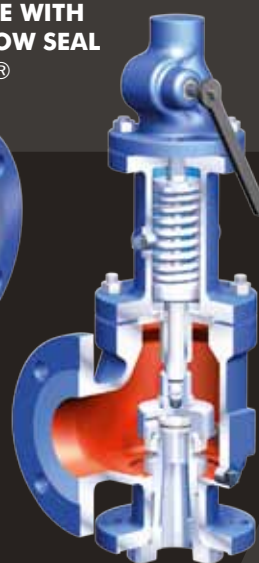
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VALVE ACTUATORS WITH AC POWER

The wider Rotork PAX range of linear valve actuators is made up of a variety of linear actuators and motorised regulators. PAX1 units are flexible, low-voltage actuators that are suitable for use in remote explosion-hazard locations. They offer a thrust output of up to 2890 N (650 lbf), enabling control of most regulators, small valves and pumps. They are capable of controlling pressure ranges of 0–0.5 psig to 0–3000 psig.

Common applications include pump stroke control, valve control, test equipment and the automation of mechanical spring-loaded pressure regulators. Hazardous area rated to FM, CSA and ATEX, they also have high levels of ingress protection; NEMA 4X, Type 6P, IP66 and IP68 (7 m for 72 hours), increasing the areas in which they can be used. They have a wide ambient temperature range of -40 to +80°C.

The addition of an AC power variant allows for longer cable runs without degradation of the power supply. This allows PAX series units to be installed within existing installations where DC power does not exist or is too expensive or difficult to run.

The PAX1 is suitable for midstream and downstream natural gas systems demanding precision and reliability, such as natural gas distribution automation. The AC PAX1 is especially well suited for water and power industrial applications. In the water industry, the integration of an AC PAX1 unit allows for optimisation and control.

Rotork Australia

www.rotork.com



HMI/PLC DEVICES

Turck has expanded its TX700 HMI/PLC device series with two variants for food and beverage applications (TX700FB) and two variants with high brightness displays for sunlight readability (TX700HB). The FB devices are available in 7" and 15" screen diagonals and the HB variants in 7" and 10" screen diagonals.

The FB devices were developed to comply with hygienic design requirements (DIN EN1672-2, EHEDG/FDA 21 CFR 177.2006) and come with a stainless steel front with a polyester coating. The device front has been designed with protection to IP69K so that the devices are waterproof at high pressure up to 80°C. The FB products are also resistant to acids and chemicals.

The HB devices with their extra bright display up to 800 cd/m² are particularly suitable for outdoor applications. The displays are manufactured with liquid bonding (LOCA) — a screen bonding process that improves screen contrast and increases brightness through reduced reflection and refraction. The HB devices with the full metal housing are resistant to mechanical influences.

The TX100, TX200, TX500 and TX700 device series enables Turck to offer a flexible range of HMI devices for visualisation, as well as HMIs with Codesys PLCs and a cloud connection.

Turck Australia Pty Ltd

www.turck.com.au



SERIAL-TO-ETHERNET DEVICE SERVER

The ICP DAS DS-2200i is a serial-to-ethernet device server that is designed to add Ethernet and internet connectivity to any RS-232/422/485 device and to eliminate the cable length limitation of legacy serial communication.

By using the VxComm Driver/Utility, the built-in COM port of the DS-2200i can be virtualised to a standard PC COM port in Windows. Serial devices can be accessed or monitored transparently over an Ethernet network without software modification. With two ethernet ports, the DS-2200i allows daisy chain connection, which enables flexibility in locating devices for easy installation and lower infrastructure costs.

The DS-2200i also adds 3000 VDC isolation and ±4 kV ESD protection that diverts the potentially damaging charge away from a sensitive circuit.

The VxComm Driver/Utility supports both 32- and 64-bit Windows 10/8/7/2008/2003/XP. The virtual COM works transparently and is protocol independent.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



ZERO TRUST SECURITY FOR INDUSTRIAL CONTROL SYSTEMS



One of the key drivers of the Fourth Industrial Revolution (Industry 4.0) has been the convergence of the physical and cyberphysical worlds. Whilst this has facilitated significant technological progress, the proliferation of IT-OT convergence and digital transformation in industrial control systems (ICS) has also exposed global critical infrastructure assets to security vulnerabilities that could have disastrous consequences for plant operators. A key philosophy that has gained in popularity, in tandem with this convergence, has been the Zero Trust security architecture framework which was first published in 2010 and has since gained a lot of momentum within the global cybersecurity community in all industry verticals. It is now commonly perceived as the answer to the growing number and sophistication of cybersecurity threats. However, is Zero Trust the Holy Grail of all security frameworks and should it be applied to ICS infrastructure assets?

