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TECHNOLOGY

AUTOMATION + CONTROL + INSTRUMENTATION

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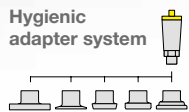
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Compact design



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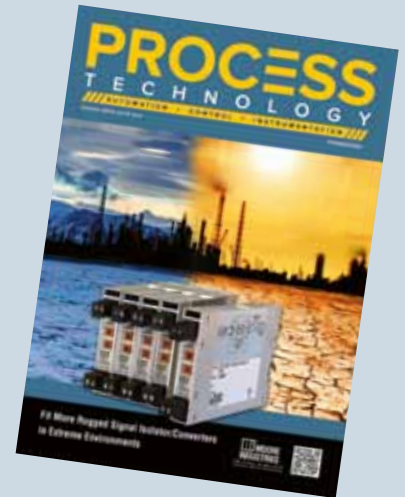
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### ON THE COVER



Space in process facilities is always at a premium, and fitting more instruments in the same limited space is a great solution. When the cabinet needs to be located in an area with extreme ambient temperatures and the location is an area where climate control of the cabinet is problematic, a narrow isolator that can withstand extremes is needed. By using a narrow isolator that can withstand extremes, users can double the isolator count in the same space without the need for climate control. This is particularly ideal for existing field-mounted cabinets.

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# INSTRUMENTATION — IT'S NOT JUST FOR PROCESS CONTROL

*Bruce Hawkins CMRP, Director of Technical Excellence, Emerson Reliability Consulting*



A large amount of operating condition information can come from process instrumentation that is already being used for process control purposes.

One significant resource for asset health information that often goes untapped in many plants is the process control system. Many potential failure modes can be discovered in their early stages using instrumentation that was installed primarily for process monitoring and control. For example, if we are already measuring flows and temperatures across a heat exchanger, we can trend this information to determine if fouling is beginning to occur and calculate the optimum time to take the exchanger offline for cleaning.

### Condition-based maintenance

Since the landmark study report entitled *Reliability Centered Maintenance* was published in 1978 by F Stanley Nowlan and Howard F Heap<sup>1</sup>, the state of the art for effective maintenance strategies has included condition-based maintenance. The *SMRP Body of Knowledge* glossary<sup>2</sup> defines condition-based maintenance as “an equipment maintenance strategy based on measuring the condition of equipment against known standards in order to assess whether it will fail during some future period, and then taking appropriate action to avoid the consequences of that failure. The condition of the equipment could be measured using condition monitoring, statistical process control, equipment performance or through the use of human senses.” The Nowlan and Heap study indicated that a calendar- or usage-based maintenance strategy was inappropriate for most assets because the dominant failure modes were not wear-out, especially as the assets increased in complexity.

Most maintenance and reliability professionals understand the concept of using condition monitoring to avoid the consequences of failure. The concept of the P-F curve, made popular by John Moubray, the author of *RCM II – Reliability-centered Maintenance*<sup>3</sup>, shows that as an asset begins to degrade toward failure, it usually provides some indication of degradation (see Figure 1). If we are able to detect these indications, we can take the necessary action to avoid the consequences of failure. We can schedule the equipment down for repair at a time

most convenient to the business instead of allowing the equipment to control the time of failure.

Although the P-F curve is great for illustrating the concept of consequence avoidance, there is one very significant issue. The interval between the potential failure point — where degradation begins to occur — and the point of functional failure is entirely dependent on the failure mode and will vary according to equipment service. In a centrifugal pump for example, the P-F interval for worn wear rings will likely be extremely high for a pump in clean water service, but it may be much lower for a pump that is moving abrasive slurry. Bearing failure in a screw conveyor may exhibit a long P-F interval in lightly loaded and slow-speed service, but it would be much shorter under high loads and speeds. According to Moubray, the checking interval to detect the onset of failure needs to be no less than half of the P-F interval, or the potential exists to completely miss the warning signals.

There is another very significant reason to use condition-based maintenance instead of a time-based approach, and that is to identify the root causes of potential failures. For example, vibration due to misalignment between the motor and driven equipment due to poor installation techniques can be detected by vibration analysis, and corrective action can be taken before significant damage occurs. Similarly, cavitation in a pump caused by low level in the suction tank can be detected in time to rectify the problem before impeller wear causes a loss of capacity. The use of condition monitoring for this purpose actually improves reliability because it offers the opportunity to remove the root causes of failure before equipment damage has occurred.

### Failure mode detection

Several technologies can be used to detect problems in machinery well in advance of a functional failure. As noted in Figure 1, vibration analysis, oil analysis and infrared thermography are some of the most common. Others common technologies include ultrasonic leak detection, contact

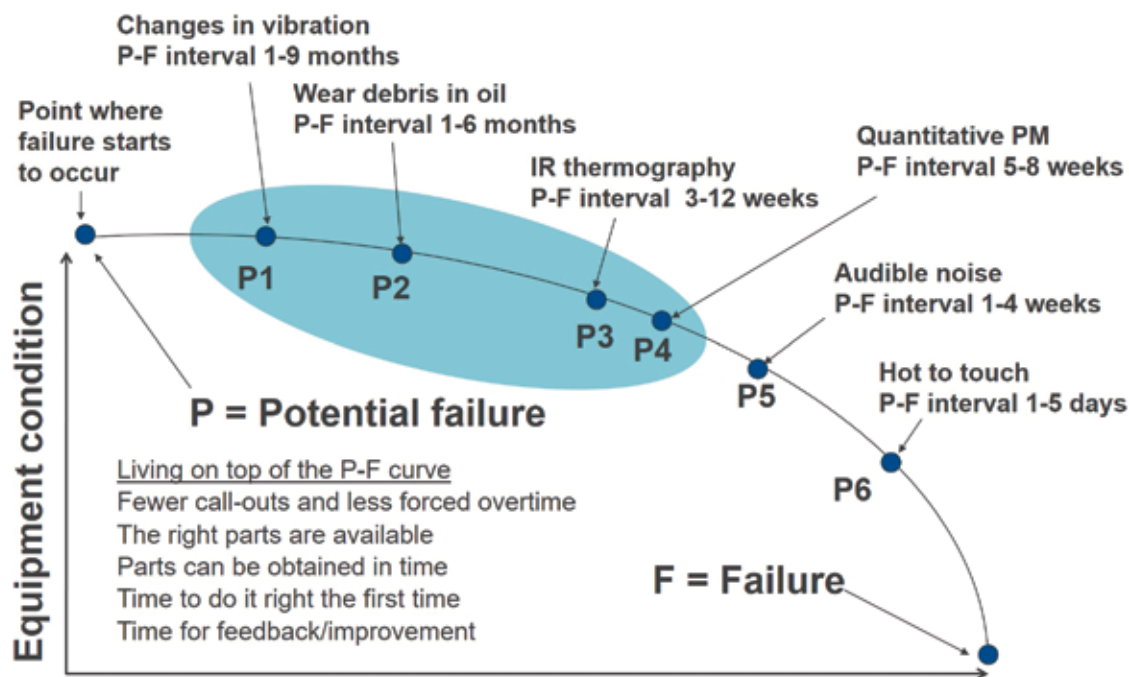


Figure 1: The P-F curve.

ultrasonics, ultrasonic thickness testing and motor circuit analysis. Less common technologies are remote visual inspection, eddy current testing, radiography, magnetic particle and liquid dye penetrant testing. However, many equipment failure modes can be detected in their early stages through the use of common process measurements such as flow, pressure, temperature, level and position. Many process plants already have the capability of using these techniques for condition monitoring but fail to do so, primarily because instrumentation is perceived to be only for process control.

Although the processes in use and the products produced by manufacturing plants around the world vary widely, most have similar types of equipment. For this discussion, we will focus on some of those common assets:

- Centrifugal pumps
- Shell and tube heat exchangers
- Centrifugal compressors
- Blowers and fans
- Cooling towers

### Centrifugal pumps

Some of the typical failure modes of centrifugal pumps and the process parameters that can be used to detect them are:

- Worn, plugged or loose impeller: changes in flow
- Worn wear rings or worn pump casing: changes in flow
- Seal leak: seal pot level
- Bearing problems: changes in temperature

As with the other rotating machinery in these examples, detecting failure modes will also require the traditional condition monitoring technologies such as vibration analysis, oil analysis and infrared thermography.

### Shell and tube heat exchangers

Typical failure modes of shell and tube heat exchangers and the process parameters that can be used to detect them are:

- End cap baffle failure or gasket leak: changes in temperature
- Tube fouling and plugged tubes, or trapped air: changes in temperature
- Tube rupture or tube-to-tubesheet seal failure: changes in temperature or flow
- External leaks: changes in flow

### Centrifugal compressors

Process parameters that can be used to detect the typical failure modes of centrifugal compressors are:

- Bypass valve failed open or inlet guide vanes partially closed: changes in flow
- Discharge check or block valve partially closed: changes in flow or pressure
- Intercooler failure: changes in flow or temperature
- Worn impeller: changes in flow
- Plugged inlet filter: high differential pressure or changes in flow
- Aftercooler failure or bearing problems: changes in temperature

### Blowers and fans

Process parameters that can be used to detect failures of centrifugal blowers and fans include:

- Worn fan wheel or inlet control vanes partially closed: changes in flow
- Drive belts slip: changes in flow or pressure
- Inlet screen obstructed or inlet filter plugged: changes in flow or pressure
- Expansion joint failure: changes in flow or pressure

### Cooling towers

Typical failure modes of cooling towers and the process parameters that can be used to detect them include:

- Degraded internals: changes in temperature
- Fan bearing, motor or gearbox failure: changes in temperature
- Plugged media or discharge screen: changes in temperature
- Basin cracked: changes in basin level
- Plugged holes in the distribution box: changes in temperature
- Drift eliminator failure: changes in makeup water flow

## The total condition monitoring solution

As seen in the examples listed above, process parameter data should be used with the traditional condition monitoring technologies to gain insight into equipment health. However, with some additional instrumentation, we can get an even more comprehensive picture of asset health and root cause determination. For example, on all rotating machinery, vibration transmit-

ters can be added to the driver and driven machines, and temperature transmitters can be placed in the lubricant system and bearing caps.

On centrifugal pumps, pressure transmitters on both the suction and discharge piping can help detect (along with vibration) incipient cavitation. This data, along with flow measurement, can provide operators with sufficient information to enable them to keep the pump operating at its best efficiency point for maximum reliability. Addition of a pressure transmitter on the seal pot can give indication of a seal leak.

On shell and tube heat exchangers, measuring the flow through both the hot side and cold side along with the temperature differential can enable calculation of actual heat duties on both sides and the actual heat transfer coefficients. Trending this information can help the site determine the rate of fouling and determine the optimum time for cleaning or tube bundle replacement. If corrosion is an issue, corrosion transmitters can be added to detect this.

Centrifugal machines, such as blowers, fans and compressors, can benefit from the addition of position transmitters on any inlet or discharge vanes to provide feedback to the flow control loop. If the unit is variable speed, a speed transmitter can provide the necessary feedback and ensure that the unit is not operated near a critical speed. Differential pressure transmitters across the inlet filters can facilitate determination of the optimum filter change interval. Electrical current measurement can determine the actual loads on the system and help identify system-related problems such as baghouse filter blinding.

A forced-draft cooling tower presents several opportunities for the addition of instrumentation for condition monitoring. Temperature measurement across the tower can provide indication of the actual approach temperature and can help determine efficiencies. The potential for scaling, corrosion and biological growth can be determined by installation of pH, ORP and conductivity sensors. Flowmeters can be added to the blowdown and makeup systems to help control the cycles of concentration in the basin and minimise makeup water consumption.

