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ON THE COVER

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Food production is a matter of trust, and hygiene is the number one priority in the manufacturing process. Success is determined by both the reliability and the efficiency that make flawless production possible — whether during bottling, container filling or CIP cleaning. This makes it all the more important for plant operators to be able to rely fully on the measurement technology employed. Level and pressure sensors from VEGA have made a name for themselves over many decades for their reliability and longevity. VEGA completes its measurement technology portfolio for food production with two new compact instrument series, consisting of pressure sensors and level switches. The VEGABAR and VEGAPOINT product families prove that automation can be both simple and highly efficient at the same time, without compromising on dependability, hygiene or accuracy. The new measuring instruments are perfectly tailored to standard applications that still demand the highest quality. Their standardised hygienic adapter system provides the flexibility needed to reduce and keep installation work and parts inventory at a minimum. The process fittings can be selected as needed and adapted to local requirements.

Due to the all-round switch status display, all sensor states can be visually discerned from any direction. The colour of the illuminated ring — which can be customised from over 256 different colours — remains clearly visible, even in daylight. At a glance, the user can see if the measuring process is running, if the sensor is switched or if there is a possible malfunction in the process.

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FROM DICKENS TO THE JETSONS

FORGET THE CRYSTAL BALL

Glenn Johnson, Editor



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Predicting the future of manufacturing gives analysts something to do, but only the nurturing of talent and flexibility can truly create a future-ready enterprise.

Predicting the future has always been fraught with danger (and risk of embarrassment), as hindsight shows. But, when it comes to 'smart manufacturing', there is no shortage of future prediction going on at the moment.

While advances in technology, particularly around the Internet of Things and AI, have been held up as changing the world of manufacturing in the future for some years now, the 'real' external world outside the world of automation is also having an impact on how we see the future of automation panning out.

As the mysterious Chinese philosopher Lau Tzu pointed out in the 6th century BCE: "Those who have knowledge don't predict. Those who predict don't have knowledge."

Sorting through the 'chicken entrails' of IIoT, digitisation, big data analytics, artificial intelligence and machine learning, and trying to combine them with the dice-rolling of economic prediction in a post-Trump global market, is difficult. However, the crystal ball gazers are ever present, and when it comes to smart manufacturing, they have been promising a lot of change — at least certain types of change.

In thinking about this article, I have read a number of recent white papers about future manufacturing. These tend to be produced, not by people in the industries they discuss, but by industry analysts in their city offices, looking from afar at the "global landscape" with the eyes of an all-seeing deity it would seem.

So let's have a look at what they are saying.

Mass customisation

This one has been a big topic ever since the idea of 'batch size 1' was proposed some years back. While it is difficult

to expect totally individual single-item batches happening tomorrow, most prognosticators are predicting that within the next 10 to 15 years, factories and plants across multiple sectors will be "high-tech engines of mass customization, able to respond quickly and effectively to changing customer and market demands"¹.

Here is another quote:

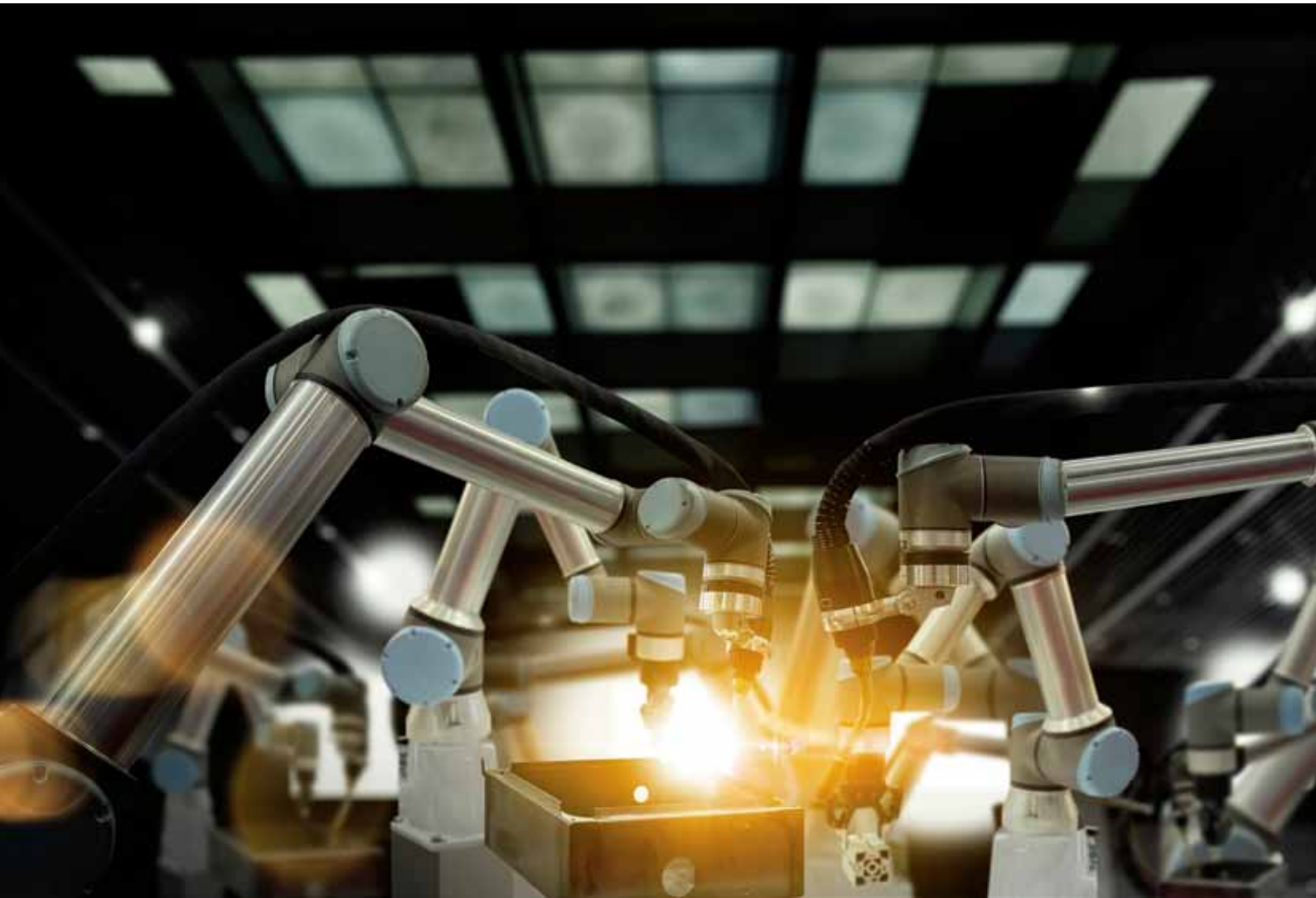
"Highly automated and information-intensive, the factory of tomorrow will look like an integrated hardware and software system. This system will be fuelled by vast quantities of information from every corner of the enterprise and beyond, moderated by analytical systems that can identify and extract insights and opportunities from that information, and comprised of intelligent machines that learn, act, and work alongside highly skilled human beings in safe and collaborative environments."

As no doubt the readers of this publication all know, this statement seems to be based on a particular image of a 'factory' that someone might have if they had never stepped into one — and perhaps only one kind of factory: one that makes discrete manufactured solid objects.

But a 'factory' could be making 'objects' from automobiles to smartphones to plastic toothbrushes or children's toys — or anything from medicinal tablets to biscuits or beer. Or maybe it is a continuous process plant processing petroleum or gas, crushing rocks and refining ore, or creating the plastics needed for the cars, toothbrushes and toys. After all, they are all part of the economy and supply chain in the world of manufacturing. And these different industries have different relationships to 'big data' and are impacted by external forces, each in different ways.

Or there's this quote from the same authors:

"Today's image of manufacturing as a dark, dirty, and unattractive place to work



will give way to a bright and exciting new reality. This reality is in the early stages of formation today as trends such as connectivity and networking, information and process digitization, advanced analytics and computing, and new models of production like 3D printing take hold and play out.”

It looks like we’re moving from the Victorian world of *Oliver Twist* to the robot-served world of the *Jetsons* (bright and exciting flying Ubers notwithstanding).

Autonomous factories

Writers from within the automation industry take a different tone. Recently we published an article by ABB on what would be necessary to create an autonomous plant, operating in much the same way as an autonomous vehicle.

In ‘The road from automation to autonomous systems’², the author describes the first step to autonomy as being ‘autonomous engineering’, in which it is first necessary for a plant or processing system to have the ability to make adjustments to its own configuration in real time. Only then can autonomous control be possible, eliminating human error, by replacing what are now human operational decisions with those activated by artificial intelligence.

However, the vision of an autonomous factory of the size we see today seems a fair way off: the sheer complexity of a plant such as an automobile factory will mean the need for some rethinking of how manufacturing plants operate now.

Federated manufacturing

The Frost & Sullivan report quoted above actually proposed the concept of federated manufacturing, based on “the establishment of so-called micro-factories that, for example, will enable significant levels of personalization using 3-D printing and digital manufacturing techniques”.

Taking advantage of today’s more networked social and business environment, federated manufacturing implies a move away from the centralised operations of today towards an on-demand manufacturing model. Manufacturers will find ways to shorten the production and delivery cycle, removing the need for large centralised manufacturing facilities.

There are already examples of federated manufacturing beginning to occur. One example found in the literature is the small automotive manufacturer Local Motors. The company describes itself as “a ground mobility company focused on shaping the future for the better...with a belief in open collaboration and co-creation”. As far back as 2007, the

company “began low volume vehicle manufacturing of open-source designs using multiple micro-factories”.

A viewing of the company’s website speaks for itself³, with a Guinness World Record-breaking rally car, an autonomous mini-bus (known as Olli, already operating in Glenelg, South Australia), a Domino’s Pizza delivery vehicle and custom-built military vehicles among the list of the company’s achievements. Through micro-manufacturing, Local Motors gets its products to customers up to 24 times faster than traditional manufacturing processes.

According to realityweb.com, there is already evidence of changes to operations and maintenance models that will enable federated manufacturing⁴.

“More original equipment manufacturers (OEMs) are exploring or migrating to hardware as a service (HaaS). With HaaS, the OEM leases the industrial machinery to the manufacturing plant and services its own equipment.”

With the ongoing reduction in the cost of connectivity, storage and computational power, machine learning is being applied to data derived from machine sensors, detecting anomalous behaviour, and allowing the HaaS OEM to provide the necessary pre-emptive maintenance to their hardware on



TAKING ADVANTAGE OF TODAY'S MORE NETWORKED SOCIAL AND BUSINESS ENVIRONMENT, FEDERATED MANUFACTURING IMPLIES A MOVE AWAY FROM THE CENTRALISED OPERATIONS OF TODAY TOWARDS AN ON-DEMAND MANUFACTURING MODEL.

the manufacturer's site. Automated machine learning through AI enables these companies to scale their operations to many machines at many sites.

Global economic influences

Surveys on the subject of federated manufacturing seem to indicate that many believe that such Industry 4.0 manufacturing models will lead to a slowdown in the trend towards relocating to low-wage countries; however, in a rapidly changing and increasingly interconnected global market this may not be the case. The reality today is more complex than a simplistic east/west dichotomy.

In an article for *Forbes* in 2018, Marco Annunziata⁵ wrote of the change in global markets over the last 20 years:

"In 1995, advanced economies accounted for about 60% of global GDP, and emerging markets only 40%. Those shares have now reversed: emerging markets today make up more than half of the global economy. Global trade helped them lift hundreds of millions out of poverty and create a middle class; the process supported stronger economic growth across the globe."