You might be wondering: what is Zero Trust? In simple terms, Zero Trust is not a solution, it's an extensive security framework that requires all system users, including computing devices, to be continuously authenticated and authorised prior to granting or keeping access to system applications and data. Zero Trust operates under the notion of 'least privilege', which translates to providing minimal system access to the extent of users and operators being able to perform the required system functions. Zero Trust architecture is underpinned by a combination of advanced security technologies such as multi-factor authentication (MFA), identity and access management (IAM), network segmentation and next-generation end-point security protection such as network firewalls and intrusion-prevention systems — all of which are now available for ICS assets in most industry verticals.

Now the question is, should Zero Trust be applied to ICS infrastructure? The short answer is yes. Zero Trust is considered the gold standard when it comes to protecting ICS infrastructure against internal and external security threats; however, there are a number of challenges that need to be considered when trying to adapt a Zero Trust security architecture within an ICS infrastructure.

The first challenge is what we refer to as 'technical debt', which pertains to the retrofit rework required on systems to sup-

port required functionality; in the case of Zero Trust and ICS, such functionality could be IAM and MFA, network segmentation, monitoring, etc. Another challenge is with legacy ICS assets and their inability to provide least-privilege access control, which is a key component in a Zero Trust security environment. For these reasons, successful Zero Trust security implementations are often delivered in greenfield installations as the hardware and software better support this security framework. Furthermore, it's much easier to architect the ICS system and sub-systems with the appropriate network segmentation before the ICS goes into production.

The good news for brownfield installations is that most of these advanced security concepts can be bolted onto existing ICS infrastructure assets with minimal effort or investment, all of which are designed to significantly increase the security posture of the ICS if properly architected, implemented and continuously monitored and managed.

There's no question that Zero Trust is a significant paradigm shift from traditional cybersecurity; as such, it will take time for organisations to migrate to the new security philosophies and best practices. Traditional cybersecurity concepts focus on verification and trust, whereas Zero Trust cybersecurity concepts focus on least-privilege underpinned by authentication and authorisation.

As the saying goes, there's no need to boil the ocean. This statement is especially true when it comes to cybersecurity, where it doesn't have to be an all-or-nothing approach. At Siemens, we strongly promote the Defence in Depth (DiD) security framework to our customers to protect their ICS environment from internal and external cybersecurity threats. What's interesting with the DiD framework is that it shares a lot of similar concepts and philosophies as the Zero Trust security framework, especially in the realms of IAM, network segmentation, application whitelisting in addition to advanced monitoring and actionable intelligence. DiD is a cybersecurity strategy that provides multiple, redundant defensive controls in a thoughtfully layered approach in the event where one security control fails or a vulnerability is exploited, the system continues to operate with integrity.

As the number and sophistication of cyber threats and exposures continue to evolve and increase in frequency, it's simply not feasible to eliminate all security threat vectors from an ICS infrastructure. The objective should be to implement a strong cyber-resilience strategy based on industry standards and best practices whilst raising your ICS security status to a level that is considered 'too expensive to attack'.



**Serge Maillet is the Industrial Cyber Security - Country Segment Manager for Siemens Digital Industries in Australia and New Zealand. Serge has an engineering background in industrial (OT) networks and holds a Master of Science degree in cybersecurity. He helps organisations in all industry verticals with increasing their IT-OT cybersecurity posture and compliance for critical infrastructure assets.*



HANDHELD HMI

IDEC Corporation has introduced a handheld human-machine interface. The HG1P is lightweight and robust and with a 4.3" LCD screen designed to enhance operator interactions for automated machine tending and robotics applications.

At only 500 g and with contoured hand grips, a hand strap and a wall hanging bracket, the HG1P's ergonomic design is intended to make it comfortable to use for long periods. The hardy design is tested to withstand 1.5 m drops, and it uses a flush mount selector switch to prevent breakage.

The TFT colour LCD touch panel displays at 480x272 pixels and is bordered with 12 physical momentary function keys (F1 to F12) with click-feedback, which write to internal memory bits within the HMI. In addition, a hardwired emergency stop button, selector switch and a 3-position enabling switch make this handheld HMI flexible for designers and convenient for users.

The HG1P is configured with WindO/I-NV4 software as for other IDEC HMIs, and a common mini-USB cable or USB-A memory stick can be used to download configurations and save data.

Connectivity to automation platforms is via a standard 19-pin connector, using optional cables from IDEC up to 7 m long or user-created cables up to 15 m long. The cable transmits power, hardwired signals and digital communications. Available in both serial and Ethernet models, the HG1P supports major industrial communication protocols such as Modbus TCP/IP, Modbus RTU, FTP client, FTP server, webserver and user communication.

