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AUTOMATION + CONTROL + INSTRUMENTATION

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ON THE COVER

With the growth of Industrial Ethernet networks in process manufacturing plants and automation facilities, data exchange in a facility and across global corporate networks is becoming commonplace. This has introduced new possibilities for using the copious amounts of data in existing field devices. There are new ERP, MES and asset management systems that collect some of this data now, but the more critical challenge is how existing and new manufacturing facilities cost effectively obtain the critical plant floor data and send it to these higher level information systems. The answer is to take advantage of the digital HART data already available from the HART digital signal found in most smart field instruments. Smart HART devices often contain more than process variable data, including such information as instrument status, diagnostic data, alarms, calibration values and alert messages.

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MOVING BULK SOLID MATERIALS

WEIGHING THE PROS AND CONS OF PNEUMATIC AND MECHANICAL CONVEYING

*David Boger, Allen Powell and Paul Sattler**

The choice between dilute phase pneumatic conveying, tubular cable conveying and flexible screw conveying is not always clear.

Most materials can be conveyed using any of several methods. The final selection comes down to balancing the pros and cons of each type of system for the particular application, with all its variables. That said, the following guidelines will help in selecting the optimum method for conveying different types of bulk solid products.

The first rule

The first rule is: ask the experts. While the science of conveying has advanced significantly over the past several decades, there is still an art to selecting the best overall system and engineering it to meet individual needs. The final analysis requires an intimate understanding of the material and process as they relate to the strengths and limitations of each conveyor technology. Consult with a specialist who does not have a vested interest in selling only one type of equipment. An expert will weigh each parameter and recommend the best solution for each application.

A corollary to the first rule is: test before buying. Testing will assure that the specified system will, in fact, convey the subject material the required distance without degradation or undesirable changes in product characteristics. A fully equipped testing facility will contain full-size systems that are easily reconfigured, as well as a full range of accessories and peripheral equipment. It will contain both pneumatic and mechanical bulk handling equipment to produce an objective recommendation based on the actual material to be conveyed. By verifying performance prior to fabrication, costly misjudgements and delays can be avoided in installing and commissioning the system.

Equipment comparison

A ***flexible screw conveyor*** (Figure 1), also known as a spiral conveyor, helical conveyor or centerless auger conveyor, consists of a flexible screw contained in a flexible or rigid tube that is driven by an electric motor. It is a relatively simple design, and generally the most economical choice, with efficient performance, high reliability, and low capital and operating costs. When properly engineered and tested, it will provide excellent performance across a broad range of applications. There are also systems specifically designed to convey difficult-to-handle materials that tend to pack, cake, smear or fluidise, or break apart.

Pneumatic conveyors move bulk materials that are suspended in a gas stream (most often air, but sometimes an inert gas) introduced by either a positive pressure blower upstream of material intake points, or by a vacuum pump downstream of material discharge points. Product is separated from the gas stream at the end of the line by filter receivers or cyclone separators or sent directly into process vessels. These systems, which may be more complex than mechanical conveyors, can be integrated into process or production lines and will readily handle diverse products in the same equipment. Positive pressure pneumatic conveying is generally used to convey materials from a single source to one or multiple destinations, over relatively longer distances and with greater capacity than vacuum systems with similar size conveying lines. Vacuum systems allow easy pick-up of materials from open containers using wands, so are better suited to transport material from multiple sources such as storage vessels, process equipment and rail cars to single or multiple destinations.

Tubular cable conveyors (Figure 2), also known as drag or disc conveyors, consist of low friction polymer discs attached to a steel cable. The discs and cable are driven by a wheel at one end of the circuit, while a second wheel maintains the cable's tension. The entire circuit is enclosed inside steel tubing. Tubular cable conveyors gently slide bulk solid material at relatively slow speeds through this tubing in the space between the discs. A truly 'modular' system, tubular cable conveyors can have multiple inlets and outlets (which may be added or moved). The conveyor can be routed at nearly any angle, and pass through small openings in walls or ceilings.

Figure 1: Example of a sanitary mobile flexible screw conveyor.

Choosing a system

The factors to evaluate when selecting a type of conveying system are:

- Material characteristics
- Material source and destination
- Conveying parameters
- Plant conditions
- Economics

Material characteristics

First, consider the properties of the material to be conveyed, including bulk density, flow properties, temperature, moisture content, inherent hazards and allowable degree of degradation. Both pneumatic and mechanical conveyors will handle a wide range of products, from fine powders to large particles. Both types can be designed to move materials that are friable or fragile, as well as temperature-sensitive materials.

Individual parameters or a combination of requirements can swing the advantage to one conveyor or other. Pneumatic conveying systems are best suited for dry, free-flowing to semi-free-flowing bulk products. Highly engineered screw conveyors are available for moving more difficult materials that might cause a pneumatic conveyor to plug, and a general-purpose screw conveyor to bind or seize. These conveyors have specially designed screws, tight tolerances and straight conveyor tubes to efficiently handle a broad variety of non-free-flowing products such as brown sugar, TiO_2 or products that have high fat or oil content. With their relatively slower speed, tubular cable conveyors are highly regarded for gently moving shape sensitive, fragile or friable materials with minimal damage.

Where temperature and moisture content must be maintained, exposure to large volumes of air can rule out pneumatics. While it is possible to condition pneumatic conveyor air for temperature and moisture, this adds considerably to the costs. In such cases either a flexible screw conveyor or a tubular cable conveyor is more effective.

Flexible screw conveyors and tubular cable conveyors are also a better choice when dealing with blended materials because they prevent the separation of blends throughout the entire length of the conveyor, regardless of differences in the flow characteristics, or bulk density.

Extremely fine (submicron) powders are best conveyed with an enclosed flexible screw system because the amount of dust created by the process is minimal and requires little or no air filtration at the discharge point. Fine particles can clog the filters in a pneumatic conveying system, adding to maintenance cost and requiring larger space. Fine particles tend to migrate along the edges of the discs and the inner wall of the conveyor tubing in a tubular cable conveyor, which can cause additional drag and increased component wear.

Pneumatic conveying is usually best when handling hazardous materials that require inert gas blanketing to prevent explosions, oxidation or other changes in product characteristics. When complete containment of a material is necessary, vacuum pneumatic conveying is the method of choice since any breaches in the system will generally leak air into the conveyor, not material into the plant environment. Likewise, with very-high-temperature material, a positive pressure pneumatic conveyor has the advantage.

If degradation of product during transport is a concern, all three systems must be properly designed to minimise damage. This is where testing becomes particularly important, especially if there are no fixed, measurable criteria for the permissible degree of degradation. Testing can determine how much degradation occurs with each technology at varying flow rates and operating conditions. A test program will ensure that, whatever the bulk product, it will reach its destination with properties intact.

Plant personnel handling abrasives expect to maintain equipment and replace components. With flexible screw conveying, the inner screw may need to be replaced periodically, but downtime is minimal. Tubular cable conveyors are more likely to suffer component damage and downtime from the handling of abrasive materials due to their design. Dilute phase pneumatic systems can also handle abrasive materials if other parameters favour this conveying method, but will require periodic replacement of elbows, rotary valves and other components. Proper design and specification of the system, eg, layouts that minimise impact points and the use of wear-resistant elbows, can increase the viability of pneumatic systems.

Material source and destination

Material sources include process equipment, small containers (bags, drums or boxes), bulk bags or bulk transportation vehicles (trucks, rail cars, and ships/barges).

When materials are introduced from multiple sources, either sequentially or simultaneously, pneumatic conveyers or tubular cable conveyors are the better choice. However, as pneumatic conveyors require separate receiving equipment at every destination, tubular cable conveyors can be the lower cost alternative when delivering to multiple discharge points.

For material in bags, drums or boxes, a vacuum conveying system with a pick-up wand can pull material directly from the

Figure 2: Cutaway of tubular cable conveyors.

container. Use of a flexible screw conveyor or tubular cable conveyor requires that the containers be dumped or discharged into a hopper fitted with an intake adapter. Either technology is suitable for conveying products being discharged from bulk bags.

Emptying larger volumes of material from trucks, rail cars and ships is best accomplished with a pneumatic conveying system due to the configurations of these larger containers.

Conveying parameters

Where distances are short, pneumatic units tend to be more expensive. As distance increases, the limits of a single flexible screw conveyor are reached and may require several conveyors in series. At some point, the multiple flexible screw conveyor transfer system becomes more costly than a comparable tubular cable or pneumatic system. The higher capacities associated with moving large volumes of materials in a relatively short time, as in unloading ships or barges, are better suited to a pneumatic system that utilises large diameter conveying lines.

Where equipment mobility is a requirement, either flexible screw conveyors or vacuum conveyors can be designed as self-contained modular units on caster-mounted frames. However, if the same equipment is used to move varied bulk solids, then a pneumatic conveyor is better, since flexible screw conveyors may require screws of different geometries to handle dissimilar materials.

Where cross-contamination is a concern, flexible screw conveyors are easy to clean because they lack internal seals, crevices or joints that can trap particles or breed contamination. Simply reversing the screw rotation will evacuate residual material and the interior surfaces can be flushed with air, water, steam or cleaning solution. Wet or dry cleaning accessories can be attached to the cable of a tubular cable conveyor to minimise downtown between changeovers. In contrast, a pneumatic conveying system must be specially designed to decrease cleaning difficulty, with conveying lines broken into detachable sections, and supports that allow removal of heavy rotors from rotary airlock valves, increasing cost significantly.

If complete discharge of a batch is essential, positive pressure or vacuum pneumatic conveyors and tubular cable conveyors hold the advantage over flexible screw conveyors, which will retain material after the conveyor has stopped discharging. This is why the lower end cap of a flexible screw conveyor must be removed and the screw reversed to evacuate residual material before the conveyor can be sanitised.

Plant conditions

The plant layout, routing requirements and space considerations are all important when comparing conveying options. Pneumatic conveyors are well suited to straight horizontal or vertical routing, but should not be routed at other elevations because gravity and friction may negatively affect performance of the system. When conveying to an elevated point in a straight or curved path, a flexible screw conveyor is the better choice. Where there are numerous changes in direction, or turnings in a limited space, either a pneumatic or tubular cable conveyor has the advantage.

Physical limitations such as floor space and ceiling height also impact the choice of conveyors. Flexible screw conveyors require a larger bend radius and cannot make tight turns, while pneumatic conveying lines and tubular cable conveyors can handle right-angle bends. If filter receivers of pneumatic systems require more headroom than the ceiling permits, one may need to consider a mechanical conveyor.

At floor level, a wide range of factors may come into play when determining how much vertical space is required including the material source and whether the conveying equipment requires a metered feed of material or can been flood-fed.

When an application requires multiple types of conveying, all three conveying technologies can be employed, eliminating compromise.

It comes down to economics

Ultimately, the decision then comes down to economics, with flexible screw conveyors offering lower capital and operating costs, especially over shorter distances involving lower capacities. Pneumatic conveyors, although higher in initial cost and power consumption, offer greater cost-effectiveness when conveying in higher capacities or over longer distances. The initial tubular cable conveyor investment usually falls somewhere between the costs of a flexible screw conveyor and a pneumatic system.

In the final analysis, an expert, unbiased opinion and full-scale testing should confirm the proper conveyor choice for individual applications.