The traditionally more protectionist behaviours of large economies like China have now influenced other advanced economies to retaliate in kind, most notably the United

States. In addition, the changing market demographics are having an influence. In 2018, banking executive Peter Wong wrote an article in the *South China Morning Post*⁶ that compares the growth of the middle class in Asia to the post-World War II growth of the middle class in the West:

"By 2030, it is forecasted that two-thirds of the global middle class will be living in Asia. In contrast, North America and Europe will together account for only a fifth of the world's middle-class population, down from more than half in 2010." If a disruption in the growth of the Asian middle class should occur, both mature and emerging markets could be detrimentally affected.

Preparing for the future

As a result of these global forces, pragmatic business leaders need to take practical steps to adapt to the changing world economic landscape, and cushion their businesses from economic shocks. Modern automation technology and emerging concepts like federated manufacturing may provide the necessary agility that businesses need:

- Federated manufacturing, supported by additive manufacturing processes and the IIoT, will allow companies to operate efficiently at smaller scale, gaining flexibility in how they localise production.
- In larger markets such as Europe and the US, companies can build local supply chains, better nurturing domestic business relationships.
- Digital twin technologies can help companies better manage not only their plants, but also their supply chains, even being able to simulate disruption and better prepare for shocks.
- Countries with strong education and training programs, and an immigration policy that attracts talent, will have a competitive edge — something that Australia needs to remedy in short order. The nurturing of talent is an imperative now to prepare for the future.

Albert Einstein once said: "I never think of the future, it comes soon enough." However, while the ivory tower prognosticators wax lyrical about a Jetsons future, there must be a middle ground that needs to be found.

The future cannot be predicted, because it doesn't exist except as ideas. And while it has always been true that the most flexible tend to weather any storm, now more than ever, planning for flexibility and agility would seem to be the first best option — and investing in emerging technologies in automation and process control may well be the recipe needed to do it.

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WET GAS SENSOR FOR FCI ST80 FLOWMETERS

Fluid Components International (FCI) has announced an optional wet gas MASSter sensor for the ST80 Series flowmeters to deliver accurate, repeatable gas flow measurement in the presence of moisture and condensation droplets.

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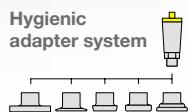
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Hygienic adapter system



IO-Link



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Wireless pressure gauges prevent toxic gas release at chemical plant

Toray Fine Chemicals (TFC) in Chiba, part of Toray Industries, is the only plant to produce DMSO (dimethyl sulfoxide) and polysulfide polymer in Japan, and also produces acrylic polymer.

Wastewater discharged from the plant's manufacturing processes is biologically treated at the plant's wastewater treatment plant before being released to public water bodies. A typical blower used in a wastewater treatment process is an aeration blower that sends oxygen into the aeration tank. At TFC there are also six blowers that are used for biological treatment equipment other than general aeration tanks.

The operation state of the six non-aeration blowers was monitored continuously by using the on/off signal from the control circuit as a signal to the monitoring system. Like aeration blowers, if these blowers are stopped, the supply of oxygen is stopped. Once the supply of oxygen is stopped, the processing of waste liquid sludge becomes anaerobic and toxic hydrogen sulfide and phosphorous is generated. Therefore, when the blower stops abnormally due to some fault, it is critical to restore oxygen supply immediately to avoid toxic releases.

In the case of an aeration blower, early detection of a malfunction of the blower is possible by the monitoring of pump operation and trend monitoring of the dissolved oxygen in the aeration tank. However, for the six blowers in the biological treatment facility, it was difficult to detect a malfunction as the blowers could only be monitored through manual rounds.

Three continuous monitoring methods can help to detect blower malfunction due to breakage or detachment of a drive belt: monitoring load current (power), monitoring of the blower discharge flow rate and monitoring of the blower discharge output pressure.

The monitoring of load current required significant rework — such as adding new measurement equipment into the existing control panel and other related installations — to send output back to the operator station. Monitoring of blower discharge flow rate would have required large-scale construction work to install a flowmeter for the discharge

pipework with a large diameter. On the other hand, continuous monitoring of the discharge pressure of the blowers using the existing process connection pressure gauge was seen as a more viable option.

Choosing the third option, TFC installed Rosemount wireless pressure gauges — replacing the existing mechanical pressure gauges — to measure the discharge pressure of the blowers. Previously, it was difficult to detect malfunctions, as there was only the on/off status monitoring of the blower or periodic manual rounds in which visual inspection was necessary to detect any detached or broken belt. With WPG, the discharge pressure was continuously monitored at the operator station with minimal manual rounds and the early detection of blower malfunctioning is now possible.

With continuous monitoring and trending of blower discharge pressure, TFC is now able to prevent the generation of toxic gas by early detection of blower malfunctions, which would impact the supply of oxygen to the biological treatment facility. Blower discharge pressure trending can also be used to detect and confirm membrane clogging issues. The Rosemount wireless pressure gauge utilises piezoresistive sensor technology to deliver reliable pressure readings, and the large 4.5" gauge face also provides easy field visibility.

Using wireless gauges meant that the total instrument and installation costs were reduced by approximately 50% when compared to wired instrumentation. There was no additional mechanical gauge needed for field checks, and there were no more mechanical gauge failures due to high vibration of the blower, hence the measurement was reliable and maintenance-free.

"With the Rosemount wireless pressure gauges, we were able to prevent the wastewater treatment capacity from decreasing by 13% for every blower failure, and therefore avoid the loss of about 450,000 yen per day," said Takashi Kuroda, of Toray Fine Chemicals.

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BREAKING DOWN BUSINESS RISKS THROUGH MACHINE HEALTH VISIBILITY

When it comes to managing risk in an industrial business, many consider damage through natural disasters and fire or explosions to be of great concern, because they can cost a company dearly. But there are common interruptions such as machinery breakdowns that are often overlooked and, who says that these don't cause any fires or explosions themselves?

In the Allianz Risk Barometer 2019 global report, the impact of business interruption (BI) was identified as the major risk for companies. According to the report, 37% of responses ranked BI as one of the most important risks companies face. In terms of the type of BI feared the most, 28% of respondents said machinery breakdown was of great concern. What was alarming is that the average cost of machinery breakdown to a business was reported to be €540,000. This is money businesses can't afford to lose, especially in the current economic environment.

With a lens into manufacturing, managing machine health is an effective way to reduce company risk. Before the advent of Industry 4.0, machine maintenance had primarily been reactive or preventive. The Industrial Internet of Things (IIoT) has introduced better ways for production and maintenance staff to make the most of their machines. Both teams have disparate goals, with production looking into maximising uptime, while maintenance plans and executes what deems to be necessary downtime, which has proven quite costly and not always necessary to the business.

The ways many manufacturers have managed their maintenance haven't changed for a long time, but now there is an opportunity to drive higher rates of production and reduce BI risk.

In an ideal world, manufacturers want machines to run longer, but there are numerous risk factors that can impact an operation. This includes efficient uptime and downtime of equipment, reducing unpleasant BI surprises and navigating the loss of production through outdated maintenance practices. The evolution of Industry 4.0 has been the cornerstone in transitioning equipment maintenance to continuous condition monitoring so that machines are serviced only when needed and a higher production throughput is guaranteed.

With continuous condition monitoring, staff can see how hard the equipment is working and understand the impact on the health of their machines. It also helps to reduce the BI risk, alleviating the concerns of production, operations and other stakeholders involved, increasing the certainty around customer deliveries.

Production, operations and maintenance managers should be the main stakeholders in discussions around IIoT because they represent the teams responsible for keeping everything running. Conversations around machine health visibility are key — these teams need access to the data behind their machine



performance, to inform important decisions on when to interrupt business production or keep pushing their equipment to maximise business revenue. The ultimate benefit of understanding machine health is that production, operations and maintenance teams can potentially drive higher revenue through continuous production, which then becomes a revenue enabler on its own.

Manufacturing is a competitive industry by nature, but in organisations where teams often work in silos to deliver the best results for the business, establishing trust among divisions brings a number of challenges.

Relationship building tends to get overlooked due to the fast pace and constant pressure in the manufacturing environment; there is little room to work on it when you're constantly at the mercy of repairing unplanned downtime.

IIoT empowers staff with knowledge from real-time equipment monitoring, so they can engage maintenance when and where needed. Because both production and maintenance operate with the same reliable (and shared) data, they can see what action is really needed and make informed decisions on downtime — building further trust while maintaining visibility within the business. It also provides peace of mind knowing machines can run harder and longer for continuous production.

Garnering and maintaining the customer's trust is equally important and using IIoT data helps to drive more production certainty so that your customers know you can deliver; it helps secure your commitment to your clients and the confidence of your customers who rely on your products.

Continuous condition monitoring powered by IIoT isn't new but it's still in its infancy. It's helping many manufacturers in transitioning to a new way of maintaining their machines and business health. While technology is 'easy' to change, getting the support of staff to understand the value of IIoT and its BI reduction potential requires a paradigm shift, which is never as easy. It is, however, achievable through creating the right conversations with the right stakeholders who are willing to solve their most pressing business challenges, together.



Brad Parsons is the CEO and Founder of MOVUS. Brad spent 25 years in a corporate career which spanned national and global positions in organisations including Aurizon, Flight Centre, News Limited and Multiplex. Prior to starting MOVUS he worked on automation blueprints projects for BHP and Aurizon. His inspiration for MOVUS came from a strategic condition monitoring program which he worked on for Sydney Trains.

IP69K SAFETY LIGHT CURTAINS

Schmersal has released the SLC/SLG440 IP69K range of IP69K safety light curtains and light grids. Suitable for use in hygiene-sensitive sectors including food, pharmaceuticals, meat and milk processing, the range is resistant to all daily cleaning processes prevalent in such industries.

Its design protects against ingress of water during close-range high-pressure and high-temperature spray. Based on strict requirements, the seals of the SLC/SLG440 series can withstand frequent cleaning with water, alkali solutions, foam, hot steam or high-pressure jets.

The SLC/SLG 440 IP69K locking caps are manufactured in stainless steel (V4A) as are the cable inlet and the fastening parts. Transparent protective tubes are made of polycarbonate, offer high resistance to cleaning agents and can withstand strong mechanical loads. If spray lances should accidentally strike the SLC/SLG 440 IP69K's enclosure during pressure washing in food production or there is impact with the enclosure, the safety and protection function will continue to work due to the robust protective tubes.

The SLC440 IP69K range is available in lengths from 170 to 1920 mm and two resolutions of 14 and 30 mm, and as 2, 3 and 4 light beam grids. They are suitable for use in safety circuits up to PLe (EN 13849) or SIL3 (IEC 61508).

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The ECD Triton DO82 optical dissolved oxygen analyser is a solution for long-term dissolved oxygen measurements in wastewater aeration basins, aquaculture and all types of environmental water. The DO82 optical dissolved oxygen sensor uses fluorescence quenching to determine the oxygen concentration in water. The use of this optical method minimises maintenance, increases reliability and improves the long-term accuracy of the measurement in demanding municipal waste water and industrial wastewater applications.

The DO82 sensor is unaffected by changes in the flow, pH or conductivity of the sample and there is no need to replace or service membranes, electrolytes or anode/cathode assemblies required for other sensors.

A long-life membrane cap provides years of service, and there is no required annual membrane replacement. It is also easily replaceable if physically damaged.

The system is available with a waterproof fixed or detachable cable, as well as hand rail-mounted immersion assemblies, flow through cells and automatic spray cleaning systems.

The analyser interfaces directly with any T80 Transmitter, offering 4–20 mA with Modbus RTU or HART Communication, relays and timers.

