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DIGITAL TWINS
A PRIMER FOR INDUSTRIAL ENTERPRISES
— PART 1

Steve Dertien – Chief Technology Officer, Jonathan Lang – Lead Principal Business Analyst, David Immerman – Business Analyst, PTC

In recent years there has been a great deal of buzz around the concept of digital twins, gaining prominent placement in analyst predictions.

According to IDC's 2019 Digital Transformation FutureScape, 30% of G2000 companies will have implemented 'advanced digital twins' to optimise their operations by 2020, the vast majority of which will be industrial enterprises. While discussions of the digital twin concept have framed this technology as a modern business imperative, the first mention can be dated back to NASA in the 1960s with the Apollo 13 mission. For enterprises deep in multitudes of digital transformation initiatives, digital twins can be convenient to lump into the category of nice-to-haves to add to the end of the to-do list. The truth is, digital twin technology is available today — and if you're an industrial enterprise, it's very likely that your existing technology can start compounding additional value unified through a digital twin strategy. In doing so, enterprises can expect to achieve outcomes like differentiation for their products, improved operational effectiveness across processes and optimised productivity for their people.

But guidance for enterprises looking to develop digital twin strategies has been sparse — with most conversations occurring at the conceptual level. Complicating matters, there has not been a consensus in industry as to what a digital twin is, creating confusion and barriers to widespread adoption. In this article, we will unravel the concept for business leaders looking to bring their digital twin strategy from vision to value.

Why is the time right to develop a digital twin strategy?

Industrial businesses are feeling more pressure than ever before to deliver results and react to constantly changing market landscapes. Competitive and disruptive threats are reshaping product and service expectations to demand higher quality and greater flexibility. Global trade and cost pressures are presenting new risks that are demanding ruthless efficiency and lean, agile operational processes for industrial companies to compete at blazing speed. A looming skilled labour shortage is forcing companies to rethink the way they empower their frontline workers to remain productive and agile. Companies are undergoing digital transformation and applying technology to try to address these challenges — and they're generating an incredible amount of data in the process, giving way to a new set of technology-based business challenges.
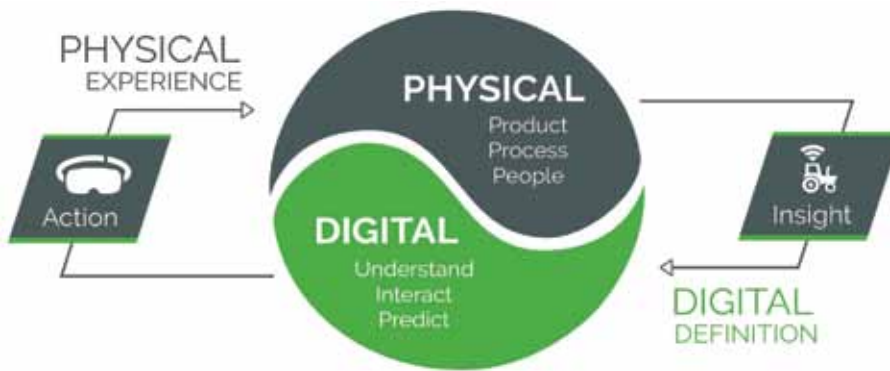
Figure 1: Digital twins are digital models that virtually represent their physical counterparts.

What is a digital twin?

Digital twins are digital models that virtually represent their physical counterparts. This virtual representation of a physical product, an operational process or a person's task is used to understand or predict the physical counterpart by leveraging both the business system data that defines it and its physical world experience captured through sensors.

What started out with the capture and storage of enterprise data has slowly crept out of the server closet. Sensors are everywhere, and telemetry data is being created by not only smart, connected products, but for entire enterprise processes and systems, and with augmented reality and other people-centred technologies being adopted, there are even digital connections to people. The result is that today this data exists in siloes across organisations, each possessing limited context, which in turn limits its value. Companies have recognised the need to integrate this new data but have been struggling with the strategy to do so in a scalable and effective way. Systems integration spending is growing rapidly year on year, and accounts for increasingly large portions of industrial companies' spend. One key objective of this spending is to map data from currently isolated technology silos as companies recognise the value of centralising and simplifying the process of information discovery and analysis. In addition to providing universal data access, companies also recognise that exploring the relationship between interrelated datasets offers higher order insights than any one set alone. This data unification is a necessary prerequisite to building a digital twin, and is often referred to as a digital thread.

With new technologies like augmented reality and IoT creating and demanding vast amounts of data from disparate sources, it is more important than ever that companies have a clear strategy as to how and why they will integrate their various operational and information technology. The digital thread is the essential groundwork that can turn the common dilemma of spiralling cost and complexity of digital transformation into an opportunity to enable faster time to value, greater agility in change management and more data-driven decision-making. A digital twin is a model for contextualising, analysing and realising the value of the digital thread in a way that enables it to be acted upon and scaled across multiple solutions and front-end applications. In other words, the value of a digital thread is manifest through the discrete use cases served by digital twins.

What enterprise outcomes does the digital thread deliver?

Defining the product and service experience

Customers of industrial product manufacturers are feeling pressure to ensure maximum return on their investments. It is an imperative that product and service providers become proactive in their contribution to customer success. Yet defining the customer journey end to end has proven to be a challenging and costly endeavour for enterprises of all kinds. For example, sales organisations often analyse customer purchasing history to understand new market opportunities. Separately, R&D may analyse smart, connected product usage data to identify utilisation of specific features for future development. Both seek to define the characteristics of successful customers, yet each is working with limited datasets. By mapping these streams of value-rich insight under a digital thread of the product or customer experience, transparency is created across roles and opportunities are unlocked to develop digital twins that proactively strengthen the customer relationship, improve the quality and value of products and tap in to new sources of service revenue.

Operational process visibility

Companies are struggling to keep pace and manage the necessary rate of change in their operational processes. By the time information becomes available to the necessary stakeholders in upstream and downstream functions in the value chain, risk has escalated, placing companies in a reactive state that is costly, wasteful and inefficient. Mapping operational process data utilising a digital thread for asset and process-related data, companies can develop digital twins to gain the transparency and operational predictability to simulate and orchestrate change or optimise operational processes with high speed and accuracy.

Data-driven people

Studies that show that employees spend upwards of 35% of their workday looking for and consolidating information. When you build, for instance, a digital thread of a production process, that thread can centralise data about asset utilisation, health and overall throughput, to provide workers with a holistic view of end-to-end operations. Analysing this data either in real time or in retrospect through a digital twin can improve decision-making not only at the management or total system level, but for the individual workers involved in that process. With the

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emergence of augmented reality, frontline workers can experience this value for the first time. The concept that digital twins centralise and present data in an actionable format is a key characteristic of their value.

A digital thread is the connection synchronising related upstream and downstream information. A digital thread creates continuity and accessibility to a common set of data, defining the product, process or people that it relates to across the enterprise functions. It solves a few key challenges of its own:

- **360-degree views:** By mapping related datasets through a common platform, true 360-degree views of products and processes become available, unlocking the opportunity for higher order insights delivered through a digital twin.
- **Single source of truth:** Visibility is achieved upstream and downstream across roles by delivering real-time updates and channels for communication, driving a culture of agility and innovation.
- **Scalability:** New products, processes and technologies are coming online every day. With a digital thread architecture, data is interoperable from the start — enabling scalable gains in efficiency and change management.

What use cases are creating value for industrial enterprises today?

Opportunities to create value from digital twins exist across industries, but their deployment is delivering most significant early impact in industrial organisations. This is due to the prevalence of connected products as well as connected-operational environments, and even the emergence of connected workers through augmented reality. Industrial companies may also have much of the requisite technology deployed today. The impetus for connecting the dots between these technologies to create a functioning twin is driven by functional business challenges and opportunities.

Once a twin is established, we see examples of digital twins driving value across the business and nucleating around a few key use cases led by functional champions in engineering, manufacturing and operations, as well as maintenance and service. While a unique product, process or person may have a common digital twin, use cases are delivered through 'lenses' into this digital twin that are specific to the role and task. Multiple twins can also be combined to create system-wide visibility that provides broader insight for a total business function or system of twins.

Key digital twin use cases

A number of digital twin use cases can be found, impacting from the top management level right down to the service technician.

Key outcomes from digital twins in relation to product engineering are:

- **Corporate/CXO:** For senior management, a digital twin can unlock new outcome- and usage-based business models that increase customer lifetime value and profitability.
- **Product engineering:** For discrete manufacturers a digital twin enables a 'voice of the product' that replaces usage assumptions with facts, accelerating time to market with optimised features and designs.
- **Sales and marketing:** Digital twins can help develop customer transparency and alignment that reduces cycle and lead times and provides opportunities for up-sell, cross-sell and relationship building.
- **Manufacturing and operations:** At the plant operational level, digital twins allow production visibility and planning that improves operational agility, increases throughput and optimises process efficiency throughout the supply chain.
- **Customer and technician service:** Digital twins create enhanced service delivery and offerings that improve customer satisfaction through increased uptime and quicker time to resolution.

In Part 2

In Part 2 of this article we will examine the three main digital twin use cases (engineering, manufacturing and service) and the high-level steps involved in building a digital twin.

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City of Tacoma WWTP gains a clearer view with new DCS

Tacoma, a city south of Seattle in a state known for its year-round rainfall, knows the importance of proper water and wastewater treatment to keep its more than 208,000 residents serviced and safe.

The City of Tacoma Environmental Services operates out of two wastewater plants, the Central and North End plants, which maintain 48 pump stations along a 1050-km collection system when combined.

The Central treatment plant was built in 1954 with secondary treatment upgrades completed in 1988 to meet new effluent standards from the Environmental Protection Agency (EPA). In 2006, additional upgrades were implemented to increase the plant's capacity to 526 million litres per day.

The North End treatment plant was built in 1968 and has a capacity of 114 million litres per day. Major upgrades were completed in the late '80s to meet requirements from the EPA mandate, and secondary treatment upgrades were added to the plant in 1997. Unique from other wastewater facilities, the North End plant is a physical/chemical treatment plant due to its smaller footprint and transfers solids to the Central plant for processing.

Both plants were operating on decades-old equipment and required upgrades.

"We were dealing with legacy systems that no longer suited or supported our operations," said Chris Roberts, Tacoma Automation Support Team, City of Tacoma Environmental Services. "It wasn't a 'want' but a 'need' to find a new solution for both the Central and North End plants that would make smoother, more efficient processes possible."

The city collaborated with Carollo Engineers, an environmental engineering firm that specialises in the planning, design and construction of water and wastewater facilities, to help with the technology selection process. The combined team evaluated different solutions and, after an extensive selection process, the PlantPAx distributed control system (DCS) from Rockwell Automation was chosen.

"We wanted a solution and a partner that would offer the hands-on support we needed as a smaller player in the DCS world," said Roberts. "Through our research and evaluation, we found that Rockwell Automation had the local programming and technical support we were looking for."

Once the technology selection process was completed, the team continued working with Carollo Engineers to prepare for system implementation. After a three-year preparation period, the city was ready to implement a fully standardised PlantPAx DCS and production intelligence solution to help increase plant efficiencies, save energy and improve visibility into its operations.

The flexible, modern DCS provides a plant-wide solution with predefined code and faceplates that improve ease of use for operators. The detailed Library of Process Objects with add-on instructions allows for a standard method of operation, decreases engineering deployment time and simplifies integration of non-Rockwell Automation devices.

"Our operations team requested modified, customised graphics to align closer with the greyscale standard but allow for more colour to match the existing colour schemes of the plants and, because of the flexibility of the PlantPAx system and its object library, we were able to easily do that," said Roberts.

Historian and production intelligence software was implemented to improve the operator's view into key process and performance data. The operators now have automated reporting capabilities and an easy-to-understand view into historical and real-time process trends, such as pumping metrics, and all process operations from the control room.

As part of the solution, the team implemented 22 new PLCs along with an Industrial Data Center from Rockwell Automation to help decrease server footprint and improve infrastructure reliability. The Industrial Data Center offers a virtualised environment for testing configuration and software changes without impacting production.