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www.flexicon.com.au

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RETROREFLECTIVE SENSORS

Wenglor has released retroreflective sensors with three different light-band heights to be used as two-dimensional laser light barriers.

Treotham Automation Pty Ltd

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NEW PRODUCTS

HAZARDOUS LOCATION SENSORS

The Model S88 Intelligent Sensors range, from ECD, includes pH, ORP, ion selective, dissolved oxygen, conductivity and resistivity sensors. The range features two universal sensor designs: insertion/submersion or valve retractable with a flared end to prevent blowout. The sensors have 316 stainless steel housings, although various materials of construction are available to maximise sensor performance while minimising cost of ownership.

The pH sensors convert the analog signals from the electrode cartridge into a digital protocol that allows two-way communication with the transmitter. The identity of the sensor, measurement type and serial number are stored in the sensor's memory along with three calibration registers. When connected to an ECD digital analyser, the sensor's information is uploaded to the analyser. This configures the displays and outputs of the transmitter to the values appropriate to the sensor's measured parameter.

The insertion sensor uses a ¾″ MNPT compression fitting as the process connection. This allows a variable insertion length to accommodate installation in pipe tees or flow cells, or through tank walls. If the fitting is reversed, the sensor can be installed in a stand pipe for submersion into a tank.

The valve-retractable sensor uses a 1″ ball valve with a 1″ NPT process connection. Loosening the rear compression fitting allows the sensor to slide freely through the ball valve but stop at the compression fitting for either insertion into the process or retraction from the process.

AMS Instrumentation & Calibration Pty Ltd
www.ams-ic.com.au

VACUUM PADS

SMC's ZP3P series vacuum pads feature a blue-coloured, silicone rubber pad to prevent wrinkles and are compliant with FDA requirements.

The series is designed for product handing. The thin, soft pad skirt is said to offer a strong grip and reduce leakage, so that it can handle thin workpieces that might otherwise deform during adsorption.

The pads are designed for delicate operations such as the handling of vinyl and film, due to the flat shape of the vacuum pad with a central stopper.

The vacuum pad is made from FDA-complaint silicone rubber and is suited to stringent applications in the food and pharmaceutical industries. The blue colour can also be detected easily during contamination inspections.

The series also includes a fluoro blue bellow option, the ZP3P-JT series. While the flat-style vacuum pad is suitable for the handling of soft film, paper or foil packages and sheets, the bellow style allows for absorption of a larger range of bag shapes and pouches filled with foodstuffs.

SMC Australia | New Zealand
www.smcanz.com

CLOUD SOLUTION

KELLER AG für Druckmesstechnik has announced a cloud solution called KOLIBRI Cloud. With personal logins and SSL encryption, the KOLIBRI Cloud is said to enable secure and convenient access to measured data.

Available data is used without installation, maintenance and management of databases, FTP or email servers. Measurements can be graphically displayed in real time and the export function allows users to download to Excel and CSV formats. The integrated alarm system allows easy monitoring of all measuring points, eg, if a level is high or a battery level is low, a warning message will be sent by email.

The KOLIBRI Cloud API allows custom software to retrieve metrics via HTTPS in a standardised JSON format. In this way, the measurement data can be forwarded to in-house own systems, visualised or processed further on the user's own display software. Open source software and documentation also help users to build cloud solutions based on the mechanisms of the KOLIBRI cloud.

The cloud is compatible with all KELLER IoT devices, including the GSM and ARC series as well as remote data transmission units based on IoT protocols such as LoRa.

Bestech Australia Pty Ltd
www.bestech.com.au

Perfect match

New AirLINE SP valve island from Bürkert is perfectly matched to the connection of the distributed Siemens peripheral systems SIMATIC ET 200SP and SIMATIC ET 200SPHA.

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The new valve island compatible with
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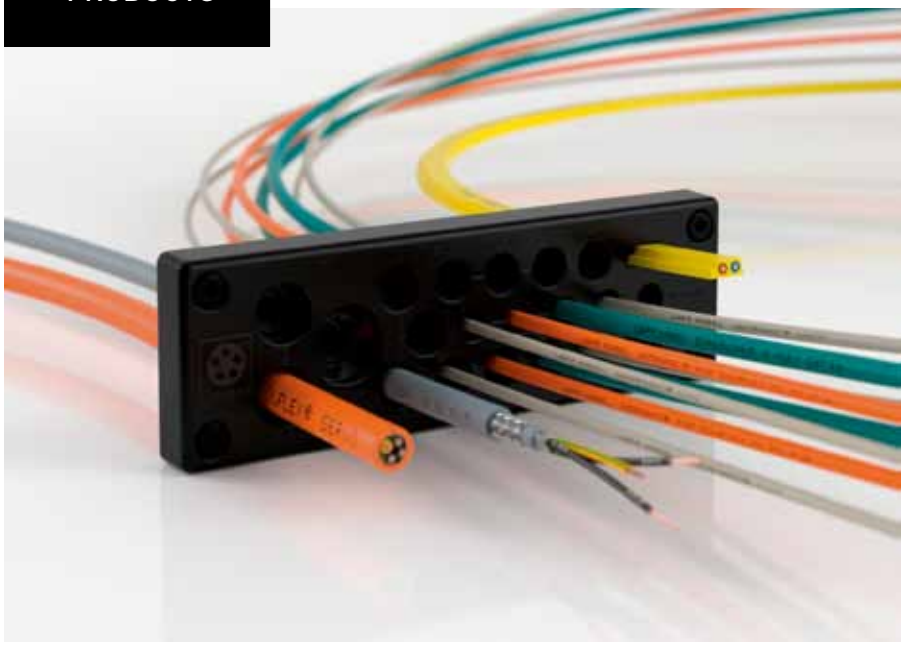

CABLE ENTRY SYSTEM

The SKINTOP CUBE MULTI is a multi-cable entry system with gel technology, offering large, variable clamping ranges, high packing density and the optimum strain relief on the entire cable bundle.

The SKINTOP CUBE MULTI is used wherever cables need to be installed into a housing in tight areas without connectors and compressed air connections. With a gel-based cable bushing system, non-assembled cables and media hoses used in the construction of control and switching cabinets and apparatus can be installed quickly, securely and efficiently.

SKINTOP CUBE MULTI is designed for temperatures from -30 to +100°C. It is permanently oil, grease, UV and ozone resistant and has a fire behaviour meeting UL94 standards. SKINTOP CUBE MULTI is available in both standard configurations and as a customised solution tailored to the application.

LAPP Australia Pty Ltd
lappaustralia.com.au

FLAT PACK INDUCTIVE SENSORS

The compact IQ IO-Link inductive sensors in a rectangular housing are suitable for the limited space found in conveyor technology and factory automation. The flush installation of the sensor facilitates mounting and prevents mechanical damage. Together with a high impact and vibration resistance and a wide temperature range, this helps ensure long life.

In order to solve demanding position detection tasks, the distance value is continuously provided via IO-Link. Two switch points can be set to the nearest millimetre via IO-Link. The sensor also provides various configuration options, such as NO/NC or PNP/NPN, which reduces storage costs for different sensor types.

The IQ inductive sensors are offered with protection ratings of IP65, IP67 and IP68, and have an operating temperature range of -40 to +85°C.

ifm efector pty ltd
www.ifm.com/au

PRESSURE INSTRUMENT MONOFLANGE

The WIKA model IVM monoflange for connecting pressure measuring instruments to the process is suitable for applications involving critical liquids, gases and vapours. Special seals also prevent fugitive emissions in accordance with TA-Luft (VDI 2440) and ISO 15848-1.

The monoflange is manufactured and tested to comply with various common standards such as ASME BPVC. It is designed for a long service life, even under difficult conditions. The valves work durably, smoothly and precisely, even at high pressures. The metal seat of the non-rotating spindle tip is tested for bubble tightness. To avoid seizure and leaks, the threaded mounting of the bonnets is not in contact with the medium.

In a version with OS&Y bonnet, firesafe tested to API 607 and ISO 10497/BS 6755-2, the IVM can also be mounted directly to the process without additional isolation.

For the combination of the monoflange (or other protective devices) with a pressure measuring instrument, WIKA also offers professional assembly to provide an application-specific, complete solution, ready for installation and leak-tested.

WIKA Australia
www.wika.com.au

POLYMER BEARINGS FOR FOOD CONTACT

igus has developed two optically and magnetically detectable materials for its plain and spherical bearings: the iglidur FC180 and igumid FC. The materials comply with FDA and EU10/2011 regulations and are therefore suitable for use in the food industry.

The new material is visually detectable by its blue colour as well as by metal detectors due to the inclusion of appropriate, food-compatible additives. In this way, broken pieces can be quickly detected and removed in the event of damage to the system. As a result, the purity of the product is secured and costly product recalls are prevented.

In the igubal spherical bearings range, igus now relies on a detectable material. With the housing material igumid FC in combination with iglidur FC180 as spherical ball material, the self-adjusting bearings are approved for direct food contact. The detectability of the materials was also confirmed by Sesotec GmbH, a specialist in foreign body detection and manufacturer of metal detectors for the food industry. Fragments as small as 0.0139 g (iglidur FC180) and 0.0157 g (igumid FC) could still be identified on a conveyor belt when passing through a metal detector. The vibration dampening bearings are resistant to corrosion and media due to their polymer base, allowing them to withstand cleaning with water and many cleaning agents.

Treotham Automation Pty Ltd

www.treotham.com.au

INDUCTIVE COUPLERS

Balluff's BIC0073, BIC0074, BIC0075 and BIC0076 inductive couplers eliminate the need for mechanical slip rings that are prone to needing maintenance, making them suitable for non-contact, high-power transmission applications. Their IP67 rating allows them to stand up to harsh environments, including oil and water, and internal temperature monitoring keeps them from overheating.

Uses include battery charging stations for automated guided vehicles (AGVs), automated tool changers, and robotic end effectors with high power requirements.

The couplers can transfer power at up to 120 W, 5 A at 24 VDC, are IP67-rated for harsh environments, have a LED for visualisation of operating status, and feature internal temperature monitoring.

Balluff Pty Ltd

www.balluff.com.au

Robotic welder automates arc welding with no capital investment

Nowhere in US manufacturing is the shortage of labour felt as urgently as in the welding sector, which is now facing an acute shortage of welders. The industry's hiring challenge, combined with the struggle metal fabrication companies experience in producing quality parts quickly and in small runs, prompted Hirebotics to develop the BotX Welder.

"Many people didn't believe that collaborative robots could perform such heavy-duty tasks as welding," said Rob Goldiez, co-founder of Hirebotics. "We realised the need for a solution for small and medium-sized metal fabricators trying to find welders."

Hirebotics' hire-a-robot business model, built on cobots from Universal Robots, set the foundation for the BotX. It is a welding solution powered by the UR10e cobot that is easy to teach, producing automation quality with small-batch part runs.

In developing BotX, Hirebotics addressed two major hurdles of robotic welding: the ease of programming and the ease in which a user can obtain the system without assuming the risk of ownership. There are no installation costs with BotX and, with cloud monitoring, manufacturers pay only for the hours the system actually welds. "You can hire and fire BotX as your business needs dictate," explained Goldiez.