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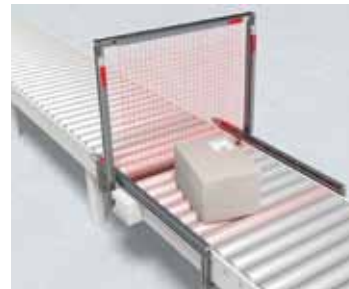
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3D CONTOUR MEASUREMENT SYSTEM



The CMS 700i 3D contour measurement system is based on Leuze's CML 730i measuring light curtains and can be adapted to specific customer requirements. The complete system includes all components, the switch cabinet,

fastening elements and connection technology under one part number. The CMS 700i meters the contour and position of passing objects regardless of their shape and surface structure. Even flat objects such as polybags can be precisely and economically detected without complicated camera installation.

The minimum dimensions for height, width and length are 5 x 50 x 50 mm. The object information can, for example, be used to optimise the load on a pallet or to optimise the incoming goods. At the same time, deformations or protrusions of the object that might cause problems or downtime when warehousing are automatically detected.

The Ethernet TCP/IP or Profinet interface ensures speedy integration of the 3D contour measurement system. The system can collect peripheral data, such as from scales or barcode scanners, via an open Ethernet interface and pass it on with a timestamp.

Leuze electronic Pty Ltd

www.leuze.com.au

POINT LEVEL INSTRUMENTS

Endress+Hauser has released the Liquiphant FTL51B and FTL41 vibrating fork (vibronic) level instruments. The FTL51B features Industry 4.0 and IIoT capabilities, including access via wireless Bluetooth technology, and automatic proof tests and verification. Operational status is provided by a high-visibility LED.

The Liquiphant FTL51B can be used in storage tanks, containers and pipes for point level detection of all types of liquids. The instrument's vibronic sensor is not affected by changing media properties, flow, turbulence, gas bubbles, foam, vibration or build-up. The instrument works in process temperatures of -50 to 150°C and pressures up to 1450 psi (100 bar). It can be used in SIL2 and SIL3 hazardous locations, and has built-in automatic maintenance and verification functions.



The more economical, general-purpose FTL41 is similar to the FTL51B but works at lower pressures — up to 580 psi (40 bar) — and with a narrower temperature range of -40 to 150°C.

Both perform proof tests, with the FTL51B meeting SIL and WHG (Water Resources Act) requirements. Tests can be activated remotely at a control system or locally via a magnet or push-button test. The proof test diagnoses the sensor for corrosion and build-up, and ensures the entire instrument is operating properly. Verification can be activated either manually or automatically via Endress+Hauser's Heartbeat Technology, providing a verification report sufficient as documentation for various regulatory agencies.

Access via Bluetooth technology and a mobile device allows a user to identify each device, commission it, check the status, start a proof test and download verification documentation.

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INSTRUMENTATION & SENSORS

8-PATH ULTRASONIC GAS FLOWMETER



Emerson has introduced the Daniel 3418 eight-path ultrasonic gas flowmeter, which delivers accurate flow measurement in natural gas custody transfer applications with reduced upstream piping requirements and without flow conditioning. The Daniel 3418 compensates for flow distortions that result from pipe bends, shorter straight runs or smaller design footprints, allowing it to operate in more design configurations without sacrificing accuracy and long-term performance.

The 3418 has passed all perturbation tests for OIML R-137 Accuracy Class 0.5 with only five pipe diameters in front of the meter and without a flow conditioner. It features eight interlocked direct chordal paths, positioned as two British Gas path layouts where the second is the mirror image of the first, allowing the meter to cancel out asymmetrical velocity effects. This design enables the meter to measure flow with greater resolution and accurately calculate swirl, reducing the need for flow conditioning and long upstream piping configurations.

As a part of the Daniel Gas Ultrasonic product line, the 3418 features the ability to calculate standard flow and directly integrate with temperature and pressure transmitters, gas chromatographs and flow computers while providing real-time meter and process diagnostics. The 3418 uses Emerson's proprietary MeterLink diagnostic software with specific enhancements designed to mimic the look and feel of the original Daniel four-path gas ultrasonic meter interface.

Emerson Automation Solutions
www.emerson.com/au/automation

SPINDLE MONITORING SYSTEM

Schaeffler has introduced its SpindleSense spindle monitoring system to Australasian industry to optimise machine tool uptime and performance.

Schaeffler Australia says the main spindle is crucial to the performance capability of the complete machine tool used to cut and shape metal and other materials. The spindle bearing support is one of the most heavily loaded components because it must transmit machining forces precisely at very high speeds for long periods of time and the risk of collisions can never be ruled out. The majority of machine tool downtimes can be traced back to defective spindles, particularly as a result of collisions and continuous, undetected overloads, according to Schaeffler.

The SpindleSense monitoring system is designed to provide electronic protection against continuous overload and collision damage, and utilises a sensor ring that monitors displacement of the spindle bearing with micrometre precision. Measurement of displacements, in combination with Schaeffler's expertise in rolling bearings, enables assessment of the operating conditions and detection of critical operating conditions within 2 ms.

All of the software and the required algorithms are integrated into the 16 mm-wide sensor ring. No further components are required for the system. The system is locally functional and transmits an individual warning signal to the machine's control system, which makes it possible to detect a collision within 2 ms — minimising subsequent damage — and to provide long-term protection for machine tool spindles.

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ABB has expanded its digital analytical measurement range of solutions with the launch of the AWT420 transmitter. The 4-wire, dual-channel analytical transmitter measures multiple parameters in a single device, optimising process performance for water usage and treatment.

Capable of measuring multiple parameters including pH/ORP, conductivity, dissolved oxygen and turbidity, the AWT420 is said to be versatile and user-friendly.

The product offers interchangeable communications and sensor modules enabling the transmitter to be upgraded as required without having to purchase additional units. Modules for HART, Profibus, Modbus or Ethernet communications and ABB's digital EZLink pH/ORP, conductivity, dissolved oxygen or turbidity sensors are available.

Each pluggable module is factory calibrated and can be removed and exchanged via the transmitter's hinged door, allowing fast upgrading in the field. The transmitter's intuitive interface, simple set-up menus and one-button calibration routine also eliminate the need for specialist installation or commissioning expertise.

Additional operational flexibility is provided by the transmitter's dual-channel design. Users can opt for analog or digital sensors or a mixture of the two. The inclusion of integrated PID enables the transmitter to provide direct or reverse acting control. In pH applications, this function can also be used to provide dual acid/base control.

The transmitter's easy-to-navigate, full-colour TFT display means sensor data can be quickly located and viewed in situ via the device's display or saved onto an internal SD card for analysis using ABB's DataManager Pro tool. The inclusion of Bluetooth technology also enables access via a smartphone using ABB's EZLink connect app.

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GAS FLOW MEASUREMENT

WHAT YOU DON'T KNOW CAN BE VERY EXPENSIVE

Art Womack, Senior Engineer, Fluid Components International

Inaccurate or inconsistent measurement of air and gases can result in serious accidents, emergency shutdowns, unplanned maintenance or production slow-downs.

There are six to eight viable air/gas flow measurement technologies on the market today, but only about half of them are suitable for the heavy-duty metering applications found in the most challenging chemical plant processes.

Each of them has its own strengths and weaknesses, depending on exactly what needs to be measured, the required accuracy, where it needs to be measured, etc.

The truism "knowledge is power" definitely applies when it comes to choosing an air/gas flow meter for measurement tasks in chemical plants. The same flow sensing technology that you choose for one application in your plant is quite possibly the wrong choice in a different application that can even be in close proximity.

The cost of choosing the wrong flow meter in terms of extra maintenance, repairs and spares in large chemical plants can add up quickly to tens of thousands of dollars alone. If safety events or poor product quality or a production slow-down or environmental

compliance issues occur, then the cost of failing to recognise the subtle differences in air/gas flow measurement technologies can be punitive.

Common measurement applications

Flow meters are used to measure air/gas flow rate and totalised flow. Due to the hazardous operating environment of chemical plants, air/gas flow meters generally require hazardous area approvals and often must be SIL compliant as part of a safety instrumented system (SIS) in many applications. Four of the most common and the most demanding air/gas flow measurement applications in chemical plants are gas distribution metering, flaring systems, tank blanketing and flue gas monitoring.

Gas distribution metering

Many chemical processes require large varying volumes of specific gases, such as nitrogen, argon and oxygen for inert ion or



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purging or blanketing; hydrogen is required as a catalyst and other specific gases are used as well. The accurate measurement of these gases is necessary for process control, gas inventory control and cost management.

Flaring systems

In petrochemical production, refining and storage, flare gas systems are used to burn off and dispose of waste, excess or off-gases and as a safety system (Figure 1). The accurate, responsive and reliable measurement of flare gas is essential in order to assure proper operation of the flare gas system, which protects people and equipment from hazardous combustible gas to maintain a safe working environment and to avoid environmental contamination.

Tank blanketing

Nitrogen blanketing is used in the chemical and petroleum refining industries to reduce the hazards associated with flammable

liquids, which supports plant safety and can help increase productivity. Blanketing or padding is a process of applying inert nitrogen gas to the vapour space of a tank or vessel (Figure 2), which minimises the possibility of an explosion or fire by reducing the oxygen content or the concentration of flammable or explosive vapours.

Flue gas monitoring

Measuring the output of chemical plant waste gases through large stacks or flues with scrubber systems for environmental compliance requires multiple air/gas flow sensors, placed in strategic locations (Figure 3). Stack continuous emission monitoring systems (CEMS) must meet various international and national emission standards.

Air/gas measurement challenges

Accurate, dependable gas flow measurement applications present challenges to chemical industry plant, process and instrument engineers. The following issues require careful attention when choosing a flow meter sensing technology:

- **Low and high flows:** Sensitivity to low flow conditions is required to identify and measure leaking valves and the normal low flow associated in day-to-day operations. The capability to measure very high flows is needed during system upset conditions requiring a meter that needs to measure flow accurately over an extremely wide turndown range.
- **Meter calibration:** The calibration of flow meters specifically for hydrocarbon composition gases and matching to actual process conditions is essential.
- **Large line sizes:** As pipe sizes increase, the number of effective and suitable flow meter sensing technologies decreases.
- **Available straight-run:** All velocity-based flowmeter technologies have pipe straight-run requirements upstream and downstream from the meter in order to achieve accurate flow measurement. These straight-run requirements may not be available in crowded production sites and process plants.
- **Limited access:** Access to piping for installation, maintenance or servicing is frequently difficult. For example, spool-piece flowmeters can require prolonged process shutdowns and extensive on-site labour costs to install and continuously maintain the system, as opposed to insertion-style meters that can be easily inserted into or retracted out of the process through a ball valve.
- **Agency approvals:** When installing meters in hazardous (Ex) locations, the entire flow metering instrument should carry agency approval credentials for installation in environments with potential hazardous gases; enclosure-only ratings are inadequate.

Major gas measurement technologies

There are two basic types of flowmeters: liquid and air/gas. Liquid is primarily measured in terms of volumetric flow, while air/gas is a mass flow measurement because of the unique properties of gases (versus liquids). While some volumetric technologies can

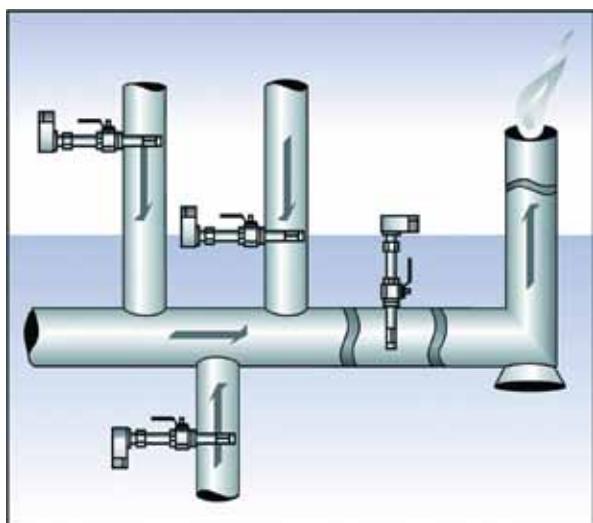


Figure 1: Flaring system.

measure air/gas flow rates, there can be problems with totalised flow. Generally, the best choice is mass flow sensing technology when measuring air/gases — especially in critical applications.