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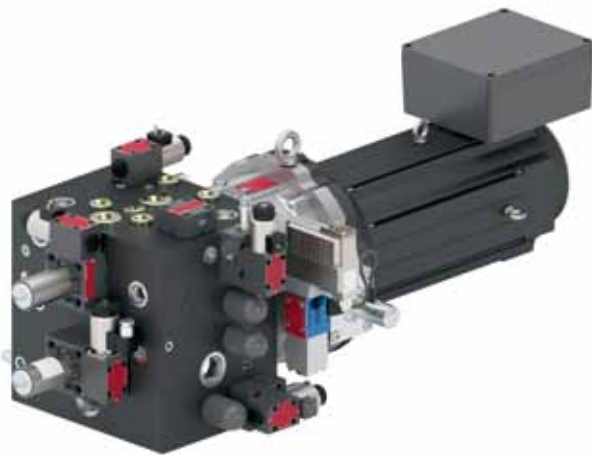
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MODULAR ELECTROHYDROSTATIC ACTUATION SYSTEM

The Moog Modular Electrohydrostatic Actuation System (Modular EAS) features standardised modules with a wide number of customisation options available. This process allows for extensive application potential by meeting the specific application requirements. The system's smallest scope of delivery consists of a basic manifold and an electrohydrostatic pump unit (EPU), which Moog delivers as an assembled and tested unit.

To expand the system, the basic module can be combined with various options or adapted with additional standardised high-speed manifolds in order to build a complete motion control system. The localised power allows for energy efficiency due to the elimination of the flow control valving and centralised piping, which should reduce the amount of wasted energy commonly found on traditional hydraulic systems.

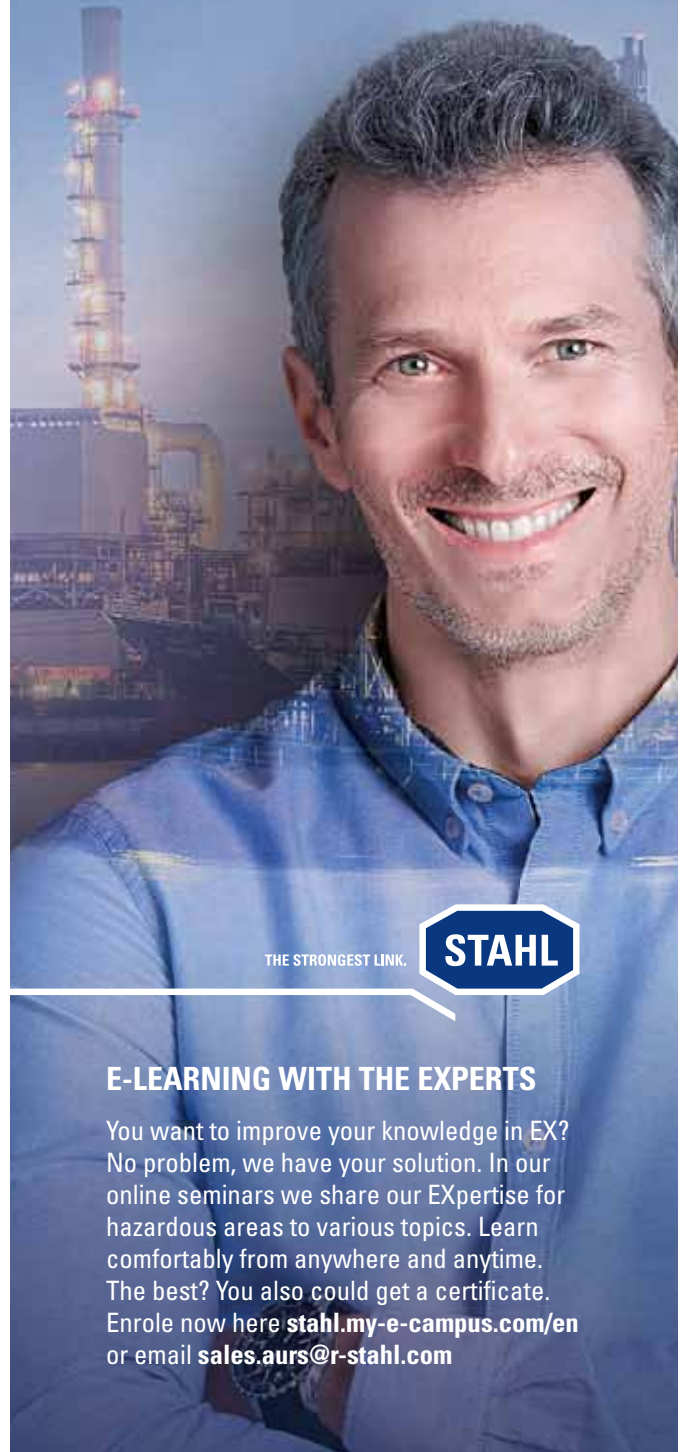
Benefits include high force capability and force density; low environment impact due to up to 90% lower oil requirement; and low noise emission.