The complete welding system comes with the UR10e cobot arm, cloud connector, welder, wire feeder, MIG welding gun, weld table and configurable user-input touch buttons. The customer simply provides wire, gas and parts. Customers can teach BotX the required welds simply via an intuitive app on any smartphone or tablet utilising welding libraries created in welding labs. A cloud connection enables 24/7 support by Hirebotics.

"We chose Universal Robots' e-Series line for several reasons," said Goldiez. "With Universal Robots' open architecture, we were able to control not only wire feed speed and voltage, but torch angle as well, which ensures a quality weld every time.

"UR's open platform also enabled us to develop a cloud-based software solution that allows us to ensure a customer is always running with the latest features at no charge. We can respond to a customer's request for additional features within weeks and push those features out to the customer with no on-site visits.

"The fact that they're collaborative and don't require safety fencing like traditional industrial robots means a smaller footprint for the equivalent working space or, put another way, less floor space to produce the same-sized part — in many cases less than half the floor space of traditional automation," he continued. "The collaborative nature of the solution enables an operator to move between multiple cells without interrupting production, greatly increasing the productivity of an employee."

PMI in Wisconsin was one of the first customers of the BotX. "A large order would mean we needed to hire 10–15 welders to fulfil it — and they're just not out there," said Erik Larson, VP of Operations at PMI. "As a result, we would use no-bid contracts on a regular basis. With the BotX solution, we now quote that work and have been awarded contracts, so it has really helped grow our business. The BotX Welder doesn't require expensive, dedicated fixturing and robot experts on the scene."

Now PMI's existing operators can handle the day-to-day control of the BotX, which welds a variety of smaller product runs. The Wisconsin job shop has now stored weld programs for more than 50 different parts in their BotX app. "We are now able to deliver quality equivalent to what we could accomplish manufacturing with very expensive tooling typically used with higher-volume part runs," said Larson. "Being able to simply hire the BotX Welder, and quickly switch between welds by using our smartphone — and only pay for the hours it works — is huge for us. It took our area lead, who had no prior robotics experience, half an hour to teach it how to weld the first part."

Another significant benefit was PMI's ability to get the BotX welds certified for customers who require this. "This now means we do not need to use certified welders to oversee the operation. As long as the cobot welder's program is certified, any operator can tend the cobot welder. This really unlocks a lot of resources for us," explained Larson. "Hirebotics and Universal Robots really hit the mark with this, we're looking forward to a long partnership with them."

Universal Robots

www.universal-robots.com

MULTIVARIABLE FLUOROMETER

TriOS has introduced the multivariable matrixFlu sensor with excitation and detection at multiple wavelengths in a single, compact design.

When exposed to specific wavelengths of light the different pigments of algae, cyanobacteria and coloured dissolved organics (CDOMs) in water naturally fluoresce or glow. The amount of fluorescence back from each of these different pigments, at their specific wavelengths, can be measured by the optical detection channels within the matrixFlu fluorometer to provide not only the single values but also a 4x4 matrix of wavelength combinations to allow quasi-synchronous in-situ detection of excitation emission matrices (EEMs).

Stability of measurement values is achieved through the combination of specially selected LEDs (for fluorescence excitation) and internal temperature compensation.

Equipped with the TriOS G2 (browser) interface, the matrixFlu allows the user to configure the sensor, set measurement cycles and download information from the internal datalogger of the sensor via any browser and device (computer, tablet or phone). Furthermore, the G2 interface enables quick integration into third-party systems from complete SCADA process control to standalone data loggers in remote monitoring.

The nanocoated hydrophobic lens of the TriOS matrixFlu helps to repel build-up and minimise manual cleaning, though in more demanding applications the sensor can also be supplied with an automated brush wiper system to keep the lens clean.

The matrixFlu can be used for surface water, lakes, rivers, ponds, drinking water treatment plants and environmental monitoring to get real-time data, without manual sampling or reagents.

Control Components Pty Ltd

www.controlcomponents.com.au

FLOATING ROOF MONITORING USING RADAR TECHNOLOGY

PART 2

Automatic floating roof monitoring can provide certainty that floating roof tanks are working as intended.

The world's first floating roof storage tank was built in 1923 and it is estimated that today, more than half of all storage tanks are of this type. Safety, economy and effectiveness were the driving forces behind the innovation back in the day, and the key reasons for using floating roofs have remained the same ever since. However, as we saw in Part 1 of this article, there are a number of risks associated with floating roofs that need to be mitigated.

One method of risk mitigation is regular physical inspection, but there are various reasons why this may not be performed regularly. Alternatively, an automatic floating roof monitoring (AFRM) system means operators can be certain that their floating roof tanks are working as intended.

As described previously, there are two main ways to automatically measure roof tilt: with non-contacting radar and with guided wave radar.

AFRM with non-contacting radar

In this case the gauges are attached to the tank shell at the top of the tank or, if it is an internal floating roof tank, to the external tank roof. Typically, three non-contacting radars are mounted 120° apart around the edge of the tank. In the case of an external floating roof tank, illustrated in Figure 1, the gauges are usually mounted on a swivel arm to create clearance from the tank wall and at the same time allow personnel to reach the gauge for service purposes. A reflector bed is placed on the tank roof below each radar gauge. This ensures accurate measurement without being affected by any protruding objects on the roof surface.

Principle of tilt detection

The non-contacting radar gauges measure the distance down to the floating roof. The tilt of the roof is then tracked by comparing the distances d_1, d_2, and d_3 as shown in Figure 1.

Suitable applications

Distance measurement with non-contacting radar gauges is a technology that has proven itself to be very reliable. It is suitable for both external and internal floating roof tanks, and for any tank size.

Alarm limits and system accuracy

There are many factors that influence the monitoring system's measurement accuracy. They need to be taken into account when configuring the alarm limits for each tank. These factors include, for example:

- Tank wall and roof movements — large storage tanks always have some movement of roof and walls due to sun and shade causing heat expansion or contraction.
- Weather conditions — strong wind and rain can cause the swivel arm, the floating roof and the tank wall to move or lean.
- Tank fill level — the tank walls will bulge as the tank is filled, which causes movement of gauges mounted to the wall.
- Inherent instability of a floating roof — a floating roof is never 100% level. Some small degree of tilt will always be present even in perfect conditions.

This means that a general figure for what constitutes excessive tilt cannot be provided — this will simply vary too much between different sites and even different tanks. The best way to determine suitable alarm limits is to keep track of roof movements after installation and then set the limit based on the typical tilt that occurs for each individual tank during normal operation.

Communication

With a non-contacting radar installation, data transmission from the tank to the control room can be done with both wired and wireless communication depending on what is most suitable.

Additional capabilities

The non-contacting radar solution can also track the buoyancy of the roof — ie, if the roof is floating higher or lower than normal. This requires that a separate automatic tank gauge is installed for ordinary level gauging, measuring the product level through a still-pipe (Figure 2). By comparing the product level from the tank gauge (d_4) to the roof distance from the tilt gauges ($d_{1,2,3}$) it can be determined if the roof is floating higher or lower than normal.

The non-contacting system could also be configured to work as an overfill prevention sensor. In tanks where it is not possible

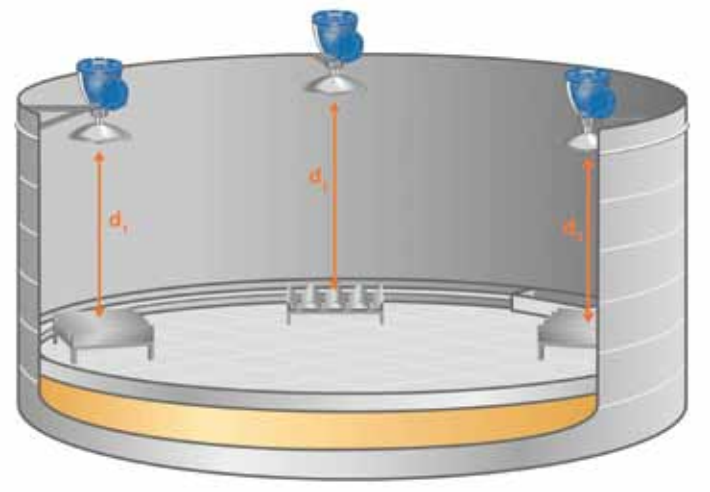

Figure 1: Radar installation on external floating roof tank.

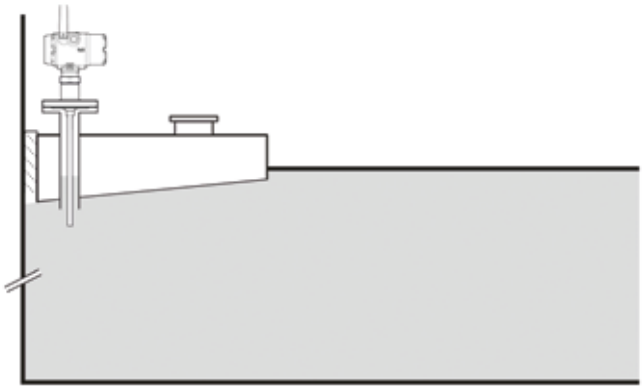

Figure 3: Guided wave radar installation for AFRM.

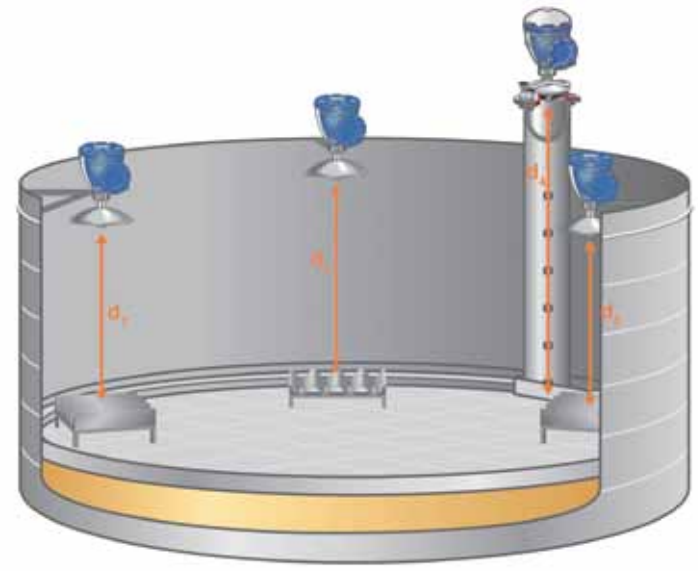

Figure 2: Non-contacting monitoring with automatic tank gauge as reference for roof buoyancy calculation.

to install an overfill sensor that measures the liquid level directly, the tilt gauges could be set up to trigger an overfill alarm if the floating roof should rise above the maximum allowed height.

AFRM with guided wave radar

In the case of guided wave radar, the radar gauges are installed directly on the top side of the floating roof. Three or more wireless and battery-powered guided wave radar transmitters are installed in nozzles spaced evenly around the roof perimeter. The guided wave radar transmitters have rigid probes that penetrate through the roof and into the liquid below (Figure 3).

Using wireless devices enables installation without the need for flexible wiring that can cope with the movement of the roof. A wireless repeater mounted at the top of the tank ensures that when the roof is at a low position the radar transmitters can still send uninterrupted data back to the control room despite the devices being below the upper edge of the tank shell.