Coriolis

The principle of operation for Coriolis flowmeters relies on a vibrating tube where the flow of a fluid causes changes in frequency, phase shift or amplitude, which is proportional to the mass flow rate. Coriolis meters are highly accurate and frequently used in custody transfer applications, but they are on the expensive side and require labour-intensive inline installation.

Differential pressure

DP meter sensors come in several designs, including orifice plates, pitot tubes and Venturis. The typical DP meter designs requires the fluid to move through or past two points of reference, creating a differential pressure rate that is equivalent to the rate of flow using the Bernoulli equation with some modifications. If the air/gas or fluid is dirty, there can be orifice clogging issues that require frequent maintenance in order to maintain accuracy.

Ultrasonic

Flowmeters designed with ultrasonic flow sensing technology rely on ultrasound and the Doppler Effect to measure volumetric flow rate.

In ultrasonic flowmeters, a transducer emits a beam of ultrasound to a receiving transducer. The transmitted frequency of the beam is altered linearly by particles or bubbles in the fluid stream. The shift in frequencies between the transmitter and receiver can be used to generate a signal proportional to the flow rate.

Optical

Flow meters designed with optical sensing rely on laser technology and photo-detectors. This technology requires the presence particles in the gas stream. These particles scatter the light beam and the time it takes for these particles to travel from one laser beam to the other laser beam can be used to calculate the gas velocity and volumetric flow rate. These meters have good accuracy and wide turndown, but are traditionally expensive.

Thermal dispersion

Flowmeters with thermal dispersion sensors provide direct mass flow measurement. Two thermowell-protected platinum RTD temperature sensors are placed in the process stream. One RTD is heated while the other senses the actual process temperature. The temperature difference between these sensors generates a voltage output that is proportional to the media cooling effect, and can be used to measure the gas mass flow rate without the need for additional pressure or temperature transmitters.

Flowmeter calibration

In measuring flow accurately, second only to selecting the proper flow sensor is the method of calibration. There are two methods used in calibrating air/gas flow meters:

1. The Direct Method, where the meter is calibrated to a specific pure process gas or to the actual components of a mixed gas in use.
2. The Air Equivalency Method, where the meter is calibrated using air and then the calibration is adjusted with a predefined correction factor.

It is important to ask your supplier about the method of flowmeter calibration. You should know if manufacturers contract out and with whom, or if they operate their own calibration laboratory with direct method calibration test stands and equipment traceable to NIST and ISO/IEC 17025.

Installation considerations

When choosing an air/gas flowmeter technology, two of the most important criteria to consider are the location and the manufacturer's installation requirements. Most flowmeter technologies require a stable fluid flow profile upstream and downstream from the point of meter installation; a specific number of pipe diameters in each direction. Flow sensors are potentially sensitive to swirling air/gas conditions in the pipe, or pressure drops (turndowns) or flow surges.

In many cases, irregular flow issues can be solved with flow conditioners. There are various types of flow conditioners that can be inserted strategically in the pipe to 'straighten' the flow before it reaches the flow sensor. They consist of tabs or honeycombs or vanes or other designs, which all straighten the flow.

There are two ways to install a flowmeter: inline or insertion. Inline

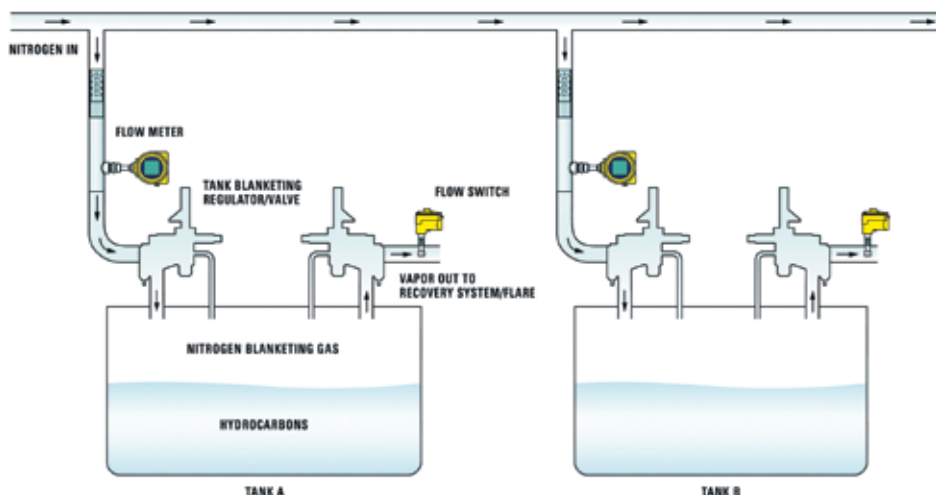


Figure 2: Tank blanketing.

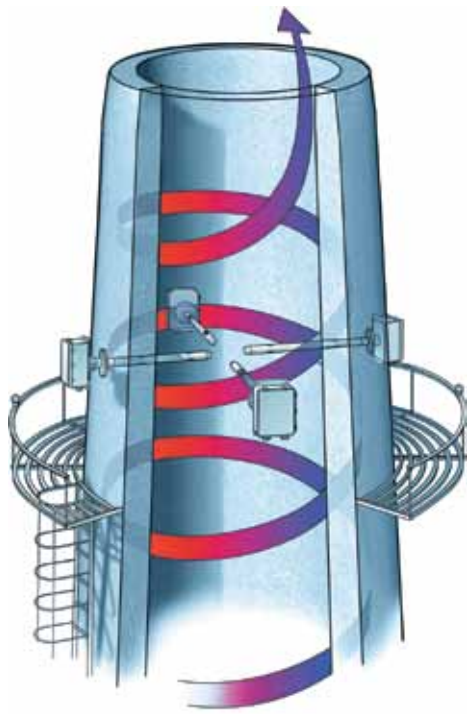


Figure 3: Stack gas monitoring system.

flowmeters must be installed horizontally inside a section of the pipe. Insertion flowmeters are top mounted through a tap point.

Some flowmeters can only be installed using one method. Venturi meters, for example, must be installed inline (inside the pipe). In comparison, thermal meters, some DP meters (orifice plates) and others can be installed in either inline or insertion configurations.

Lastly, when considering installation requirements, some flowmeter technologies rely on direct mass flow sensors. Other flowmeters infer mass flow and require pressure or temperature sensors to be installed nearby along with transmitters, which can add to their cost and installation complexity.

Maintenance requirements

All flowmeters require maintenance. Some meters, however, require more maintenance. The type of air/gas fluid to be measured can have a major impact. Pure process gases in a benign plant environment are generally going to have less impact on a flowmeter than dirty waste gases.

Some meter designs require less cleaning or are easier to clean than others. For example, top-mount insertion-style meters with packing glands can be quickly pulled out of the pipe without shutting down the process and cleaned in place with compressed air and then returned to service.

Conclusions

There are many factors to consider when choosing a flowmeter for application within a chemical plant. A good checklist of considerations would include:

- Accuracy
- Repeatability
- Flow sensor technology
- Calibration type
- Installation requirements
- Maintenance
- Cost

In considering the cost of a flowmeter, there are three crucial factors to think about:

3. The purchase price of the meter
4. The installed cost
5. The lifecycle cost

Stopping your analysis at the purchase price is misleading when it comes to reviewing the true cost of instrumentation — especially flowmeters.

We've discussed the two types of flow meter installation. Insertion configuration flowmeters are simpler to install, which is going to result generally in a lower installed cost versus a flowmeter that is less expensive to purchase though it requires an inline installation.

The last factor to consider is the lifecycle cost. How long does the manufacturer expect the flowmeter to remain in service? Is its life span 5, 10 or 20 years? Over that lifetime, what kind of maintenance will be required? Some meters have movable parts that can break and require repair. Some meters depend on small orifices that tend to narrow or clog in dirty environments, requiring cleaning. These expenses can add up over time, which increases the cost of ownership.

Knowledge and experience with flowmeters is power. The more you know about flowmeter technologies, the better the decisions that you'll make.

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Cobot solution improves tea palletising quality and safety



The global market for tea has been projected to grow by US\$7.9 billion between 2017 and 2022 due to rising trends like premiumisation and the addition of exotic flavours in mature markets, as well as tea's health positioning on a global scale.

Nestlé Suisse SA Orbe, a factory producing tea in capsules under the Special.T brand, addresses this growing trend.

"In the past, this plant, equipped with low- and medium-speed lines, was handling palletising manually," explained Cédric Rey, Fill & Pack Maintenance & Improvement Manager at Nestlé. "As volume and productivity needed to increase, we were looking to use cobotic palletising to avoid repetitive non-ergonomic tasks for operators. We wanted them to handle activities with higher added value."

The team at Nestlé Suisse SA Orbe approached Sidel with its cobotic requirements back in 2017, leveraging the long-standing relationship between the two companies. At the time, Sidel was already working on developing a new cobot palletising solution and was able to take the opportunity to directly embed the customer's requirements into their new program.

Nestlé Suisse SA Orbe was looking to use collaborative robotic palletising, an innovative Industry 4.0 technology. With this in mind, they required a robust, precise and user-friendly cobotic solution, working as an industrial answer to their challenge of pallet stability.

"At our Orbe site, best-in-class pallet quality is absolutely key, as our cases with the tea capsules are very light, long and narrow," Rey said. "This is why accurate case placement on the pallet and tight layers are major requirements to guarantee pallet

stability, avoiding products moving through the complete supply chain, maintaining their full integrity and ultimately ending up in consumers' hands without any damage.

"Additionally, we also needed to ensure the safety of our operators. It was imperative that the same level of safety would be maintained after switching from manual labour to cobot technology, ensuring that the solution is working safely with no fences around it. For us, the user-friendliness of the new cobotic solution was extremely important as well: for instance, an intuitive navigation of its HMI was a must."

Two cobotic palletisers have now been installed downstream after two Cermex SW21 compact side-loading case packers. These CoboAccess_Pal solutions feature an industrial

automation platform based on the combination of PC and PLC.

"This association makes sure the cobot performs better-controlled picking and trajectories, leading to greater pallet quality and stability, instrumental for smooth pallet transportation through the supply chain," said Laurent Cristol, Strategic Account Director Nestlé, at Sidel. "Additionally, they allow for an immediate restarting of the machine in the case of potential problems or emergency stops and, as such, minimise downtime."

CoboAccess_Pal's HMI is well suited to meet the customer's requirement for a user-friendly solution. Based on an intuitive tablet approach to navigation, the HMI facilitates the daily jobs for Nestlé Suisse SA Orbe operators, as they can access standard operating procedure (SOP) and maintenance sheets for easier and faster troubleshooting and root cause analysis. Sidel made sure to get the safety of the CoboAccess_Pal objectively validated by Apave in addition to the equipment's full compliance with European Machinery Directive 2006/42/EC.

The system always performs case handling above the conveyor or the pallet station, which ensures that cases never fall on the floor, therefore maximising protection.