## Expanding condition monitoring

The effort that most organisations spend on condition monitoring is usually determined by asset criticality: if the asset is highly critical, more in-depth monitoring is justified. This is why large, valuable rotating equipment, like turbines and compressors, are usually equipped with expensive continuous monitoring systems. However, as can be seen from the above examples, even fewer critical assets can benefit from extensive condition monitoring. In fact, benchmark data indicates that the deeper throughout the asset base that condition monitoring is employed, the lower the operating costs and the higher the reliability the site will enjoy. In addition, knowledge of asset condition can help reduce the likelihood of those unexpected equipment failures that invariably happen on nights or weekends.

Using a route-based strategy to access additional condition monitoring points is labour-intensive because valuable technician time must be spent on non-productive travel time to get to the field. This is even more of a drawback when the conditions in the field warrant additional preparation time such as getting permits or wearing special clothing. Additionally, many plants are experiencing shortages of skilled labour due to an ageing workforce. Rather than consuming technician time making trips to the field, time is better served in analysing the information derived from condition monitoring sources. Therefore, permanently installed instrumentation should be considered any time a condition monitoring strategy is defined for an asset.

In addition to the labour savings to access information, permanently installed sensors offer a number of advantages. Technicians don't have to be sent out to hazardous areas where their safety could be at risk. If an asset is not required to operate continuously, scheduling a condition monitoring route can be challenging because the technician's schedule must be aligned with the operating schedule. Although this is not an insurmountable barrier in plants with their own predictive maintenance staff, it is frequently an issue in plants that use contract predictive maintenance services. Readings can be taken from permanently installed sensors at any time, and the results can be saved for later analysis. And

finally, permanently installed instruments solve the problem discussed earlier — the high variability in the P-F interval for different assets and different failure modes. Permanently installed sensors make the checking frequency infinitely adjustable.

In the past, the high installation cost of permanently mounted sensors has limited the number of instruments that can be used for remote condition monitoring. However, relatively recent advances in wireless technology have dramatically reduced the per-point installation cost (often by up to 50%), enabling a wider deployment of devices whose primary purpose is condition monitoring. A wireless network also presents a number of additional advantages including being cheaper and easier to deploy than wired instruments, and allowing easy scope change and expansion.

If an organisation wants to expand its condition monitoring footprint, a wireless network would likely be the most cost-effective solution.

## Summary

Organisations that experience top quartile performance in maintenance costs and reliability share a common trait: they have a deep desire to understand the operating condition of their assets to ensure that their business goals are achieved and that they do not suffer unexpected failures and downtime. Much of this operating condition information can come from process instrumentation already being used for process control purposes, and wireless technology can offer a cost-effective means to expand the number of monitoring points. Expanding the use of condition monitoring will help the organisation take a more proactive approach to managing their assets and will result in improved cost and reliability performance.

## References

1. Nowlan FS, Heap HF 1978, *Reliability Centered Maintenance*, Report A066-579
2. Society for Maintenance & Reliability Professionals, *SMRP Body of Knowledge*, <<<https://smrp.org/SMRP-Library/Body-of-Knowledge>>>
3. Moubray J 1997, *Reliability-centered Maintenance*, Industrial Press, Inc., Second Edition

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

# HOT PRODUCTS

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## COMPACT CONTROLLER

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## IIoT GATEWAYS

The Neusys IGT Series is a range of ARM-based industrial IoT gateways that come with a pre-installed Debian system.

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## When one SCADA is better than five



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The Utility Department at the city of Fort Smith, Arkansas, provides water and wastewater services to 150,000 people within the city limits and in the greater area. The department recently replaced five disparate SCADA systems with a single, robust software platform. This brought numerous benefits for the department, including continuity of operations across four plants (two water, two sewer), stronger security, improved reporting and uniform HMI graphics that standardise operations and training across all sites.

The new SCADA, which includes 51 RTU sites, puts all data into one seamless system. In choosing and implementing the software for the project, the utility department worked with systems integrator Brown Engineers of Little Rock. The two organisations worked closely on the project for a year, completing it in late 2019.

The utility now uses Ignition software from Inductive Automation — an industrial application platform with numerous tools for building solutions in HMI, SCADA and the IIoT.

Lance McAvoy is utility director for the City of Fort Smith Utility Department and the project had been a goal of his for quite some time, and he is happy with the result.

“First is continuity of operations,” he said. “I can look at all the SCADA with the plants, distribution system and collection system all from one terminal as opposed to having to go to individual locations to see each one. We have four treatment plants and two of them are located in other counties. One of them is a 45-minute drive from my office. Now we can jump on a terminal and diagnose remotely.”

Training is also much easier now, as the utility has been afforded a means to create a uniform visual standard for screens across all the facilities.

“In the past we had multiple integrators with the SCADA software we were using,” McAvoy said. “There was no continuity in screens as to what red meant, what green meant, what yellow meant. Now everybody is on the same page. If I have to pull an operator from one plant to another, when they get over there they’re looking at the same SCADA system. And the security is a huge factor: we have a much more secure system than we did before.”

The five legacy SCADA systems were installed at various times over a number of years, and there were different versions of the software.

The HMIs were therefore not uniform, and neither were the naming conventions. Data was also trapped at each facility.

Brown Engineers replaced all five legacy systems with Ignition. It cost the department two-thirds what it would have cost to upgrade the old software. The utility also gained more modern technology, greater access to data, streamlined operations and scalability for future needs.

To kick off the project, Brown Engineers did a workshop at the beginning of the process to show the department what Ignition could do.

“In the workshop, we showed the staff a lot of the features of the software,” said Dee Brown, principal and co-founder of Brown Engineers. “That was both in terms of graphics and user-defined types (UDTs) development. We got the staff to agree to the colour schemes upfront, and from there it was much easier to keep everything with the same look and feel throughout the system.”

Brown also got input from the department, which was incorporated into the design.

“The workshop was very helpful,” McAvoy said. “We brought in the supervisors at the plant to get the buy-in, to show them that this actually is going to make our lives easier.”

A critical aspect of the project is the Ignition Gateway Area Network, which enables the department to connect multiple gateways together, allowing many distributed features between gateways. It synchronises data across all sites.

“They have five gateways with master/backup redundancy,” Brown said. “The master/backup connections go through their IT facility at a central location. They have a troubleshooting page in case some of their wide area network goes down, and the screens have a tree view of the navigation menu on the side.”

Operators and managers are now also seeing more data than ever before.

“We have status overview pages for the treatment plants and pump stations,” said John Guthrie, project manager for the upgrade. “I can see the information for every pump station in town. I see if there are any new alarms or any pumps we need to address, and I look over the plants to see how they’re doing.”

**ESM Australia**  
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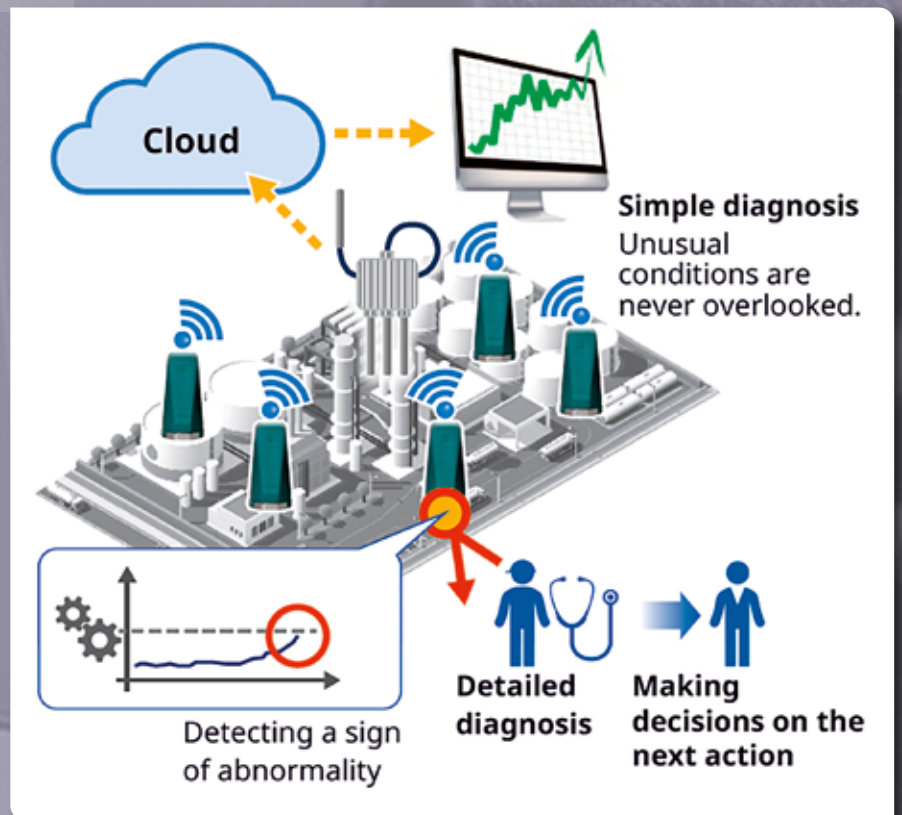


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## AFTER



## BEFORE



## VALVE ACTUATOR SHUTDOWN BATTERY OPTION

Rotork has announced a shutdown battery option for its IQT3 Series valve actuators, designed to offer a pre-programmed movement of the valve on loss of power or communications. This is the first time that the IQT3 has been offered with a shutdown battery option in an explosion-proof design. A lithium-ion battery supplies the potentially vital backup power from within the actuator enclosure.

In the event of mains power loss, the Shutdown Battery can continue to function automatically to a site-configurable end-of-travel safe position, providing fail-to-position functionality on critical valves. The failure mode can change depending on customer requirements. This fail-to-position can be fail-closed, open, stay put or go-to-a-percent position, depending on what fail-to-position action is needed to ensure the process fails to a safe operating state. With the Shutdown Battery there is no need for additional back-up systems, such as compressors, to provide this functionality.

The IQT Shutdown Battery also features a UPS mode. This ensures that there is continued control and operation of the actuator on loss of mains power until the battery charge has run out. Operations can continue as normal while the battery charge lasts, mitigating the risk of deferred or lost revenue due to power outages.

Solar-powered installations are increasingly required for remote installations, such as pipeline pump stations. Here, the IQT Shutdown Battery mitigates fluctuating solar power and eliminates the need for expensive external batteries.

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



## MOTOR CONTROL DEVELOPMENT ALGORITHMS

MathWorks has introduced Motor Control Blockset, an add-on product for Simulink for designing and implementing motor control algorithms. Now, motor control engineers can use reference examples and Simulink blocks for developing field-oriented control algorithms to spin brushless motors. The blockset extends the set of Simulink products for motor control design, enabling engineers to test algorithms with each design change; generate fast and compact ANSI/ISO C code; and use simulation to validate software, reducing certification testing cycles.

Instead of a process where handwritten code is not verified until actual motor testing, engineers can use simulation and code generation to catch errors earlier and speed up their motor control development projects.

MathWorks is working with motor control hardware providers to develop reference examples that support their motor control kits, starting with several Texas Instruments kits based on their C2000 real-time microcontrollers. Engineers using these kits can automatically estimate motor parameters, generate application code and spin motors in minutes. Additionally, Motor Control Blockset can be used with Simulink Real-Time and Speedgoat real-time target machines for rapid control prototyping, including field-oriented control autotuning.

**MathWorks Australia**  
[au.mathworks.com](http://au.mathworks.com)

## PLC SOFTWARE UPDATE

IDEC Corporation has announced an update to add EtherNet/IP communications to the MicroSmart FC6A Plus PLC. This update provides more options for end users, designers and OEMs to integrate the FC6A Plus with many types of I/O systems and intelligent automation devices.