Principle of tilt detection

The guided wave radar measures the ullage — the amount of free space above the liquid surface. If the roof starts to tilt, the radar transmitters will register a deviation of distances d_1, d_2, and d_3 as shown in Figure 4.

Suitable applications

Floating roof monitoring with guided wave radar is suitable for external floating roof tanks of any size.

Alarm limits and system accuracy

Many of the factors that influence accuracy of the non-contacting solution apply also in this case. The system has a natural variation

	Installation with Non-Contacting Radar	Installation with Guided Wave Radar
Number of radar devices	Min 3, max 6	Min 3, max 6
Installation	At top of tank shell or through external (fixed) tank roof	Directly on floating roof
Track roof buoyancy	Yes – requires reference gauge	Yes
Can work as overfill alarm	Yes	No
Data transmission	Wired or wireless	Wireless
Suitable for external floating roof tanks	Yes	Yes
Suitable for internal floating roof tanks	Yes	No

Table 1: Non-contacting versus GWR comparison.

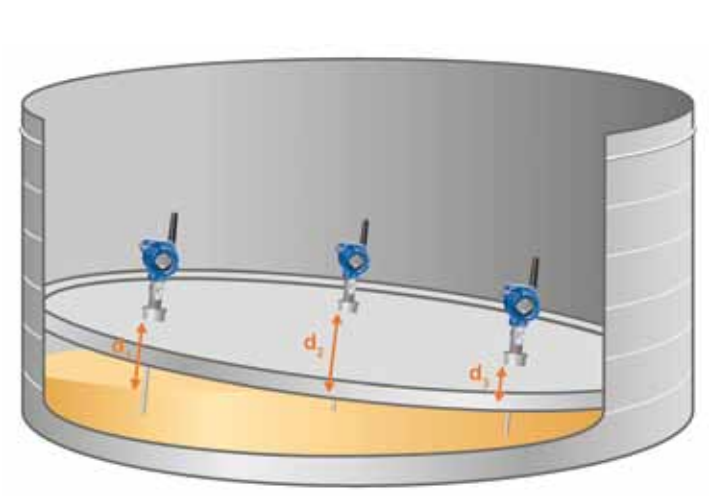

Figure 4: Tilt detection with guided wave radar.

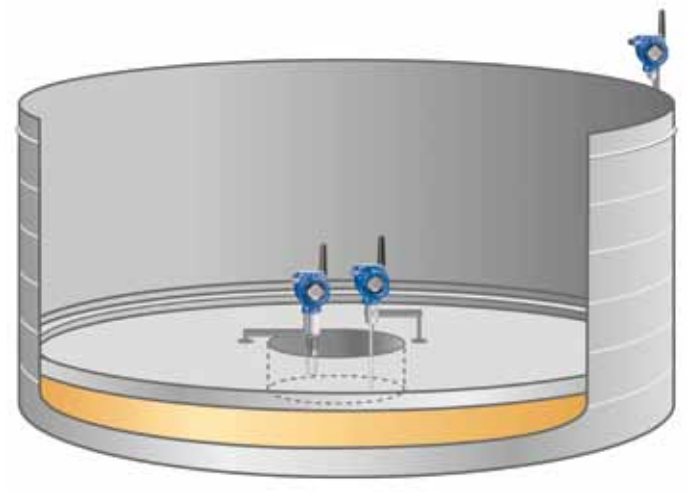

Figure 5: Drain sump monitoring with wireless instruments.

that depends on conditions independent of the floating roof itself, such as sun, shade, wind and fill level.

Determining performance of the system and setting an alarm level should thus be done according to the same principle as the non-contacting solution: first monitor the tilt during normal operation and then set alarm limits based on what is found to be ordinary behaviour of each floating roof.

Communication

If a wireless network already exists at the site, integration of an automatic floating roof monitoring system with wireless guided wave radars is usually quick and painless. If not, typically only a few repeaters and a gateway need to be installed for reliable transfer of data to the control room.

Additional capabilities

The guided wave radar solution can also measure roof buoyancy. Because the gauges are installed directly on the floating roof and measure the free space (ullage), a guided wave radar system does not need a reference tank gauge for this task.

Additional solutions for AFRM

Roof tilt is not the only variable that is worth monitoring. Additional sensors can provide added value and more information about roof status. For example, external floating roof tanks often have rainwater gathering on the roof. The water must be drained off, but if the drain system is blocked, water can pool on the roof and lead to corrosion (Figure 5). If there is enough water it can even destabilise the roof. Adding a level switch to the drain sump is a simple way to know if the water level in the sump rises and spills out onto the roof. For this use, wireless instruments provide quick installation, and potentially easy integration with the roof level monitoring system.

The ability to detect hydrocarbons on the roof and in the drain sump is yet another feature that provides valuable insight into the health of the floating roof. If hydrocarbons are present, it could mean that the drain pipe or the deck is leaking. Whichever the case, quick action is necessary to limit emissions, prevent product loss and contamination, and prevent escalation of the problem. A wireless hydrocarbon sensor provides simple installation on top of the floating roof and will trip the alarm quickly and reliably.

Both level switches and hydrocarbon detectors are available in battery-powered versions with wireless communication. This provides great synergy with the wireless guided wave radar solution for monitoring roof tilt, as a wireless network with repeaters and gateways will always be installed.

User interface

The operator interface that is used for the floating roof monitoring system should perform all the monitoring and calculation of tilt automatically, and alert the operator if there is a deviation. Ideally the following alarm functionality should be available:

- Roof tilting
- Roof floating higher than normal
- Roof floating lower than normal
- High liquid level in roof drain sump
- Hydrocarbons in roof drain sump/on roof

Non-contacting versus GWR comparison

Which type of installation is preferred varies site by site or even tank by tank. For example, if wired tank gauging infrastructure is already in place, a non-contacting radar installation may be the most suitable. Or if industrial wireless networks are already used in the tank farm, installation will most likely be quicker with the guided wave radar alternative. Either way, the system is flexible and cross-compatible — mixing installation types at the same site is fully supported. When considering which kind of installation is most suitable, the comparison in Table 1 can be used as a guide.

Conclusion

AFRM is yet another way in which technology increases safety and efficiency in tank farms. Instead of relying on manual inspections that are time-consuming, expensive and potentially unsafe, automatic monitoring provides peace of mind through real-time, around-the-clock verification that the roof is operating as normal.

The key benefit of using radar is that it provides proactive monitoring. Where switches, liquid detectors and video surveillance are reactive and will only raise the alarm once product is already on the deck, radar-based systems immediately provide early warnings if the roof deviates from normal behaviour. This allows for taking preventive measures: sending out operators for detailed inspection and then planning repairs as part of an ordinary maintenance schedule, thus avoiding more serious failures of the floating roof.

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

OPINION

THE BUSINESS CASE FOR INDUSTRIAL IoT

For over five decades, industrial sensors and actuators have been instrumental in the evolution and automation of processes within heavy industries. Systems like SCADA, PLCs and RTUs have been in use since the 1960s. Distributed controls systems were introduced in the 1970s to provide distributed control of production plants.

These systems generated massive amounts of time-series data. Data historians became the tool of choice in the 1980s, with systems such as OSIsoft's PI having been the go-to tool for operations teams across many industries for decades now.

Throughout the start of this new millennium, the internet has touched and transformed many consumer industries; however, the industrial transformation is still catching up. In 2016, Artesian Capital did a review of the Australian Industrial IoT start-up landscape. It didn't look very promising back then, did it?

Production and operations continue to face even more pressure to improve performance. Competition is no longer 'down the road', now it's global. The need for higher uptime and availability is affecting all industries and the tension between operations and maintenance is now even more prevalent.

In early August the Australian Industry Group released a report about Industry 4.0. Its Chief Executive, Innes Willox, is quoted as saying "... despite expected cost efficiencies through adoption of connected devices, often called the Internet of Things (IoT), challenges remain for promoting the business value of IoT. According to the latest ABS data on business use of IT, more than 60% of businesses did not see any value in IoT ..."

Maybe the subtlety lies in who within the Australian businesses answered the questions within the ABS survey? The use of IT takes place in every single department of an organisation, from sales and marketing, to maintenance and production, through to the supply chain. Because of this, companies shouldn't write off the business case for IIoT — rather we need to be mindful about the different types of technology and who benefits from them.

I recently met with a customer who is the production manager at a large coal processing facility. IIoT technology we supplied (FitMachine) managed to save 12 hours of production downtime (or around $1.7 million). Two days later I met with the operations manager of a food and beverage factory, where IIoT technology helped the plant avoid a couple of breakdowns in the last couple of months; one of these episodes had previously cost the company $250,000 of production downtime.

Our conversations with clients and prospects keep pointing us to production and operations stakeholders. The issues aren't limited to Australian industrial businesses. I've been travelling around New Zealand working with customers to kick off the scaling of their national IIoT deployments. Again, the stories I was told in the field and in head offices were all about the benefits of IIoT to the production and operations teams: transparency around equipment uptime and increasing safety.

It became clear to me that the efficiencies and cost savings from IIoT directly impact these two teams. And these conversations obviously evolve to creating new opportunities; if the operations and production teams both understand their uptime

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and machine health, they will inevitably start looking into increasing their throughput by optimising the use of their existing assets, instead of incurring new capital expenses.

When we look at the impact that the production and operations teams have in industrial manufacturing and processing businesses, we start questioning ourselves: "What other efficiencies can we create in a heavily process-oriented supply chain?"

Light manufacturing businesses such as food and beverage might push their business case towards reducing idle product stock and decreasing inventory and spare parts levels. Heavy asset businesses with strong zero harm policies look at the safety aspects of IIoT from the outset; by having IIoT sensors monitoring remote equipment, they reduce the need for long-distance travel and for accessing machines in hazardous locations.

The IIoT is obviously not an out-of-the-box solution that fits all industries and business cases, but recent market developments indicate a huge uptake of the technology in the very near future. Those developments include the lower cost of remote condition monitoring sensors and platforms, successful pilot projects deployed across the globe in different industries and the realisation of its benefits among the established OT (operations technology) players.

When building your business case for an industrial IoT solution, ensure you have a holistic understanding of how the processes connect to one another; take a deep dive into the processes you're looking at improving; make sure you know what the performance indicators and personal motivations of the teams are; pick one critical challenge to tackle; and above all, start small. Once you prove you created efficiencies (and potential cost savings) in a small part of the business, you already have a business case to build upon and scale your mission.

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.

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RADAR LEVEL TRANSMITTER

Hawk Measurement Systems (HAWK) has announced the release of its SENATOR radar level transmitter product line. The SENATOR radar level transmitter is a non-contact sensor that uses FMCW technology. FMCW technology features a continuous signal transmission, providing immediate measurement updates with zero delay.

The transmitter can be installed inside or outside of tanks and can penetrate a variety of nonmetallic materials such as various polymers and composites. It has the ability to precisely measure distance, level and volume of liquids, solids, corrosives, powders, granulates, rocks, pastes and hygienic liquids.