The implementation process for the full solution was completed in 2017, and now the modern DCS helps the city see into their process more clearly.

With the new system, the city is working on implementing a predictive maintenance strategy versus reactive. If an alarm went off or any issues arose with the legacy systems, operators would have to physically go and inspect what was happening. Now, they have contextualised data through the process software in the central control room, which decreases troubleshooting time and costs associated with operational delays.

"Our operators now have more data available to observe, and it's organised in a way that allows them to understand what's happening at any stage of the process," said Roberts. "The standardised language and graphics make it easier to document the process and key data points, as well."

Energy data from the new DCS feeds information to the energy management team to help identify sources of power savings. Currently this team has identified over US$34K of savings each year.

"We're always aiming to identify better, more efficient ways to run our plants, and the modern DCS system we have now is helping us do just that," said Roberts.

For a longer and more detailed version of this story, go to: https://bit.ly/3f6jpul

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SECURITY PLATFORM FOR IIoT

HMS Networks has announced Anybus CompactCom IIoT Secure products for both EtherNet/IP and Profinet, including a new complete security platform for IIoT communication over OPC UA and MQTT.

The Anybus CompactCom range enables device manufacturers to connect their industrial devices to all major industrial Ethernet networks, and IIoT connectivity is supported via OPC UA and MQTT. However, increased IIoT connectivity calls for next-level data security solutions to ensure that data from automation devices reach the cloud in a secure way.

HMS has therefore released a ready-made embedded security device and software that enables fully secure communication from devices in the field to the cloud. CompactCom IIoT Secure features security hardware, secure boot, certificate management and encryption, as well as secure OPC UA and MQTT communication. The release focuses on CompactCom for EtherNet/IP and Profinet with OPC UA and MQTT connectivity and includes a number of software and hardware elements.

In the software, encryption is provided for data sent to the cloud using secure OPC UA channels or uses encrypted traffic via MQTT over TLS, while secure boot functionality ensures the usage of HMS firmware only. Authentication is provided through certificate management and secure access and file transfer over TLS using HTTPS and WebDAV.

In the hardware, a security chip ensures full product integrity and identity, and the solution is said to have been thoroughly tested from a cybersecurity point of view by HMS. Pre-conformance testing has been performed for the networks in question, facilitating customer product certification.

Global M2M
www.globalm2m.com.au

IP67 MANAGED ETHERNET SWITCH

The Turck TBEN-L-SE-M2 managed Ethernet switches offer data rates of up to 1 Gbps. The gigabit high-speed backbone and cut-through forwarding principle for forwarding data frames is designed to provide fast data flow from I/O modules, motors or IP cameras. In robot applications, the high-speed link-up technology supports tool changes with Fast Startup or Quick Connect in less than 150 ms.

The robust, light and compact IP67 housings enable the Ethernet switches to be field mounted, which makes them suitable for decentralised and modularised applications where they can help simplify installation and cut wiring and hardware costs. Network load monitoring provides a constant overview of the network load. The integrated broadcast block protects against network overload due to broadcast storms for maximum availability.

With NAT routing, the Turck Ethernet switch eliminates IP address conflicts during machine integration, while an embedded firewall ensures controlled and secure data exchange. Turck's multiprotocol standard also combines support for three industrial Ethernet protocols, Profinet, EtherNet/IP and Modbus TCP in the same firmware.

Turck Australia Pty Ltd
www.turck.com.au

EDGE NETWORKING GATEWAY

The FlexEdge Intelligent Edge Automation Platform from Red Lion is said to bring greater versatility to edge computing. The DA50D and DA70D models feature a modular design and intuitive software to enable quick customisation and deployment in a range of applications. The robust, industrial-grade networking gateway is deployable as a wired or cellular solution to securely connect different networks through flexible networking functionality.

FlexEdge offers a wide variety of wireless and wired communication options for connection to any industrial communication requirement, regardless of protocol or manufacturer, and offers a form factor and platform that adapts as quickly as application needs change. It is available with advanced networking functionality or advanced automation features, including protocol conversion, an advanced web server, data logging and cloud connectivity.

Both the DA50D and DA70D feature wide operating temperatures from -40 to +75°C while remaining flexible for data-driven applications with real-time system alarms and LED diagnostic indicators. With multiple isolated serial ports, Ethernet, optional Wi-Fi and cellular communication sleds, optional field-installable I/O and a certified, robust enclosure, FlexEdge is designed to be suitable for almost any industrial environment with demanding requirements.

The platform carries certifications that make it suitable for oil and gas, water, wastewater, maritime, hazardous areas and factory automation applications.

Control Logic Pty Ltd
www.controllogic.com.au

SAW FLOW SENSOR

Bürkert's FLOWave SAW flow sensor is now also available as the compact variant FLOWave S with an all-stainless steel design.

The FLOWave range is based on SAW (surface acoustic wave) technology and is mainly designed for applications with high hygienic demands. This is achieved by using stainless steel materials and a measuring tube free of any wetted parts except for the actual tube. FLOWave sensors are suitable for liquids with low or no conductivity.

The FLOWave S model is offered without an integrated display, making it considerably more compact and offering the same functionality as other members of the Bürkert flowmeter range, but suitable for space-constrained environments.

Due to the transmitter design, the FLOWave S is also resistant to mechanical or external influences, such as vibrations and cleaning media, making it suitable for applications where hygiene and ease of cleaning are essential and where less installation space is available.

Burkert Fluid Control Systems
www.burkert.com.au

PREMIUM EFFICIENCY MOTORS

NORD has introduced its UNIVERSAL premium efficiency motor, with 20 models in the range extending from 0.12 to 45 kW power.

The NORD UNIVERSAL motor is certified to CE, UL, CSA, CCC, ISI and EAC and meets appropriate minimum efficiency levels to ensure suitability for markets that include Europe, US, Canada, Russia, China, India and others. The motor is also certified to Bureau Veritas for marine and offshore applications. The three-phase NORD UNIVERSAL motor can be used with four standard voltage supplies noted on the motor nameplate: 380 V, 50 Hz; 400 V, 50 H; 415 V, 50 Hz; and 460 V, 60 Hz additionally; however, it can also be used at 440 V, 60 Hz and 480 V, 60 Hz.

Available in 4-pole configuration, the robust motors suit IEC frame sizes from 63 to 225, and are available in B3 foot, B5 flange or B14 face mounting and to suit the US market it can be supplied as NEMA C-face and NEMA foot mount. The motor can also be directly mounted to NORD gearboxes providing a compact and more efficient drive solution.

As standard the motor is protected to IP55, is totally enclosed fan cooled (TEFC) and has Class F insulation.

Other options available for the NORD UNIVERSAL motor include quick connectors, single or double protection canopies, space heater, spring applied brake and forced ventilation. If required, the motor enclosures can also be provided with an IP66 rating, which means they are dust tight and protected against heavy seas or powerful jets of water.

NORD Drivesystems (Aust) Pty Ltd
www.nord.com

MULTI-SENSING PRESSURE SENSOR

Omron E8PC pressure sensors can detect signs of abnormalities in cooling water and hydraulic oil by simultaneous measurement of pressure and temperature.

With the Omron E8PC pressure sensor, notifications of changes in the cooling water or hydraulic oil states are said to be easy to understand — users can see the cause of the abnormality. For example, a rise in hydraulic oil temperature can be used to detect signs of leak. Monitoring hydraulic oil temperature changes can also help to understand how much of a rise in temperature will affect packing degradation.

By mounting sensors on multiple pipes, users can tell from the sensor LED displays what abnormality has occurred, and in which pipe. Since data output to a PLC by IO-Link communications is possible, it is easy to perform maintenance before entering an abnormal state.

The E8PC also features an analog current output function in addition to the IO-Link communications function that can perform self-diagnosis of abnormalities in the sensor itself. Omron offers a variety of replacement adapters to enable easy replacement of current pressure gauges and flow meters.

Omron Electronics Pty Ltd
www.omron.com.au

PARTICULATE MONITOR AND LOGGER

Delta Ohm (Italy) has recently added the HD50PM particulate monitor to its range of web-based data loggers.

The HD50PM will detect PM3.0-PM10 μm particulate sizes and can log up to 900,000 samples with logging intervals from 1 sample/s to 1 sample/h.

The integrated web server allows configuration and real-time measurement monitoring from any PC, tablet or smartphone connected to the same local network of the data logger or by simply using the IP address of the logger without the need to install any specific software. The device also allows the configuration of email-based alarm messaging.

Applications include building automation, clean rooms and manufacturing environments.

W&B Instruments Pty Ltd
www.wandbinstruments.com.au

HOW INDUSTRY WILL CHANGE POST-COVID-19

The COVID-19 pandemic has changed Australia's manufacturing industry forever, and experts across the globe agree that businesses now have to change the way they operate. From end-user demand to supply-chain disruptions and plant closures, companies across many sectors are facing monumental COVID-19 impacts.

With increasing customer uncertainty, industry is facing disrupted supply chains and a significant drop in consumer demand. Cash flow and sources of capital are under pressure like never before. An estimated 75% of organisations globally have reported disruptions to their supply chains — some experiencing dramatic reductions in demand.

And with so many countries closing their borders, up to 70% of internationals flights have been grounded. This has seen freight costs double or even quadruple, as well as long delays in delivery times.

Chinese manufacturing has also been severely disrupted due to COVID-19, and Australian supply chains have had limited access to essential supplies. Unable to source materials from China, domestic manufacturing has had to swiftly adjust to meet local demands.

To survive, many businesses will have to reinvent themselves with new capabilities and skills.

Since the early 1960s, manufacturing as a percentage of Australian GDP has dropped from 30% to 5.7% in recent years, and to save costs, many Australian businesses have relied on overseas manufacturing. But COVID-19 has forced many of those manufacturers to now rethink their manufacturing strategy.

How technology can help to reduce costs

The best way to reduce costs is by employing technology. Digitisation has made this a reality, and innovation now holds the key to long-term innovation.

Flexibility and faster decision-making cycles are key to building resilience, adapting to new situations and new processes, and driving innovation to remain relevant. Advanced manufacturing has the potential to benefit all manufacturers.

The federal government recognises that the future of Australian manufacturing lies in embracing new technologies and developing high value-added products and services for the global marketplace. A raft of incentives is now being offered to support Australia's manufacturing industry and minimise the reliance on off-shore manufactured goods. This includes the $100 million Advanced Manufacturing Growth Fund (AMGF) to create jobs, grow businesses, improve productivity and be globally competitive. It includes programs to encourage investment in new technologies and stimulate further research.

The AMGF provides grants that support capital projects from small and medium enterprises.

Manufacturing must undergo a rapid digital transformation

Companies investing in new technology will be the ones to better respond to change and continue to operate efficiently in an ever-evolving landscape, so manufacturing must undergo a rapid digital transformation.

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Business resilience in the new world will require more connected, intelligent solutions to re-ignite operations, and as a result, Industry 4.0 is increasing in relevance like never before. Technologies such as robotics and artificial intelligence (AI) are set to change the local manufacturing landscape, allowing more employees to upskill.

Also, expect to see greater flexibility in the workplace in the future, with more staff working remotely and fewer people on the factory floor.

However, this also raises some significant challenges and threats. Managing a virtual workforce can be extremely challenging. Businesses must now consider their digital capacity as well as online security and online privacy.

Every crisis provides opportunities

The challenges we face with COVID-19 are significant, but temporary. Every crisis provides opportunities — and it's now up to industry to capitalise on those opportunities. The current crisis has taught us many lessons — most important of which is to ALWAYS be prepared.

It's time for organisations to invest in Industry 4.0 technologies to help plan for all contingencies to ensure their future viability. Organisations must increase their focus on supplier risk programs.

As your business contingency plans take effect, you must keep assessing the impact on your supply chain and operations. A key lesson is to synchronise supply, manufacturing, logistics and fulfilment and reposition inventory.

Finally, industry needs to focus more on building a highly skilled and flexible workforce, with high-performing employees who are constantly learning new digital skills.

Industrial transformation in Australia will depend ultimately on the adequacy of our workforce and management skills. Education and training must be a key element of your industrial strategies going forward.