The FC6A Plus is expandable to support up to 2060 I/O, making it suitable for controlling machines or small-scale manufacturing operations. With the addition of industry-standard EtherNet/IP scanner capabilities, the FC6A Plus can now connect with, monitor and control any I/O, variable speed drive, motor control or other intelligent automation device using this industrial protocol. In addition, it can be configured as an EtherNet/IP adapter allowing it to interact with other peer and supervisory systems, such as PLCs and HMIs.

From now, FC6A Plus CPUs will ship with the latest firmware and EtherNet/IP connectivity already installed and ready for use. For CPUs already in service, users can obtain the current WindLDR software (version 8.15.0 or later) for free, and then use it to perform the upgrade. Once a new or upgraded CPU is deployed, Ethernet port 2 can be configured with the EtherNet/IP protocol.

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The Beckhoff C7015 compact industrial PC, which measures 85 x 167 x 43 mm, is designed to be a high-performance IP65/67 device designed for installation within machine environments. The space-saving, fanless device is suited to high-performance automation, visualisation and communication purposes. Its applications range from classic machine control to the decentralised edge computing utilised in advanced Industry 4.0 technology.

The C7015 is equipped with an Intel Atom multicore CPU with up to four processor cores. Compared to conventional ARM-based edge devices, it is able to support far more demanding applications as well as decentralised data pre-processing and the acquisition of large data volumes.

The IP 65/67 IPC also serves as a machine controller. Installing it directly in the field can save electrical cabinet space, reducing machine footprint, especially when combined with other components with a high protection rating, such as a distributed servo drive system or EtherCAT P I/O modules.

The integrated EtherCAT P connection of the C7015 creates a range of options for sensor and actuator connection via the IP67-protected EPP modules. In this way, complex diagnostic or condition monitoring tasks can be decentralised and supported with minimal installation effort. A special mounting plate enables direct attachment of an EPP module to the C7015. If required, additional EPP modules can be flexibly connected via EtherCAT P for specific applications.

**Beckhoff Automation Pty Ltd**

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

### ENCLOSURE PRESSURISATION UNIT

The Envrio-Line pressurisation unit is a simple, cost-effective environmental pressurisation system designed for applications in non-hazardous areas that contain dusty, dirty and corrosive atmospheres. It uses a supply of compressed air or inert gas to regulate and monitor the pressure within the sealed enclosure. This prevents the accumulation of damaging and caustic gases and dusts, and helps extend the life of the equipment within the pressurised enclosure.

Since the unit is designed for use in non-hazardous areas, the enclosure can be energised before engaging the air supply. The redundant regulator is used to keep incoming enclosure pressure at a maximum of 5 psi. After the enclosure has been sealed, the enclosure pressure control regulator is used to set a safe reading on the enclosure pressure gauge.



The Enviro-Line pressurisation unit is easy to use and comes with a regulator, an optional vent and an optional enclosure pressure switch for indicating loss of pressure in the enclosure. It is delivered as a complete kit, which includes an adaptable mounting plate, enclosure pressure gauge, tubing, fittings and fastening hardware. Mounting plates can be adapted for every configuration.

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People for Process Automation



# DIGITALISATION: IT'S TIME TO WALK THE WALK

*Tom Hardy, Automation Solutions Innovator, Yokogawa*

When looking at areas for process improvement through digitalisation, the monitoring of rotating equipment stands out as having the greatest potential ROI.

IoT, Big Data, Industry 4.0 and many other terms have been discussed for almost 10 years, but with little in the way of actual outcomes. Extravagant vendor marketing has dazzled us with possibilities yet failed to provide anything tangible. What has happened is disillusionment among many end users who have been convinced to part with hard-fought budget based upon promises that have failed to materialise. Not only have traditional vendors been involved, but the rise of IoT and its potential as a new market has attracted many new vendors and consultants to the process industries, many with an understanding of industrial processes that is questionable.

Rotating machinery is the most widely used form of mechanical equipment in process industries yet can also be the most problematic. Operational faults can not only lead to machine and process downtime, but also excess energy consumption, loss of production, safety incidents and the potential for catastrophic damage. It's clear that when reviewing areas for process improvement, rotating equipment stands out above many others: that is, if you know what to look for.

Research has shown that the majority of equipment damage in this area is caused during installation, start-up or shutdown. Other longer-term factors can slowly erode performance, such as bearing wear, part degradation, lubrication issues and rising imbalance. Degradation will reveal itself in many ways, the challenge being to identify the signs and take corrective action early. In doing so you are gifted the potential to improve reliability and

performance, increase overall life expectancy and maximise return on investment from your machinery.

With degradation occurring very slowly and over long periods it can, as mentioned, be difficult to identify. Rotating machinery in a slow state of decline will show irregular or increased vibration, elevated surface temperature and an altered acoustic profile. In the early stages these indicators are very subtle and challenging to pick up using normal diagnostic methods. Yet the benefits in doing so are huge, allowing early stage corrective action in the most efficient and least disruptive manner.

Each application has its nuances, but in general there are a multitude of factors that can impact the performance and life of plant process equipment.

- Environmental degradation: environmental conditions such as corrosive gas and dust, climate conditions such as desert and snow.
- Thermal degradation: conduction and radiation from heat sources.
- Mechanical deterioration: wear and tear.
- Location: foundation degradation, movement, shock.

Understanding the process and its environment — and how they impact performance — is the first step in planning and optimising maintenance strategies. Research suggests that approximately 40% of expenditure on rotating machinery is wasted in ineffective maintenance. Conventional preventive techniques performed during operator rounds are time-intensive and not always possible to perform effectively, and as a result degradation is often detected too late to be useful.





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Utilising sensors designed for condition monitoring can provide precise readings at more frequent intervals and allow for more accurate decision-making without the maintenance overhead. Sensing vibration and surface temperature can equip operations personnel with the data required to make more informed decisions on an ongoing basis — that is if they are designed for the environment in which they are to operate, if location is carefully considered, they have the means to communicate effectively in confined environments, and there is a clear understanding of what you want to measure and why.

Let's be clear that in pursuing such a strategy you will be opening up a huge well of data and it's easy to become disillusioned and intimidated when faced with such volumes. Yet careful, early-stage understanding of how to deal with such a rich dataset along with expected outcomes can smooth the process.

Machine learning technology can perform advanced analytics and pattern recognition on sensor data, detecting anomalies faster than any human ever could, all while generating alerts and automated performance reports. In doing so the creation of large databases of asset health progressively improves the effectiveness of the software, thus building a broader understanding of how the components of your process impact overall performance. Creation of equipment profiles, comparing like-for-like performance of assets, guiding anomaly detection rapidly and with greater accuracy, all contributes to the protection of process integrity. This is where the real value lies and where many proposed solutions have fallen down in recent years.

You don't need high-end process equipment or millisecond data points to measure effectively with this type of strategy. Samples should be taken at much greater intervals and over longer periods, so patience is a virtue. It's all about the collective data profile and how the machine behaves compared to how it should behave.

Devices designed for this purpose need to be easy to install compared to fixed precision sensors, keeping overhead to a minimum. Ideally, they would require no wiring, utilise wireless technology and be battery powered. Easy-to-deploy and maintenance-free sensors not only gain favour with maintenance teams for these reasons alone, but do so for the resulting output.

Operations teams also understand how the same conditions that contribute to machine degradation also affect the control and monitoring equipment around them. The last thing they need is to add hardware that is not fit for purpose, so any sensors used need to be rugged and have the ability to withstand the same harsh exposure. Most end users understand that commercial products are not necessarily the best fit for harsh industrial applications. The trouble is that cheap 'flick-and-stick' sensors seem appealing from a cost perspective, only to later reveal significant consequential costs due to performance and longevity issues.

Beyond the sensors, selecting complementary technology for existing plant architecture is important. LoRaWAN is an example of an IoT communications protocol that won't interfere with existing industrial wireless networks, has long-range transmission capability and reduces network hardware required to cover large plant areas.

With sensor and connectivity issues addressed you need to be mindful of where your data will be held and analysed. There's a lot of conjecture around this topic, with many solutions being sold that are 'all or nothing': hugely complex cloud-based analytic solutions for full site monitoring from day one, when many operations personnel want to dip a toe in the water first before being teased into the ocean. Although this may be a long-term goal, you need the initial flexibility and reassurance that you can start small and scale up as and when desired.

In our experience, machine learning should have the option to be performed in a private cloud or on-premises if and where possible. This provides scalability with minimal worry about cost, security or sovereignty while keeping your data close and your industrial network secure. Local solutions also allow for easy integration with other control systems without the hassle of third-party APIs.

Outcomes matter, so consider all aspects of what you want to achieve with condition monitoring and keep compromise to a minimum. If it's not fit for purpose, there is a lack of understanding of your needs or it's an 'all or nothing' offering, then it just might not be for you.

*Yokogawa created the Sushi Sensor range to address all the above, and more. The company has been walking the walk for over 30 years in Australia and New Zealand ensuring the right technology, application and outcomes to support manufacturing in the region.*

**Yokogawa Australia Pty Ltd**  
[www.yokogawa.com/au](http://www.yokogawa.com/au)

**LONG-RANGE DATA LOGGERS**

Delta Ohm has recently released the LR35 series of long-range data loggers that feature a range of several kilometres and up to four years of battery life.

Indoor and outdoor (IP67) versions are available. Measurement parameters include temperature, relative humidity, CO<sub>2</sub>, PM DP and solar energy. An optional display (LCD) is available for both indoor and outdoor versions.

Transmission from the data logger can be collected and viewed in a variety of ways including cloud-based platforms (Delta Ohm and third party), public gateways and commercial gateways (connected through Wi-Fi, Ethernet and 4G) and 'The Things Network' — an open source, decentralised infrastructure for the IoT.

Applications include environmental monitoring, agricultural applications (soil moisture, rain and solar), food and pharmaceutical manufacturing, storage and transport, solar farms, solar power and sunshine conditions.

**W&B Instruments Pty Ltd**  
[www.wandbinstruments.com.au](http://www.wandbinstruments.com.au)



**SERVO DRIVE**

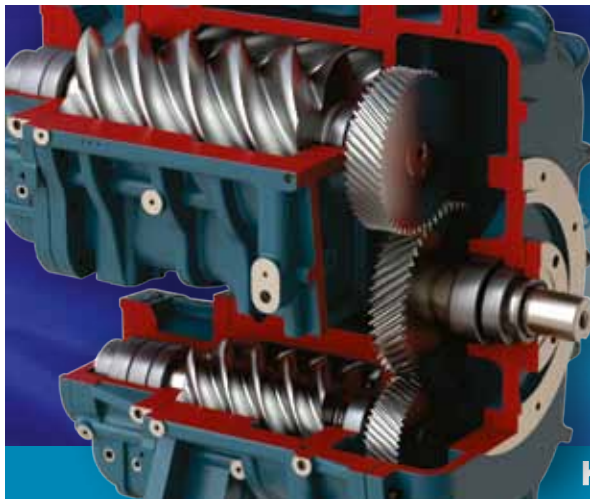
The Fatek Automation SD3 series servo drive is a high-performance AC servo system with advanced functions that supports various motor options including low, medium and high inertia servos from 50 W through to 2 kW.

The SD3 offers many motion control functionalities for a wide range of industry and machine applications. In addition, the SD3 series implements Modbus communication protocol as a standard, to connect with the Fatek FBs PLC and the Fatek P5/P2 series HMI.

Major applications include machine tools and processing machines for various industries including textile machines, X-Y table control, sealing machines, feeding machines, carving machines, lathes, high-speed winding machines, cut-to-length applications, textile equipment and a large variety of automation machinery.

The drives are programmed using Servo studio software that eases set-up, tuning, state monitoring and effective use of the SD3 servo amplifier. With its enhanced functionality, users can set up the damping filter from the intuitive interface, use an additional function 'vibration noise frequency measurement (FFT)' and even get a log of the amplifier alarm. In addition, smooth start-up of the machine is facilitated through an amplifier point table (that can be set up to 16 points), using the test run features.