The system is suitable for a wide range of industrial machinery and can be used on metal-pressing applications from forging, powder and sheet metal presses to hot forming, punching and isostatic press machines. In wood and paper milling, testing and power generation applications, the system allows for decentralisation of the machine axes. Additional applications can be found in the marine sector, on operational mobile machinery, and on injection and blow moulding machinery in the plastics sector.

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CONTROLLER I/O MODULES

IDEC Corporation has expanded its MicroSmart FC6A All-in-One PLC family with three 12 VDC CPUs, giving end users, designers and OEMs more options for automating battery-backed equipment.

Many applications require 12 VDC power. Smaller smart relays may support too few I/O points and lack enough programmability, while more full-featured PLCs are too expensive and don't provide the necessary I/O voltages. The 16 I/O FC6A All-in-One CPUs with 12 VDC enable these PLCs to handle over 100 I/O points in an economical and expandable form factor.

Still included are all of the standard FC6A All-in-One features, including Ethernet, USB and serial connectivity; SD memory slot; replaceable battery; HMI module; up to three I/O expansion modules with removable terminal blocks; and easy expansion of communication ports.

The rugged form factor can withstand -25 to 65°C operating temperatures and Class I Div 2 environments. Users can configure and monitor the PLC using the WindEdit app for iOS and Android over Bluetooth and Ethernet. The popular Modbus TCP and RTU industrial protocols are built in, as are data logging and web server functions.

The updated modules available for the FC6A All-in-One 12 VDC CPUs are the FC6A-C16R1DE 16-point 12 VDC relay output module; the FC6A-C16K1DE 16-point 12 VDC transistor sink output module; and the FC6A-C16P1DE 16-point 12 VDC transistor source output module.

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EDGE AI INFERENCE PLATFORM

The Neosys Nuvo-7162GC edge AI inference platform supports NVIDIA Quadro P2200 and Intel 9th/8th-Gen Core processors.

With the NVIDIA Quadro P2200, the Nuvo-7162GC can deliver up to 3.8 TFLOPS of GPU computing power for real-time AI inference tasks. To ensure optimum system performance and reliability in harsh industrial environments, the system employs Neosys's Cassette and dissipation design. It allows the system to operate at up to 54°C ambient without GPU throttling, while the system can operate up to 60°C ambient without performance degradation.

Equipped with rugged construction and wide-temperature operation capability, it is designed to be deployed into confined places and power sophisticated machine vision, automation and video analytics solutions in volatile conditions.

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ELECTRO-HYDRAULIC LINEAR ACTUATORS

Thomson Warner H-Track electro-hydraulic linear actuators can move loads of up to 2177 kg from a compact mounting envelope. The actuators are suitable for space-constrained applications requiring high load handling and shock resistance.

Hydraulic cylinder-based systems require a complex assembly of hoses, pumps, valves and reservoirs. This infrastructure can be costly to install, operate and maintain, and the fluid itself requires careful handling. Thomson Linear H-Track actuators resolve this issue with a miniaturised hydraulic pump that is powered by a DC motor. The pump, cylinder and reservoir are a single unit that fits into a small housing about the size of a screw-type actuator. This hybrid actuator has a force rating of 21.35 kN and can achieve travel speeds of nearly 100 mm per second. Users can select between motors and pumps to optimise for higher load capacity or higher speed than can typically be attained with ball screw-based designs.

Using hydraulic power to create linear motion also has a cushioning effect that enables the system to absorb shock loads that might otherwise bend the ball screw or the extension tube, especially if the shock load occurred while the actuator was extended.

The ability to configure multiple pump and cylinder sizes enables Thomson to create H-Track iterations with various levels of speed and load capacity. Its pumping and reservoir architecture minimises components and optimises the volume/pressure differential. A split-tank shuttle valve with back pressure relief adds further efficiencies.



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A NEW ERA IN OIL AND GAS FLOW COMPUTING

Tim Manning, Product Manager, Flow Computing, Bedrock Automation



Consolidating oil and gas flow measurement and control on a single and secure platform improves productivity and profitability.

Traditionally, most oil and gas production sites used a flow computer at the wellhead for measurement and simple control functions, and a PLC at a central facility for more sophisticated control. Operational and measurement data was collected from the well site once an hour and that was good enough. Some of these flow computers performed quite well in the harsh environments of the field, while others — and most PLCs — did not. No-one was thinking about cybersecurity at the wellhead and if any security was implemented, it was external to the flow computer or PLC.