In the next decade, there will be some golden opportunities for local companies, created by the technology revolution and surging demand from Asia's vast and affluent new middle class. Let's not miss out on them…

Harry Mulder is Engineering Manager, Omron Oceania

MOISTURE PROTECTION ENCLOSURE FOR CONNECTORS

Co-developed with Cellpack, the WAGO Gelbox is designed to protect WAGO splicing connectors from moisture and humidity, and is able to achieve IPX8 levels of moisture protection. The user has only to open the box, insert the connector and close the box to achieve protection from condensation, heavy precipitation and powerful water jets.

The polyurethane gel used is silicone-free, making the Gelbox suitable use in any branch of industry — including those where varnishes, paints and other sensitive products are used. In addition, the gel has already reacted and is therefore label-free.

The product is available in six sizes, can be used in a wide variety of low- and extra-low-voltage applications and is compatible with both WAGO's 221 Series COMPACT splicing connectors and 2273 Series COMPACT PUSH WIRE connectors.

WAGO Pty Ltd
www.wago.com.au

POWER METER CONCENTRATOR

The ICP DAS PMC-5231 is a power meter concentrator designed to assist with energy saving and carbon reduction in the Industry 4.0 age. It provides flexible integration with ICP DAS power meters via RS-485 or Ethernet interface, and features various functions such as measuring the power consumption of devices, energy usage analysis, power demand management and alarm notification. The product features a built-in Micro SD card. After retrieving the power data from the power meter, it will save the power data in a data log file and automatically send the file to the backend management centre for analysis.

The device offers a user-friendly and intuitive website interface that allows users to implement an energy monitoring system with a few clicks away, and no programming is required. In addition to ICP DAS XV-Board and M-7000 I/O modules, the PMC-5231 can also connect to standard Modbus TCP/RTU slave modules. By working with the I/O modules, and functions such as IF-THEN-ELSE logic rule execution and alarm notification functions including LINE/Email, it offers more power demand management and alarm notification functions, and is able to perform load shedding of the devices if required.

The product also supports the Modbus TCP/RTU, SNMP, FTP and MQTT protocols for integration with backend SCADA, MES, IT, IoT or network management systems.

ICP Electronics Australia Pty Ltd
www.icp-australia.com.au

I/O-INTEGRATED GATEWAY DEVICES

The ADAM-6700 series are intelligent, I/O-integrated gateway devices with an all-in-one design. Users can perform data collection, storage, processing, calculation and analysis locally. For 24/7 online equipment monitoring, these gateways are suitable for predictive maintenance and helping to minimise downtime.

ADAM-6700 series gateways have a Linux OS installed and feature a built-in small footprint Node-RED graphical programming toolset. The devices support all commonly used industrial IT/OT interfaces and have a built-in I/O interface. This interface collects analog and digital data from temperature, humidity, vibration, water levels, current and pressure sensors and then executes digital and analog output instructions such as turning on/off lights or power switches.

If an abnormality is detected, the ADAM-6700 series gateways can trigger an alert and send email notifications immediately. The gateways support Ethernet, Wi-Fi, 3G, 4G and other network communication protocols. Once the data is processed and analysed, it is transmitted directly via SCADA, database, or cloud service providers for AI deep learning and other advanced applications.

Target applications of the ADAM-6700 series include factory management, environment monitoring/management and energy management.

Advantech Australia Pty Ltd
www.advantech.net.au

MOBILE MACHINE MONITORING

Machine builders are constantly looking for new ways to differentiate themselves and to bring additional value to customers. The ability to quickly check machine status and performance is becoming more and more important in the light of digitalisation.

For users of Ewon Flexy products by HMS Networks, eCatcher Mobile KPIs brings live machine KPIs directly to their mobile devices. The solution is based upon the secure eCatcher software, which establishes remote connections to Ewon-connected machines via the cloud service Talk2M. By using a mobile device with the eCatcher Mobile app for iOS and Android installed, users get a live look into their machines' status and performance from anywhere in the world.

HMS has now updated the mobile version for iOS and Android — eCatcher Mobile — to enable presentation of live KPIs from any machine equipped with an Ewon Flexy. Ewon users will feel at home since this feature is already available in the free browser-based web portal M2Web. Users start by selecting up to six KPIs from the list of defined machine variables inside each machine-connected Ewon Flexy, and all KPIs can be set to trigger alarms. After a few configuration clicks, the user gets a live view of the chosen KPIs, enabling instant monitoring of machine status.

Global Automation Asia-Pacific
www.globalautomation.com.au

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ACCESSING AND INTEGRATING CRITICAL ISOLATED DATA

The truth behind the hype.

Industrial markets are talking about edge technology and the remarkable advantages it brings in implementing the IIoT and Industry 4.0. Edge has become a buzzword with many voices defining it and maintaining how it should be done. The claims have led to a lot of misconceptions as to what edge technology is, what it does and who needs it.

Does edge technology take the place of the control system?

Prospective users ask if edge technology is supposed to replace SCADA or their control system. The answer is no. Edge technology — whether edge gateways, edge devices or the new edge controllers — are complementary to control systems. They're designed to make systems smarter. An edge device works in concert with the control system to provide access to data not currently available.

Every industrial control system connects and collects data from sensors and actuators, but there are some sensors and actuators that are not connected. These isolated production elements provide no data to the control systems and make it difficult for businesses to respond rapidly to complex problems or achieve desired business outcomes because they don't have the whole picture. Getting data from these disparate machines that are not currently connected due to factors such as incompatibility or proprietary software is the benefit of the edge layer. The edge device takes control system data and non-control system data and integrates it, so users have one view of the entire operation and make better decisions with this holistic view of the equipment than would be possible otherwise.

If you already use PLCs or PACs, do you need edge technology?

Yes. No matter what type of control system is used, in order for users to gain access to the isolated data, the system requires edge technology. Edge technology not only allows data from isolated elements to be accessed, it also gathers data from other business or internet constructs and consolidates the information. Equally important, edge technology allows better analytics to be run at the plant level to help give meaning to the data collected. So regardless of the user's control system, edge technology is needed to make the system smarter. But which type of technology to choose is based on system architecture and goals.

Edge gateways, edge devices and edge controllers

The primary types of edge technologies are edge gateways, edge devices, and the new edge controllers that integrate PLC/PAC and edge functions into a single box (see Figures 1 and 2, page 20).

Edge gateways would likely be sufficient if your application requires the collection of data at the machine and then offloads that data to the cloud or other higher-level computing systems for processing. Users need to do research, however, to be sure they're not using an edge gateway where an edge device with the advantage of local processing would significantly reduce latency, improve security, reduce cloud storage costs and enhance real-time decision-making.

Edge devices allow processing at the machine level. The device is integrated with the current control system, consolidates additional IoT data from available sensors and smart devices, and is the choice in existing brownfield plants that don't want to change control systems.

Edge controllers integrate both PLC/PAC control and edge processing into a single system. Edge controllers offer a generational advancement to PLC- and PAC-based industrial control systems by enabling safe, secure communication between real-time deterministic control and non-deterministic applications that leverage external data to analyse and optimise business operations. Edge controllers provide software-defined controls with enhanced optimisation capabilities, while maintaining the stringent reliability, safety and security required in industrial applications. The integration of control functions and edge processing makes edge controllers the obvious choice for greenfield projects. In addition, because of the controller's other benefits, existing plants may want to evaluate an edge controller before choosing another edge device.

Advantages of edge control technology

True edge control technology is innovative and new, but is an evolutionary, rather than a revolutionary, development. While offering significant advantages, it is easy to integrate with a plant's existing systems. Users need to be aware of edge control characteristics and benefits, so they don't get older edge technology represented as edge control. Below are some of the capabilities of a true edge controller.

Multiple operating systems in a single box

Key to the ability to process at the edge while providing control functions is the edge controller's integration of multiple operating systems in a single system. Enhanced non-deterministic edge processing runs on a general-purpose operating system (OS) such as Linux, in parallel with a real-time operating system (RTOS) used for deterministic control. Both systems operate on the same physical hardware. The real-time system can optimise equipment control by leveraging data and analytics supplied by the general-purpose system. The general-purpose system can also work in conjunction with external data sources such as enterprise, financial, environmental and other databases via the internet. Communication between the real-time and non-real-time systems must be highly secure to ensure that the integrity of the real-time control system is maintained. Users need to evaluate carefully to be sure the edge controller being considered has this multi-operating system capability. Both OSes need to work in a safe and cooperative manner, meaning if the general OS fails or crashes it should have no impact on the RTOS. Likewise, there is no way the applications running on the general-purpose OS can impact the determinism on the RTOS side.

Based on hypervisor technology

The technology behind a true edge controller includes a multi-core processor layered with a bare-metal hypervisor. Through the hypervisor, the multi-core hardware is managed to provide the experience of two independent controllers with a secure communication link between them. This cooperative framework allows near-real-time analytics to run in parallel with real-time deterministic control processes. The ability to run the two operating systems (an RTOS such as VxWorks and a general-purpose OS such as Linux) in tandem is an entirely new approach to the optimisation of control processes. Hypervisor technology makes it possible to run analytics and optimisation applications at the machine level without directly impacting deterministic, real-time control, assuring new levels of reliability and security.

Modern programming languages simplify analytics

Today with current PACs, users are accustomed to creating rudimentary analytics using IEC 61131-3 languages. In contrast, advanced edge controllers can host modern programming languages, including C/C++, Java and Python, on the general-purpose OS, while supporting standard IEC 61131 languages and C on the RTOS. These and other advanced languages can be used to apply complex optimisation algorithms or analytics to operations without affecting the control process. This enables the use of an 'outer loop' layer in an application that can 'advise' the typical 'see-think-do' control loop, optimising the real-time control application. In case there is a disruption of some type in this outer loop, the real-time deterministic control is not affected and continues to provide the same functionality as a traditional PAC (see Figure 3, page 21).
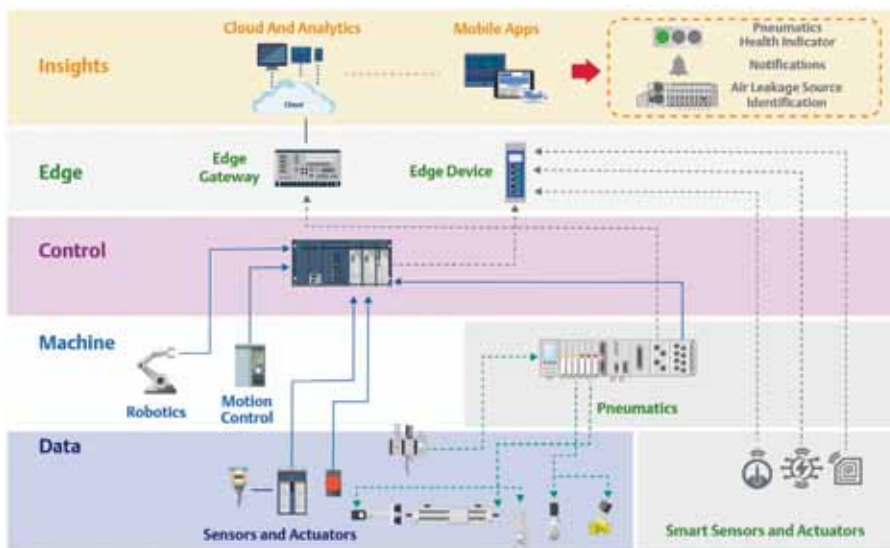
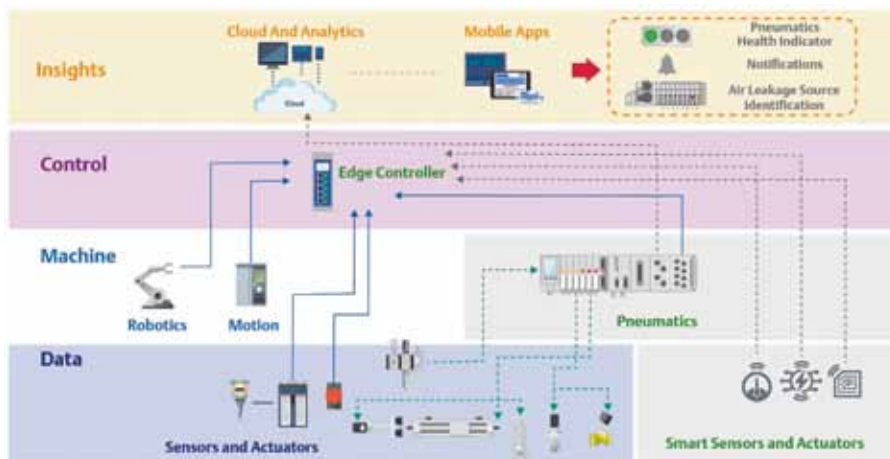Figure 1: Edge devices and gateways provide cloud interface connectivity.