"CoboAccess_Pal is also extremely easy to install, said Cristol. "At the factory in Orbe, it took one week including commissioning time; plus it can be easily moved between lines in less than 10 minutes."

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SURGE RELIEF VALVES AND SKIDS

M&J Valve surge relief valves and skids are designed and manufactured for critical protection against dangerous system pressure spikes and pipeline surges. Pressure surges travel at sonic velocities through the pipeline at speeds of up to 1000 m/s and can cause severe infrastructure damage, loss of product and environmental harm, as well as a significant threat to personnel safety.

For dirty service such as crude, and seawater pipelines, M&J Valve offers nitrogen-loaded surge relief valves, which means they can operate independent of fluid properties. For clean service, they offer pilot-operated surge relief valves. The company has also evolved a patented rate-of-rise surge relief system that not only assists in providing pipeline safety protection, but also overall pipeline system stability.

The M&J Valve solution combines a traditional surge pressure relief valve with a predictive pressure rate-of-rise system to allow pre-emptive action against a developing surge event. The solution utilises a spring-biased reference chamber that imparts a pressure differential across a fixed orifice. The fixed orifice pressure differential is constantly monitored, and upon reaching a preset limit, will trigger the main surge relief valve to open. As the surge dissipates, the valve closes without slamming shut, preventing 'chatter'.

Because it uses no electronic devices, the M&J Valve surge relief system is not affected by power loss, communication disruption or cyber attacks: making it far less vulnerable to external factors. The complete circuit is mechanical and is designed to provide a reliable hydraulic safety barrier against transient pressure surges.

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GENIE GETS A LIFT FROM SEEING AIR LEAKS IN ACTION



Genie is a US company that designs and builds innovative vertical work platforms and material lifts to make working at heights safer and more productive in a whole range of industries.

The business's plant in Redmond, Washington builds material lifts and uses between 1,800 and 2,600 CFM of compressed air each day. That volume of compressed air runs up to 200 torque tools per line and process equipment responsible for moving large sheets of half inch steel and positioning of parts. If the tools don't have enough compressed air pressure to function properly, the results could be costly.

The high cost of low pressure

"If we were to lose pressure on the system we use to vacuum sheets up and transfer them to the laser to be cut, we wouldn't be able to pick up or move the sheets," explained Josh Stockert, Genie Maintenance Supervisor, Terex AWP. "If one sheet misses a transfer, we've lost nearly 20 sheets of cut parts, which could add up to 200,000 parts. If the pressure is too low on our torque tools, we could wind up with mistorqued units."

The more leaks there are, the higher the demand for compressed air. Increased demand for air pressure raises the risk of not being able to supply an adequate amount to all the tools and process equipment that need it.

Compressed air leaks also increase energy costs. According to the US Department of Energy Office of Industrial Technologies, a single 3 mm leak in a compressed air line can cost upwards of US\$2,500 (~AU\$3,600) a year.

Expediting air leak detection

To reduce the risks of low air pressure, Genie is vigilant about finding and fixing air leaks. Some leaks occur in hoses and fittings high up in the rafters; others show up on the torque tools on the shop floor. In the past, during monthly preventive maintenance (PM) operations, Genie dedicated one or two maintenance technicians to hunt for air leaks. The technicians first sprayed joints and hoses with a soap and water mixture to reveal bubbles that indicate leaks. Then they fixed the leaks and retested with soapy water.

"It's very labour intensive," said Stockert. "It might take 30 to 45 minutes to find one leak in the rafters, and then come back down to get material to fix it, go back up and fix the leak, and verify with soap and water that the leak was fixed."

The soap and water method works, but slowly; and it requires a lot of clean-up afterward to prevent slipping hazards. Genie also tried using traditional ultrasonic leak detectors, but found they only detect very high frequency leaks and air leaks can occur at many frequency ranges.

So, when Fluke offered the company a chance to test its Fluke ii900 Sonic Industrial Imager, Genie immediately accepted. The ii900 includes an array of tiny super-sensitive microphones that detect sounds in both the human hearing range (2 to 20,000 Hz), and the ultrasonic range (20 kHz and higher). It allows the user to actually see sound.

Seeing sound

The ii900 applies proprietary algorithms to determine the location of the leak. The results produce a colour SoundMap image superimposed over a visible light image of the equipment to show the exact leak location. The user views the results on a 7" LCD screen as a still image or a real time video.

"Being able to visualise where the problem is and how big it is adds another dimension," said Stockert. "You can identify which threads, fitting, or hose is affected. Being able to pinpoint where the leak is coming from on that image is extremely exciting. You can see different angles and determine 'Yep it's these threads versus that hose that feeds this fitting.'"

Testing during production without disrupting operations

The ability to visually scan large areas from up to 50 m away with the ii900 has expedited leak detection at Genie and significantly reduced the hours of labour spent on that task. "Rather than taking at least an hour...it takes me all of 30 seconds to a minute to find an air leak with the ii900 camera. Some days we can find and repair 30 or 40 leaks in just a couple hours," said Stockert. "Now, we can stand on the sideline and scan the airline overhead, while carts and people are moving underneath. We're not affecting their work, but we can tag the leak and then move a lift to that spot during lunch and fix it rather than having to wait for a weekend PM shift."

Initially, the primary objective for Genie when testing the Fluke ii900 Sonic Industrial Imager was to save energy.

After the initial air leak inspections and corrections, Stockert saw a 25.7% recovery in their compressed air capacity. "We were near the top end of what our compressor system can put out," he said. "By correcting the leaks found using the ii900, one of our four compressors is nearly idle much of the time." The reduction in compressor usage translates to an estimated US\$48,754 (~AU\$70,860) in annual electrical energy savings. However, Stockert believes that there is an additional benefit derived from not having to add more compressor capacity.

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EDGE AI INFERENCE PLATFORM

Neosys Technology's Nuvo-7164GC is described as an edge AI inference platform, designed for advanced inference acceleration applications such as voice, video and image services.

The Nuvo-7164GC supports an NVIDIA Tesla P4 GPU featuring 5.5 TFLOPS in FP32 and a Tesla T4 GPU featuring 8.1 TFLOPS in FP32 and 130 TOPs in INT8 for real-time inference based

on a trained neural network model. In addition, it supports an Intel 9/8th-Gen Coffee Lake Core 8- and 6-core CPU and 32 GB of DDR4-2666 RAM.

As Neosys's cassette and air tunnel design, which guides the intake air flow through the passive heatsink of the NVIDIA Tesla P4/T4, Nuvo-7164GC is capable of effectively dissipating the heat generated by the GPU. This design allows system operation at up to 60°C ambient temperature with sustained 100% GPU loading.

Nuvo-7164GC also incorporates an M.2 NVMe interface that supports disk read/write speeds over 2000 MBps and USB 3.1 and GbE ports for fast data transfer.

The Nuvo-7164GC is designed to be a suitable platform for AI inference, deep learning, autonomous driving, facial recognition and machine vision.

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ROBUST CABLE RANGE

LAPP's ROBUST series consists of cable and connector solutions for power, control and data transmission, as well as bus, sensor and Ethernet connections. Due to their chemical resistance, as well as being highly ozone, UV and weather resistant in compliance with EN 50396 and HD 605 S2, the ROBUST cable range is certified to be suitable for wet cleaning in the food and beverage industry in accordance with ECOLAB, European and North American standards, as well as for outdoor use. In contact with hot steam, they are said to have a service life 10 times greater than normal rubber or polyurethane sheathed cable.

The ROBUST series is suitable for use in the food and beverage industry, machine tool manufacture, the chemical industry, medical engineering, laundries, car wash systems, composting and sewage plants, and agricultural machinery.

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WIRELESS INFRASTRUCTURE MANAGEMENT

Emerson has added two IIoT solutions to its Plantweb Insight data analytics platform that the company says will enable industrial facilities to transform the way they manage their enterprise-level wireless network infrastructure.

As digitalisation and wireless technology adoption continue to rapidly expand in industrial facilities throughout the world, the need for greater visibility of network infrastructure performance is key. The Plantweb Insight applications provide a quick-to-implement, scalable IIoT solution that helps users advance their digital transformation strategies and achieve greater operational efficiencies.

The Plantweb Insight Network Management application provides continuous, centralised monitoring of WirelessHART networks. This application provides a singular, consolidated view of the status of all wireless networks in a facility, with embedded expertise and guidance for advanced network management.

A key feature is a configurable mesh network diagram, providing visualisation of network design and connections along with device-specific information. It also provides an exportable record of syslog alerts, network details outlining conformance to network best practices and more.

The Plantweb Insight Power Module Management application drills down to the device level, allowing facilities to keep their wireless devices appropriately powered so they can continuously transmit key monitoring data. By aggregating power module statuses, users can evolve traditional maintenance planning and implement more efficient and cost-effective practices.

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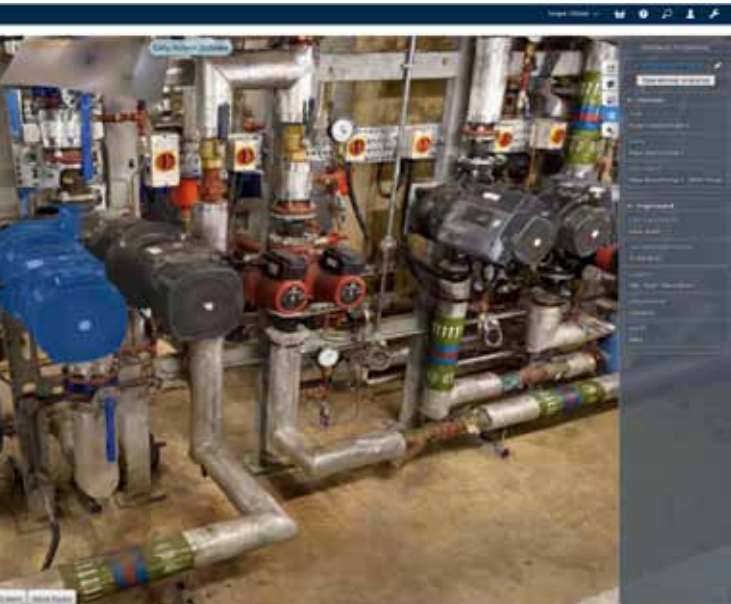
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DIGITAL TWIN SERVICES

Bentley Systems has introduced digital twin services for asset and network performance. AssetWise Digital Twin Services converges digital context, digital components and digital chronology to provide immersive visualisation and advanced analytics for enhanced decision support and improved performance of infrastructure assets. OpenUtilities Digital Twin Services use digital twins for consolidating, validating and aligning GIS, reality modelling, performance, simulation and other enterprise data required to effectively manage assets including power plants, substations and entire networks.

AssetWise Digital Twin Services includes iTwin Immersive Asset Service — providing immersive visualisation and analytics visibility, in a rich, interactive 4D digital twin context; AssetWise 4D Analytics, which uses advanced analytics and machine learning to provide insights into current conditions and trends, and to predict future performance; and AssetWise Linear Analytics, which takes data from many observed sources and aligns it, with engineering fidelity, to location and time on a linear network.

OpenUtilities Digital Twin Services is aimed at energy utilities faced with modernising their ageing infrastructure along with the new challenges of distributed energy resources at the grid edge. OpenUtilities Digital Twin Services consolidate, validate and align ET (engineering technology), IT and OT information including network GIS, reality modelling, performance, simulation and other enterprise data across departmental and workflow silos. OpenUtilities Digital Twin Services enable organisations to identify data quality issues, visualise these issues on a map and resolve issues using smart rules and machine learning. Predefined and user-extensible dashboards and analytics provide insights and visualisation for OpenUtilities digital twins.