Over the last 10 years, however, the CSG and shale gas boom and changing oil and gas markets have driven an evolution in oil and gas production, much of which is being enabled by a revolution in communications and computing technology. Wellhead measurement

and automation will never be the same. In this article we look at the forces driving the change and how control and communications architectures are evolving to help producers take advantage of emerging opportunities to increase security and profitability from their operations.

Complexity and consolidation

Where traditional production site designs were calling for one or two wells per pad, today's production well pad designs are calling for numerous wells, each of which may produce oil, natural gas and water. Where wellhead and facility controls were once performed in separate locations, many more sites are performing everything at the same location: the well pad. The economics of the modern oil and gas field require concentrating measurement and control in a single location.

With the concentration at the wellhead comes increasing demand for a single platform for measurement supported by sophisticated control algorithms and the ability to provide real-time and historical data to multiple users. As more and more users discover the com-



petitive advantage and productivity improvement they can gain from better data analysis and the requirements to collect, store, process and transmit data, this demand will only increase. There is no longer any reason to accept measurement technology and automation equipment that isn't rugged enough to handle harsh oilfield environments or secure enough to survive today's growing cyber-threat landscape.

Consolidating flow measurement and control

With the new well pad designs, consolidating all flow measurement and control into a single platform makes sense because everything is at the pad. Such a modern digital field platform should perform best-in-class, API-compliant oil and gas measurement as well as DCS/PLC class control. The measurement functionality and control capability should be accessible in an integrated programming environment so that the controls have easy access to measurement data. The automation platform's operating system should actively protect the measurement application from anything that might affect the accuracy and validity of the measurement.

More power to the process

Additionally, processor speeds and RAM must be many times better than current legacy flow computers and PLC/RTUs. A custody transfer application, for example, may involve up to 24 simultaneous measurement calculations, along with the wellhead and facility controls. Taking full advantage of these powerful microprocessors requires a robust and secure real-time operating system (RTOS).

A measurement application, by its very nature, requires a lot of non-volatile memory to store the measurement history and configuration data. Although traditional wellhead and facility controls have not been very memory intensive, the need to perform more sophisticated control and edge computing at the wellhead is changing that. Taking advantage of the business and productivity benefits of measurement and automation consolidation requires orders of magnitude more non-volatile memory than has been available on legacy flow computers and PLCs.

Open connectivity

Consolidating measurement, well controls and facility controls in a single and secure platform also changes communication requirements.

In the traditional flow computer installation, where there is a single well with minimal controls, it is not unusual for communications to occur as seldom as once an hour. The measurement collection system collects the historical data, event logs and configuration data from the flow computers as required. At the facilities, a local HMI typically provides real-time access to the facility PLC data, but only a subset of that data is available to the SCADA system.

A multi-well pad, however, requires near real-time data for both measurement and control. Legacy communication architectures, in which the flow computers and PLCs communicate directly with each SCADA system or HMI, may not have the bandwidth required for more complex, demanding data flows. These new data flow models require newer, open protocols such as the Open Platform Communications Unified Architecture (OPC UA) and Message Queuing Telemetry Transport (MQTT).

OPC UA is fast becoming an important communication standard for managing open communications across multivendor applications and devices across a network. To access data, an OPC UA client program, for example, a SCADA system connects to OPC UA servers and allows multiple SCADA HMI or other clients to connect and exchange data. OPC UA also allows for secure communications, unlike legacy protocols.

MQTT is a publish/subscribe protocol with true report-by-exception capabilities built in. It is designed to optimise connections from remote locations with minimal code. MQTT can support both real-time and historical data. The field device simply publishes data to an MQTT server once, on change. Any number of other devices can also subscribe to the data, which is published on the MQTT server, making the data available to the subscribers automatically. This approach simplifies the design of the SCADA network and makes providing data for other applications easier than ever. MQTT is also a secure communications protocol.



Intrinsic cybersecurity

With openness comes vulnerability, so achieving the benefits of openness requires embedding advanced, cyber-secure public key infrastructures (PKIs) into all devices starting at the chip level. This makes the device responsible for its own security. The system is no longer dependent on an external, bolted-on network of firewalls, intrusion detection devices, etc to parse out whether incoming signals can be trusted. This provides an entirely new level of depth to the defence. While elite hackers can bypass firewalls, breaking properly implemented strong cryptography that is enabled by a PKI is not a practical possibility. It presents the attacker with a whole new set of barriers along multiple signal paths, not just one. The controller essentially has an immune system.

In a PKI, all trusted parties have unique certificates that identify them. The certificates also include data that defines each party's system roles and privileges. Certificates are issued and managed by a certificate authority (CA). PKI mechanisms allow all members of the trust web to recognise other members and exclude imposters automatically.