Figure 2: Edge controllers combine edge processing and PLC/PAC functionality.

Rapid start-up

The key advantage of edge technology is that it makes possible the collection of vital data from industrial assets whether or not this data resides in traditional PLC/PAC controllers. Traditionally, people have had to open the control logic and integrate this additional data into the PLC — an expensive and potentially disruptive step. The benefit of the edge controller is this additional data is available without modifying the PLC logic. This helps users start getting a holistic system view into the optimisation apps without having to engage the original OEM to modify the machine logic. The data collected on the edge must be cleaned and normalised into a similar structure, which simplifies app development. OPC UA has emerged as the preferred approach for data representation as it is open, secure and structured.

Rugged design

Edge controllers are, by definition, at the machine level, which greatly increases the harshness of the environment. Edge devices must be rugged enough to withstand high heat, variances in air quality and vibration — with no compromise of performance. Users should choose UL-certified devices that have been designed to work at the machine level.

Heat is a particular challenge. Edge controllers and devices require a standard operating range of -20 to 60°C. Many so-called edge devices de-rate processor performance when they cross 50°C since they aren't created for harsh environments. This slows down operation, which is unacceptable for high-performance devices that must operate effectively at the machine level. Instead, look for heat transfer technology built into the edge controller that will maintain full performance throughout the entire temperature range.

Security

One of the keys to the data security of edge controllers is the use of the OPC UA protocol. OPC UA is a secure, platform-independent, scalable and object-oriented architecture for representing and communicating information. By using OPC UA, information can be modelled so that an application can inherently derive its meaning and consequently make better decisions based on that meaning. This enables applications to gain intelligence that can lead to new and exciting outcomes in data management. In addition, OPC UA provides a mechanism to protect the confidentiality and integrity of information and to determine whether applications are trustworthy — a fundamental need of Industry 4.0. OPC UA also allows contextualisation of data for better analytics.

Putting edge control to work in your systems

What can edge control do for industrial enterprises that they're not able to do now? Below are a few examples.

Remote monitoring of control system health

Big industrial firms, and OEMs with large fleets or numerous remote assets, find it very difficult today to assess the health of their fleet,
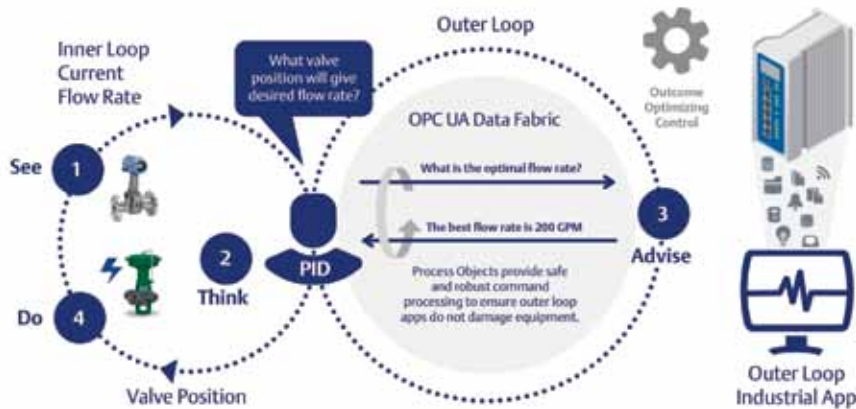
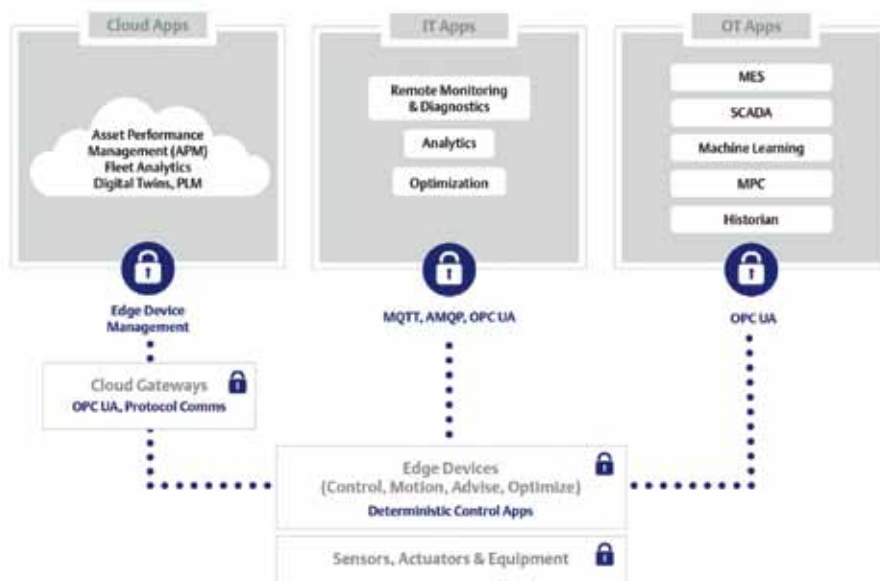Figure 3: Process control and optimisation in a single device.

Figure 4: Cloud applications.

equipment and plants. While large SCADA systems usually provide alerts for operational alarms and events, it can be quite challenging to actually debug and diagnose issues in the field, especially in remote areas.

Incorporating edge computing concepts with a PAC makes it possible to monitor and diagnose a fleet of control systems remotely using cloud-based services, all configured in a secure manner. Access to detailed fault logs, hardware and firmware versions enables operators to debug faults remotely, reducing operational costs and unplanned downtime. It is even possible to update control systems remotely in a secure manner to fix faults, with no on-site time required.

Achieve a new level of business automation

Edge controllers facilitate the integration of a wide range of different devices and equipment by using business automation tools and standard IT communications protocols, making it possible to achieve a new level of business automation (Figure 4). Highly efficient maintenance and supply schedules can easily be set up, with notifications sent directly from the device to third-party suppliers and contractors. It's also now possible to connect to IT, OT and cloud infrastructure directly from the control system to flatten the architecture and enable new levels of efficiency.

Gain new productivity with predictive analytics

Using an edge controller, it's possible to gain a much higher level of efficiency and productivity by running predictive analytics on operational data and then using the results of this analysis to proactively optimise control actions. This process is akin to traditional process feedforward control where process variables are used to anticipate changes so the system can respond to the process before an error occurs, increasing efficiency. For example, automatically tuning PID loops with great precision reduces time for set-up and loop adjustments. Edge controllers provide the interface between the predictive diagnostics applications and real-time control facilitating the feedback loop that allows advanced analytics to dynamically improve process operations in a safe and secure manner.

Integrated voice assisted human-machine interface

Voice assistants are increasingly gaining adoption in the consumer market, and edge controls provide a secure strategy to incorporate voice assistance into HMIs. Using a third-party IoT kit such as Amazon's AWS IoT Greengrass, edge controllers can be integrated quite easily with voice assistants such as Amazon Alexa. This kind of technology can be used alongside HMI visualisation systems in a secure manner, providing productivity gains in industrial settings by reducing training and troubleshooting time.

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

RESETTABLE CIRCUIT BREAKER TERMINALS

The maxGUARD series of resettable electronic circuit breaker terminals is a modular system that combines both electronic overload protection and 24 VDC distribution in the one terminal.

maxGUARD overcomes the limitations of 24 VDC switchmode power supplies, such as foldback or loss of supply under short circuit or high inrush conditions. The current-sensing feature enables overload trips and instant trip of the breaker under short circuit, allowing isolation of faults on a 24 VDC control system without losing the 24 V supply.

With maxGUARD, the terminal blocks previously installed separately for 24 VDC distribution are now integrated with the electronic circuit breaker module. This saves considerable time during installation and reduces the overall amount of space required on the terminal rail by up to 50%.

Available in single-slice modules with a 6 mm width, they can be arranged to custom requirements with either fixed or adjustable current modules from 1 to 12 A. Assembly is as simple as installing terminals on a rail. Users connect the modules together with standard Weidmüller coloured plug-in cross-connection combs.

Two control module options offer additional functions of remote reset, system trip indication, 90% alarm and system shutdown. Conformal-coated variants are also available for harsh environments and corrosive atmospheres.

The series now also has approvals for Marine, Class 2 (North America) and Ex areas, and offers integrated test points for easy maintenance and troubleshooting.

Weidmuller Pty Ltd
www.weidmuller.com.au
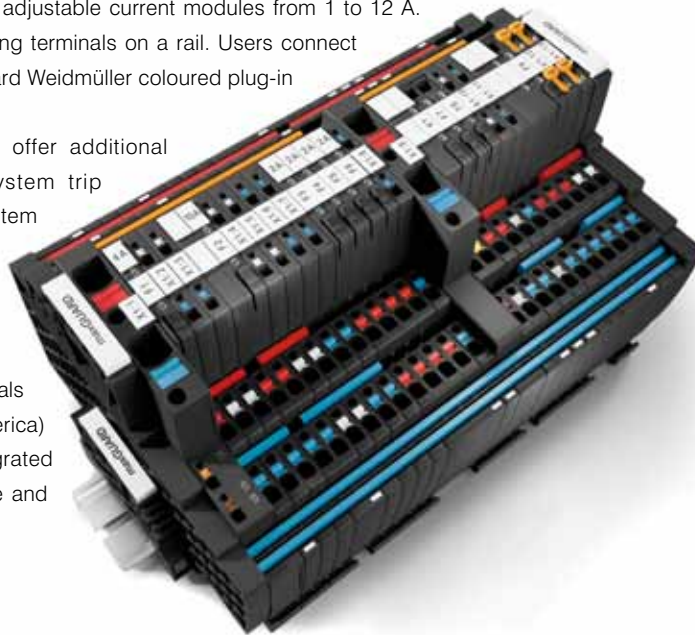
EDGE AI COMPUTER

The Aaeon BOXER-8320AI multi-core AI@Edge controller is a high-performance, compact PC designed for edge artificial intelligence applications. Utilising the power of two Intel Movidius Myriad X VPUs, the BOXER-8320AI integrates hardware and software AI solutions into a single device.

The Intel Movidius Myriad X is said to be the first VPU to feature the Neural Compute Engine — a dedicated hardware accelerator for running on-device deep neural network applications. The BOXER-8320AI is also equipped with an Intel Core i3 CPU, 16 GB of DDR4 system memory, two Gigabit RJ-45 Ethernet connectors, four USB 3.2 ports and four RS-232/422/485 ports. An internal 2.5″ SATA bay for a hard drive or SSD provides operating system and data storage. VGA and HDMI outputs are provided for high-resolution displays.

The fanless design of the BOXER-8320AI coupled with an operating temperature range of -20 to 60°C aims to provide reliable operation in industrial and embedded environments. The BOXER-8320AI can be powered from a 9–30 VDC source or an optional 100–240 VAC power pack.

The BOXER-8320AI is compact and measures only 67 x 186 x 151 mm. It can be DIN rail or wall mounted allowing the computer to be conveniently installed in equipment enclosures.

Interworld Electronics and Computer Industries
www.ieci.com.au

INSERTION THERMAL ENERGY METER

The Series IEFB is a field-adjustable insertion thermal energy meter that uses electromagnetic technology to measure fluid velocity and energy consumption. The high-accuracy version is adjustable to fit pipe sizes from 100 to 250 mm, while the standard-accuracy version fits pipe sizes 100 to 900 mm.

The product incorporates a temperature meter and a calculator into a single unit. The LCD display provides clear readings of the meter's values, including temperature and energy consumption, making it suitable for installation on chillers, boilers, and other heating and cooling applications.