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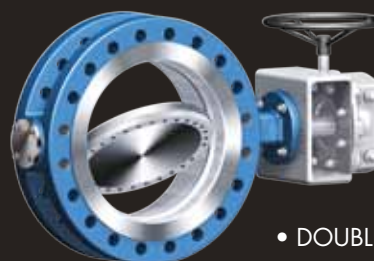
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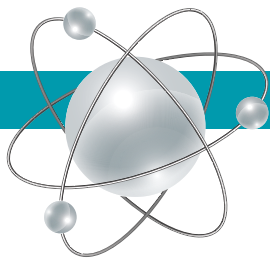


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Researchers develop sensor to test milk quality



Food safety is a critical factor in the food industry, not least in the dairy sector. Here, udder infections can lead to harmful organisms entering the milk, and chemical substances such as antibiotics or pesticides can contaminate the product via fodder or as a result of inadequate control of equipment and storage facilities. In order to prevent adulterated milk entering the food chain, checks are conducted throughout the entire production process and supply chain. Yet these standard tests are expensive and time-consuming. Samples are taken from milk tankers containing a mixture of product collected from any number of dairy farms and then analysed in the lab. If the milk proves to be contaminated, the entire load must be destroyed, with high losses for all of the farmers and dairies concerned. If there were a test with which farmers could check their own milk before it is collected by the tanker, such wastage could be avoided.

In the MOLOKO project (Multiplex photonic sensor for plasmonic-based Online detection of contaminants in milk), 12 partners from seven countries — including one dairy — have devised a fast and inexpensive test for identifying quality factors in milk. In a test lasting around five minutes, a new optoplasmonic sensor analyses the product for a total of six substances, thereby providing a supplementary check and an early-warning system within the supply chain, well before the milk is pumped into the tanker. The sensor is functionalised with receptors for specific antibodies that serve as indicators of various quality and safety parameters for milk. It thereby allows dairy farms to carry out automated, on-site quantitative analyses.

The entire system consists of a re-usable microfluidic chip, organic light-emitting transistors (OLETs) or diodes (OLEDs), a sensor comprising organic photodetectors (OPDs), a nanostructured plasmonic grating and the specific antibodies. The organic photodetector is undergoing development at the Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP, and the microfluidic chip at the Fraunhofer Institute for Electronic Nano Systems ENAS. The OLET, meanwhile, is being developed by CNR-ISMN in Bologna, and the photonic grating by the company Plasmore Srl in Pavia, both in Italy. Coordinator of the project is CNR-ISMN.

“The unique thing about our chip is that it can be re-used,” explained Andreas Morschhauser, researcher at Fraunhofer ENAS.

“The target molecules are stripped from the immobilised antibodies by a regenerating buffer. This means that the antibodies can be re-used for further tests.”

The estimated life of the chip is 100 test cycles. In each test, a total of six parameters relating to contaminants and proteins are measured. For this purpose, Morschhauser and his colleagues have developed a microfluidic system in the form of an automated, miniaturised cartridge that is replaceable. In addition to supplying information on milk safety and quality, the measured parameters also tell farmers about the health and condition of each cow. This helps them to spot infections at an early stage and begin treatment immediately. Timely treatment can lead to a more judicious administration of antibiotics and therefore to a reduction in their use.

But how does the test work?

“Light emitted by the transistor falls onto a grating coated with antibodies specific to the various substances being tested for,” said Dr Michael Törker, a researcher at Fraunhofer FEP. “When milk is flushed over the grating, any target molecules in the milk then bond with the antibodies. This alters the refractive index in the immediate vicinity of the grating, which in turn modifies how this light is reflected. The reflected light is registered by the photodetector, which measures minimal changes in the refractive index.”

This basic phenomenon, which occurs on specially structured nanogratings, is known as surface plasmon resonance. It provides rapid and highly sensitive readings.

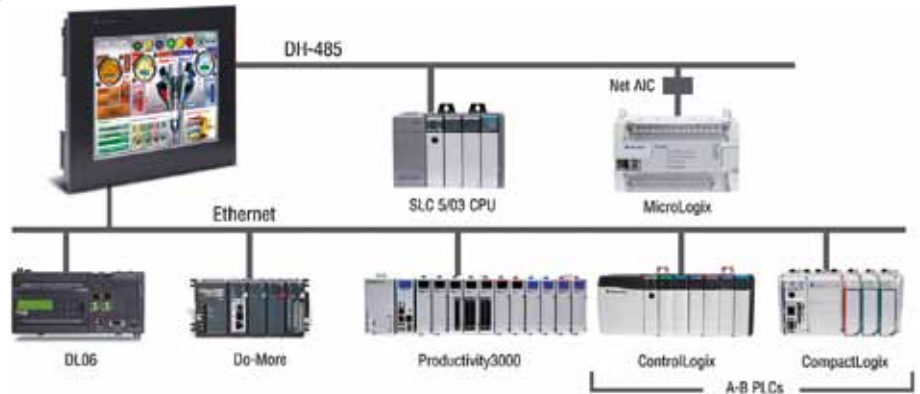
The aim is to use this biosensor at various points along the value chain — both as a lab device and directly installed in dairy equipment. Moreover, it will also be suitable for testing the quality of liquids other than milk, such as beer or water. The only adjustment required is a modification to the immobilised capture molecules and to the requisite reaction buffer. This would merely involve replacing the capture molecules with ones suitably modified for the purpose in question.

Fraunhofer Institute for Organic Electronics, Electron Beam and Plasma Technology FEP
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**CORROSION
MONITORING**

Emerson has introduced the Plantweb Insight Inline Corrosion application to provide the oil and gas industry real-time interpretation and analysis of critical data that helps prioritise maintenance and make informed integrity decisions.



The Plantweb Insight Inline Corrosion application delivers field data from Emerson's Roxar wireless corrosion transmitters, providing insight into instrument health and process corrosivity. It offers alerts on preset thresholds for severe corrosivity, probe lifespan for electric resistance (ER) probes and low battery levels. The easy-to-read dashboard displays a heatmap with intelligence on corrosivity of fluid levels based on the NACE standard.

This IIoT-based application integrates into existing wireless infrastructures and delivers field data as frequently as once every 15 minutes. By keeping operators updated on changing conditions remotely, the application allows personnel to make fewer manual inspections in the field, thereby minimising their exposure to hazardous areas.

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SMART GLASSES

Konica Minolta has announced a wearable augmented reality (AR) solution, the AIRe Lens. This smart glasses device is designed to enhance training and knowledge sharing in traditionally skilled manual labour and industrial environments.

Developed for a range of applications, the AIRe Lens is said to offer the durability, comfort and high optical quality required for all-day use. With its head-mounted functionality, end users can receive information and step-by-step guidance through work processes, such as assembly, maintenance or quality assurance tasks, while maintaining mobility, keeping hands free and reducing workplace accidents.

With the AIRe Lens, organisations can leverage wearable technology to address concerns including high staff training costs, limited options for tracking work productivity, difficulty in finding skilled industrial workers, long downtimes or employee inefficiencies.

The AIRe Lens is a collaborative creation of the company's own Industrial Optical System Business Headquarters (IOH) in Japan, which designed the optical element at the core of this solution, and Konica Minolta's European Business Innovation Centre (BIC).

Konica Minolta
www.konicaminolta.com.au

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Pfannenbergs' DTS8000 range of wall-mounted cooling units are maintenance free, remove hot spots from cabinets and are suitable for tough industrial or outdoor applications.



Whether in washdown locations or control rooms, the DTS series key internal electronics are positioned away from potentially moist or caustic air in hazardous environments. The wide condenser fin spacing allows for filterless operation.

The stainless steel units have an epoxy coating on all exposed copper tubing, with conformal-coated fans and backward-curved impellers that have a standard life of 55,000 h.

An active condensation management system utilises a PTC heart which eliminates the need for a drain line, and an optional cover is available to protect the fan if used in washdown or in high-dust or debris areas.

Control Logic Pty Ltd
www.controllogic.com.au



DRY BLOCK TEMPERATURE CALIBRATOR

The Jofra CTC-1205 dry block temperature calibrator is an industrial-class temperature calibrator. It has an accuracy of $\pm 2^{\circ}\text{C}$, with a stability of $\pm 0.1^{\circ}\text{C}$ and immersion depth of 110 mm (with insulation plug 137 mm). It is available to rent from TechRentals.



It covers a wide temperature range from 100 to 1205°C, performs a three-point temperature calibration quickly and can be run using two modes.

The device integrates many versatile functions such as Set, Preset Mode, Auto Switch Test and Auto Stepping. These functionalities offer smart, fast and simple ways to achieve calibration tasks.

The Jofra CTC-1205 also offers advanced features such as Intelligent Recalibration Information, which warns the users if any calibration certificates are overdue, as well as advanced feedback algorithms to address heat losses due to mass loading from large sensors.

TechRentals

www.techrentals.com.au

GIGABIT SWITCHES

Belden has released a range of full Gigabit OCTOPUS PoE managed switches designed to meet evolving data demands by increasing bandwidth in industrial settings.

As the IIoT increases the number of devices typically operated across a network, bandwidth expectations also rise. Equipped with Gigabit Ethernet on all ports and enclosed in an L-shaped housing, Hirschmann's full Gigabit OCTOPUS switches are designed to offer a solution for optimising network performance in extreme, condensed operating spaces.

The Hirschmann Gigabit OCTOPUS switches offer high network performance with full Gigabit Ethernet options on all ports, a vibration-proof and waterproof IP67 housing design that is L-shaped for efficient cabling and reduced cabling to end devices using PoE.

The switches come with a variety of feature sets including three housing sizes for 8, 16 or 24 ports.

The full Gigabit OCTOPUS switches are suitable for applications requiring high data transfer rates in extreme operating conditions, such as general manufacturing, automotive and machine building settings.

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DEEPWATER WIND FARMS

TAKE RENEWABLE ENERGY OFFSHORE

The global offshore industry is diversifying from oil and gas into renewables as cutting-edge technology and research have facilitated the installation of wind farms in deep water.

This year's Australasian Oil and Gas Exhibition and Conference is set to hear from Dr Daniel Veen, one of the Australian experts developing globally significant software capable of integrating the systems which underpin giant offshore wind turbines installed at depths greater than 60 m.

Global offshore wind power is projected to grow 15-fold over the next two decades. In December last year the biggest floating turbine in the world, located off the coast of Portugal, started transmitting electricity to the grid in what was described as a milestone for the industry.

Most offshore wind turbines are on fixed foundations at less than 60 m depth. In the case of the Portugal turbine and about a dozen other trial sites, these giant floating turbines have been installed at up to 100 m by tethering them to the seabed. Each turbine can successfully generate up to 8.4 MW. GE Renewable Energy now has a 12 MW turbine with a 220 m rotor size to be installed off the coast of France.

"I don't think we've reached the maximum size for these turbines yet. Simulations show they can get bigger, more efficient and more sophisticated," said Dr Veen ahead of the conference. "There are no deepwater turbines in Australia at the moment but a fixed wind farm off the coast of Gippsland in Victoria is being explored by Star of the South. What I find interesting is the push for this technology isn't coming from governments — it's coming from industry, particularly in China and Europe."

"As an industry, we are working towards offshore wind farms of a scale that will diversify the offshore industry into renewables. Wind is more reliable out at sea, and the ability to build and

install these wind turbines is becoming more cost-effective," Veen continued. "Power is transmitted back to shore via subsea power lines, and while there is a risk there, we already rely on undersea cables for a range of technology, including Australia's connection to the internet."

At Bentley, Veen is part of an international team based in seven different time zones and three continents developing software for hydrodynamic floating systems. He is also Bentley's representative on a project led by the American International Energy Agency, known as OC6.