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## DIGITAL FLOWMETER

Measuring compressed air consumption is the first step towards identifying high compressed air use areas and compressed air leaks, and optimising air use.

The EXAIR Digital Flowmeter has a digital display that shows the exact amount of compressed air being used, making it easy to identify costly leaks or inefficient air products. Many companies install the digital flowmeter on each major leg of their air distribution system to constantly monitor and benchmark compressed air usage.

EXAIR Digital Flowmeters are available in four fundamental versions and can be used on Schedule 40 iron pipe, Type L copper pipe or aluminium pipe. The Standard version is designed to provide accuracy and an easy-to-read display of current compressed air consumption, daily consumption or cumulative consumption, while the Wireless version has a radio module within each meter that transmits data to an Ethernet-connected gateway. Using the ZigBee mesh network protocol, data can be passed from meter to meter to extend the distance over which the wireless system can operate.

The Hot Tap version allows for installation under pressure, eliminating the need to isolate and remove pressure from the pipe it is being installed into, reducing installation time while maintaining safety. The Pressure Sensing version monitors pressure as well as flow with a pressure sensor mounted between the two flow sensing probes.

EXAIR's Digital Flowmeters are easy to install, sensitive at low flows and no calibration or setup is required. They are also CE and RoHS compliant.

**Compressed Air Australia Pty Ltd**  
[www.caasafety.com.au](http://www.caasafety.com.au)



## I/O MODULES FOR PACs

The ICP DAS I-9K (analog I/O) and I-97K (digital I/O) I/O modules allow for the combining of a variety of I/O functions within the WP-9000, XP-9000, LX-9000 and LP-9000 programmable automation controllers (PACs).

The I-9012 AIO is a high-performance analog input module that provides 16-bit resolution and a sampling rate of up to 200 kS/s per channel. It provides eight input channels, and the input range is programmable to  $\pm 5$  or  $\pm 10$  V. The trigger output and the trigger input pin cloud allow a multitude of I-9K modules to be simultaneously sampled. The module also provides 4 kV ESD protection and 2500 VRMS intra-module isolation.

The I-97K DIO modules are based on a parallel interface with high communication speed and provide programmable power-on value, safe value and retentive functions. All the I-97K DI modules provide 16 channels and a DI low pass filter function.

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

Unlike conventional compressors, Kaishan 2-Stage technology divides the overall compression ratio between two distinct stages. This significantly reduces internal leakage losses resulting in high efficiency gains and extended bearing life due to reduced applied loads. Combined with optional variable speed control, energy savings of more than 50% are possible compared to other single stage rotary screw compressors.

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### BURNER SAFETY CONTROLLER

The PNOZ m B1 Burner from the PNOZmulti 2 safe small controller range from Pilz supports simultaneous monitoring and safe control of furnaces from Version 10.12 of the PNOZmulti Configurator software tool.

Manufacturers of burner and thermal plant and machinery have a large number of legal and normative requirements to consider: with the PNOZ m B1 Burner, not only can users now configure a variety of burner applications more easily, but they can also monitor plant-dependent safety functions at the same time.

The burner base unit is supported from Version 10.12 of the corresponding PNOZmulti Configurator software tool, which now provides a burner function block for configuration of the base unit PNOZ m B1 Burner. This software element is certified in accordance with the relevant European standards, including EN 298 and EN 50156.

The burner function block emulates the advanced functionality of an electronic automatic burner control system with flexible configuration. As a result it is able to manage the entire burner plant. Users save time when designing and engineering their furnace so that various burner types, such as master and slave burners, direct or indirect ignition, low or high temperature operation, can be controlled and monitored safely.

**Pilz Australia Industrial Automation LP**  
[www.pilz.com.au](http://www.pilz.com.au)

### RUGGED EMBEDDED COMPUTER

The PIP40 Series rugged embedded computer from MPL is based in the latest Intel technology and is available in a compact aluminium housing with DIN rail or flange to fit a rugged MIL IP67 enclosure, a 19" rack system or an open frame solution with a cooling plate.

The chassis design allows the PIP40 to operate in moderate to harsh environments and integrates standard I/O connectors for easy connection or lockable headers, depending on housing choice or needs. The series can be used for most high-quality x86 applications where a complete but still expandable solution is needed.

The housings offer sufficient space for 2.5" SSD or other expansions like UPS or RAID, as well as two mPCIe and three m.2 slots to allow expansion. The internal expansion bus allows the integration of PCIe/104 or PCIe cards. The series meets the CE and FCC standards, allowing EN50155, IEC 60945 or MIL-STD-810 certifications to be met.

**Backplane Systems Technology Pty Ltd**  
[www.backplane.com.au](http://www.backplane.com.au)



### PORTABLE HCDP TESTER

The Michell CDP301 portable HCDP tester uses the chilled-mirror principle for both hydrocarbon and water dew-point measurements and is designed to follow the requirements as described in ASTM D1142. Based on the visual manual method of observing the formation of condensate, the CDP301 uses a high-definition visual image to assist users and allows image capture and reliable logging of measurements for later review.

The device features automatic mirror cooling rate control according to ISO 6327 and ASTM D1142 test methods for natural-gas dew-point measurements, and is self-contained and rechargeable battery powered. It is also Ex d certified for IECEx ATEX Zone 1 IIB+H2 T3 and has a 100 barg operating pressure rating.

The CDP301 offers greater than 60°C measurement depression range (up to 100 barg pressure) and better than ±0.5°C accuracy.

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



### MODBUS TRANSMITTER WITH DUAL UNIVERSAL INPUTS

Moore Industries has announced the TMZ PC-programmable Modbus transmitter with dual universal input channels, which accepts most industry standard temperature, current or voltage signals. This dual universal input (2PRG) model allows users to increase measurement density while also reducing overall point costs by doubling the monitoring capability in a single unit. The digital Modbus output of the TMZ also reduces error that is inherent on analog 4–20 mA output transmitters due to their required D/A conversion.

Users can quickly and easily configure each TMZ universal input for any thermocouple, RTD, potentiometer, ohms, millivolt, mA or voltage signal with the company's PC program. Since measurements from both inputs are available on the Modbus output, the host system has the option of monitoring each point individually or combining their readings for backup/failover, averaging or differential measurement strategies. Additionally, the

TMZ's input terminal temperature reading used for cold junction compensation on thermocouple inputs is also available on the Modbus output, which is convenient for determining ambient or internal cabinet temperatures. Up to 32 TMZs (without repeaters) can be multi-dropped onto a single low-cost communication link (such as a twisted wire pair), eliminating the need to run a dedicated wire for each signal.

The TMZ is also available in single input channel models. All TMZ models are 100% made in the USA and feature long-term stability (5 years), 20-bit input resolution, isolation and robust RFI/EMI protection.

**Moore Industries Pacific Inc**

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



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# HOW THE INTERNET OF THINGS CAN TRANSFORM YOUR WATER NETWORK

## FIVE USE CASES TO LEVERAGE THE IoT AND IMPROVE YOUR OPERATIONS

*Luc Turner, Industry Manager – Water & Wastewater, Endress+Hauser*

The water industry has undergone enormous changes in the past 20 years. To ensure plants and networks kept running safely, it was the norm to have a large team of operations staff to carry out such time-consuming tasks as manual measurements. Today we are largely able to operate water treatment plants remotely, which is a boon to productivity, accuracy and efficiency.

Increasing population, industrialisation and climate change intensifies water scarcity. Communities across the world have an urgent requirement for safe, reliable and affordable water and wastewater (W/WW) services. W/WW is a non-cyclical industry: authorities will continue to invest in upgrades as long as populations increase and infrastructure ages. It is therefore critical to leverage the right solutions at the right time to ensure these

investments are effective in improving operations and justifying capital expenditure.

Everyone in the W/WW industry should be focusing on the Internet of Things (IoT) and how it can improve their operations. The IoT connects digital objects such as sensors and flow meters to the internet, turning them into 'smart' assets that can communicate with users and application systems. This allows for more efficient process control and optimised network management. General water monitoring operations that were previously manual and inefficient can now be automated, continuously reporting on their own status in real time.

Planning and implementing large-scale IoT solutions isn't simple, and there are many aspects to consider. A typical IoT solution is made up of several layers, each with their own challenges. The



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most well-accepted visualisation of an IoT water solution was originally developed by the Smart Water Area Networks (SWAN) forum. It consists of five distinct layers including:

- Physical layer (pipes, pumps, valves, etc)
- Sensor layer (process instrumentation)
- Communication layer (storage and transmission of data)
- Data management and display (visualisation tools)
- Data fusion and analytics (predictive algorithms and artificial intelligence)

Let's first consider the sensing layer — the primary tools required to control a plant or distribution network. Though often overlooked, without accurate and reliable data from process sensors, implementation of an IoT-based system is pointless. However, large-scale IoT systems may require the installation

of thousands of sensors, and so engineers will naturally be sensitive to the costs of both the sensing element and overall installation. The power consumption of sensing elements is also important, given that most large-scale IoT solutions will be battery powered. Finding a reliable, accurate and fit-for-purpose process sensor is fundamental to the success of an IoT-based system.

The communication layer is responsible for the secure transmission of data to upper layers where data management and analytics is performed. This is no simple task in Australia, where there can be hundreds of kilometres between network locations. It is important to consider the various transmission technologies available and decide which would be most appropriate. This may include low-power wide-area networks (LPWANs), cellular (3G/4G/5G), Wi-Fi, satellite or a mixture of technologies. Major network providers in Australia offer a range of technologies to suit many use cases.

Once any challenges with sensing and communications are resolved, data is transported into the visualisation and analytics layers. Data visualisation can consist of a SCADA system or a cloud-based dashboard tool. It should be remembered that IoT applications can generate huge amounts of data, so it's important to be aware of the volume of data that will be transmitted on an hourly, daily or monthly basis and adjust the system to meet specific requirements.

Data analytics refers to the ability to crunch data, define patterns and perform forecasts. It can be as simple as displaying information in an easy-to-read format, or as advanced as using machine learning and artificial intelligence (AI) to make predictions. These tools make it easier for the management team and key stakeholders to understand the information and prove the ROI.

There are multiple ways that the IoT can help the W/WW industry improve operational efficiency and make smarter decisions for future investment. The following are five of the most common use cases and their benefits.

### Sewer level detection

Attending emergency callouts for sewer overflows can be both expensive to the local authority responsible and unpleasant for nearby inhabitants. Without a reliable method of sewer level measurement, these blockages are often unpredictable. By deploying a network of level sensors and integrating data into a cloud-based system, we can begin to form AI-based predictions and provide early warnings of sewer-blockage events. This enables action to be taken to avoid expensive overflows and achieve operational efficiency.

### Industrial effluent monitoring

Controlled release of waste effluent from industrial users directly into a local sewage system is very common. However, few of these sites are equipped with water-quality sensors to provide an early indication of pollution. Typically, composite liquid samples are taken over a weekly period (or even longer) and measured in the laboratory. With this method, it's easy to miss significant pollution events which may adversely influence a downstream wastewater treatment plant. Flow metering can also be incorporated into this system to provide load details and information for billing requirements. Water quality and flow sensors provide real-time (or near real-time) data to a centrally managed system, allowing operators to locate the source and predict the spread of pollution events from industrial sites.