In a controller module with an integrated flow computer and PLC, this security makes it possible to know that the actor is an engineer who is authorised to change the user programming or an operator who has permission to change a set point. If the actor has the proper PKI credentials, the controller allows the action. If not, the controller automatically blocks it.

Protection in challenging physical environments

Traditional flow computers have a temperature specification of -40 to $+70^{\circ}\text{C}$, and their simplified construction — typically one or two circuit boards housed in a plastic or metal housing — has been adequate for the wellhead. PLCs traditionally have an even narrower temperature specification of 0 to $+60^{\circ}\text{C}$ because they are typically installed in a more controlled environment. However, neither flow computers nor PLCs were designed to withstand high-voltage incidents.

Technological advancements have made reliable measurement and control possible in hazardous and extreme physical environments. New designs are pushing the temperature envelope as high as $+80^{\circ}\text{C}$. Replacing plastic enclosures with sealed all-metal helps prevent physical damage, ingress of dust and moisture, and for advanced designs, even intrinsic hardening to extreme electromagnetic pulse threats (EMP interference).

Beyond the wellhead

The demand for a single, rugged platform with consolidated measurement and controls, edge computing, advanced connectivity and intrinsic cybersecurity exists across the entire oil and gas market: production, transmission and distribution. The platform needs to be scalable in order to meet the needs of every environment.

Some locations need many runs of measurement, with relatively little control. This requires the capability to communicate to many transmitters via HART or other fieldbuses but may not require many physical I/O points. Other locations may need one, two or three runs of measurement, but may need more control and the ability to interface with many external devices.

For instance, a LACT unit may only require one or two runs of measurement, but will also perform unit controls, communicate with HART and Modbus devices, interface with access control readers, drive local printers for printing tickets, allow access via a local HMI and need to support legacy SCADA protocols. These protocols include Enron Modbus as well as the latest open standards protocols such as OPC UA and MQTT. This application typically requires 10 to 20 physical I/O points, yet requires robust communications to many other field devices, all while ensuring the reliability and security of the measurement and control platform.

Conclusion

Ever-present volatility in both the supply and demand for petroleum products is pushing petroleum and natural gas producers to find new solutions to manage operations profitably. Consolidating measurement and control at the well pad provides heightened availability to real-time and historical data that is enabling a new generation of efficiency and profitability optimisation.

Taking full advantage of these opportunities requires an automation and measurement platform significantly more open, more secure and powerful than even the latest technology that the flow computer market leaders are offering. The openness is critical to enabling oil and gas producers to deploy and integrate best-in-class technologies that they can configure to their specific needs to get a true competitive edge. Intrinsic cybersecurity is essential to eliminate any vulnerability that open standards may introduce, and the computational power is necessary to provide the bandwidth for running advanced flow calculations at high speeds.

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SEMI-OPEN PALLETISING CELL

The FlexLink RI20 semi-open palletising cell is suitable for palletising closed boxes within fast-moving consumer goods industries. The unit includes enhanced safety features that allow a safe coexistence between the robot and operators on the production floor. The presence of operators in the safety area dynamically adjusts the speed of the

robot instead of stopping it, reducing unnecessary downtime. Also, two pallet loading docks create a seamless pallet exchange that allows them to be filled in succession and increase capacity by up to 5%.

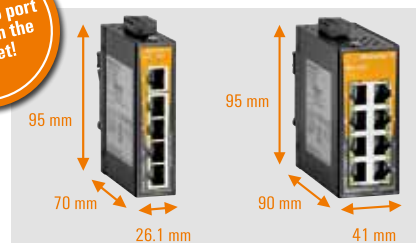
The compact design of the unit saves up to 40% floor space compared to heavy robot palletisers. The mainframe does not have to be attached to the floor and the RI20 can easily be moved using a forklift. The palletising unit can be relocated in just a few hours, 50% quicker than alternative solutions, and can be used in multiple lines during the day.

The RI20 has an intuitive, web-based pallet pattern manager and does not require robot programming. It takes less than 10 minutes to set up a new recipe, or just a few clicks to load an existing design.

The RI20 is available with several options: a rigid interlayer module, the Robot Config software (pallet pattern manager), a portable tablet, the remote assistance package, a preventive info package and a data collection package.

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SAFETY GATE CONTROL UNIT

The Pilz PITgatebox control unit is now available in a total of 15 preconfigured types, which offer various combination options comprising pushbuttons, switches, emergency stop pushbuttons and the PITreader reader unit for user authentication. As a result, users can be flexible in implementing their individual safety gate application, in packaging, robotics, factory automation

or woodworking for example. PITgatebox enables simple operation of safety gate switches or systems, but operators can also execute commands such as activate, stop or reset plant or machinery intuitively at the touch of a button.