The unit's high measuring accuracy and long lifetime should keep annual operating costs at a minimum. In addition, it offers several output options, including selectable BACnet MS/TP or Modbus RTU communications protocol over 2-wire RS-485 and standard analog, frequency and alarm outputs.

Dwyer Instruments (Aust) Pty Ltd
www.dwyer-inst.com.au

EXPLOSION-PROTECTED REMOTE I/O SYSTEM

The IS1+ remote I/O system from R.STAHL allows Ethernet communication in hazardous areas via Profinet, Modbus TCP and EtherNet/IP.

With transmission rates of 100 Mbps, its optical cables are suited to fast, explosion-protected data transmission for Zone 1, as well as utilising inherently safe fibre-optic technology to cross distances of up to 30 km. This type of protection ensures that potentially ignitable optical energy is limited to a non-ignitable level, even under error conditions.

For Zone 2 and distances of up to 100 m, Cat 5 copper cables with 'EC' protection can be used. Even in explosive atmospheres, all modules can be exchanged during operations and IS1+ stations can be easily expanded without disconnection.

The available I/O IS1+ modules feature up to 16 channels and are available with intrinsically safe, non-intrinsically safe and pneumatic interfaces as well as being used extensively with most major DCS/PCS/PLC systems. In addition to its Profinet connection and a comprehensive diagnosis function, Stahl IS1+ is suitable for predictive maintenance applications as well as plant asset management system implementation.

Control Logic Pty Ltd
www.controllogic.com.au

NEW SITUATIONS REQUIRE NEW SOLUTIONS

The much-talked-about IIoT has already proven itself a reliable method of pushing information from connected devices in industrial plants to cloud-based solutions providing operational insights. It works now, and IIoT-related services are available from many suppliers. The remote monitoring and alert notification it can provide have shown that it can be relied upon, and that it can provide information simply and cost-effectively — and in easily digestible ways via dashboards etc.

However, despite the positive track record, the take-up of IIoT technology has been slower than the number of articles in the media would suggest — and I am left wondering why.

Is it the cybersecurity aspect? Both control system owners and company IT infrastructure owners are extremely reluctant to open their networks to the outside world, and for good reason. There is the chance of unintentional and intentional harm to be inflicted, so for many, the easy answer to whether to utilise the IIoT is 'no'. However, this limits the available options: separate communication paths from devices at crucial measurement points in the process can give key performance data critical for process optimisation.

In any case are we really opening up our networks? In simple applications, the edge device delivering IIoT data to the web may only be pushing data out to a cloud service, with no need for any inbound connectivity.

Or is it that we haven't really needed this additional information as much as we thought? Employees are onsite and our existing control systems are providing all the data and alarms we need, so why bother?

The recent societal shutdown has demonstrated that the communications infrastructure in Australia is reliable and has the capacity to support increased traffic. And if COVID-19 has taught us anything, it is that we need to be prepared for potential business interruption and reductions in on-site staff numbers with short notice.

In a situation such as this, remote access to plant and equipment performance becomes necessary, and perhaps the pandemic will provide a catalyst for more investment in being able to monitor more processes remotely, and be alerted to issues in a cost-effective way.

Remote service is another area where we have seen some successes but again the take-up is slow.

We can now, over 3/4/5G, remotely assist an onsite technician directly from anywhere and wherever they are (as long as there is cellular coverage or Wi-Fi available). Even Ex-rated phones and tablets are now available which further expand the use case.

These services produce great benefits — the site's own staff get more familiar and comfortable with the devices, and money and time are saved due to the reduction in travel — not to mention the reduction in carbon footprint.

Due to the COVID-19 lockdown in New Zealand, our company recently commissioned a tank level solution remotely from Syd-ney. With 3/4G communications, and a remote access solution supplied to gain access to the individual device's communication ports, the remote commissioning was a great success — without the usual travel time and expenditure.

We should be doing more remote service jobs. They allow better use of our specialists' time, so they are available to more customers. It also removes the geographic restrictions: we can access assistance from all parts of the globe, and easily access higher levels of support should there be a quirky challenge. And, of course, it is more cost-effective for our customers.

I think it is really only a mindset shift that is required. Until you experience it yourself and try the solutions out, you don't realise how good they are, and how well they actually work. Some still have a hesitancy to use video chat like FaceTime, or WhatsApp, but once you get into it, it has many advantages and saves time, money and overall stress.

We are creatures of habit and if something isn't broken, why fix it? But new situations require different and new solutions.

In some ways we have been very lucky, in that we could (at least in Australia) have the majority of the workforce onsite to run essential parts of our business. But what if next time that's not the case and total lockdown is mandated. How do we react? Could, in theory, some processes still be run remotely with the help of the IIoT? Water and wastewater could, with very minimal site attendance. Some food production such as fish farms could. Could your business? It is something to think about...

Sydney-based Managing Director of the Australian operations of Endress+Hauser, a Switzerland-based innovator and provider of both lab and process instrumentation, service and solutions, Warwick Bardsley has had a ground-up career in industrial instrumentation and control over the last 30 years, with a family history in manufacturing, business operation and management.

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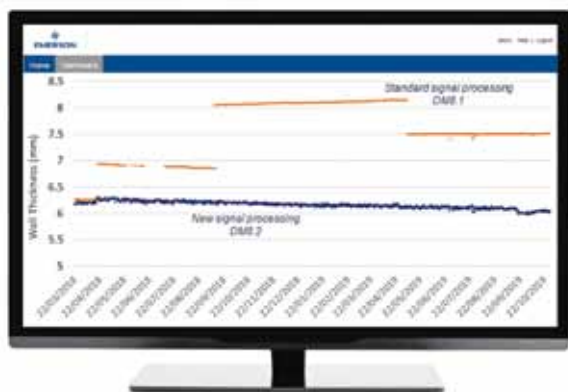
CORROSION ANALYSIS SOFTWARE

Emerson's DataManager v8.2 helps refiners monitor corrosion of hydrofluoric (HF) acid alkylation units to prevent costly, unplanned shutdowns and maximise profits and productivity. DataManager Analysis Software for Rosemount Wireless Permasense corrosion and erosion monitoring systems offers continuous sensor monitoring that provides early detection of corrosion in HF acid alkylation units and mitigates the risk of loss of containment.

Alkylation units ensure facilities meet gasoline quality specifications and allow for the production of premium gasoline grades, adding significant economic value to the refinery operation. These units are extremely susceptible to aggressive corrosion. Corrosion can lead to an HF release, which may cause significant production loss and place the health and safety of the refinery staff and local community at risk.

Measuring corrosion damage in HF acid alkylation units using traditional methods is difficult. Iron fluoride can scale and build up on the inside of pipes, confusing normal ultrasonic thickness measurements. Additionally, traditional intrusive probes or frequent manual inspections present safety risks due to the hazardous environment of these units.

Emerson's latest version of DataManager solves these problems by helping refiners gain a better understanding of the correlation between corrosion rates and upsets or changes in process conditions. Engineered with an updated signal processing module, the solution delivers data directly to the engineer's desk with wireless, non-intrusive sensors that communicate with an Emerson Wireless Gateway, reducing the frequency of manual inspections. These sensors are designed to withstand harsh, potentially high-temperature refinery conditions.

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

POINT-TO-POINT WIRELESS I/O MODULE

Acromag has broadened its Vertu range of instrumentation with the release of the VWB2000 signal wire replacement system in a rugged NEMA 4X/IP68 industrial housing. The point-to-point wireless signal bridge takes analog, discrete or Modbus signals at one location and reproduces them at a second location.

The system consists of two pre-paired transmitter/receiver units that have a range of 1.6 km outside or 152 m indoors in industrial environments. This range can be extended using wireless repeater units or high-gain directional antennas. An LCD display provides signal strength and other diagnostic information.

The wireless I/O bridge is easy to set up and install. Each unit has one analog I/O channel, four discrete I/O and Modbus communications that are field-configurable using the push-button controls. Free Windows software simplifies configuration on a PC via USB and enables features such as encryption and analog signal calibration. The weather-tight enclosure is cast aluminium with a glass window and a corrosion-resistant powder coating for field mounting. Units can mount directly to a supporting conduit or securely to pipes and walls.

Each unit has both inputs and outputs for bidirectional communication. Analog inputs accept 4–20 mA, 0–5 V, 0–10 V or 1–5 V signals. Analog output is 4–20 mA. Digital I/O channels support 0–5 V TTL logic levels. Modbus RTU serial communication is EIA-485 compatible.

Metromatics Pty Ltd
www.metromatics.com.au

ETHERCAT SLICE I/O AND CONTROLLER

The AMAX-5000 series EtherCAT Slice I/O and Controller is designed with the smallest programmable automation controller (PAC) in the Core i class, modular I/O and a PCIe communication interface. With this series, equipment manufacturers can easily set EtherCAT I/O modules to perform tasks such as data acquisition, detection and machine control. When it comes to integration, manufacturers will also benefit from cloud platform and IT/OT integration from the PAC's open architecture.

Included in the AMAX-5000 series is the AMAX-5580 embedded controller. Its compact size (13.9 x 10 x 8 cm), and featuring a built-in 6th Generation Intel Core i processor, saves space while providing optimal computing performance. The AMAX-5580 supports CODESYS software that industrial equipment manufacturers can use for program development and testing. It also provides a VGA and HDMI dual display interface to facilitate equipment status visualisation.

The AMAX-5000 series is a core platform for Advantech's Edge SRP software and hardware integration solutions. It can be integrated with third-party software, making it easier for industrial equipment manu-facturers to develop smart IIoT applications. For predictive equipment maintenance applications, after configuring the acquisition and analysis software on the AMAX-5580, the EtherCAT I/O module allows operators to rapidly collect data remotely and obtain equipment status and diagnostics.

Advantech Australia Pty Ltd
www.advantech.net.au

SCREW COMPRESSORS

Boge has introduced an updated generation of its C-series screw com-pressors. The C-2 compressors are available as a complete solution ready for connection together with compressed air receiver and dryer, as well as in a standalone version for larger complete systems. The machines are compact in design and, due to their easily accessible components, designed to be maintenance-friendly and ergonomic. Fitted with a sound insulation hood, the compressors are quieter than their predecessors.

Boge offers the compressors in versions that are belt-driven, directly coupled, frequency-controlled and also directly coupled at the same time in the same casing. Apart from the sound insulation hood, optional super-soundproofing can be supplied to reduce noise levels further.

From 7.5 kW, the compressors are available with frequency-controlled fans, meaning the cooling capacity can be adapted optimally to the environmental conditions. A dryer can also be integrated across the entire series, and a control system adapted to user requirements. Users have the choice between the basic control and the high-end focus control 2.0 version.

Boge Compressors Ltd
www.boge.net.au

BÜRKERT'S EDIP INTEGRATES NETWORKING AND FIELD DEVICES

Digitally integrated field devices make system implementation and management simpler.

In supporting the majors, Bürkert discovered there was clear opportunity to provide intelligent networking of its products that could connect and integrate a number of field devices on existing systems. From sensors to actuators, in an industrial environment, EDIP makes possible what users are already familiar with in their daily lives, such as smartphones or tablets, allowing the user to monitor and control complete processes by means of user-friendly and intuitive touch controls, without the costly exercise of changing existing infrastructure.

Flexibility built into state-of-the art products

For the past five years, Bürkert has designed and manufactured with the future in mind. EDIP consists of three main components: hardware, software and communication — a device platform that standardises the operation, communication and interfaces of process devices.

Communication

The spinal cord and connecting link of EDIP is a digital interface based on the CANopen industrial standard: the Bürkert system büS. This concept requires no master — all networked devices have equal rights and automatically allocate addresses. The message recipient (consumer) monitors the information provider (producer) and reports an error if the information is not delivered.

Software

Another important element of EDIP is the Bürkert Communicator configuration software. This software is used for the configuration, parameterisation, diagnosis and servicing of all new Bürkert products. In addition to the basic functions of configuration and parameterisation, the software also features a graph view for displaying process values. Settings can be saved, modified, printed and transferred to other devices. The graphical programming interface makes it possible to implement virtually unlimited functions and to control customised processes. Access to the network is possible during operation and users have the option to connect several devices simultaneously.