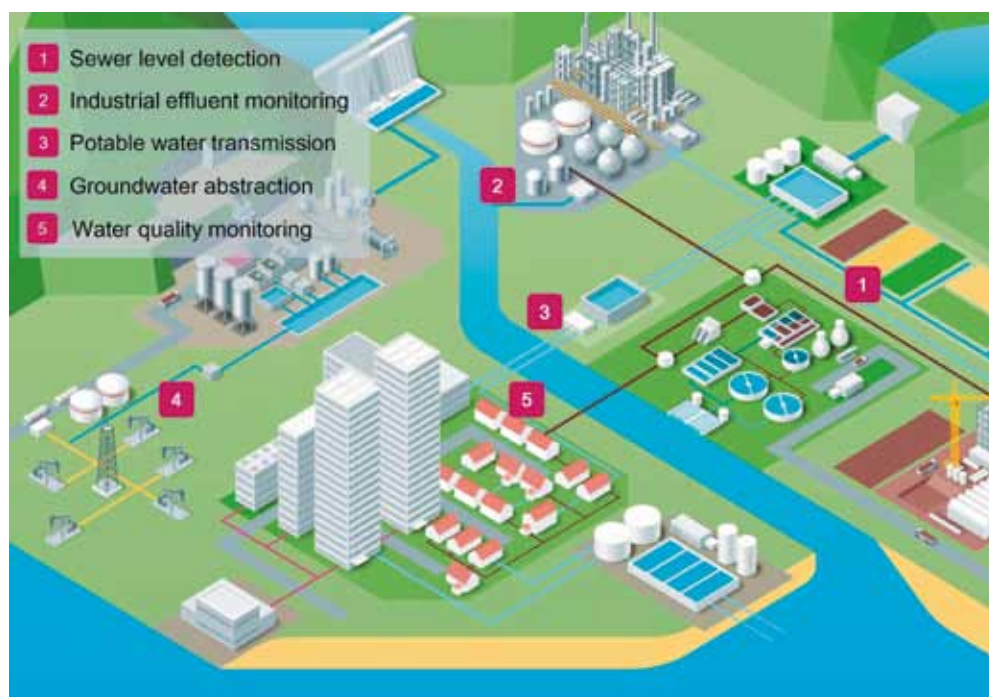


Figure 1: Five key use cases for IoT technology in water and wastewater networks.

### Potable water storage and transmission

Drinking water is an expensive resource, particularly in areas suffering extreme drought. The devastating bushfires of 2019 and 2020 serve as a reminder to the Australian population that our most precious resource must be protected. Potable water leakage detection has thus become a significant use case for the IoT. Smart sensors can be deployed across the network to feed data into a system providing real-time warnings of leakage events, ensuring they are rapidly corrected. Complex acoustic sensors have proved to be extremely accurate, though relatively simple solutions such as pressure monitoring or flow metering have also been very successful.

While early warning of a leakage event is obviously beneficial, extensive pressure or flow monitoring of the water distribution network can also identify areas requiring rehabilitation before a burst occurs. With predictive maintenance, unplanned network shutdowns can be avoided leading to significant cost savings.

### Groundwater abstraction

Irrigated agriculture in the Murray Darling River Basin in Australia accounts for 60% of Australia's entire water consumption and is worth an estimated \$2 billion a year. Developing a standard for metering groundwater abstracted from this basin has been a key issue in recent years. Not only do we need to accurately monitor flow, dam levels and bore levels, we require a reliable method to remotely transmit data to a centrally managed system. In Australia, the vast distances that data needs to travel is a major challenge to overcome. However, successfully providing access to this data will minimise undue costs to water users and unregulated removal of water. Some instruments are even smart enough to allow remote verifications, further increasing the reliability of measured values.

### Water quality monitoring

Water quality monitoring generally consists of several key parameters (pH, turbidity, free chlorine, etc) to ensure that drinking water is safe or treated wastewater meets environmental guidelines. These parameters are either measured online by process instrumenta-

tion or by manual grab sampling, which may examine a composite sample over a weekly period. Most modern treatment plants will have automated online monitoring systems at the outlet of their treatment plant, though the distribution network may be largely untouched. With ad hoc or manual-based measurement, it's easy to miss a pollution event which may cause environmental damage or population health effects.

Online monitoring in the distribution network ensures that water quality is permanently measured. Real-time warning of pollution events is possible to ensure that they are quickly resolved and downstream operations are not adversely affected. Predictive algorithms can use water quality trends to provide early warnings of pollution and to inform authorities of the potential spread. Furthermore, we can use online monitoring parameters as an input for network asset condition assessment — for example, pH and conductivity in wastewater pump stations. This can allow for predictive maintenance and further improvement to network operations.

### The IoT is the future – now

IoT technology solutions can provide enormous benefits that were not previously possible. The volume of information that can now be transmitted is truly staggering, as are the advanced data visualisation solutions that decipher this information and turn it into valuable outcomes for a wide variety of stakeholders.

For a successful IoT solution to be deployed, every level of the system architecture must be clearly understood. Once that's accomplished, multiple use cases can be explored, all of which can provide quantitative benefits. In these testing times of decreasing water security, IoT technology has been proven to boost operational efficiency and provide smart investment decisions. As utilities continue to make quantum leaps in their use of IoT technology, now is not the time to be left behind.

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## Custom vacuum solution improves pet food pouch unloading

Adelaide-based packaging machine builder HMPS recently partnered with SMC Corporation Australia New Zealand to design and custom fit a new HMPS pouch unloader cell for an export customer in Thailand. Used to unload pouches of pet food from trays, the machine offers high speed in a small footprint. It is the first machine the company has built where a robot is retrofitted with a vacuum head for off-loading pouches of pet food from a retort.

Pouches have increased in popularity over the years as a flexible packaging option, and using a vacuum system to handle this packaging option remains the most reliable and trusted solution.

"The customer has an old compressor in their factory and requested a solution that is more energy efficient in terms of compressed air," explained Sergio Palacio, Project Engineer for HMPS. "Compressors can be expensive to replace, and our customer wanted to automate their line without causing unnecessary downtime, additional costs or drastic changes to the rest of the plant"

Based on this brief, HMPS looked to SMC for the vacuum technology necessary to achieve the customer brief. The two companies have worked together for years and Palacio said that this project required out-of-the-box thinking and close collaboration.

"We chose SMC's vacuum products because of their reduced air consumption while offering continuous vacuum where required," he said. "We looked to deliver a more efficient and powerful solution with a specially designed and engineered vacuum head."

Jason Sutton, SMC Area Sales Engineer, said that their design departments worked together to deliver an innovative solution. "From SMC's side, the design was led by our engineering department in New Zealand, headed up by Sergey Vetrov, while I oversaw the project on the ground together with the HMPS team. Our team was proactive, detail-orientated and invested in the project."

"This was one of many projects where SMC worked with OEM to develop a special 'fit-to-purpose' complete solution," said Vetrov. "The project delivered a custom-made solution as a result of preliminary tests with actual pet food products in order to prove the concept with selected SMC standard vacuum components."

"During the final stage we designed and delivered a bespoke solution with a direct interface to the robotic arm as per HMPS's specification."

While the specially engineered vacuum head used in this application is made up of standard SMC vacuum products, the solution has been engineered into a unique multifunctional and energy-efficient vacuum design.

"We needed to increase the speed of the application while factoring in energy savings to help reduce pressure on the compressor," explained Palacio.

SMC selected the ZH vacuum ejectors and ZP vacuum cups from its vacuum range for this specific application.

"The pouches are wet with traces of chemicals and, as such, we used the ZH series to help take away any water and chemicals while protecting the vacuum system," said Sutton. "The multi-bellow pads fitted



in our vacuum cups (ZP series) are made for quick release and reduced consumption. Because there is no chamber, the vacuum response time was immediate, and no air is delivered to a vacuum cup unless it is in use.

"Here, as soon as the air shuts off, atmospheric pressure enters and the multi-bellow pads expand like a spring to assist with the easing of pressure and tension, releasing the product immediately."

HMPS made use of SMC's IP65-rated stainless steel products for this application to withstand the wet and humid conditions in the factory, and to meet health and safety demands. Components for the application were specifically selected to withstand caustic acid washdown.

The latest machine performs far better than its predecessor and has achieved 28% in energy savings.

It is also no secret that every millisecond counts in packaging.

"Through the unique combination of a new vision system and SMC's vacuum head, the customer is enjoying less waste, faster speeds and a reduced cycle time of 15%," said Palacio.

According to Palacio, the robotic cell can process 576 products per minute and is able to handle four different pouch sizes and four different gravy contents.

"It's important to note that the gravy affects the shape of the product and the performance of the vacuum head," he said. "The vacuum cups used for this application adjust to ensure constant suction when required. This same technology can be applied across an array of products in pouches such as soups, rice, biscuits, etc."

Palacio is pleased to announce that the customer is extremely happy with the results. "This new vacuum head will be retrofitted on an additional three machines at this same plant and SMC's special vacuum head will become HMPS's new standard going forward."

**SMC Australia | New Zealand**

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

**IP65 TABLET PC**

The Winmate M101S is a 10.1” rugged IP65 tablet PC with features designed to withstand industrial use while helping to increase productivity, improve safety and reduce operational costs.

The dual camera design allows for clear images with its 8 MP main camera and 2 MP webcam. An optional barcode or RFID reader can be implemented into its design for additional functionality. Equipped standard with a hot-swappable battery design, a high-capacity battery pack is optionally available. Two programmable function keys are also located on the top right and bottom right on the tablet.

The processing power comes from Intel’s Core i5-7200U Kaby Lake processor paired with Intel Graphics. The tablet features an In-Plane Switching (IPS) screen with direct optical bonding and projective capacitive touch, which is outdoor viewable and offers 1920 x 1200 pixel resolution.

Weighing 1.25 kg, the M101S offers lightweight mobility in a rugged tablet designed for use in field services, vehicles, logistics and warehouse management.

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**MOTOR SAFETY CONTROLLER**

The Schmersal BMC Control Box is a compact and complete safety solution for single- or three-phase machines. Traditional safety systems simply interrupt the power source and allow the system to ‘coast’ to a stop. The BMC Control Box has an optional monitored DC braking system to significantly decrease the system stop time. The use of DC injection for the braking function allows for the safety function to be applied immediately, with the braking applied at the same time rather than delayed.

Compatible with up to four safety input functions from a diverse range of hardware types (light curtains, magnetic sensors, emergency stops), the device is suited to small standalone machines. Being highly configurable allows for a common product to be used in multiple machine types. Meeting the highest safety levels (CAT 4/ PLe/SIL 3), the unit is suitable for applications where operators are working close to hazards like mixing, drilling and milling machines.

Designed around the TÜV-certified SRB-E 204 ST, the comprehensive safety solution is said to simplify design and reduce installation time and validation costs. With in-built detailed LED feedback and the LEXX Diagnostic application, fault-finding is fast and easy, which reduces production losses and downtime.

**Control Logic Pty Ltd**  
[www.controllogic.com.au](http://www.controllogic.com.au)



## THE RISE OF INDUSTRIAL ROBOTS

There's nothing new about industrial robots! In fact, they've been used in manufacturing since the 1970s — the automotive industry being one early adopter. Articulated arms were the most common robot type, which were used for tasks like welding.

The 1990s saw the emergence of parallel (or 'spider') robots with fixed inverted mountings, as well as SCARA (Selective Compliance Assembly Robotic Arm) types. These were used mainly for pick-and-place applications, such as loading product into packaging. AGVs (automated guided vehicles) also started to be used around the same time, to convey goods along a single, fixed path. Dedicated areas needed to be zoned off for AGV use, and tapes laid on the floor along the route.

The advantages of automating tasks with robots, instead of manual labour, are well understood. Robots can perform repetitive tasks faster and more efficiently than humans. They can do so without breaks and can operate 24/7 in environments that humans find harsh and inhospitable. Thus the motivation for industry (manufacturing in particular) to employ robots has always been high. This is especially so for countries with high labour rates and diminishing skilled workforces — a growing problem in recent years. Furthermore, with markets becoming more global, competition among manufacturers has never been greater.