All types of PITgatebox consist of a die-cast zinc metal housing with IP65 protection, which is resistant to shock, vibration and collision. Appropriate accessories for the control elements are also available. Due to the slimline design, the control unit can be installed quickly and easily on standard profile systems. A 12-pin M12 connection and rotatable end caps ensure a simple, flexible installation with little wiring effort.

Users obtain individual permission for access to the plant or machine on a coded RFID key, which they use to authenticate themselves on the safety gate: the key is read in PITreader and, with the appropriate permission, access is granted. Commands such as machine stop, unlock, lock or reset machine can also be controlled based on successful authentication. As only authorised persons gain access, the machine is protected against misuse or manipulation and downtimes are reduced.

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IIoT EDGE CONTROLLER

The ICP DAS WISE-5231M IIoT edge controller functions as a control unit for use in remote logic control and monitoring in various industrial applications. It offers a web interface that allows users to implement IF-THEN-ELSE control logic on controllers and no programming is required. With the built-in IF-THEN-ELSE logic engine, the edge controller can execute the automation logic stably and efficiently, and it also provides mathematics operations, schedules and email alarm functions.

The product allows connection to XV-boards, DCON I/O modules and Modbus TCP/RTU slave modules. The wide range of selection options enables flexibility in I/O module integration to meet the requirements of various applications. It also provides an MQTT client, and can directly connect to major public IoT cloud platforms (such as Microsoft Azure or IBM Bluemix) and an MQTT broker. It also provides CGI command functions to integrate with IP cameras for access control applications.

ICP Electronics Australia Pty Ltd

www.icp-australia.com.au



HIGH-SPEED INDUSTRIAL CAMERA

The CB654 PCIe industrial camera from Ximea GmbH offers 65 MP at a data rate of 70 fps when streaming in a 10-bit RAW image format.

The CB654 utilises a GMAX3265 CMOS sensor from Gpixel, which has picture parameters close to sCMOS performance. Resolution is 9344 x 7000. The sCMOS level of picture quality is reflected in low noise and dark current of 2 e/s that makes the cameras suitable for both industrial as well as demanding scientific applications such as flat panel inspection, printed circuit board (PCB) examination and motion capture.

There are various grades of GMAX3265 available and XIMEA can supply multiple camera versions to provide different levels of quality. For overall heat dissipation reduction and even better noise results, the cameras are equipped with a fan cooler that can be removed and replaced with a heatsink or water cooling system.

The data interface is PCI Express Gen3 with the bandwidth of 64 Gbps and real data throughput of 7000 MBps without the need for frame grabbers or special software.

Additional benefits of using a PCIe interface are direct memory access (DMA) with low CPU load and practically zero latency. The cable length can reach up to 300 m with fibre optic and GPIO connectors ensure triggering and synchronisation. An active EF-mount lens interface enables remote control of aperture, focus and image stabilisation.

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Campbell's Australia achieves energy savings with motors



Campbell's Australia was sceptical that new motor technology could deliver big energy savings at a factory in Shepparton. The proof was in the power bill.

The giant soup can that overlooks the Campbell's Shepparton factory in northern Victoria is heritage-listed; a nod to the importance of the factory in a regional city which has played such a pivotal role in Australian food manufacturing.

The history is on the outside; inside, there's a strong push for modern, energy-efficient technology and waste reduction across the production line, as part of the company's target to reduce energy consumption by 20% by 2025.

Nevertheless, when local ABB Value Provider A1 Electric Motors suggested a motor and drive upgrade with impressive projections for the energy savings, Campbell's Shepparton Environmental and Safety Manager Mark Hyland was hesitant. "I wanted to see another factory make the first move, so I could read the case study about it and act on it then," said Hyland with a laugh.

Facilities and sustainability fall under Hyland's remit at Campbell's Shepparton, but he was dubious. A1 Electric Motors was telling him he could realise 14% energy savings by installing an ABB IE5 SynRM synchronous reluctance motor and variable speed drive package.

"The design of our SynRM motors is key to their energy efficiency," explained John Rieusset, Food and Beverage Sector Lead at ABB Australia. "The rotor has neither magnets nor windings and suffers virtually no power losses. And, because there are no magnetic forces in the rotor, maintenance is as straightforward as with induction motors. They also run a lot cooler, extending the life of the motor."

Electric motors use one-third of the world's electricity, with numbers predicted to double in the next two decades, so technologies that improve their energy efficiency can play a key role in lowering global emissions.

Hyland is a long-time employee at Campbell's Australia and rightly proud of the improvements in sustainability he's overseen at Campbell's

Shepparton, including water savings of more than 90 million litres a year. All the same, he was reluctant to pull out a working motor to run the trial of the ABB SynRM technology.