The device is available in 24 and 80 GHz frequencies. The 24 GHz version is used in a wide range of applications with good beam directivity and operates with agitation and condensation drop. The 80 GHz has good focusing frequency and is available with a small-sized antenna, no dead zone and long-range measurement without interference from the environment. The transmitter is suitable for applications from sawdust to molten steel.

Hawk Measurement Systems Pty Ltd
www.hawkmeasure.com

Tasmanian distillery combats counterfeiting using IoT

Old Kempton Distillery (OKD) is located in the small town of Kempton in Tasmania, where it produces some of the finest single malt whiskies. The product is produced, distilled, aged and bottled on the property.

With counterfeiting product becoming a global issue, particularly in the whisky industry, Robbie Gilligan, Business Manager and Brand Ambassador for OKD, said the company decided to take proactive action to protect its growing brand.

OKD implemented the HID Global IoT platform for brand protection, combined with the web application developed by local integrator AusNFC, to combat counterfeiting of its whiskies, premium gin and other liquor products.

"We were seeking the best brand protection technology available and a solution that would also allow us to securely engage with our customers, long after a sale. We believe that HID Trusted Tag Services and the support provided through AusNFC provide just that," said Gilligan.

The distillery's solution incorporates HID Trusted Tag Services into the AusNFC web application that drive the front-end mobile experience on customers' phones.

An HID cryptographically secure near-field communication (NFC) tag is embedded into the label of every liquor bottle, which links to HID's cloud authentication service.

By tapping their iPhone or Android phone to the bottle, the customer activates a secure communications channel that authenticates the provenance of their premium product — down to the actual bottle number.

Unlike QR codes, each tap generates a unique URL, preventing counterfeiters from copying, spoofing or manipulating the URL for false verification.

"HID's IoT technology is enabling mass adoption of brand protection by major brands worldwide that are seeking to address more sophisticated attempts by fraudsters focused on imitating their products," said Mark Robinton, Director of Business Development and Strategic Innovation at HID Global.

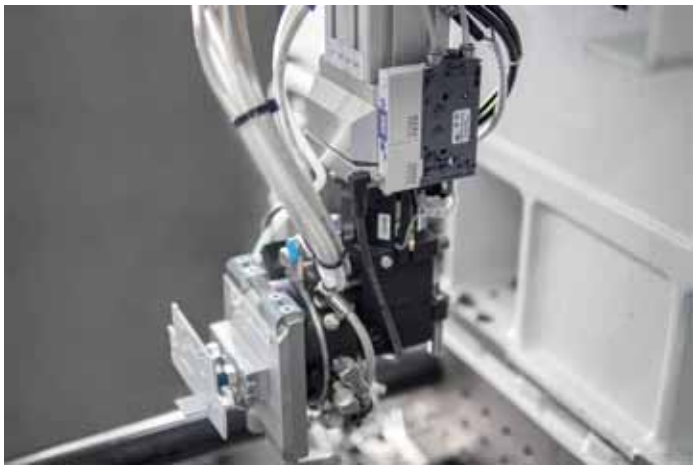
According to Larry Hower, CEO of AusNFC, NFC technology is becoming more widely used and the solution is applicable to many different industries. "HID Trusted Tag Services is changing the game for authenticating brands and staying connected to buyers through a mobile experience," he said.

The NFC tags come in many form factors for a variety of product shapes and sizes requiring brand authentication. The tags are embedded into each product during the manufacturing process and are easily read using NFC-enabled smartphones (both Android and iOS v11 and newer). The advanced cryptographic capabilities of the embedded tags make them virtually impossible to be cloned or copied, and the extended security features in HID's cloud authentication service provide privacy-preserving brand authentication and consumer engagement in a closed and trusted environment.

"The brand protection solution from HID and AusNFC goes a long way in helping us preserve the uniqueness of our whisky and shutting the door to imitations," concluded Gilligan.

AusNFC Pty Ltd

www.ausnfc.com.au



COMPACT EJECTOR

The Schmalz SCPM compact ejector combines powerful suction with straightforward integration directly into the vacuum gripping system due to its slim, lightweight design.

With optimised power density and compact dimensions, the ejector can be used close to the suction cup. Up to 16 ejectors can be easily blocked to form a compact pneumatic unit with just one connection. This means that users can set up and individually control this number of vacuum circuits with one device, allowing different parts to be handled independently of one another with only one terminal.

Using different modules, three different versions can be created with just one main body. In addition to the basic version SCPMb, there is also a 'c' version — where 'c' stands for 'controlled'. With additional features such as the automatic air-saving function and active blow-off, this version reduces compressed air consumption during handling by more than 80%.

The intelligent 'i' version of the SCPM also offers numerous functions for monitoring and controlling the entire production process. The SCPMi version is equipped with an IO-Link interface and NFC (near field communication) and transmits all relevant process data clearly to mobile devices and computers.

Schmalz Australia Pty Ltd

www.millsom.com.au

INTRINSICALLY SAFE CAMERA

The Onsight Ex-Cube 800 Zone 1/21 certified intrinsically safe camera allows users to stream HD quality images and video in potentially hazardous gas and dust environments. It can record standard images and 30 fps video at full HD resolution with its 13 MP camera and built-in 48 Gb onboard memory. Switching modes the user has a longwave infrared thermal imaging camera, as well as Fusion mode to overlay the thermal and visual images.

The compact size of the Ex-Cube 800 allows it to be mounted on the user's helmet, on a monopod or handheld as a conventional camera. Pairing it to a tablet and smartphone provides live visuals from the Ex-Cube 800 on the paired device and remote control of the Ex-Cube, including adjusting zoom and lighting, taking pictures or creating recordings. The built-in lighting ring and laser pointer assist with use in dimly lit spaces and for highlighting specific subjects.

With *Onsight Connect Enterprise*, the Ex-Cube 800 acts as a Wi-Fi based endpoint, allowing the sharing of live video, sound and images with full live data and localised media encryption.

The Ex-Cube 800 can survive a 2 m drop to concrete, is water and dust proof with an ingress rating of IP64, and will operate in temperatures of -20 to 55°C. The rechargeable Li-ion battery provides up to 4 h run time, depending on media and illumination settings. It can be charged through any USB port using a magnetic connector and files can be transferred wirelessly or via USB.

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BULKHEAD MOUNT HOUSINGS

The ilme MKAS IVG20 zinc alloy bulkhead mounting housings, coated for electromagnetic compatibility, provide full shielding not only outside but also inside the cabinet — especially important for highly sensitive applications.

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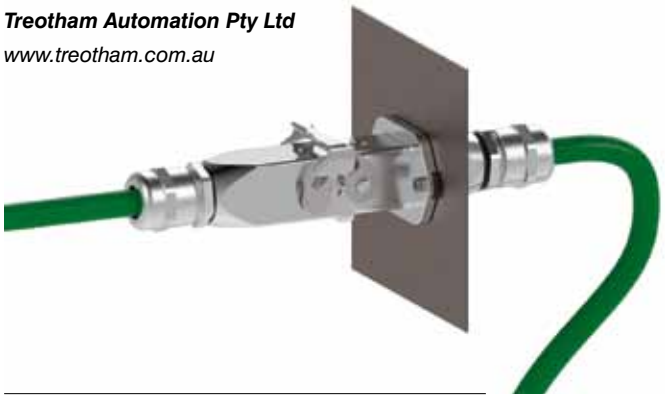

INSULATION RESISTANCE TESTER

The Megger MIT525 is a compact and lightweight 5 kV insulation resistance tester (IRT) capable of resistance measurements up to 10 TΩ. It is available to rent from TechRentals.

Testing options include polarisation index, dielectric absorption ratio, dielectric discharge, stepped voltage and ramp test. The unit has a CAT IV 600 V safety rating as well as a dedicated voltmeter function (30 to 660 V).

The tester has a large, easy-to-read screen that is effective in both bright and dimly lit environments. The screen displays resistance, voltage, leakage current, capacitance, battery status and time constant. The instrument has a rapid charge, Li-ion battery with the ability to take measurements on a flat battery when connected to mains power.

The product has advanced memory capabilities including time/date stamping of results. Additionally, users can download test data to a PC through the PowerDB Lite asset management software supplied with the instrument. The Megger MIT1025 10 kV model is also available.

TechRentals
www.techrentals.com.au

Dynamic energy management system for SMBs

The growing use of renewable energy sources is resulting in substantial fluctuations in energy production. Fraunhofer researchers have now made it possible to design industrial processes in small and medium-sized businesses to be demand-responsive. This enables companies to maximise their use of green power from their own power plants, to respond to fluctuations and in the future to contribute to stabilising the energy supply.

Researchers are exploring how a dynamic energy management system can be incorporated in the everyday business routine in a manufacturing SMB. © Fraunhofer IFF/Viktoria Kühne

The proportion of coal in the energy mix is diminishing, while renewables are steadily growing in importance. This is confronting grid operators with challenges: if the sun is shining in a clear blue sky and a fresh breeze is blowing, solar modules and wind turbines generate more power than is needed. If, however, the sky is overcast and the wind is still, power becomes a scarce commodity. How can such production fluctuations be stabilised to ensure a stable energy supply, despite the growing number of volatile power sources?

Researchers at the Fraunhofer Institute for Factory Operation and Automation IFF in Magdeburg see a solution among small and medium-sized businesses, which generate power themselves from sun, wind or even their own manufacturing waste. They will become more active stakeholders in the future smart grid, helping to make it more reliable and more stable. Achieving this goal entails designing internal energy-relevant industrial processes to be demand-responsive, managing controllable loads dynamically, generating renewable energy and using energy storage systems.

"We are developing new solutions and applications together with Mageburg-Stendal University of Applied Sciences and other partners in the European project RELflex," said Dr Pio Lombardi, RELflex project manager at the Fraunhofer IFF. "They are primarily intended to help make manufacturing processes in SMBs more demand-responsive.

"This means businesses can adapt their manufacturing processes to the actual energy situation, fall back on energy from their storage systems during bottlenecks and possibly even use other energy sources such as incinerated wood waste."

The heart of the development is the XDEMS dynamic energy management system.

The researchers are currently exploring how this energy management system can be utilised in the everyday business routine at one of their project partners, aRTE Möbel GmbH. One benefit is that it enables companies to utilise the energy they generate with photovoltaics and other technology for their own manufacturing processes, thus becoming more self-sufficient and less dependent on grid operators. This has an impact on business models as well: the bar can be raised higher for green products, which can be made not only out of organically produced materials but also with green energy.

SMBs can respond to the fluctuating energy supply in different ways.

"Adapting manufacturing and installing backup storage systems would be the most efficient way," Lombardi said. "Whenever a lot of energy is available, items are made to stock and warehoused. A second option would be to let employees work flexibly, for instance, at later hours or even on weekends, based on the energy situation."

The researchers intend to gauge the acceptance of this idea in a corresponding survey. Energy storage systems are a potential third option. They remain expensive, though, because of the high capital expenditures, and energy storage still entails losses, depending on the technology.