However, up until the last decade or so, robot use was mostly confined to large organisations with significant investments in assembly lines. Costs were very high, even for medium-sized operations, and ROIs too long to be considered economically viable. Also, robotic programming and maintenance was considered somewhat of an esoteric science. Detailed information was highly proprietary to the original supplier and difficult to come by; as were staff with the necessary skills to manipulate robots.

These factors proved to be significant barriers for robot acceptance.

However, there's little denying the rapid rise industrial robots have enjoyed over the last few years. Not only have traditional users of robots been more active, other industries are finding new applications for robots, applications that did not exist even a few years ago. What has changed to cause such a sudden and dramatic uptake?

Undoubtedly, the single biggest factor driving the surge in robots has been the significant fall in prices. Surveys have shown that SMEs hereto believed robots to be unaffordable and therefore didn't consider using them. But lower purchase costs have reduced the ROI to such an extent that robots have become feasible.

The expansion of the robot market has caught the attention of both automation and robot vendors. They have ramped up their development efforts, resulting in better and more versatile product offerings. The involvement of the traditional automation vendors in the market has also improved the integration between robots and the control systems that run the rest of the plant, which had been an impediment.

Just about every aspect of robots has seen improvement over the last decade, with faster computing hardware delivering ever-increasing processing power. The servos used within



robots are now more accurate, as are the visual inspection systems robots rely on to 'see' the real world. But it's the software systems used to control robots that have perhaps seen the biggest changes. Development times for robot projects have reduced enormously due to the significant advances in development environments and better simulation, including integration of CAD software.

A more recent innovation has been the introduction of artificial intelligence (AI), which allows robots to make better, more human-like decisions, resulting in better outcomes for the user.

The types of robots on offer has also increased: industrial robots are not restricted to fixed installations anymore, as intelligent mobile robots now exist to transport goods around a premise. They can determine their own route and can detect obstacles in their path (such as closed doors) and navigate around them. They can also operate as a fleet, where they're controlled from a central management system that determines their most efficient routes. The carrying capacity has also increased significantly: some up to 1.5 tonnes! Mobile robots are now being used in hospitals to safely transport medical equipment and autonomously disinfect facilities to protect staff and patients.

Collaborative robots (often called cobots) are a recent addition to the modern workplace. They are designed to work side by side with humans, without the need for safety barriers. By combining the best aspects of robots (performing repetitive tasks) and humans (thinking to make decisions), they achieve outcomes for users.

Robots are no longer considered the exclusive realm of large corporations with sizeable resources. SMEs should now seriously consider deploying robots for a broad range of tasks to help boost productivity, reduce costs and improve workplace safety.



*Harry Mulder is Engineering Manager for Omron Oceania, a global leader in industrial robotics and automation.*

## HYGIENIC TEMPERATURE INSTRUMENTS

The OPTITEMP TRA-H6x/-C6x temperature sensors are designed for hygienic applications in the food and beverage industry and come with 3A, FDA and EHEDG approvals.

The line includes standard temperature assemblies and compact designs, featuring a fast responding sensor tip with reduced heat conducting error for high accuracy at short immersion depths. They can be ordered with replaceable Pt100-inserts or non-replaceable Pt100 for faster response. All devices are designed vibration proof and rated IP69.

Process connection options include a modular adaptive system using G $\frac{1}{2}$  hygienic process connection as the basis, both in 'steel-to-steel' and 'steel-to-PEEK' versions. A broad variety of hygienic process adapters is also available.

All devices feature a 4–20 mA output, while options for the TRA-H6x include HART, Bluetooth and NFC. As an alternative to commonly used cable glands, an M12 connector is available. Wireless configuration, monitoring and basic verification are possible via the OPTICHECK Temperature Mobile App when selecting OPTITEMP TT 33 or TT 53 as the temperature transmitter.

**KROHNE Australia Pty Ltd**

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



## VENTURI TUBE PRIMARY FLOW ELEMENT

The McMenon FPD300 classical venturi tube is a robust, low pressure-loss device that is available in line sizes 50 to 1200 mm as standard, with larger sizes available upon request. The meter can measure a wide range of clean liquids and gases. Smaller sized units are machined from bar stock or forged bar; larger sizes are typically fabricated from rolled plate with forged flanges. For applications requiring very low pressure loss, McMenon offers a version that has a longer outlet cone with a shallower internal angle. This combination reduces the overall pressure loss.

The benefits of the McMenon FPD300 venturi tubes include the fact that they have no moving parts and are virtually maintenance-free, and that the performance of the device can be calculated from measurement of the key dimensions alone.

Suitable for a wide range of liquids, gases and steam, they are available in a wide range of materials to suit the process fluid and the working conditions, are suitable for horizontal or vertical pipelines, and are less affected by upstream disturbances than many other devices.

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## PRESSURE TRANSMITTERS



Said to be rugged, resilient and easy to configure, the ABB PxS100 range of pressure transmitters offer features that include QR codes for easy access to online operational instructions and advice; abrasive resistant technology to protect the metallic diaphragm and extend working life; and ABB's H-shield to protect against monatomic hydrogen and ensure measurement accuracy.

Using ABB's range of adaptable connectors and flanges, the series can be rapidly configured to accommodate hundreds of mountings, spans and certification-equivalent options. The simple HMI rotates for visibility from any angle, features 'through the glass' configuration capabilities and can be ordered with an easily accessible backlight for low-light environments.

In compact and robust stainless steel housing, the range offers IP66, IP67, IP68 and IP69K protection for operability in high humidity or where there are high levels of dust concentration. The ingress protection makes it suitable for clean-in-place applications in the food and beverage sector.

In alignment with specifications requested by its reference market, the product provides base accuracy of 0.25% of span, with the option of improvement to 0.1%. It is available in both gauge and absolute sensor variants and offers five different measurement ranges, covering applications from 40 mbar up to 100 bar due to its 10:1 turndown capability and full rangeability.

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

## 3D RADAR PROTECTIVE DEVICE

Optoelectronic protective devices can reach their physical limits in harsh environments due to interference, especially in the case of clouds of dirt.

SICK safeRS is a non-contact 3D protective device based on the LBK System from Inxpect, a safe radar system with performance level d and SIL 2 in accordance with ISO 13849-1 and IEC 62061. Consisting of a control unit and up to six radar sensors, the device safeguards hazardous areas in a wide variety of stationary applications. For example, automated machines are able to switch to safe mode as soon as people enter or stay in the protected area.

Due to the product's high robustness against dirt, dust, wood chips and flying sparks as well as vibration and shock, the company says operation is ensured even under difficult conditions. The unit also features robust housing, free configuration and diagnostic software, as well as quick and easy commissioning.

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## ULTRASONIC GAS FLOWMETER

The Endress+Hauser Proline Prosonic Flow G 300 flowmeter is designed for a wide range of gas applications and is said to provide reliable flow measurement, even with wet gas and changing gas properties and compositions. A pressure-rated sensor housing with rupture disc limits safety risks. The compact transmitter offers high flexibility in terms of operation and system integration, including access from one side, remote display and improved connectivity options. Heartbeat Technology also helps to ensure compliance and process safety.

The G 300 is a flexible device with user-definable gas mixtures for demanding measuring tasks. It is said to also maintain reliability even with humid or wet gas as the sensor design is insensitive to condensate. A multivariable device offering no pressure loss, it offers real-time pressure- and temperature-compensated values, full access to process and diagnostic information, and numerous, freely configurable I/Os with reduced complexity.

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## LASER TRIANGULATION SENSOR

The Micro Epsilon optoNCDT 1220 entry-level laser triangulation sensor is suitable for measurement of displacement, distance and position in high-volume applications. The compact, light-weight sensor comes with an integrated controller that makes it suitable for applications where high accelerations occur. It also offers a measuring rate of up to 1 kHz (adjustable) as well as measurement with high accuracy and precision. The unit provides analog output.

The optoNCDT 1220 also features Auto Target Compensation (ATC) that allows for a stable distance signal control irrespective of the colour or brightness of the target. The compact sensor can be easily integrated in industrial plant, equipment and machinery, where restricted space is common, without the need for complex adjustment. It also features function keys and a web interface for easy and fast commissioning.

Example applications of the 1220 include, but are not limited to, robot grippers and in automation technology involving machine building, electronics and 3D printing.

**Bestech Australia Pty Ltd**  
[www.bestech.com.au](http://www.bestech.com.au)



## MAGNETOSTRICTIVE LEVEL TRANSMITTERS

With floats as small as 18 mm in diameter, the FLM-CA and FLM-CM magnetostrictive level transmitters from WIKA fit into space-critical locations. The FLM-CA is designed for use in the process industry, while the FLM-CM is designed for other industrial applications.

Both instruments have a high resolution (0.1 mm) and measure with an accuracy of either  $\pm 1.25$  or  $\pm 2.5$  mm. The model FLM-CA is also available in a hazardous area version with ATEX approval and in a vibration-resistant version (up to 4g).

The level transmitters have a 4–20 mA output signal and the model FLM-CA can also communicate via HART6 protocol. They are available with probe lengths of up to 1 m (FLM-CM) or 3 m (FLM-CA) as well as with different temperature and pressure ranges. With an ingress protection of IP68, they are also protected against external influences.

**WIKA Australia**  
[www.wika.com.au](http://www.wika.com.au)



ULTRASONIC LEVEL TRANSMITTER

ABB has launched the LST200 ultrasonic level transmitter, designed specifically for industries with large installed bases of level measurement devices — particularly water and wastewater treatment. With a modular design and intelligent algorithms, the product should be easy to install, commission and maintain.

Commissioning is said to be easy due to a set-up menu that guides users through configuration within 1 min. It also has a blue backlight that makes it highly visible in strong sunlight or darkness in locations such as lagoons and settling ponds. Maintaining the device is made easy through real-time echo waveform and diagnostic messaging for efficient troubleshooting.

High stability is achieved by an algorithm that enables the device to detect and automatically compensate for any instability in the strength of the ultrasonic signal. This makes it suitable for process basins for aeration, chlorine contact, skimmer tanks, sedimentation and flotation thickeners, where there can be unstable surface echo from foam or turbulence.

An intelligent algorithm with noise filtering makes the product useful in wet wells, lift stations and pumping stations as it is immune to noise from heavy equipment such as variable speed-drives. Temperature compensation offers accuracy that is better than ±3 mm or 0.25% of full span.

Submersible in water, the product can survive flooding. It has a waterproof rating of IP68, which is relevant for the water and wastewater industries. A non-contact instrument made from polycarbonate, it is resistant to process liquids such as mild acid and base, chloride and oxidiser.



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## DYNAMIC REFERENCE DIFFUSE SENSOR



Sensors must detect a wide range of products and films on the conveyor belts of primary and secondary packaging machines for confectionery and baked goods. Leuze has developed the DRT 25C dynamic reference diffuse sensor for this area of application.

The sensor works with three light spots and uses reference technology. The latter references the conveyor belt instead of the product. In the first step, the surface characteristics of the belt are taught in. This enables the sensor to subsequently detect all objects that do not correspond to the belt surface as 'deviations', even if the conveyor belt is dirty or vibrating. With this approach, the surface properties of the products, such as the colour, gloss or transparency, do not influence the detection. The DRT 25C uses its three light spots to detect the entire spectrum: small, flat, or also tall and spherical products. Even irregular shapes and contours or products with openings are detected. Due to the wide scanning range, these are also detected as a continuous piece.

No realignment of the sensor is needed when products or packaging materials are changed over. This reduces the set-up time required and enables higher product volumes. The DRT 25C is quickly set up due to automatic teaching by means of the teach button. Additional functions can be conveniently integrated into the machine control via IO-Link: for example a warning for excessive debris, use of the counter built into the sensor or locking the teach button.