Hardware

Users can use EDIP to implement different modular hardware systems. The device platform is therefore ideal for both compact and modular field devices. Modules can be combined for the individual application requirements. An example is the SCU (System Control Unit). Depending on the application requirements, it is possible to expand this unit to include additional I/O modules for the integration of any number of sensors and actuators.

A platform that offers unlimited possibilities

Through its various integrated elements, EDIP's intelligent networking offers an unlimited range of possibilities through:
- Standardised interfaces for convenient device integration
- Graphical programming for individual process steps
- Providing one tool for commissioning, diagnosis and service
- Reduced parameterisation for fast and east startup
- Individualised and flexible implementation for short delivery times
- An intuitive user interface for easy and convenient operation
- Leading the way in intelligent networking

Bürkert strives to lead the way in networked automation solutions. With over 70 years' experience in developing and implementing solutions by providing worldwide connectivity options that cater to customers' requirements, regardless of plant processes, preferred setup or integration needs.

Driven by the movement of mass production and process automation throughout industries, Bürkert aims to simplify and provide peace of mind by offering reliability in both fit-for-purpose products and support.

Bürkert provides a number of gateway and networked options for customers with adaptable and integrative product and technology. As world leaders in supporting core and essential industries, continual innovation is imperative to meet growing demands.

Burkert Fluid Control Systems
www.burkert.com.au

FAST-RESPONSE ONLINE HYGROMETER SYSTEM

The SF82 Online fast response hygrometer from Michell Instruments provides users with more choice and flexibility for dewpoint and trace humidity measurements. It is intended to complement the Easidew Online universal dewpoint hygrometer by covering a higher dewpoint range up to +60°C.

Developed as a fast-response, quick-to-install hygrometer system, the SF82 covers a dewpoint measurement range of -60 up to +60°C dewpoint. The Process Sensing Technologies thick-film moisture sensor provides fast measurements of low dewpoints even in high ambient temperatures. This makes it suitable for use in industrial drying applications such as compressed air and plastic manufacturing.

The Easidew Online covers a dewpoint measurement range of -110 up to +20°C dewpoint. This wide measurement range is especially suited to applications needing measurements at the drier end of the scale such as additive manufacturing or monitoring controlled environments in glove boxes. This hygrometer incorporates the latest Michell ceramic metal-oxide technology, providing stable and repeatable moisture measurements.

As standard, both online hygrometers include: a 2-wire sensor (either SF82 or Easidew), a configurable display with 1/8 DIN mount format, RS485 digital communications, a stainless steel sensor sample block with 1/8″ NPT inlet and outlets and a sensor cable of selectable length. Both the SF82 Online and Easidew Online are also eligible for Michell's sensor exchange program for quick and simple maintenance with the minimum of process downtime.

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

MODULAR GATE BOX INPUT SUBMODULE

Euchner has released an additional module for its MGB2 Multifunctional Gate Box Modular. The MSM submodule provides users with additional safety inputs for connecting external switches, meaning they can easily be connected to Profinet/Profisafe.

The MCM extension modules can be used with the MSM submodule as a decentralised peripheral for connecting electromechanical safety switches with M12 plugs. The failsafe inputs can record the signal states of safety switches such as rope pull switches, emergency stop buttons and position switches, and can transfer the safety signals to the control system via Profinet using the Profisafe protocol. The MSM submodule has three dual-channel digital inputs, allowing up to six slots to be used as secure inputs when using the small MCM extension module. The MSM is equally suitable for M12 push-pull plugs and M12 threaded plugs. In addition, the system is hot-pluggable during operation and needs only minimal configuration before it is ready for use.

The MGB2 Modular has a modular system design to give users greater flexibility. As a result, extension modules and submodules are easily scalable and functions can be expanded and changed without difficulty. This means users benefit from a system that is customisable and flexible enough to meet any potential future requirements.

Treotham Automation Pty Ltd
www.treotham.com.au

EDGE DAQ SYSTEM FOR MACHINE MONITORING

ADLINK Technology has released the MCM-204 edge data acquisition system for machine condition monitoring (MCM). Powered by the ARM Cortex-A9 processor, the MCM-204 is designed as a standalone DAQ device without the need for a host computer, and provides dual Ethernet ports to transmit data back to the backend server and enable daisy-chain connection of multiple devices. Commonly used vibration-related indices, such as voltage, FFT and RMS, can be calculated by the MCM-204, bringing the benefits of edge computing to a large-scale infrastructure. In addition, the MCM-204 offers flexible support for various data access options, providing easier remote management and firmware/algorithm update through the built-in web console. All these features make the MCM-204 suitable for remote real-time monitoring, analysis and control.

The MCM-204 standalone edge system is designed to be easily integrated at field sites, to perform the task of filtering raw data without the need for a host computer — reducing the required data.

ADLINK's MCM-204 features a 24-bit high resolution ADC and captures high-frequency signals at 128 kS/s. All channels have a built-in IEPE 4 mA excitation current source, eliminating the need for additional signal conditioning to trigger sensors to capture signals. In addition, the MCM-204 can also support digital tachometer, digital temperature sensor and voltage output load current sensor functions for acquiring rotating speed, temperature and load current of the machine, thus providing a wide range of options for equipment monitoring tasks. Users can easily build a real-time monitoring system without having to expend effort on programming development.

*ADLINK Technology Inc*

www.adlinktech.com

FLOWMETERS AND CONTROLLERS WITH ETHERNET

Bronkhorst High-Tech has announced the availability of EtherNet/IP and Modbus-TCP interface options for its mass flow meters and controllers, as well as its digital pressure controllers. Like the previously developed EtherCAT and Profinet communication protocols, EtherNet/IP and Modbus-TCP interfaces are based on Ethernet communication. They can therefore be applied with standard Ethernet cabling and support an unlimited number of nodes.

EtherNet/IP is designed for use in industrial environments and time-critical applications, while Modbus-TCP protocol is used for data exchange between I/O controllers and I/O devices (slave field devices). Bronkhorst instruments can be implemented as Modbus slave devices.

Bronkhorst says it has many years of experience with fieldbus communication. With its 'multi-bus' concept, the company offers a choice of nine fieldbus interface options. The wide range of digital metering and control devices is applied in many different markets, such as the food and beverage and chemical industries, gas and fluid analysis equipment, glass and tool coating processes, testing fuel cells for the automotive industry and in machinery used to produce electronic chips, LED lights and solar cells.

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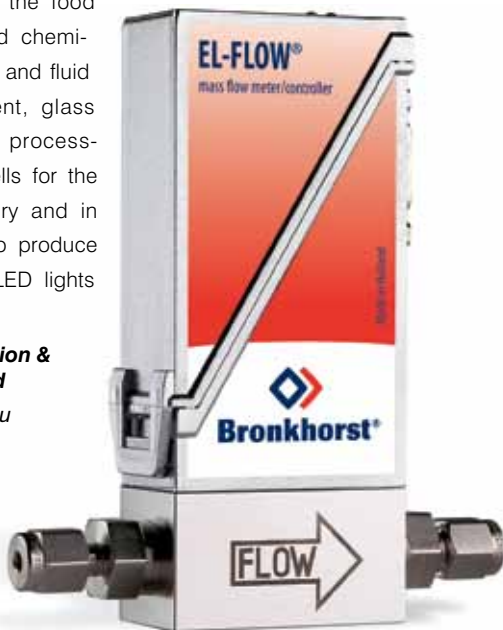
COMPACT EMBEDDED SYSTEM

The Neousys Nuvo-7531 compact fanless embedded computer is designed as a solution for industrial automation, machine vision and automated guided vehicle applications.

Powered by an Intel 9th/8th-Gen Core 65W/35W CPU that offers more than 50% computation performance improvement over the previous generation, the Nuvo-7531 Series is built in a 212 x 165 x 63 mm low-profile chassis.

The Nuvo-7531 features four Gigabit Ethernet and four USB 3.1 ports with screw-locks. The screw-lock design offers rugged connectivity by ensuring the connector is screwed on and does not fall off easily. For data storage purposes, there is a hot-swappable HDD tray to hot-swap the storage drive without turning off the system or dismantling the chassis.

In addition, Nuvo-7531 supports three mPCIe slots for expansion so Wi-Fi or 3G/4G modules can be installed to achieve wireless communication. For convenience, there is a pet-door at the bottom of the enclosure for easy installation or maintenance of mPCIe and M.2 modules. It also offers four channels each of isolated digital inputs and outputs and has an operating temperature range of -25 to 60°C.

Backplane Systems Technology Pty Ltd
www.backplane.com.au

Power from waste heat: maximum yield with supercritical CO_2

Generating power from waste heat is not just worthwhile for steelworks. New turbines driven by supercritical carbon dioxide are boosting the efficiency of power generation enormously.

A major technological advance in power generation using industrial waste heat is just around the corner, as the first turbines driven by supercritical CO_2 (sCO_2) are ready for operation. This heralds a new generation of turbines that offer higher efficiency than steam turbines, while needing significantly less build space.

The Oil & Gas Division at Siemens Energy in the US is already working to equip a gas compressor station with these turbines for the Canadian energy company TC Energy, which will enable it to convert its waste heat into power more efficiently in the future. The sCO_2 turbine is expected to go on the grid in 2021, and it will supply electricity for more than 10,000 households.

Simon Kobler and Stefan Glos at Siemens Energy Technology Development in Germany are preparing more potential applications. They're working on making sCO_2 turbines available in the near future that will be capable of converting even larger volumes of waste heat — like heat generated in steelworks and glass foundries — into power. They're currently doing the preparatory work as part of the Carbosola research project sponsored by the German Ministry of Economic Affairs and Energy.

"We're working with Dresden University of Technology, the Helmholtz Center in Dresden and the German Aerospace Center in Cologne to create a demonstrator that will show that the technology for sizeable volumes of waste heat is commercially mature," said Kobler. "Clarifying how to design and build the turbines is less important for us. We're well-positioned to address issues like this based on our many years of experience in turbine manufacture. Our priority is to provide even stronger support at a theoretical and experimental level for the performance this technology promises before we launch any products on the market."

The new sCO_2 turbines offer extraordinary promise. That's due to the unusual properties of CO_2 when it's compressed by pressure in excess of 73.8 bar at temperatures higher than 31°C. Under these conditions its consistency is as thick as a liquid, but it flows as easily as a gas. And that's ideal for power conversion in the turbine. An increase in the physical density of the working medium without impeding its flow properties will increase its power density and therefore the electricity yield. But the high power density can be used for more than just increasing electricity yield in applications that currently use steam turbines. It also makes it possible to construct turbines that need significantly less build space than steam turbines offering the same output.

"Depending on the temperature of the heat source, sCO_2 turbines can be smaller than steam turbines by up to a factor of 10," said Glos. "sCO_2 turbines are therefore interesting for the conversion of industrial waste heat into electricity in two ways. Firstly, the high power density of sCO_2 at low temperatures is a particular advantage. At the same time, most industrial plants don't have the space to install a steam turbine."

To ensure that Siemens Energy also has some real application experience when the Carbosola project reaches its conclusion, Kobler and Glos are working to create a prototype pilot plant in collaboration with one of their customers in parallel with the research project.

"Many industrial firms that generate large volumes of waste heat have a strong interest in being able to make use of power generation using sCO_2 turbines as soon as possible," Kobler explained. "It won't be hard to convince steelworks and glass foundries of the benefits of this new technology."

Siemens Ltd

www.siemens.com.au

SANITARY BULK BAG FILLER

The latest sanitary bulk bag filling system from Flexicon features dual SWING-DOWN fillers fed by high-capacity weigh hoppers, achieving fill rates of up to 40 bulk bags per hour.

The filler design simultaneously lowers and pivots each fill head into a vertically oriented position that places the inflatable spout connection collar, inflator button and four bag loop latches within reach of an operator standing on the plant floor, increasing the safety and speed of connecting bulk bags.