The Fraunhofer researchers are starting out by focusing on the monitoring system at aRTE Möbel GmbH. They are using suitable instrumentation to measure the energy generated by the private photovoltaic system and the power consumed by individual manufacturing lines or groups of manufacturing lines in real time. In a second step, the researchers will be using their XDEMS software to compile load and production forecasts from the recorded data. How much power will the photovoltaic system generate in the coming week? How many tables and cabinets have to be manufactured in that time? And how can manufacturing be controlled best to coordinate these two factors optimally, ie, to inject a minimum of power into the grid and not have to withdraw power from it? The software makes relevant suggestions here: for example, a traffic light system might be conceivable. A green light could show employees that enough power is being produced and that items can be made to stock, for instance. If energy is in short supply, however, a red light could indicate that the line ought to be used later. "We still have to consult with aRTE Möbel GmbH management about the exact form information feedback to employees will take," Lombardi added. Once they have finished developing the monitoring system, the researchers will start working on the forecasting and control system next year.

Fraunhofer Institute for Factory Operation and Automation IFF
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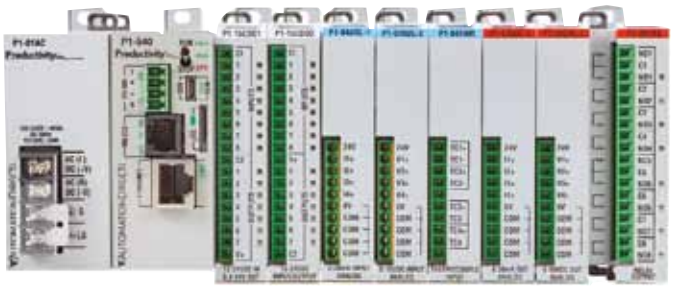

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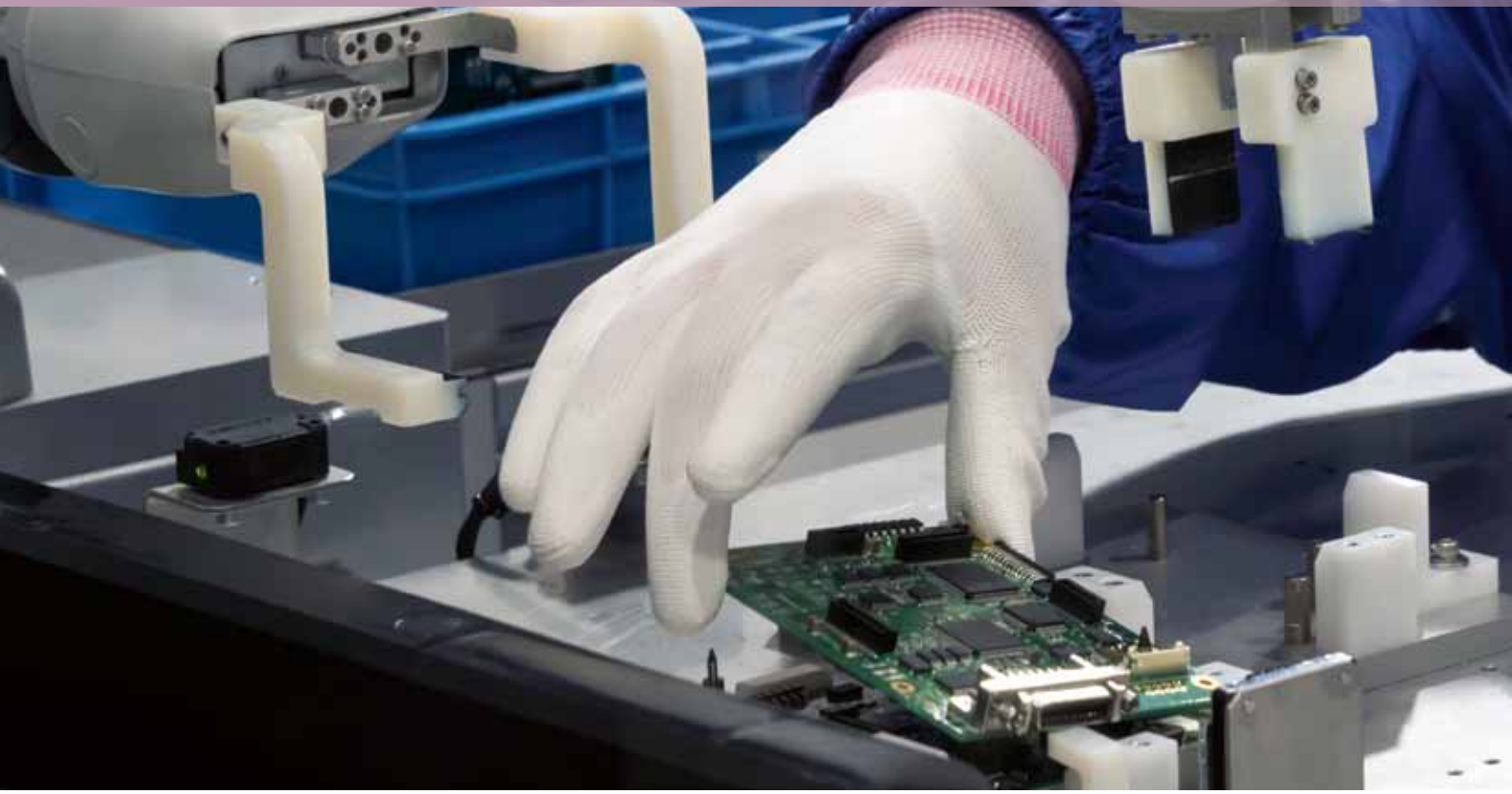
COLLABORATIVE ROBOTS

APPLICATION BENEFITS FOR MANUFACTURERS

*Tina Hull**



Collaborative robotic applications, a relatively new innovation in the robotic industry, are designed to team up with a human operator to flexibly perform a wide variety of tasks.

In the initial decades of robotic applications, the technology functioned without human interaction. This was for two reasons: the flexibility of robots was limited, so humans had little reason to interact with them; and the robotic arm's high-speed motions posed significant hazards for anyone who got too close. Despite their lack of flexibility, robotics helped lower operating costs, capital costs, labour turnover and waste while improving product quality, production work and employee safety.

Technology has advanced to the point where humans and robots can now share tasks, and this new partnership boosts flexibility for manufacturers. Today's business and technological drivers, such as data-driven services, decreasing product lifetimes, the introduction of machine learning and the need to differentiate individual products and brands, are making flexible collaborative robot applications — where humans and robots work in tandem — an effective option for manufacturers.

Enabling collaborative robots

The robots used in collaborative applications today manage to minimise their potential for harm by limiting their power and force capabilities to levels suitable for human contact. They

often employ force feedback, low-inertia servomotors, elastic actuators and collision detection technology.

Collaborative robots are more compact than conventional robots and often have lightweight frames with soft, rounded edges and minimised pinch points. They are equipped with sensors that are capable of detecting when a person has entered the collaborative workspace as well as when contact is made. Well-defined collaborative workspaces enable the robot to operate at higher speeds when people are not present within the hazard zone.

Force-torque (FT) sensors are a key component of hand-guiding mechanisms for training on new tasks. Hand-guided teaching is one of the most significant benefits of today's collaborative robot applications because it enables the operator to prepare the robot for new applications without requiring advanced knowledge of robot programming.

To make a collaborative robot application suitable for the operator, principles for safe operation also need to be applied to the rest of the system, including the end effector and fixtures. Hazardous end effectors include any that present sharp edges or high heat, such as those used in welding applications.

Applications for collaborative robots

A collaborative application incorporates a robot designed for collaborative use that is working in close proximity with an operator. Many manufacturers introduce robots designed for collaborative applications into their facilities to take care of pick-and-place tasks, but the versatility of these robots goes far beyond those applications. Since these robots allow a significant amount of human control and authority over machinery, they can take on almost any repetitive task in manufacturing.

Packaging and palletising are production-line stages that can be repetitive and tedious for workers. Collaborative robot applications, in which the robots are equipped with flexible grippers and vision systems that can recognise various product types, can take care of the redundant tasks and heavy lifting while operators work on tasks that require human input.

Collaborative robotic applications can also perform processing tasks that require machine tools to act upon raw materials and works in progress. Many of these tasks require tools to traverse a precise path repeatedly. Depending on how complex the path is, it can be difficult to train the requisite number of human workers on these tasks, whereas training robots — whether through programming or hand-guided teaching — gives fast, precise and consistent results.

Machine tending is another useful application for collaborative robots. Although the process of loading parts and materials into machines is often dangerous as well as repetitive, humans currently perform most machine tending tasks. Because qualified workers are difficult to find, manufacturers are incorporating flexible robotic solutions to boost productivity while minimising hazards to workers. Robots can perform tasks such as loading materials into computer numerical control (CNC) milling machines, emptying plastic injection machines and inserting printed circuit boards (PCBs) into testing machines.

Collaborative robots and risk assessments

Although robots designed for collaborative applications may be lighter in weight and move slower than conventional robots, safety measures are still important. Features like collision detection technology and low-inertia servomotors help minimise risk, but they don't completely remove it. Hazards must be identified through risk assessments for various applications, and appropriate training and safety measures must be implemented.

Potential risks to identify include operator conditions such as fatigue or stress, clearance around obstacles such as building structures, foreseeable contact and consequences of such contact, and other hazards associated with the work area as well as misuse or lack of operator training. Operators need to be aware of the robot's pathways and process.

Collaborative robots are ideal for automating machine tending tasks, such as removing finished parts from CNC machines. Source: Omron Automation Americas.

While each application is unique, some guidelines help evaluate the safety of a robot while performing a given task in collaboration with a human operator. Things to consider may include:

- How long and often the operator will be inside the collaborative workspace
- The potential frequency and duration of contact between the operator and the robot
- Whether or not there is a high potential for head or neck contact (if so, the collaborative application should be reconsidered or redesigned)
- What happens during the transition into or out of the collaborative workspace
- Whether the robot might engage in unexpected starts capable of startling the operator
- If more than one operator will work with the collaborative robot or be able to access the collaborative workspace (if so, sensing devices to monitor additional individuals may need to be evaluated)
- Any potential pinch points and crushing due to additional structures in and around the workplace
- What out-of-the-ordinary events would require a manual restart
- If different levels of drive power pose varying hazard levels to the operator
- If the operator might be wearing personal protective equipment (PPE) that could get caught in clamping fixtures
- Any drive and power hazards that may exist even if the robot is not moving.

The flexible arm of many collaborative robots can be fitted with a wide variety of end effectors and trained on new tasks via hand-guided teaching. Source: Omron Automation Americas.

End-of-arm tooling (EOAT) is also a key source of potential hazard to the operator. A thorough risk assessment will include questions about EOAT including:

- *Are there extreme temperatures capable of causing injury to the operator if contact is made?* If so, a protective cover could be added, or the orientation of the robotic arm could be changed to restrict access to the hot area (such as a hot glue gun).
- *If the part became dislodged from the EOAT, could the impact injure the operator?* If so, redundant mechanisms could be added to detect and reduce the likelihood that parts might dislodge.
- *If clamping forces on the EOAT or fixtures can cause an injury, can the force be reduced?* Design considerations in this case might include using clamps capable of retracting if excessive force is detected.
- *Can exposure to sharp edges cause cuts and abrasions?* Sharp edges could be rounded or made of softer materials to reduce risk.