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**Leuze electronic Pty Ltd**

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

## PRESSURE TRANSMITTERS WITH IO-LINK



Pressure transmitters from Turck's PT1000/2000 series are now also available with an IO-Link interface and two programmable switching outputs. Besides their ability to withstand shocks and changes in pressure and temperature, the sensors also offer all the benefits of digital

communication, including enhanced diagnostics and flexible parameterisation.

For example, IO-Link enables users to monitor electrical short circuits, overpressure and underpressure, as well as values exceeding the maximum operating temperature. Other data for efficient condition monitoring can be supplied by an operating hours counter, a maximum and minimum pressure memory, and an overpressure meter.

The pressure transmitters can be operated with two switching outputs or with IO-Link communication and one additional switching output as required. These switching outputs can be set for either PNP or NPN operation. This makes it possible to set the location of the switch points within the measuring range and their behaviour as required.

Turck offers the compact pressure sensors with protection to IP67 and IP69K in two different designs: PT1000 series transmitters cover a measuring range from 0–1 to 0–40 bar and operate with a ceramic measuring cell. PT2000 series devices are provided with fully welded measuring cells for higher pressure ranges. Their measuring range goes up to 1000 bar. Regardless of the series, the pressure sensors offer a high measuring accuracy of  $\pm 0.3\%$  FS BSL.

**Turck Australia Pty Ltd**

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

## TURBINE FLOWMETER

The Trimec Flow Products PT Turbopulse turbine flowmeter series measure flows of low-viscosity liquids from 27 to 4500 L/min in a range of sizes from 25 to 100 mm.

The meters have an axial rotor and flow guides, and need to be installed in straight sections of pipe either horizontal or vertical so that the flow is conditioned. The series has IS approvals and the meters are available in flanged or threaded versions.

The meters are robust and compact, and take little space in the piping system. Applications include fuels, alcohols, solvents, insecticides, milk, chemicals, water and light hydraulic oils.

The basic construction of turbine flow meters includes a bladed turbine rotor that is axially suspended in the pipe. As the fluid flows through the pipe, it causes the rotor to spin on its axis at a speed proportional to the velocity of the fluid. The spin of each rotor is sensed by the turbine meter using gears, a photoelectric cell or a magnetic pickup installed on the outside of the flow tube or the meter body, adjacent to the perimeter of the rotor.

**Trimec Flow Products Pty Ltd**

[www.trimec-fp.com.au](http://www.trimec-fp.com.au)





FLOW SENSOR



Omron's E8FC series flow sensor introduces dual parameter sensing, where a single meter measures the temperature of a liquid, as well as its flow. The simultaneous monitoring temperatures mean many more abnormalities can be detected than when only flow is measured.

Typical applications are measuring cooling water used in moulding and welding. The water must not only flow, it must also be below a certain temperature to be effective. Faulty or sub-standard products could result if either is incorrect.

Three different models are available, analog only or analog with IO-Link (both with COM2 and COM3 baud rates). All models have a digital output for external alarm detection, which allows for easy replacement of existing units.

The meter uses its IO-Link channel to return the flow rate, temperature and a range of configurable alarm bits, set by threshold values. This allows users to keep a close eye on proceedings and perform preventive maintenance functions if required. A 4-digit high luminosity 7-segment display on the meter shows flow rate, temperature or percentages of what's expected. It also has a large indicator that changes colour to alert users to potential flow and temperature problems.

As the meter often needs to be mounted into a small or awkward space, it can be rotated up to 330° on its mounting. The display also has an 'upside-down' mode for when the meter needs to be mounted this way.

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# CHOOSING THE RIGHT HEAT EXCHANGER FOR WASTEWATER APPLICATIONS

*Matt Hale, International Sales & Marketing  
Director, HRS Heat Exchangers*

**H**eat exchangers are crucial to many processes in the water industry, whether as part of an aerobic or anaerobic digestion plant, for cooling or evaporation, and for sludge concentration. There are several different types of heat exchanger available and choosing the right one can appear daunting. For both economic and environmental reasons, maximising productivity is essential for companies to remain competitive, and correct heat exchanger selection is key to this, as is maximising the use of all outputs, including power and digestate produced through anaerobic digestion (AD).

### What is productivity?

Productivity is measured by the ratio of output per unit of input. Many water companies see it as a balancing act: how can they increase their output without increasing their costs? It is intricately linked to efficiency, ensuring that every piece of equipment and every part of the process is optimised, delivering greater value for money to the operator.

Due to the pressures on water availability, Australia already has some of the most effective water treatment infrastructure in the world, and many areas are following Perth in considering the 'direct potable reuse' of treated sewage in the water supply. There is real potential to increase the efficiency of existing AD plants, not least because some of the oldest wastewater AD facilities are now able to upgrade and take advantage of the latest technology.

The potential of such upgrades is illustrated by the 163 wastewater AD plants in the United Kingdom, which account for around 28% of the country's total AD capacity. Thanks to project upgrades and efficiency improvements, the UK AD sector delivered a 25% increase in power production from just a 12% increase in capacity between 2010 and 2015.

### Understanding the process

The most important criterion when specifying a heat exchanger is to ensure that it will be fit for purpose. To do this, it is important to understand the material being treated, the heating (or cooling) medium and the process involved. Is the material in question liquid (dirty or clean water) or semi-solid (sludge or digestate)? Is it viscous? What is the extent of the temperature difference required? Is there the option to use a source of hot or cold water from another part of the plant, and will heat regeneration technology help to improve overall energy efficiency?

Other information must also be provided for correct heat exchanger selection. For example, does the product contain solid particles? Consider also whether it is shear sensitive, if the process needs a scraped surface heat exchanger (SSHE) or whether corrugated tubes will be enough to prevent fouling. Also bear in mind the space available for the heat exchanger, and the connection pipework and fittings. The more information an operator can provide, the more likely they are to get the right heat exchanger for the job.

### Avoiding a false economy

After thoroughly researching the options available it may be that more than one type or model of heat exchanger is suitable for the purpose. To ensure optimum productivity, it is important to consider the total cost of ownership (TCO). Although some operators

can be swayed by the initial purchase price, this can be a false economy. The lifecycle cost of a heat exchanger — particularly one used to process difficult materials such as sewage sludges — heavily depends on the costs of cleaning and maintenance. Buying a cheaper design that is more prone to fouling can quickly become more expensive to operate. To keep productivity high, it is therefore essential to consider the TCO of a heat exchanger, not just the purchase price.

### Energy efficiency

The running costs of a heat exchanger also have a large effect on its overall financial viability, so selecting a heat exchanger that is energy efficient is key to enhancing productivity. Some heat exchangers have features specifically designed to improve the operational energy efficiency.

Scraped-surface heat exchangers also minimise potential fouling by keeping the tube wall clean and create turbulence within the material. Both actions help to increase heat transfer rates, and together they create a highly efficient heat transfer process ideal for high-fouling viscous materials like sludges.

Recapturing heat is also one of the easiest ways to improve efficiency, and heat exchangers represent the best way of doing this. They are an established technology, but despite their widespread use in industries such as food manufacturing and the chemical sector, they are often under-used in wastewater AD plants.

### Making the most of heat

Surplus heat can be recovered for use in the AD process itself, for example to pre-heat feedstock or digesters to improve gas production efficiency; for water treatment, pasteurisation and concentration processes; to heat offices or for space heating; or to provide hot water for cleaning. Using surplus heat is also free, without the need to buy additional fuel, and all of these applications can be carried out using a suitable heat exchanger — a well-designed system could recover and utilise 40% of the heat produced by the plant.

Furthermore, heat exchangers can be used to pasteurise digestate (the biofertiliser left over at the end of the AD process) and are more efficient than using tanks with heating jackets, as they have a much lower heat requirement. Using heat exchangers means that effective digestate pasteurisation is possible using surplus heat, rather than needing to install an additional heat source such as a biomass boiler, which could add hundreds of thousands of dollars to a project. The right system can also provide a continuous pasteurisation process, using less energy than alternative systems, while allowing additional thermal regeneration levels of up to 60%. This saved heat can then be used elsewhere, such as an evaporation plant.

Heat can also be used to separate water from digestate by concentration. This technique can reduce the overall quantity of digestate by as much as 80%, greatly lowering the transport costs associated with the removal of digestate. A well-designed concentration system will include measures to retain the valuable nutrients in the digestate, while the evaporated water can be condensed and reused. For example, the captured water can be added back to the feedstock as it enters the digester, making the entire process almost self-sufficient in terms of water use and



eliminating liquid discharges from the plant. After concentration, the treated digestate dry solid content can be as much as 20% (often a fourfold improvement), making it much easier to transport and handle.

### Maintenance matters

Using the wrong heat exchanger can soon prove costly in terms of maintenance and spare part costs. In fact, in some cases it becomes necessary to replace entire heat exchangers when they have become too expensive to clean and maintain, something commonly seen in the wastewater sector. It is therefore important to make sure that heat exchangers are designed to make cleaning and maintenance as easy and flexible as possible, while reducing cleaning and maintenance intervals.

Choosing equipment that can be remotely monitored also makes it easier to anticipate problems, enabling predictive maintenance with the help of the manufacturer. Being able to quickly identify issues helps to keep efficiency high and provides more time to plan for maintenance, resulting in less downtime for operators.

### Beware hidden costs

Another consideration is the overall installation cost, and whether fitting the heat exchanger will require the purchase of ancillary equipment. Corrugated tube-in-tube heat exchangers result in improved efficiencies, providing comparable thermal performance to other designs, but in a smaller footprint. These can often be skid- or frame-mounted, reducing the need for significant support infrastructure.

### A balancing act

While a low purchase price may appear attractive, much of the TCO comes from running costs, and keeping these lower over the lifetime of the heat exchanger will provide a greater return on investment in the long run. Whatever solution you choose, make sure to consider its energy efficiency, maintenance requirements and the costs of any ancillary equipment before signing on the dotted line. Put simply, specifying the wrong heat exchanger could decrease your productivity — choosing the right heat exchanger will almost certainly increase it.

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### ROBOTIC CONTROLLER

The ADLINK ROScube-I Series is a ROS 2-enabled robotic controller based on Intel Xeon E, 9th Gen Intel Core i7/i3 and 8th Gen Intel Core i5 processors, and features broad I/O connectivity supporting a wide variety of sensors and actuators to meet the needs of a wide range of robotic applications. It also supports an extension box for convenient functional and performance expansion with Intel VPU cards and the Intel Distribution of OpenVINO toolkit for computation of AI algorithms and inference.

Robotic systems based on the ROScube-I are supported by ADLINK's Neuron SDK, a platform specifically designed for the professional robotic applications such as autonomous mobile robots (AMR).

The ROScube-I series also features real-time middleware for communication between software components and devices, a hypervisor for safe mission-critical mission execution, ruggedised, secure connectivity with locking USB ports and the option of an RTOS such as VxWorks.

Also available for developers are the ROScube-I Starter Kit or ROScube Pico Development Kit to rapidly prototype algorithms and immediately deploy them to

ADLINK's NeuronBot ROS 2-based rapid robotic development kit for demonstration. This allows for fast improvement of AI models and acquisition of vision data to optimise operational decision-making. The NeuronBot also supports ADLINK's Neuron SDK.

**ADLINK Technology Inc**

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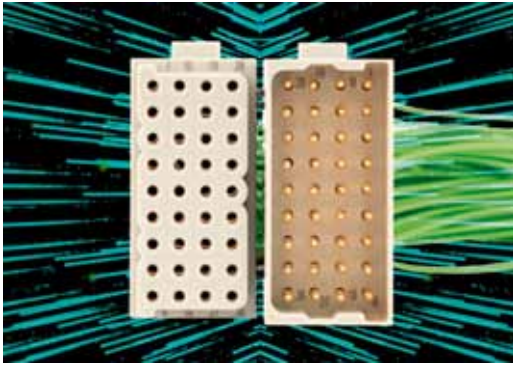
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### MODULAR CRIMP INSERT

The ILME MIXO series of modular connector units has been updated with the addition of the CX 36 IF/M crimp insert, a solution designed for the automation industry and focused on signal transmission scope.