The system employs dual gain-in-weight hoppers positioned above the bulk bag fillers, which allows pre-weighed material to descend into the bag at high rates, and saves additional time by refilling the weigh hopper while the full bag is being removed and an empty bag is being connected.

Once the inflator button is pressed and the collar secures the bag spout, filling operations are automatic: the fill head raises and returns to horizontal orientation; a dedicated blower fills the bag with air which removes creases in the bag, allowing the material to fill corners to create a stable bag; the surge hopper's roller gate valve opens; pre-weighed material fills the bag; the valve closes; the inlet seal deflates and the bag loop latches release, allowing a forklift to remove the filled bag.

Ports on each filler are vented to a dust collection system to prevent displaced air and dust from escaping.

The stainless steel system is finished to sanitary standards and equipped with a corrosion-resistant, watertight and dust-tight controls enclosure, allowing washdown.

Flexicon Corporation (Aust) Pty Ltd
www.flexicon.com.au

CELLULAR IoT CONNECTIVITY FOR REMOTE ASSETS

HMS Networks has announced its Anybus Wireless Bolt IoT that is said to enable reliable cellular-based internet connectivity for assets in the field, using the latest LTE-based networks NB-IoT and CAT-M1.

Companies are increasingly looking to connect remotely located assets for remote monitoring and control over the internet. However, there is often no local infrastructure available to connect such assets to the internet in a traditional way. The Anybus Wireless Bolt IoT aims to resolve this situation by providing reliable cellular-based internet connectivity over NB-IoT and CAT-M1 for remote assets that are otherwise hard to reach and connect.

Cellular connectivity with Wireless Bolt IoT bolted onto remote assets Wireless Bolt IoT includes all elements needed to get stationary or mobile assets online over a cellular connection. Packaged in the Bolt format for on-asset M50 hole mounting, it features a robust IP66/IP67 housing with UL NEMA 4X certificate for outdoor mounting, an integrated cellular antenna with a microcontroller and firewall.

Configuration is done via a built-in webserver or by sending REST commands via the Ethernet port. After this, Wireless Bolt IoT will transfer data transparently from the asset to the cellular internet connection using TCP/UDP based protocols. Power over Ethernet (PoE) is supported, but power can also be supplied via separate terminals.

Global M2M
www.globalm2m.com.au

TEMPERATURE MONITORING RELAY

ABB has launched a Smart Temperature Monitoring Relay that aims to meet different user needs with one device. An LCD screen provides status updates and readings with a single glance and near-field communication (NFC) enables users to adjust settings with one touch of a smartphone, making installation around 80% faster than previously.

The Smart Temperature Monitoring Relay covers a wide range of applications, eliminating the need for companies to stock, manage and configure many different devices. It offers a wide measuring range and compatibility with different sensors, such as the PTC and PT 100, making the device flexible to fit applications as desired. The device offers predefined settings for popular applications, storage space for user-defined settings and a solution to copy and paste settings when commissioning numerous devices.

The Smart Temperature Monitoring Relay has a liquid crystal display that shows key measurements and maintenance information. An intuitive push-rotate-button user interface makes it just as simple to set thresholds and parameters.

The device is also compatible with the ABB EPiC smartphone app, which uses NFC technology to make a fast, wireless exchange of data and information possible. The EPiC app is for configuring and checking the status of ABB's low-voltage products. Using the app, users can edit parameter settings more quickly, store this information in the app and copy the settings straight onto other devices — even if they are not powered. Users can upload parameters to the cloud and share them with colleagues.

ABB Australia Pty Ltd
www.abbaustralia.com.au

WIRELESS SENSOR NODE

MicroStrain LXRS wireless sensor networks from LORD Sensing enable simultaneous, high-speed sensing and data aggregation from scalable sensor networks. The wireless sensing systems are suitable for test and measurement, remote monitoring, system performance analysis and embedded applications.

The gateways are the heart of the LORD MicroStrain wireless sensing system. They coordinate and maintain wireless transmissions across a network of distributed wireless sensor nodes. Some nodes have integrated sensors, while others are designed with multisensor connectivity for application flexibility.

The Lord MicroStrain LXRS wireless communication protocol between LXRS nodes and gateways enables high-speed sampling, ± 32 μs node-to-node synchronisation and lossless data throughput under most operating conditions. Users can easily program nodes for data logging, plus continuous and periodic burst sampling with the Node Commander software. The web-based SensorCloud interface optimises data aggregation, analysis, presentation and alerts for gigabytes of sensor data from remote networks.

The IPEE-Link-LAXRS sensor offers high-resolution data with a 24-bit A/D converter, user-programmable sample rates from 1 to 104 kHz, 109.5 dB dynamic range and user-selectable low pass filtering. With a wireless range up to 2 km (800 m typical), the sensor has a high-capacity, rechargeable battery for extended use and remote configuration. It also accepts most IEPE accelerometers.

The product is suitable for vibration sensing in challenging conditions, such as critical structure and machine health monitoring. Applications include condition-based monitoring (CBM), health monitoring of rotating components, bearings, aircraft, structures and vehicles, modal analysis, vibration monitoring and product testing.
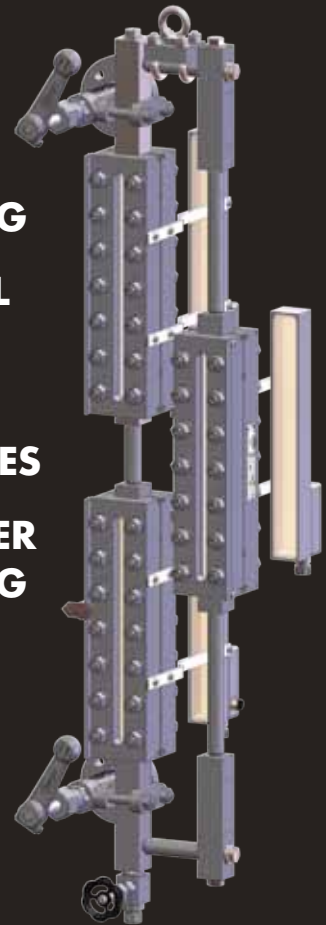
Metromatics Pty Ltd

www.metromatics.com.au

MAKING INTEGRATION AND CONTINUOUS IMPROVEMENT EASIER

ENHANCING EXISTING CONTROLS INFRASTRUCTURE INVESTMENT WITH IO-LINK TECHNOLOGIES

*Will Healy III**

For companies working with manual and semi-automated assembly processes, continuous improvement is a daily topic.

Error-proofing, kaizan, poka-yoke, six-sigma, quality management or quality assurance are a way of life when humans are involved in part of the assembly process. Your teams work hard to catch as many of these defects as possible before the mistake makes it to the customer or consumer. 'Quality is our Culture' or 'Continuous Improvement Conscious' are regularly seen in factories as not-so-subtle reminders to all of us that while perfection is impossible, the pursuit of perfection in our product is something we should live daily.

For those in management or engineering who are responsible for the quality of production in a factory, this can be a heavy burden. Regardless of how flexible we are in manufacturing, the more things we can automate in our processes will help reduce our errors and improve the end quality of our products. When

is a unique requirement. It is important to specify the appropriate control architecture during the initial design and build phase. This requires an architecture that easily integrates poka-yoke devices and traceability devices, such as RFID, into one seamless system that allows easy and low-ost expansion for the future. An expandable architecture built around the open standard of IO-Link seamlessly integrates poka-yoke devices and industrial identification devices. By keeping a few IO-Link ports open, future expansion is easy and cost effective. And the best part is the ability to implement the expandable architecture on popular control platforms from Allen-Bradley, Siemens, Mitsubishi and others.

These questions sometimes end up ruling out our first ideas and go-to solutions. However, IO-Link can easily meet these questions and challenges. IO-Link is a vendor-neutral, widely accepted technology that is regularly referenced as the USB for industrial automation. IO-Link is the next generation of continuous improvement with flexible control architectures, easy fast integration, diverse inspection options, visibility and traceability.

The objective of this article is not to make you an IO-Link expert. However, a few high-level points must be addressed to see the full benefits of the technology.

Use YOUR network and control architecture

You can't rip out what you have now. IO-Link easily utilises your existing industrial network infrastructure. The benefits can be seen regardless of whether you currently use industrial networks like EtherNet/IP or no networks with centralised PLCs. Addressing of the devices is point-to-point with a master/slave relationship as seen in Figure 1. Connectivity is made with low-cost, unshielded, standard 4-wire sensor cables with up to 20 m between the master and slave.

Automate configuration and replacement

Smart field devices can require a higher degree of skill for technicians to be able to configure or replace. A typical error-proofing sensor usually has a measurement value or pre-programmed set points for tolerances. IO-Link devices are capable of being automatically configured on set-up or replacement, eliminating manual programming of the error-proofing device (Figure 2). If troubles occur, the sensor can report diagnostic issues like a dirty lens or more importantly could possibly report if the sensor has been bypassed or disconnected.

Choose what makes sense for your business

With a universal and open standard, products and technologies can be sourced from over 60 known vendors in the automation industry. This reduces your risk in selecting and implementing components because you keep control of which organisations you do business with. With over 24 IO-Link-enabled technologies from electrical drives to proximity sensors and everything in between, the technology needed to implement error-proofing is available today with IO-Link capabilities.

looking for flexible automation equipment, there are always some base decisions that must be made:
- Will it work with what we have now? We can't rip out what we have working.
- How do we integrate the solution? We have limited time and resources.
- Can we also get it from a different supplier later if we have to replace it?
- Can we get it implemented ASAP? Like during a lunch break or scheduled shutdown?

Control architectures have significant impact on how a total error-proofing program is implemented. Having a system that works well initially is somewhat easy. The real test is how well it works as time goes on. In an error-proofing environment, easy expandability
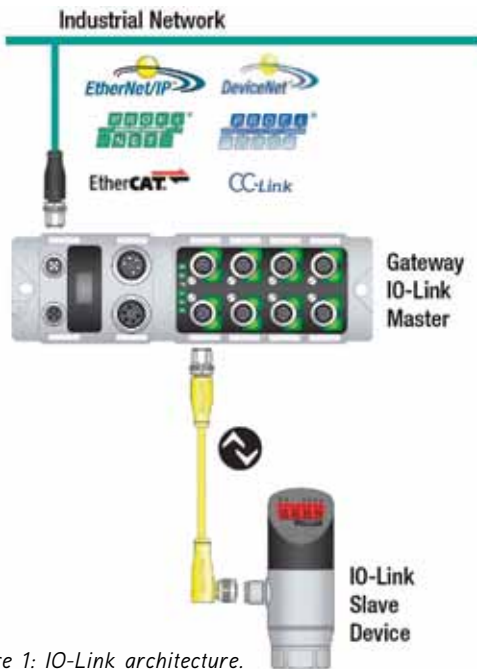
Continuous improvement

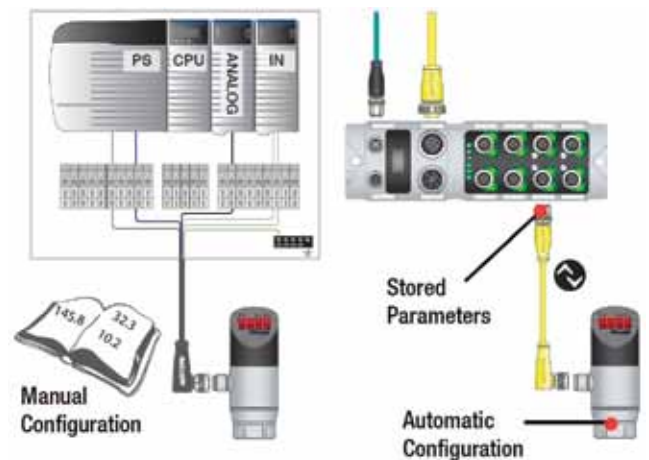

Figure 1: IO-Link architecture.

Figure 2: Manual versus automatic configuration.

Define your continuous improvement implementation plan

Your CI Implementation Plan must be flexible

Quality errors can come in a troubling variety, so the technologies utilised to detect these trouble spots tend to be various and assorted as well. Being able to flexibly implement the proper technology is vital to success. Think about these types of questions when defining your implementation process for flexibility:

- How many variants do we need to inspect?
- What technologies do we use to contain and identify non-conforming parts?
- How do we ensure rework was done properly?
- What technologies do we typically use to inspect part assemblies?
- Can we accommodate new discrete and analog inputs?