"Wind turbines in the ocean on floating structures are quite complex. We need to simulate the impact of wind loading on the turbine, how the structure moves in the ocean and how those movements stress the mooring lines into the seabed," he said.

"It's a complex system and we are taking the existing software that designs floating systems offshore and enabling it to integrate with other specialist structural, as well as aeroelastic, design software to allow an analysis of the whole integrated system."

Dr Veen is the Associate Product Manager, MOSES, Bentley Systems and will be presenting on Marine Renewable Energy as part of the Knowledge Forum at AOG 2020.

Hear from Dr Veen and other world-class thought-leaders at this year's conference, register free and discover opportunity, innovation and technical advancements.

AOG is the largest oil and gas event in Australia and returns 11-13 March 2020 to the Perth Convention & Exhibition Centre. Register FREE and join the industry where it moves forward, together.



SERVO RANGE

Omron has released additional models in its 1S servo range. The original 1S servo (up to 3 kW) has been expanded and now delivers up to 15 kW.

New technology optimises the full cycle, through the machine design, installation and commissioning tasks and finally to the maintenance once in production.

In addition to the traditional motion solution, the 1S servo offers safety over the network (FSOE) as well as its standard hardware safety input. It has improved loop control allowing accurate and higher machine productivity.

The 1S range now features a 23-bit multiturn absolute encoder without battery backup. This means it won't lose its position when power is removed. The range comes with Omron's Sysmac Studio programming software, which provides a full suite of integrated functions.

The servo can be easily connected to a controller via EtherCAT, with a 125 μs communications cycle. Also, it is easily tuned, with two degrees of freedom, and several servos can be tuned at once, meaning overall set-up time has been reduced by 50%.

The new 1S series offers simplified machine design and maintenance. It is compact with a smaller motor size and can be easily mounted, with no external terminal rail needed.

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FOUR GENERATIONS OF I/O INTEGRATION

Shishir Rege*

Over the years, technology has improved in the routing and terminating of I/O, increasing efficiency and productivity for machine builders.

For machine builders, historically the only cost-effective method for terminating I/O from sensors, actuators, valves and devices was to route all connections into the control cabinet and terminate them there. Over the years, technologies have been developed to improve the routing and terminating of I/O to increase efficiency and productivity for machine builders.

A laborious and time-consuming start

The first generation of I/O integration philosophy relied heavily on centralised control architectures and the traditional laborious, time-consuming method of technicians performing all wiring and terminating of the many individual leads into the control panel. Terminating wires is a tedious process that includes routing long cable runs from sensors and devices to the control cabinet terminals, then shielding, cutting, stripping, ferruling, labelling, crimping and terminating the hundreds of wires.

Typically, for experts this procedure takes about 7–10 minutes per wire. With this method, 100 terminations would take approximately 12 hours — equating to approximately \$700–\$1000 in labour costs. And when you include the statistical probability

of approximately 10–15% for human error, there is the accompanying additional cost of debugging wiring errors and reworking. Adding sensors or valves requires reworking as well, while the variety of cord sets required for sensors, actuators, valves and devices adds overhead and inventory costs.

In this first-generation control architecture it is helpful to picture separate 'slices' of I/O components connected and terminated in the PLC control cabinet. In a typical application, the communication head and the power supply sit on the left-hand side of the backplane bus and are followed along the backplane by the CPU, communication control I/O, individual I/O devices such as discrete 24 V input cards or 0–10 V analog cards, digital device I/O, valve manifold control I/O, RFID control I/O and specialty device control I/O. Usually, a limited number of slots are available in the backplane where individual slices of I/O control components can be inserted.

The addition of passive junction boxes

In the second generation of I/O integration, passive junction boxes were added to the architecture. These boxes help shorten cable



runs from sensors to the junction box, but they do not reduce the number of terminations or offer any diagnostic capabilities. While the passive junction box strategy does provide some reduction of labour time, it still fails to deliver any benefit for diagnostics or error prevention.

More choices: remote termination boxes or remote I/O blocks

The third philosophy in I/O architectures features distributed or remote I/O stations using fieldbus or network architecture. For controls architects, this presents the choice of using either remote termination boxes or remote I/O blocks with direct connections. Remote termination boxes help with distributing terminations closer to the sensors but do not help reduce the number of terminations. Therefore, this method allows for shorter cable runs and provides some diagnostic capabilities, but it also adds the cost of remote termination control panels. Using remote I/O blocks with direct connections delivers shorter cable runs, onboard diagnostics of short-circuits or overcurrent, and dramatically reduces the number of terminations. Just as importantly, it considerably reduces the need for debugging, reducing overall labour costs.

The limitation with this method is that a distributed network block typically can host 16 inputs or outputs or 4-8 analog points, or some mix thereof. Therefore, if you need a 17th input or output, you need to add another I/O block to the network. Furthermore,

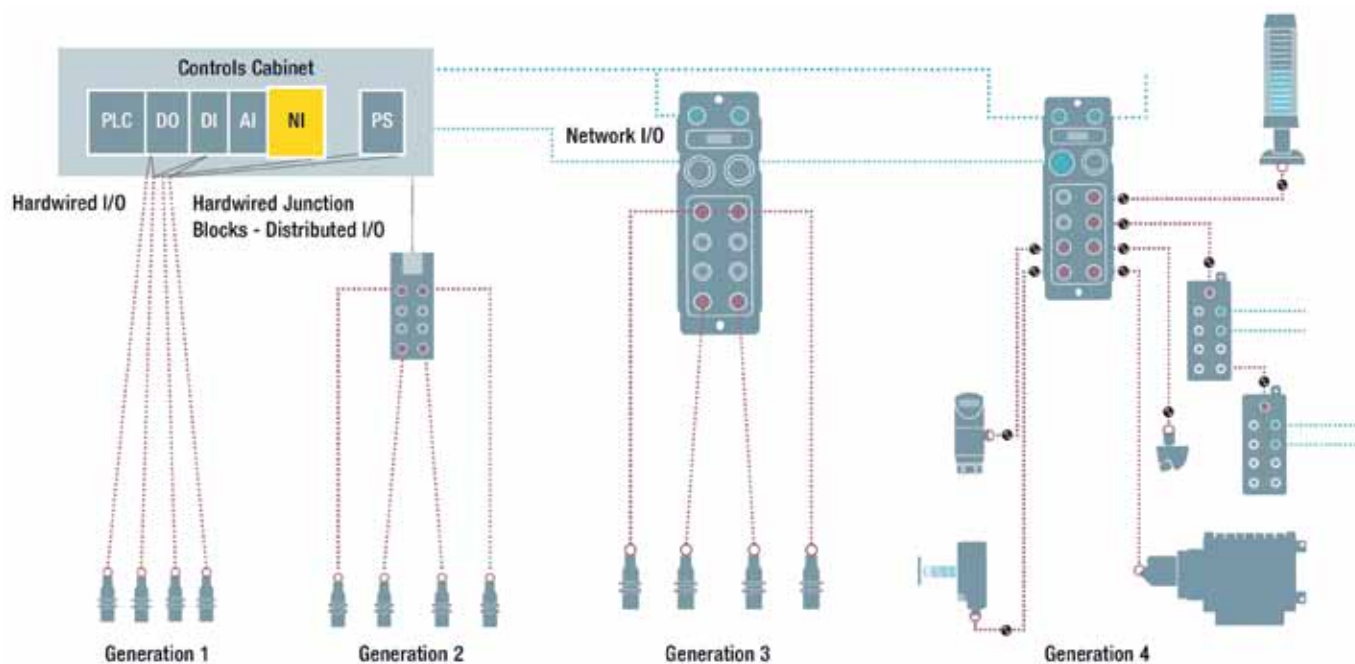


Figure 1: Four generations of I/O.



if you need one additional analog input or output, you need an additional block. Those are just two examples of the limitations with this method. In effect, this would entail moving the I/O slices from the control cabinet to the machine and connecting them with network nodes. The cost is very high when using this method to update a system.

IO-Link leading the way to Industry 4.0

The fourth, and latest, generation of I/O architecture is based on IO-Link technology. This technology has existed since 2006 and is now gaining rapid acceptance in the market. It is the technology enabling Industry 4.0 and the Industrial Internet of Things for the next generation of manufacturing. Each IO-Link master block typically provides up to eight IO-Link ports, and each port can host a variety of I/O. I/O hubs are child nodes that can be connected to the IO-Link master, and can act as a concentrator to capture discrete or analog I/O. Smart devices like RFID, smart sensors including those for pressure, colour, distance, or transducers and encoders can be directly connected to the IO-Link master, provided they offer an IO-Link interface. With this technology, one IO-Link master can host up to 240 I/O points with IO-Link I/O hubs, or

up to 64 channels of analog I/O or eight IO-Link smart devices, or any combination thereof.

An increasing number of manufacturers are introducing new devices that are compatible with IO-Link. Many new smart IO-Link devices have been produced, such as for valve manifolds, grippers, vacuum generators, stack lights, smart lights for process visualisation and RFID systems.

Because IO-Link is a data communication technology, and not a signal transmission method, IO-Link devices offer considerable diagnostic capabilities. For instance, IO-Link devices can be configured to provide notification of events and alarm conditions, or be used for ease of maintenance and troubleshooting. Another important benefit is that IO-Link based systems require only the standard unshielded, noise-immune M12 sensor cables, which are already used throughout the previous generations' architecture. With IP67-rated IO-Link masters, you can use moulded, quick-connect cables to avoid mis-wiring and reduce troubleshooting.

Reducing costs and downtime while improving the quality of automation

The use of IO-Link technology simplifies device connections and eliminates or reduces wiring and terminations dramatically, thus reducing machine build times. Additionally, IO-Link technology makes machines smarter by providing extended diagnostic capabilities and helps them be more adaptable to changing technologies for sensors and smart devices. IO-Link technology enables increased modularity of machines and reduces costs by using I/O hubs for enhanced high density of I/O, and standardises connectivity across the machine or the facility.

The IO-Link master block provides the interface to the higher-level controller (PLC) and controls the communication with connected IO-Link devices and backplane buses. IO-Link connects all sensors and devices by seamlessly bridging with a fieldbus or Ethernet. In a distributed modular I/O system with IO-Link, devices can be installed within a 20 m radius from the master, so I/O devices can be easily distributed across the machine while also enabling the use of smaller electrical cabinets. IO-Link's instantaneous feedback of machine operation improves overall equipment efficiency, improves quality of automation and optimises productivity.

**Shishir Rege is a technical sales specialist for Balluff Inc. at the company's headquarters in Florence, KY. He has more than 18 years' experience in robotics and automation in diverse industries including automotive, packaging, aerospace and medical. He holds a Master of Science in electrical engineering and an MBA.*

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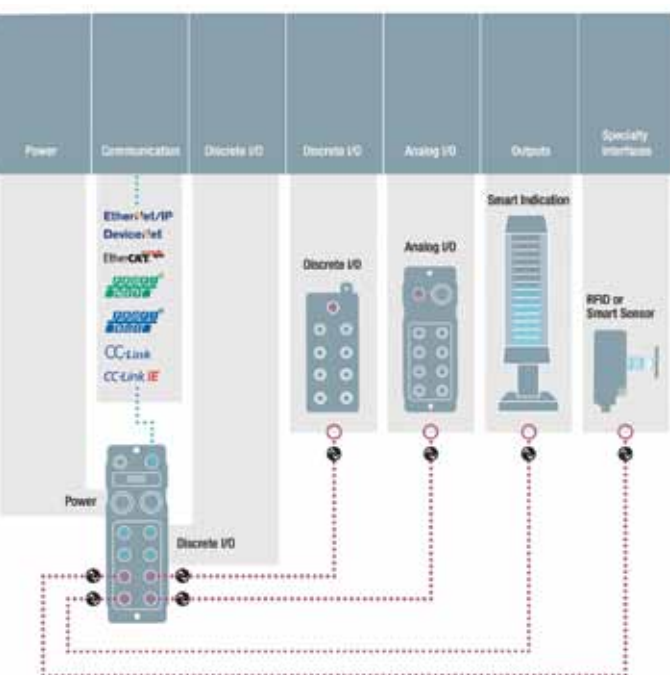


Figure 2: The use of IO-Link technology simplifies device connections, and eliminates or reduces wiring and terminations dramatically.