Conclusion

Overall, collaborative robotic applications can flexibly automate repetitive and sometimes dangerous tasks in manufacturing, including pick-and-place, packaging, processing and finishing tasks, machine tending and others. These robots are versatile and easy to train so they can take on almost any repetitive task in manufacturing. In doing so, they help reduce the risk of repetitive injuries for humans while boosting employee satisfaction.

While collaborative robots are designed with human interaction in mind, a risk assessment may still require additional reduction measures to be added. These risk assessments must consider all the ways in which the robot would interact with an operator, what aspects of the surroundings might cause clamping or entrapment, and what characteristics of the EOAT might pose a risk due to high heat, sharp edges or other hazards. If a risk assessment is performed and requisite safety measures are implemented, it will increase the overall efficiency of an application and boost performance.

**Tina Hull is a TÜV Functional Safety Expert and Product Engineer at Omron Automation Americas.*
This article was first published on Control Engineering.

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RUGGED DATA ACQUISITION MODULES

Most data acquisition instruments are designed for the laboratory or a factory floor environment and don't fare well when exposed to extreme temperatures, water spray, submersion, or high-shock and vibration situations.

To address this need, Dewesoft has released its multichannel KRYPTON data acquisition modules, which offer up to 16 channels each. Designed with an IP67 degree of protection, the modules are robust and designed to operate in temperatures anywhere from -40 to +85°C and 100% humidity.

Krypton modules communicate with each other using the EtherCAT protocol over a single cable that provides data, synchronisation and power, which means can be daisy-chained and spread out over 100 m from node to node.

Engineers have quickly adopted the KRYPTON series, mounting them right up against running car and aircraft engines or anywhere where extreme temperatures are found. Humidity is no issue for a product that can be completely submerged underwater.

The latest KRYPTON ONE series allows the placement of the conditioner as close to the sensor as possible, even in extremely hostile environments such as engine compartments. This results in short sensor cables, improving the signal quality.

The single-channel modules measure 62 x 56 x 29 mm and are machined from an aluminium brick. After the industrial-grade electronics are installed, the units are then sealed with thermally conductive and electrically isolating rubber. The units are waterproof and shockproof, withstanding shocks up to 100g.

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MULTICOLOUR LED BEACONS

The WERMA 240 series multicolour LED installation beacon is a compact signal device with up to seven colours in a single beacon: red, yellow, green, white, blue, violet and turquoise. It can be used to signal status on control panels, machinery and equipment.

A tricolour version is available as an alternative, combining the most common colours — red, yellow and green — in a single beacon. The beacon can be actuated via either a simple cable connection or a pre-assembled M12 plug. This allows the user to signal several different statuses with one device. The beacon can also be supplied with an attention-grabbing buzzer.

The beacons are easily installed with a single-hole mounting (M30 installation size), offer a long maintenance-free service life of up to 50,000 h, and have IP65 ingress protection.

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IICA NSW TO HOLD FINAL TECH EXPO FOR 2019

The NSW branch of IICA is preparing for its final Tech Expo of the year. The IICA varies the location of its Technology Expos to provide an opportunity for everyone to participate conveniently. This October the expo will be at the Rosehill Gardens Racecourse. There is easy access from the M4 with ample parking and convenient access to public transport, and it is centrally located to Sydney's manufacturers. Open from 2 pm until 6 pm on 30 October, entrance is free for industry. For those travelling from interstate, special rates have been negotiated with Rydges Hotel Parramatta.

Over 65 exhibitors have already booked in to promote the latest technology in instrumentation, including Gold Sponsors Phoenix Contact and Weidmüller; Silver Sponsors Endress+Hauser, Harting and Westermo Data Communications; and Bronze Sponsors Schneider Electric and Eaton's MTL Products. Attendees will be able to witness first-hand the latest trends and engage with vendors to really identify what products, solutions and services are available to increase efficiencies in process control and automation. Among the exhibitors:

- Endress+Hauser will be showcasing its intelligent and connected applications for the IIoT, as well as it new tablet PC.
- Fluke will be showcasing the ii900 Sonic Industrial Imager.

30 October, Rosehill Gardens Racecourse.

To book, go to: https://bookings.iica.org.au/bookings/events/event.asp?bookingid=1182.

- Moore Industries will be displaying its latest Smart HART device that can be interfaced to Modbus/TCP and HART-IP based monitoring and control systems.
- BARTEC will be demonstrating its latest products and solutions to prevent explosions wherever hazardous substances occur in the workplace.
- AMS will be exhibiting Bronkhorst thermal mass flow, ultrasonic and Coriolis mass flow meters and flow controllers, as well as the new Beamex MC6-Ex portable calibrator, and the latest McCrometer FPI magnetic flowmeter.
- PDC Group will be highlighting some of its latest in safety equipment.
- Systems 22 is excited about sharing the latest version of its groov EPIC edge programmable industrial controller.

IICA (Institute of Instrumentation Control & Automation)
www.iica.org.au

SOLVING PROBLEMS WITH METAL ADDITIVE MANUFACTURING

Companies that successfully adopt additive manufacturing apply its advantages to the challenges that they uniquely face.

With all of the hype around 3D printing, it can be easy to get lost in fascinating, intricate metal parts made with additive manufacturing. These parts, while impressive, are probably dissimilar from many of the parts you currently produce or use. So why invest in metal additive manufacturing?

The importance of metal additive manufacturing is not about what wild geometries you can dream up. It comes from what manufacturing challenges the technology is well suited to tackle. Companies that successfully adopt additive manufacturing apply its advantages to the challenges that they uniquely face. In this paper we discuss three benefits of metal additive manufacturing and three problems the technology is apt to solve.

Benefits of metal additive manufacturing

Geometric freedom

Additive manufacturing turns classic machining design methodology on its head. Large, bulky geometries are the norm in traditional design practices — small complex features add time and cost as the number of operations and set-ups increases. Additive manufacturing builds parts up instead of cutting them down, so it is more efficient to only use material exactly where it needs to be. These advantages manifest especially in curved, natural features

that would require heavy cutting with a CNC machine, so working with metal 3D printers enables geometric freedom.

Full automation

A significant portion of a machine operator's time is put to work generating toolpaths and dialling in G-code depending on the tools and materials being used. Metal 3D printers eliminate much of this set-up time by automatically generating toolpaths based on configurable settings, only requiring a few inputs like part orientation and material. After that, the printer can handle the rest.

Whether you're printing in steel, titanium or inconel, the machine deposits material in almost exactly the same way. No specialised manufacturing knowledge or CAM workflows are necessary to kick off a print, and a wide range of materials is available. Since the machines operate without supervision, you can maximise machine uptime by letting the printer run during non-working hours.

Minimal tooling or set-up

Metal additive manufacturing reduces money spent on non-revenue-generating parts because no effort is put towards tooling or workholding to support creating the part. No custom tooling or fixturing set-ups are needed to run a metal 3D printer, regardless of the parts you send it. This reduces overhead and start-up costs associated with manufacturing, and produces low-volume parts more quickly and affordably as a result.

What challenges does additive manufacturing solve?

So, how do you know which parts to print, and how they can impact you and your business's bottom line? The first step is identifying your manufacturing pain points. Where do you face challenges that impact yield, and what is the cost of these inefficiencies? Metal additive manufacturing is worth the investment if the parts increase or maintain performance with lower effort, cost or time, overall increasing your bottom line.

Below we present three use cases applicable to many industries that can be addressed with additive manufacturing, including simplified assemblies, optimised geometries, and digital inventory and legacy parts. These three use cases can take form in many different ways, but all stem from the benefits that metal additive manufacturing brings to the table.

Simplified assemblies

Complex parts manufactured through traditional methods are often broken up into separate sections to improve their manufacturability. While this simplifies the production of these components, it complicates the assembly process, leading to higher product assembly time, increased inventory needs and higher risk of component failure.

With more geometric freedom and minimal tooling and set-up, metal additive manufacturing encourages consolidating multipart assemblies into single parts for printing. This reduces overall weight, minimises part count and reduces the number of manufacturing and assembly steps required to make the part.

An example is the STANLEY PD 45 high-efficiency hydraulic post hole driver. To actuate the driver, the device uses a group of ball bearings within a housing to transfer the trigger pull force into the actuator. The original housing consisted of four parts (see Figure 1) — a cast and machined main housing, a laser cut cover plate and two bolts to fasten the housing assembly together. Stanley Infrastructure Innovation engineers reduced this four-part assembly down to one, saving 92% on cost and 95% on time.

What to look for

Are there sub-assemblies in your design that were split into multiple parts for manufacturing simplicity? Look for designs requiring features like internal channels, slots or complex surfaces that were broken into subcomponents.

Figure 1: Post hole driver actuator housing.

Optimised geometries

Metal additive manufacturing opens up a different way to make metal parts. Many of the constraints that limit designs for more traditional manufacturing methods like machining, casting or extrusion do not apply. Adhering to the limitations of the process means modifying part features to reduce manufacturing time and cost. Optimising a part for conventional manufacturing, for example, might involve reducing material removal, adding large fillets to internal corners or restricting part features to one or two faces. This often limits machined parts to simple geometries.

While metal additive manufacturing has its own set of design strategies, they are radically different than more traditional methods. Since the part is built up rather than cut away, additive manufacturing provides the geometric freedom for more organic and complex shapes that might be costly or impossible to fabricate with other methods. You can focus explicitly on what your part needs to succeed and how it can be designed in the most efficient way.

Shown in Figure 2 is a bracket that is one of four securing a 20 kW, 200 A motor for a heavy-duty robotics application. The part is performance-optimised for the loading conditions it experiences, made with a generative design CAD program to add material in exactly the right places. By doing so, the bracket's weight was reduced by 75% from its machined counterpart, improving the machine's speed and overall performance.

What to look for

Identify the performance metrics of the equipment you work on. Can processes be sped up or increase yield with better optimised parts? Think about weight savings, conformal profiles, cycle time and service life.

Digital inventory and legacy parts

Component weardown is an expected consequence of any product, no matter the industry or scale. However, some parts are easier to replace than others. Manufacturing runs create a fixed number of parts, after which spares are hard to come by. When these parts break on machines in the field, there are limited options for both manufacturers and field technicians. The manufacturer may have spare inventory that can be shipped to the site of the breakdown, which poses challenges — especially in remote or international locations. The technician can contact local manufacturers for a very small production run, but rapid manufacturing services in low volumes comes with steep price tags. Lastly, the technician could attempt to repair the part on their own, which will cause more failures down the line.

With full automation and minimal tooling and set-up, having a metal 3D printer onsite eliminates these maintenance roadblocks with fleet management software. Digital copies of replacement or legacy parts, complete with their printer settings, can be stored and sent to metal 3D printers located both on- and offsite. This means that a replacement part can be made wherever there is a printer.

What to look for

What are the most common replacement parts or wear items that break during use and in the field? What is your process for handling replacement requests? How much does creating small production runs of those replacement parts cost?

Figure 2: A generatively designed bracket for a heavy-duty robotics application.

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NEW PRODUCTS

FOOD-GRADE CONVEYOR

Hygenius is food-grade conveyor that has been designed from first concepts to reduce flat surfaces, cracks and crevices where food and bacteria can accumulate. It is fast and easy to prepare for cleaning and is fully washdown ready.