"Then a few months after A1 Electric Motors had been to see me, a motor failed on one of the refrigeration compressors, and that made it an easier decision to try the ABB SynRM technology," he said. "We were able to retrofit a SynRM motor and variable speed drive package to that compressor and we did indeed achieve the 14% energy reduction on that machine. It was good luck that the motor failed, because if it hadn't we probably wouldn't have four of them onsite now!"

The improvements in energy efficiency on that first retrofit of ABB SynRM technology was all the evidence Hyland needed to upgrade the remaining

three refrigeration compressors. "All except one of them run 24/7 in our refrigeration plant, so because the runtime is continuous, it justifies the expense quite easily."

The first SynRM motor saved Campbell's Shepparton plant just shy of \$15,000 on its electricity costs and an estimated 131 tonnes in CO₂ emissions in the first year, and also delivered significant noise reduction, lower running temperature, smoother operation and reduced vibration.

"That motor paid for itself well within the first 12 months, as did the others," said Hyland, adding that the remaining three already had some efficiency upgrades, such as variable speed drives, but still delivered 6–7% energy savings.

Other motors in the plant don't have the same runtime as the compressors, so at this point they won't retrofit more operational machines. "But it's not the end for us; when we have failures and install new technology, we'll most likely replace it with SynRM," he said.

"The timing of the arrival of the SynRM technology was perfect for us," continued Hyland. "We see all sorts of technologies coming up and it's key to understand the fit for your business — because not everything will be right. These motors came as we saw soaring energy prices, and their efficiency also supports our big focus on global warming. It's very important to us, and this kind of technology certainly makes my role easier and makes our environmental targets easier to achieve and easier to quantify."

Hyland is doing proud by the Big Can. It began its life in the '60s as a water tank for the factory and the trade dress on the monster model is to scale with an actual soup can. Just as the can has stood the test of time, Hyland is sure the ABB SynRM motors will too. "Instead of reading the case study, we became the case study," he says, "and I'm very glad we did."

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COLLABORATING ON REAL-TIME DATA

In a recent article by my USA colleague Wolfgang Kratzenberg, titled 'Be Driven by Data and Decrease Downtime', the point was made that making decisions based on real data rather than guessing or relying on theoretical values is an obvious step to improving quality and efficiencies in manufacturing.

This got me thinking about how we can work together to empower manufacturers with relevant real-time data. Sometimes the most obvious statements like "be driven by (real) data" are the hardest to put into practice and I think that this is often due to a combination of factors. These include knowledge about the technology to be implemented, the will to disrupt a settled process in order to increase efficiency or quality, and of course an understanding of ROI. In almost every case a manufacturer is the expert on his product and process but often may not have an in-depth knowledge of subsystems or machine parts used within the process.

Simply put, to make an informed decision we need to generate data about a specific part of the process and then make this available to a controller or some sort of intelligence, which can then analyse the data and provide the feedback needed. This is how we enable good decision-making around our operations. On the implementation side of these decisions, the decision could be fully automated or made by an operator or manager in real time, having been presented with the data in a meaningful context and representation. It is not necessarily about reviewing historical data through spreadsheets and databases, although this of course has a very valuable place.

The example used in Kratzenberg's article was based around condition monitoring sensors that can generate data about temperature, vibration, humidity, ambient pressure etc to provide an indication at the earliest possible stage that something is changing within the process and that an informed decision must be made. My own company, Balluff, is expert in data genera-

tion via sensors and presenting this data to the controller. This, however, can only ever be a part of the solution: the plethora of information available from a condition-monitoring sensor is most valuable when the data is selected to be relevant to the process — for example, a vibration velocity (RMS), acceleration (RMS) or vibration peak-to-peak value, which are all available from the sensor, can indicate different issues for different components. For this we need an expert to help interpret the data. For example, this could be an expert on the particular component technology such as pneumatics, gearboxes or fans — they have an understanding of what the outcome and cost implication would be if this data is not acted upon. We also need to establish a clear path on how best to process and present this data to an operator or to automatically feed back into the process, in order to make an informed change. The end user is the expert for the overall process but other stakeholders can make a valuable contribution.

In my opinion it is desirable to actively seek out partnerships and work together within industry (and academia) to ensure that the whole is greater than the sum of the parts. There is always ground for co-operation and to pool knowledge to achieve the best outcome. You don't have to be an expert on everything — just on your part of the process!



Jim Wallace is Sales Manager for Balluff Australia & New Zealand. He is also an active member of the Open IIOT Group, which is a collaboration between Balluff, SMC Corporation, ZI-Argus, NORD Drivesystems and Beckhoff Automation, aimed at furthering the implementation of Industry 4.0.



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