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I/O MODULES

Rockwell Automation has updated its range of On-Machine I/O modules to support smart machines used in harsh applications.

The Allen-Bradley ArmorBlock I/O modules can operate in a wide range of temperatures and offer up to IP69K protection in applications like automotive, materials handling, packaging and welding.

The ArmorBlock I/O options can be mounted anywhere on a machine for shorter cable runs and lower wiring costs. They use a nickel-plated zinc die-cast housing, have QuickConnect functionality and offer diagnostics in an EtherNet/IP universal digital I/O block

to reduce commissioning and troubleshooting times.

Three IO-Link hub blocks help reduce design complexity by allowing more devices through the IO-Link master. An M12 L-coded power connector on selected blocks supports higher current, allowing more blocks to be daisy-chained, resulting in lower wiring and installation costs.

For companies with separate I/O blocks for digital input and output, the ArmorBlock I/O modules are a suitable choice. They provide 16-channel self-configurable digital I/O with the flexibility to be used as the digital input or output depending on the application needs.

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DeltaBlack is an easy-to-use cellular 4G/3G/2G remote monitoring, alarming and logging solution which is suitable for use in a range of industrial applications.

The Industrial IoT edge device is designed to work in the cloud with SCADA systems or via simple user-friendly SMS commands.

With multiple I/O channels, wide operating supply voltage, DIN-rail mount and integrated RE232 modem, the device includes various sensor types including temperature and humidity, level, flow, pressure, pulse meters — electrical, water and gas — and CT current transducers.

Other features include: integrated 7-channel data logger including one relay output; customised SMS alerts; and LED indication for cellular signal quality and communication status.

The unit weighs 250 g and comes with a pre-provision SIM card. Users can remotely manage the device and access measured data anywhere by connecting the sensors and logging into ETM'S IoT Cloud Dashboard (EWO).



Suitable applications include: pump, fan, generator and motor; refrigeration and freezer systems; metering, HVAC and indoor climate; tank measurements; fire panels and intruder alarms; data centre monitoring; and agriculture.

ETM Pacific Pty Ltd
www.etmiot.com.au



BLUE LASER vs RED LASER TRIANGULATION SENSORS

Which is better?

Laser triangulation sensors are one of the most sought-after non-contact sensor technology for measuring position, distance, level, displacement, proximity and profiles of objects. They are widely used in industrial process automation and control, as well as for test and measurement in process monitoring and validation. Currently, two technologies are available: red and blue laser sensors. The conventional red laser sensors are suitable, and offer good measurement stability, for most applications. However in some applications, blue laser sensors provide better performance.

Blue laser triangulation sensors are suitable when accuracy cannot be compromised. The blue laser with a shorter wavelength does not penetrate or diffuse into the target surface — which can lead to a lack of focus that causes inaccuracy. Choosing which laser type to use may depend on the type of surfaces, target materials and required measurement speed.

Surface types

As red laser penetrates deeper onto the target surfaces as compared with blue laser, it substantially increases the area of blurry region that is reflected back to the detector. This can cause the detector to not be able to detect the exact distance to the surface. This effect is minimised when used for measuring objects with matte or low-reflective surfaces.

In the case of blue laser sensors, the light being reflected back to the detector is minimised due to the shorter wavelength. Blue laser sensors perform well when used for measuring objects with shiny, reflective or highly-polished surfaces. For shiny surfaces, the shorter wavelength of blue laser generates much less speckling and a lower noise level (by a factor of three) when compared to the red laser.

Types of target materials

Red laser sensors also have limited use in measuring hot and glowing objects. A hotter object generally emits a high radiation intensity at a wavelength similar to that of the red laser, resulting in undesirable noise. This effect does not apply for blue laser as it operates at the opposite end of the visible light spectrum.

The sensor will generate stable and accurate signals, unaffected by the object temperature. Blue laser sensors also triumph over red lasers when used for measurement on organic, food, transparent and translucent materials.

Measurement speed

Red laser sensors outperform blue laser sensors for highly dynamic applications due to the stability of the high-intensity laser in high speed applications. For example, when measuring package dimensions on a conveyor belt, red laser sensors are typically a better choice as they are able to accurately measure with high speed. They are also better in terms of overall performance and availability of measuring ranges, and are also more cost-effective compared to the blue laser sensors.

In summary, both blue laser and red laser triangulation sensors offer similar capabilities with one sensor more suitable than the other under certain conditions. Both of them can also be used for measurement of 2D and 3D profiles of objects. To select an appropriate sensor technology, the questions to be asked should be:

- How hot will the surfaces be?
- What are the surface characteristics of the target object?
- How dynamic is the application (how fast will the surface change)?
- What level of accuracy is required?

In most test and measurement cases, red laser triangulation sensor will be able to perform just fine. Blue laser triangulation sensors are not always feasible as they are higher priced than red laser triangulation sensors. However, they may be the only viable solutions in some applications.

Contact Bestech Australia at 03 9540 5100 or enquiry@bestech.com.au for more information.

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FANLESS COMPUTER

The iBase CSB200-818 is a slim fanless system designed for harsh conditions, with a wide operating temperature range. Suitable for 24/7 deployments such as in industrial automation, the compact system comes with a 12–24 VDC terminal block power input and an optional 60 W power adaptor.

The system houses a 3.5" single-board computer powered by an Intel Atom E3930, N4200 or N3350 processor and is equipped with 4 GB of DDR3L-1866 system memory that is upgradeable to 8 GB. It offers both wired and wireless connectivity with the two onboard RJ45 Gigabit Ethernet ports and dual Mini PCIe slots for optional Wi-Fi, Bluetooth and LTE interface cards.

The onboard rear I/O interface includes four high-speed USB 3.0 ports, HDMI, four COM ports and two RJ45 connectors. Other features provided are wall mounting and two wireless antennas.

The operating temperature range is -30 to +65°C when the device is configured with an Intel Atom E3930 processor and an 64 GB industrial-grade SSD. With an N-Series (N4200/N3350) CPU and 500 GB of SATA HDD, it operates between -10 to +45°C. Both temperature conditions require sufficient airflow.

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LIQUID RING VACUUM PUMPS

The Atlas Copco LRP 700-1000 VSD+ range of intelligent liquid ring vacuum pumps is suited to wet, humid and dirty applications. It uses a state-of-the-art vacuum solution and is a compact, high-performance, energy-efficient system enclosed in a strong, noise-containing canopy.

The uncomplicated plug-and-play product has an ergonomic design with HMI to ensure the optimum operator interface and ease when controlling the vacuum pump.

The soundproof housing reduces noise pollution in the immediate working environment, with operating noise in the range of 65 dB(a). Along with noise reduction, the sturdy canopy and cubicle ensure that the pump and internal electronics are effectively protected against dust and water.

The twin VSD system operates in absolute harmony within the pump, ensuring optimal vacuum performance at all times. The primary VSD maintains required vacuum levels by controlling the operating speed of the pump, matching pump performance to process demand and saving energy. The second VSD regulates the water circulation pump in response to the operating conditions.

Equipped with Atlas Copco's MkV Elektronikon controller, the LRP VSD+ has a comprehensive in-built plant management system. Key information such as pump status, operating conditions, warning alarms and maintenance information is readily available. Multiple pumps can be monitored, controlled and optimised simultaneously. It can also be paired with Atlas Copco's SMARTLINK, the LRP VSD+.

The series is designed for an array of applications, including filtration, food processing, conveying, ePS, drying, degassing, plastics calibration and rubber vulcanisation.

Atlas Copco Compressors Australia

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PYTHON AND MACHINE LEARNING ARE INCREDIBLE TOOLS FOR IA

You will probably be wondering what on earth some arcane programming language — with its name originating from Monty Python of all places — has to do with instrumentation, process control and automation in 2020.

I have observed with astonishment the incredible growth of Python — from the commercial world into industry and manufacturing processes. It is extraordinarily good at being an all-purpose programming language — a veritable Swiss Army Knife language able to handle a vast range of tasks from general-purpose programming to detailed control of hardware. What makes Python really stand out is its incredible popularity and zero cost — there is a huge community of support. As compared to other languages, Python has simplicity and flexibility. And believe it or not but Python is over 30 years old.

First let's examine the reasons for Python's success and why it will benefit you in 2020.

Why is Python such a powerful language? It requires less supporting code, it speeds up the development cycle and makes any debugging a breeze. Being an interpreted language it is considerably easier to work, and fix on the fly than with a buggy C program which simply crashes. Python can do in a single line what many programming languages require multiple lines of code.

Much to everyone's surprise, it is now increasingly being used in the industrial automation and embedded systems world (eg, Raspberry Pi and IoT systems with MicroPython). In 2018, for the second year, the IEEE, listed Python as the number one programming language (even ahead of such venerables as C and C++). Surprisingly, it was also the number one embedded language in 2018.

Specific tasks for Python range from testing to data collection and automation. Automation of tasks is a critical part of every engineer's task today. Design probably only takes 10% of an engineer's time — most of the day-to-day work is in research and testing of prototypes, debugging, production testing and — worst of all — documentation.

There is a growing need for Python programming skills in the industrial area. Typical tasks for automation engineering professionals where Python can assist are file processing (conversion from one format to another), automation of test equipment and data (such as waveforms for power quality problems) and database management (such as SQL). Python easily handles standard industrial automation tasks such as analysis of vast amounts of data from processes, logging data over a Modbus communication link and preventive maintenance. Translating a PLC database and converting this into a bunch of HTML files is done in a flash.

Areas such as numerical analysis (with awkward boundary conditions) in manufacturing, automotive, energy and thermodynamics (ranging from fluid dynamics to chemical kinetics) are fertile areas of work for Python.

Python is also a key enabler for machine learning (ML) — surely one of the most exciting technologies in recent times, particularly in the industrial automation business. For example, if you are working with a large amount of industrial sensor data and you want to predict an output value for given inputs or you want to find clusters of similarity in your sensor data, you can use ML algorithms in conjunction with Python.

Thus, when considering analysis and processing of a vast stream of industrial sensor data, why not get a Pythonista (or Python programmer) in to help you — there are plenty of them around.



Steve Mackay PhD has worked across the world for the past 40 years in the design and construction of iron ore plants, oil and gas platforms and power stations, as well as plant maintenance. He

believes university engineering programs need to be strongly focused on industry. He has been the author or editor of over 30 engineering textbooks and is currently leading the first fully online accredited engineering college with over 1500 students from over 140 countries.

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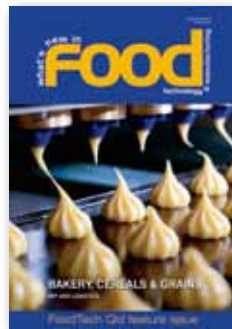
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The Beamex MC6-T is an extremely versatile portable automated temperature calibration system. It combines a state-of-the-art temperature dry-block with Beamex MC6 multifunction process calibrator and communicator technology.

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It offers versatility, that no other temperature calibrator can match.

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