Customers in the meat, poultry, seafood, fruit and veg and smallgoods markets are mindful that food hygiene is playing an increasing role in their production processes. A food contamination scare has dire consequences on a business's reputation and profitability.

Having equipment that is easy to clean to hygienic standards is critical to reducing food contamination risks. The Hygenius food-grade conveyor has been designed to meet European Hygienic Engineering Design Group (EHEDG) standards including the minimisation of cracks and crevices where food and bacteria can accumulate. A key feature is how easy it is to clean, including its rapid preparation for cleaning. Most conveyors can take in excess of 30 minutes to disassemble to prepare for hygienic cleaning; Hygenius takes only two minutes to disassemble and reassemble for cleaning. It achieves this through its purpose-built design which allows for tool-less preparation.

Fabricated in stainless steel and using EHEDG certified components, including belts, bearings, motors and feet, Hygenius is suitable for raw meat, poultry, seafood, smallgoods, fruit and vegetable and dairy producers who need to protect their customers from food contamination risks.

Australis Engineering Pty Ltd
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80 GHZ RADAR LEVEL INSTRUMENT

The Bürkert Type 8139 is a non-contact radar level measuring device for continuous level measurement. It is available with choices of an integrated antenna, a plastic horn antenna, a flange connection (DIN 2501) with encapsulated antenna system, or a clamp connection (DIN 32676, ISO 2852) with encapsulated antenna system for hygienic requirements.

The integrated antenna (G- or NPT connection) is suitable for level measurement of aggressive liquids, with special advantages for small vessels, while the plastic horn antenna (with mounting bracket) is suitable for measurements in open flumes or gauge measurement in water.

The high focus of the radar signal and the high measurement dynamics are said to allow correct measurement results even in small, narrow and high containers, as the risk of signal interference by installations, constructions and vessel walls is lower. Signal damping (for example due to signal running length, foam build-up or low dielectric values of the liquids) has a smaller effect.

The device offers continuous level measurement up to 30 m with a 4–20 mA, 2-wire connection and is adjustable using the display/configuration module and keys, or alternatively via PC-Tool with DTM.

Burkert Fluid Control Systems
www.burkert.com.au

WIRELESS QUAD TEMPERATURE SENSOR

Monnit has released the ALTA multi-probe industrial wireless temperature sensor. It features four independent sensor probes to measure and track multiple temperatures on one device, and is designed for monitoring a variety of temperature-critical applications such as food coolers and HVAC systems.

For example, one quad temperature sensor can provide a complete preventive maintenance system for HVAC applications by monitoring the input and output temperatures of air handling systems to ensure proper operation and send notifications via text or email if maintenance is required.

Sensor data is stored in the iMonnit Online Sensor Monitoring and Notification System, and can be reviewed and exported as needed from any web-enabled device such as a tablet or smartphone. Customisation allows users to set notifications and alerts from the system.

The quad temperature sensor system offers an accuracy of ±1°C over a probe temperature range of -40 to +125°C, and is housed in an IP65 NEMA 4X, CE-rated, sealed and weatherproof enclosure.

The device is powered by a single, replaceable 3.6 V battery with an expected 10-year battery life (depending on frequency updates). A solar-powered version is also available.

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AVEVA WORLD CONFERENCE COMES TO AUSTRALIA

AVEVA World Conference Australia is a forum for leaders with an interest in the evolving role of connected technology.

Digital innovation is transforming industries, and this rapid change is now driving adoption of technologies to accelerate innovation while addressing key business imperatives across industrial sectors from mining to energy to food and infrastructure.

Industrial IoT, artificial intelligence, cloud, big data, digital twin and extended reality (AR/VR/MR) are some of the technologies that are essential technology blocks that will enable organisations to:

- maximise return on capital projects
- maximise profitability across the operations value chain
- minimise risk and maximise return across the entire asset lifecycle
- enhance edge to enterprise visibility, automation and control
- evolve and enhance workforce capability.

AVEVA World Conference Australia is a forum for leaders with an interest in the evolving role of connected technology. At the conference, delegates will have opportunities to network face to face with industry peers, process experts and automation professionals.

AVEVA is bringing together users and industry experts to present a variety of application stories, best practices and breakout sessions designed to present new ideas on how organisations can progress their industrial digitalisation journey.

19–20 November, Howard Smith Wharves, Brisbane.

For more information or to register: https://sw.aveva.com/aveva-world-conference-asia-pacific-2019-australia.

AVEVA World Conference Australia is an opportunity to see how our growing range of technologies can help transform your business for sustainable success.

Cloud, mobile and IIoT technologies are most effective when they augment existing systems. From design, engineering and construction through to asset performance and real-time manufacturing operations management — all underpinned with better information management — AVEVA's products and solutions span the entire asset and operational lifecycle.

Key highlights of the AVEVA World Conference Australia include:

- industry overview and direction
- customer sharing
- interactive panel discussions
- live AR/VR demonstrations of new technologies
- live demo and exhibition
- four available technology tracks: Unified Digital Engineering; Unified Operations Centre; Asset Performance and Predictive Analytics; and Industrial Cloud Excellence
- awards dinner on Day 1 with networking opportunities.

NEW PRODUCTS

PRESSURE SENSOR

The Dytran series 2006 is an ATEX-certified IEPE pressure sensor with a sensitivity of 10 mV/psi, designed to measure dynamic pressure phenomena in the 50–500 psi range at frequencies of up to 50 kHz. Design of the series incorporates a quartz sensing element operating in compression mode, packaged in a rugged stainless steel housing, with a robust 2-pin MIL-C-5015 axial connector and a ¼-18 NPT pipe thread mount.

The sensor is acceleration compensated to minimise the effects of vibration on the output signal and is hermetically sealed for operation in high-humidity and dirty environments. Units are also case isolated to avoid EMI/ground loop interference.

Applications for this series of sensors include industrial acoustic studies, industrial pressure pulsations, pipeline leak detection and other general-purpose pressure monitoring.

Metromatics Pty Ltd

www.metromatics.com.au

PROGRAMMABLE CONTROLLER FIRMWARE UPDATE

Opto 22 has announced firmware update 1.4.1 for the groov EPIC Edge Prog

gineers and developers will find updated networking options and tools, plus additional software choices for automation and Industrial Internet of Things (IIoT) applications.

For secure remote access to the controller, the system now offers VPN client technology to connect to an OpenVPN-based VPN server. For example, an original equipment manufacturer (OEM) embedding groov EPIC in their machine design could benefit from establishing a remote connection to their equipment using industry-standard, IT-friendly VPN technology for diagnostics and predictive service. Likewise, a system integrator could use the VPN technology to provide continuing integration services after equipment is installed at a plant or location.

Also with the updated release, users can choose between Inductive Automation's Ignition Edge or the full Ignition platform — whichever edition is better suited to their application. Choosing the full Ignition option allows the controller to serve as an industrially hardened OPC-UA server to legacy PLCs — like Rockwell Automation, Siemens and Modbus — eliminating the need to purchase, configure and deploy Windows-based computers to perform this function.

In addition, the full Ignition edition allows users to install and utilise more Ignition modules, including those for database connectivity, reporting, text/email alarming and Sepasoft MES.

Updated diagnostic and troubleshooting tools have also been added to groov EPIC for testing network connectivity, including ping, test TCP port, traceroute and nslookup.

Systems 22 Pty Ltd

www.systems22.com.au

TABLET PC FOR HAZARDOUS AREAS

Smart digitisation enables the underground coal mining industry get better end-to-end visibility, enabling better decision-making and improved process efficiency.

The BARTEC Agile X IS is a robust and flexible Windows industrial tablet PC designed for rough working conditions and environments. It has numerous international certifications and can operate throughout the world.

The tablet has an Intel quad core processor developed especially and certified for rough and potentially explosive working mining environments, and includes an ergonomically positioned 1D/2D imager from Zebra. The high-resolution 10.1″ touch LCD display is readable in direct sunlight, and the device can also be operated in rainy conditions while using gloves.

A hot-swappable battery allows the battery to be replaced while working within the hazardous environment, and a range of accessories are available for greater productivity and operator safety.

BARTEC Australia Pty Ltd

www.bartec.de/au

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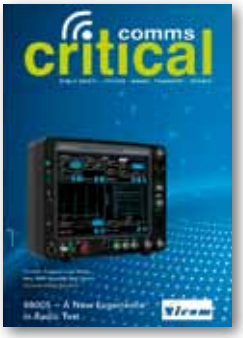

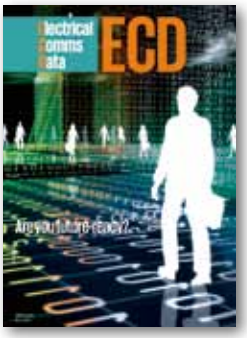

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AS I SEE IT

STEPS TO ACHIEVING INDUSTRIAL CYBERSECURITY

Industrial cybersecurity is often referred to as a journey — and that term is an important one, because it is not a product you can buy or a box you can tick, but a range of solutions and policies which may look very different from organisation to organisation.

The most important first step is education about the systems and the methods of communication — to understand the different points of access and paths used between your devices.

It should be no surprise then that my first point of advice is usually about physical security — which for some sites is more difficult than for others. For example, power stations usually have a fence surrounding the entire site and a gatehouse allowing entry only to authorised personnel or those being accompanied. Many manufacturing organisations have large sites but not always good control of who is coming or going. Water authorities have the problem of many small and remote sites that are often not manned.

Once physical security is covered, the next question that we should ask is: what happens if someone gets past our physical security? If they open the cabinet, what will they find? If they connect to a network switch, what will they be able to access?

In the case of device and network security, the solutions are going to be based upon the configuration of the software inside each device — and this level of security becomes quite difficult at times, as in many cases the ideal configuration options might not be available in your hardware.

Device security consists of ensuring that you use good passwords with enough complexity, as well as disabling insecure protocols such as telnet and HTTP in favour of SSH and HTTPS. Each device may have additional basic security settings to adjust, such as any discovery protocols that share information or enable configuration of the device without authentication (PLC discovery/browse protocols, for example).

Network security involves creating areas inside your control system that are isolated from others — with control mechanisms to ensure traffic has to flow through specific conduits so that you have control of which devices in any given area can talk to any other area. This concept is referred to as 'zones and conduits', with each area being a zone and specific paths between those zones being the conduits.

Firewall devices are an example of a conduit that acts as an interface between two zones with specified rules that determine which traffic can pass from one side to another. Another example of this is the Access Control List usually present in a Layer 3 switch. For circumstances where it's not so simple to define which devices should talk to each other and you need a tighter level of control — including the ability to control the types of messages between two devices — a deep packet inspection firewall can be used.

You also have to consider vulnerability to virus and malware attacks, which requires you to be monitoring your assets' firmware and configuration to ensure a safe state is maintained over time.

Today change management and network monitoring solutions offer many options for users to ensure that all the configuration files are maintained, and that all the devices in your network that have known vulnerabilities are flagged for updates.

Industrial cybersecurity has come a long way, and the industry is in a very mature state with many great solutions for users who are interested in ensuring that their industrial networks are secure and reliable.

Adam Rickards is an application engineer at Control Logic and began working in information technology over 20 years ago, starting with building systems for small businesses in the Geelong area. He moved into industrial networking 10 years ago.

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