With a rating of 4 A, 32 V with its 36 poles in a single module, the product features a high contact density that allows the user to save mounting space and to employ it flexibly in multiple applications. Used in combination with other MIXO modules, it aids in the efficient installation of robots and other machine implementations.

The wide range of crimp contacts, such as turned or stamped gold plated, silver plated or the specially treated HNM contacts for up to 10,000 matings (along with special frames), enlarges the installation possibilities.

**Treotham Automation Pty Ltd**

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

### ETHERNET SWITCHES

The Hirschmann Mammuthus or MTS series high-performance Ethernet switches are designed to offer an intelligent and secure IT/OT converged solution for a range of networks across many industries to maximise performance.

The series features advanced Layer 3 functionality to support flexible redundancy technology and comprehensive security solutions. In addition, IT networking technology is available with the option of PoE, PoE+, Stack MPLS, ERPS, Storm control and IPv6, and can be used in conjunction with Hirschmann's existing range of industrial Ethernet switches to provide an end-to-end solution that can be managed simultaneously by Industrial HiVision.

The range is suitable for applications in industrial IT networks, smart buildings and CCTV.

**Control Logic Pty Ltd**

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



## Get More Reliable Detection of Valves in Processing Applications

Choose rugged inductive sensors to more reliably monitor the position of valve handles on tanks and containers during processing applications. Actuated valves receive control signals from sensors and other devices to enable more efficient processing. With an assortment of potential mixtures, it is important to use sensors that are accurate, can optimize machine efficiency and stand up to harsh cleaning.

Wash-down rated Uprox Inductive sensors from Turck are ideal for liquid processing lines, in filling functions, or other types of food processing machinery to detect metal valves. Plus, IO-Link makes remote monitoring easy.

Contact your local Turck sales representative to learn more.

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

1300-132-566



## HIGH VOLTAGE DAQ MODULES

KRYPTON data acquisition modules are designed to be small, rugged and modular, especially made for field measurements in any environment. The small size of KRYPTON modules allows them to fit in tight places and they can be placed close to the sensors.

The latest addition to the KRYPTON ONE range are two modules made for high voltage and thermocouple temperature measurements with high isolation: the KRYPTONI-1xHV and the KRYPTONI-1xTH-HV. Both DAQ modules provide safety at high voltages with an over-voltage category CATII 1000V.

The KRYPTONI-1xHV module is designed for high voltage measurements with a single input range of  $\pm 1000$  V. The acquisition is based on a 24-bit SAR ADC with a sampling rate of up to 40 kS/s and an additional anti-aliasing filter. The input connector is a 4 mm safety banana jack.

The KRYPTONI-1xTH-HV is an isolated single thermocouple module designed for temperature measurements at high voltages, and supports a K-type thermocouple. Temperature is acquired by using a 24-bit delta-sigma ADC with the sampling rate up to 100 S/s. Cold junction compensation is provided by a Pt1000 sensing element. The input connector, LEMO Redel 2P series, is designed in plastic to enable sufficient isolation and clearances.

Bringing the data acquisition systems closer to the sensor greatly reduces the cost of the sensor cabling and the chance of wiring errors while improving the signal quality.

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

## DESICCANT AIR DRYERS

The DC series of desiccant dryers from Kaeser Compressors can lower the pressure dewpoint of the compressed air to  $-70^{\circ}\text{C}$ . The company says they combine high energy efficiency and low maintenance costs, delivering frost protection for control valves and lines while producing dry compressed air for sensitive processes at a lower cost.

The DC 2.0 to 11.3 models can operate in, for example, 10 min cycles to achieve pressure dewpoints down to  $-40^{\circ}\text{C}$ . During this process, the dryer switches between the two desiccant chambers only once every 5 min. This dramatically reduces the number of switching sequences between the chambers and resulting material wear on the valves and desiccant.

Long cycle times additionally reduce the amount of compressed air required to restore pressure following the desiccant regeneration phase. As an example, whereas 7.6% of the compressed air must be diverted for a 2 min cycle, this proportion falls to 1.3% with the 10 min cycle of the small DC units. This reduction makes them more efficient, saving energy and extending desiccant service life.

On/off control of the DC 2.0 to 11.3 series models allows for intermittent operation, which saves energy when there is frequent interruption of duty cycles. This employs 'reverse regeneration', where the regeneration cycle always uses up air from the downstream air receiver. A completely regenerated desiccant chamber is therefore always available each time the drying cycle restarts.

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



## IO-LINK I/O HUB

Pepperl+Fuchs has released an I/O hub with IO-Link interface that enables easy and efficient integration of binary sensors and actuators into the IO-Link communication channel. The hub offers eight ports with 16 digital inputs. In combination with the Ethernet I/O module with integrated IO-Link the device forwards up to 128 digital I/Os to higher-level control systems. Since only one connection cable is required for signal transmission and power supply, the cabling effort is reduced considerably.

With a robust, fully encapsulated metal housing, and a wide temperature range of  $-25$  to  $+70^{\circ}\text{C}$ , the IP67 rated I/O hub can also be used in demanding industrial environments.

The housing is compact and features clearly visible LEDs that indicate operation, switching status or possible errors. The slim solution reduces cabling complexity and minimises wiring errors, as it requires only one connection for signal transmission and power supply. It also allows a mixture of IO-Link sensors and common binary sensors in one set-up, freeing users from technological restrictions.

**Pepperl+Fuchs (Aust) Pty Ltd**  
[www.pepperl-fuchs.com](http://www.pepperl-fuchs.com)





## AUTOMATED INSPECTION OF GLASS BOTTLES USING A PROFILE SCANNER

The scanCONTROL laser profile scanner from Micro-Epsilon can be used in factory automation applications such as presence monitoring systems. Typical uses have previously been the detection of the empty containers at bottlers and breweries. A system based on the laser triangulation principle is installed for carrying out this presence monitoring operation, which is used when the bottle crates are received.

In a brewery or bottler, the main challenge with performing measurements on glass bottles is the reflective properties of the bottles. These properties vary due to different glass colours — such as green and brown — and also because bottles come with or without a lid. Performing measurements on bottles can also be very difficult due to the constant vibration and shaking of the bottles while they are being transported on the conveyor belt. The scanCONTROL 2900-50 offers a real-time surface compensation feature in which the exposure time and the threshold of reflection detection are adapted in real time in order to generate stable measurement results.

The scanCONTROL 2900-50 laser scanner features a special line-scanning optical system that ensures a uniform exposure of the measuring field. It operates according to the principle of optical triangulation. A laser light is projected onto the target surface via a linear optical system — the diffuse reflected light from the laser line is then replicated on a sensor array by a high-quality optical system, which then evaluates the image in two dimensions. It offers precision measurement even in harsh environments.

### Bottle inspection

Crates with empty bottles are sent for inspection to determine whether the correct type of bottle is in the crate, if the height of the bottles is appropriate and if any bottle is missing from the crate. To perform this automated inspection, the inline monitoring system is equipped with five scanCONTROL 2900-50 laser line triangulation sensors, and the crates on the conveyor belt are

scanned from above. The laser scanners are located in such a way that each scanner measures a row of bottles in the crates. The monitoring is carried out at speeds of up to 850 mm/s. The scanners measure the height of the bottles in the crate based to detect any that are not fitted correctly. While doing so, they ensure that the height of the bottles does not deviate more than 3 mm from the target height for the respective bottle type.

In addition to the high-speed measurement, the system also provides access to logged data for subsequent statistics, evaluation and process optimisation. The measured values are evaluated directly inline via a GigE Vision interface that integrates the raw data into the image processing software and then further evaluates it. The final result of the presence monitoring is received by PLC as an 'OK' or 'not OK' value, whereby any faulty crates can be removed directly. The results can also be displayed via an integrated display on the control unit.

### Other factory automation applications

Automated inspection has become particularly important in production lines in the manufacturing of steel, plastic, fabric, paper, coated board, chip packaging and the food and beverages industries. The typical applications of laser profile scanners in factory automation are in measuring diameter, thickness profiles, and edge defects of pizzas, measuring the size and weight of biscuits, inspecting labels on cans, assessment of fruits, vegetables, cheese, noodles and meat. The scanCONTROL laser scanners are available in different laser types and with a comprehensive range of accessories so that numerous measurement tasks can be solved for different industries.

**BESTECH**  
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Bestech Australia Pty Ltd

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



## BUILDING CYBER RESILIENCE FOR INDUSTRIAL CONTROL SYSTEMS

The hyper-convergence of information technology and operational technology is having a profound impact on industrial control systems (ICS). The rise of the fourth industrial revolution, also known as Industry 4.0, promises to significantly increase the performance, scalability and reliability of a plant; however, these enhancements don't come without their own challenges. One such challenge is cybersecurity. The threat landscape in automation and process control systems is evolving at an alarming rate with attacks continuously increasing in sophistication, frequency and severity. The reality is that operators of critical infrastructure assets in all industry verticals are struggling to keep up with the growing number of attack mechanisms and entities attempting cyber threats from all over the world; in fact, cyber-attacks on critical infrastructure have evolved to be the new normal for ICS operators.

There is a common misconception that the primary objective of cybersecurity should be to eliminate all security risks, exposures and vulnerabilities; however, in my experience this is simply not feasible in most situations. Nothing is unhackable. I believe that the main goal and objective should be focused on understanding the plant's security risk profile and increasing its overall security posture, using a multi-layered holistic cyber-defence approach known as 'defence in depth'. The reality is that every launched attack will cost time and money for threat actors; as such, they will normally focus on easy targets by finding easily exploitable system vulnerabilities and weaknesses. By raising the security posture of your ICS, you inherently raise the organisation's security status to a level of 'too expensive to hack', which considerably reduces the likelihood of becoming a target and victim of a cyber-attack. In simple terms, you should drive threat actors to easier targets by making your systems too expensive to attack.

Implementing a cyber-resilient ICS is a challenging topic for most organisations; moreover, there is currently a severe shortage of industrial cybersecurity professionals required to help protect ICS assets for critical infrastructures in all industry verticals — a shortage that is

expected to get much worse in the foreseeable future. In order for organisations to have a fighting chance to protect themselves against the evolving cybersecurity threat landscape, automation is currently the most efficient and effective way to drastically reduce the volume of threats and to enable continuous threat detection, prevention and remediation — of both known threats and zero-day exploits. The good news is that there are now several OT-centric industrial cybersecurity solutions developed in recent years that are designed to leverage automation coupled with AI and machine learning in order to provide operators with actionable intelligence on their critical ICS assets in near real time. Many of these security solutions also operate in passive mode, which is a crucial element for mission-critical and safety-critical systems; in other words, the security solutions should not have the potential to have any harmful impacts to the availability, performance or integrity of the ICS ecosystem.

Modern cyber-attacks require modern solutions. Organisations that try to defend against the growing sophistication of the cyber-threat landscape using manual efforts will find themselves at a significant disadvantage against very determined threat actors. Security automation tools should be leveraged whenever possible to help ensure a strong security posture for the ICS infrastructure and increase the chances of defeating threat actors and their often-devastating attacks. When it comes cyber-attacks, automation is the ultimate equaliser.



*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.*



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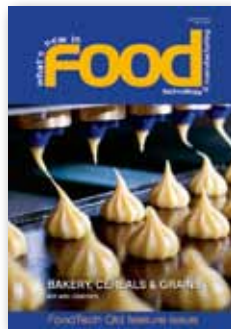
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