Flexible implementation architectures allow for multiple technologies to be selected, modified and adapted to changing requirements in the factory. The plug-and-play nature of IO-Link means that devices can be used in one application, modified for another application or moved to a better inspection location. The flexibility to plug any device, including standard discrete sensors, into an IO-Link master gives you virtually unlimited possibilities for control of your error-proofing applications like colour detection, analog I/O and linear measurement with lasers, ultrasonic and position transducers (Figure 3).

Your CI Implementation Plan must be easy to use

If you want the team to live continuous improvement, it must be clear, simple and easy to implement. The harder we make it to do the right thing, the less likely we are to implement change. So selecting an implementation plan that can be executed easily is a must.

- What does it take to set up a new inspection in production?
- How do we define the mistake or quality issue?
- How do we ensure that the issue does not appear again?
- How do we make sure the technology is implemented properly to ensure detection?

With IO-Link the ability to parameterise smart sensors and devices makes implementation and changes to inspections very easy. Some intelligent lasers and sensors can have more than a dozen programmable settings that must be accessed via a small, sometimes hard-to-see, push-button interface. The engineer or technician has to spend a significant amount of time understanding how the product is configured properly. However, with IO-Link there are a variety of ways to configure a device and parameters can be stored for future or repeated use across similar installations. In addition, a large combination of parameters can be stored, uploaded and downloaded for use in the most flexible of production capabilities (Figure 3).

In the case of a device failing, a failure in quality could occur again due to a mistake in configuration of the replacement device. With IO-Link the ability to store parameters in the master and automatically configure the device means that once the configurations are determined, the quality inspection can be maintained.

Your CI Implementation Plan must be fast to integrate

Selecting a technology that integrates into your existing control system is a major requirement when trying to implement improvements on the fly. Quality errors and deviations must be identified, contained and rectified with minimal effect on delivery to the end customer or consumer.

When integrating smart sensors and industrial network-ready technologies, the learning curve to implementation can be steep. Days or weeks of bench testing, software programming and trials can add costly delay to detection implementation. Control-ready devices that provide software function blocks or Add-On Instructions can dramatically reduce the complexity and time to integrate into the PLC.

While hardware selection is important to the success of a project, if the hardware is not easily integrated into the engineering software, any benefits gained could be lost. However, Distributed Modular I/O is easily integrated into typical engineering software with an easy three-step process.
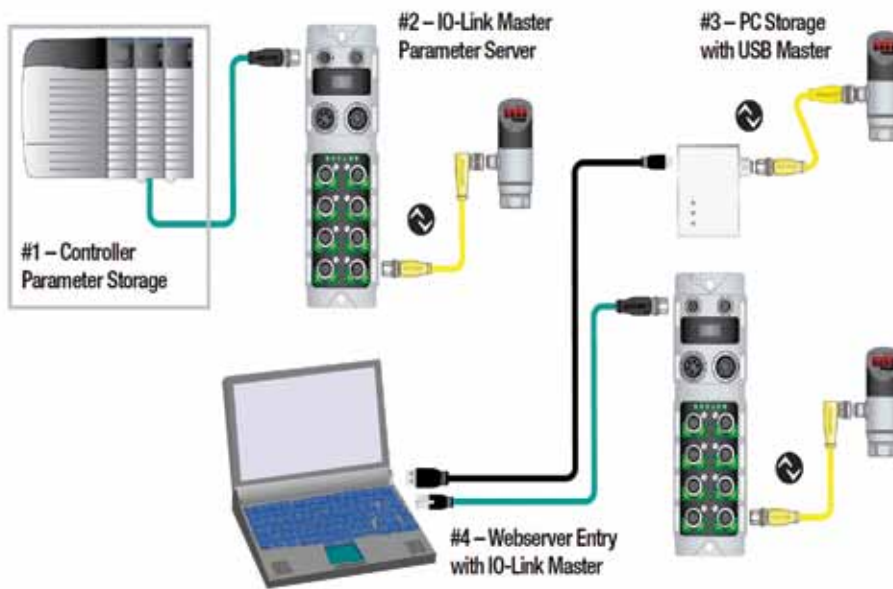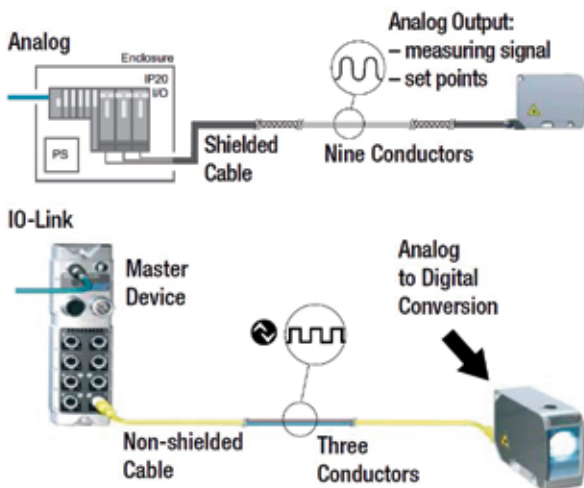
Figure 3: Multiple ways to parameterise.

Figure 4: Measurement — analog vs IO-Link.

In a typical measurement application the inspection device provides an analog output. The engineer then has to do multiple calculations based on resolutions and scaling to determine the actual engineering unit of measure, such as psi or millimetres. Many IO-Link devices provide the pre-converted actual engineering units of the measurement they are providing. For example, in Figure 4, a laser sensor would provide the position value in millimetres in the process data to allow for easy integration. This eliminates any calculations required, reduces set-up mistakes and gets the inspection operational faster.

Real-world implementation in action

By selecting IO-Link as the controls architecture in their facility, a Michigan-based manufacturer is able to reliably implement on-the-fly improvements to their production equipment. Using Allen Bradley CompactLogix PLCs and the industrial Ethernet network, EtherNet/IP, they implemented a wide variety of technologies into their assembly processes; both before and after the initial machine build. Applications in use today include: discrete poka-yoke sensors looking to ensure components were in the proper place; analog measurements inspecting component orientation; and smart sensors with diagnostics and automatic configuration.

Once they decided to have IO-Link as the architecture of choice, it was very easy for them to continuously make improvements. A process improvement engineer at this facility was tasked recently to determine the presence and orientation of a nut fed into a pedestal welder. His task was to make sure the nut was there as well as to ensure that the nut was not upside down. He stated, "With IO-Link, I was able to install the linear position transducer mechanically in the application, go into the code and have the entire project integrated in 20 minutes. I had planned a full day for implementing this application, but it was that easy."

So by selecting IO-Link as their continuous improvement implementation plan they were able to integrate error-proofing solutions flexibly, easily and fast.

Will Healy III lives in Cincinnati, Ohio, and works at Balluff's US headquarters. He has over nine years' experience in the automation and manufacturing industry and is the Strategic Marketing Manager for Balluff globally on error-proofing assembly processes. A long-time supporter of the adoption of IO-Link technology, Will is passionate about manufacturing automation and believes in supporting STEM programs in schools.

Balluff Pty Ltd
www.balluff.com.au

GPU COMPUTING EDGE AI PLATFORM

The Neousys Nuvo-8208GC is a ruggedised GPU computing edge AI platform supporting dual 250 W NVIDIA GPUs, and an Intel Xeon E or 9th/8th-Gen Core processor.

Designed specifically to support two high-end 250 W NVIDIA cards, it offers GPU power up to 28 TFLOPS in FP32 for emerging GPU-accelerated edge computing, such as autonomous driving, vision inspection and surveillance.

The system also has a workstation-grade Intel C246 chipset to support up to 128 GB ECC or non-ECC DDR4 memory. The system incorporates two hot-swappable 2.5″ trays for easy HDD/SSD replacement and an M.2 2280 NVMe socket for the high disk performance.

Its front-accessible GbE and USB 3.1 ports feature screw-lock mechanisms for securing cable connections. In addition to the dual x16 PCIe slots for GPU installation, Nuvo-8208GC has two other x8 PCIe slots and one x4 PCIe slot for expansion cards to extend functionality.

The Nuvo-8208GC has an updated power delivery design to accept 8–35 V wide-range DC input and to handle heavy power requirements from dual 250 W GPUs. The system also incorporates a heat dissipation design to support -25 to 60°C, and damping brackets to withstand 1 g_{rms} vibration.

Backplane Systems Technology Pty Ltd
www.backplane.com.au

MODULAR GATE BOX EXTENSION MODULE

Euchner has released an additional module for its MGB2 Multifunctional Gate Box Modular. The small version of the MCM extension module offers space for up to six functions, which can be designed to meet individual requirements.

The compact MCM extension module has two slots, meaning it can be assembled with up to six control or application elements; for example, with an emergency stop button and enabling switch or with a key-operated rotary switch. This means users can choose between this small extension module and the existing larger version, which has four slots to accommodate up to 12 additional control and application elements.

The submodules with the function elements are simply inserted into the extension modules via a hot plug and need only minimal configuration before they are ready for operation. The submodules can also be easily replaced if necessary. It can be installed separately from the MGB locking module and bus module — inside a production area, for example, with the bus module installed outside. The MCM can also be used in combination with the bus module without a locking module or door handle.

Treotham Automation Pty Ltd
www.treotham.com.au

MODULAR SIGNALLING COLUMNS

The A7 signalling columns from Leuze are modular and offer flexible configuration in a 70 mm diameter housing. The clear lens modules are designed with the latest LED technology to ensure a long lifetime and offer distinct visibility in sunlit areas.

The functions of the A7 signalling columns are blinking or steady light and can be achieved by control from all types of PLC. An automatic electrical connection using a bayonet lock system with tension spring technology between the modules makes the signal column easy to use.

The A7 signalling columns are available with or without a buzzer. For single sound buzzer modules (up to 105 dB) options are steady sound, pulsing sound or potentiometer for adjustment of volume. For multi-sound buzzer modules, there is the option of eight different sounds, adjustable by dip switch, and a potentiometer for adjustment of volume.

The pins of each lens are connected to the colour, not to the position. This allows the operator to change the order of the modules easily. Three different pole lengths of 100, 250 and 400 mm are available. A pre-assembled tower light with a 100 mm base in colours red, orange and green is available to order as one item number.

Leuze electronic Pty Ltd
www.leuze.com.au

DIGITAL SMART POSITIONER

The Rotork YT-3700 and YT-3750 pneumatic smart positioners employ continuous monitoring and graphic display of valve position, setpoint target over time and internal circuit board temperature over time. With single- and double-acting configurations available, they are said to provide reliable control of pneumatic valve systems for linear and rotary applications.

Valve diagnostic information to NE107 standard is provided, with Hart 7 communication protocol included as standard and a display for all settings and local device interaction.

The enhanced diagnostic package offers position-over-time continuous monitoring, and graphical visualisation trough Device Description (DD) and Device Type Manager (DTM) files. Additionally, valve signature, advanced step tests and partial stroke testing (PST) can be operated from local or remote positions. Auto-tuning functionality and non-contact sensor are included for high-frequency operating valves and an enhanced lifetime.

The steady state deviation analysis that they provide can detect friction in the valve or actuator, leakage in pneumatics and instances where there is insufficient supply pressure. A deviation timeout alarm occurs when the difference between the target position and the actual position exceeds the pre-set deviation alarm point.

To match Emergency Shutdown (ESD) systems for on-off applications, the YT-3700 range offers a full package of offline diagnostic tests that include both valve signature and partial stroke test. All information can be stored on the device or downloaded.

The YT-3700 and YT-3750 are certified to ATEX/LEXIEX standards and can operate in temperatures as low as -55°C.

Rotork Australia
www.rotork.com

TRANSFORMER WINDING ANALYSER

The Megger MWA330A transformer winding analyser is a three-phase transformer test system that combines TTR and resistance testing into one. Available to rent from TechRentals, it can be used to effectively test power transformers, distribution transformers, CTs, VTs, motors or generators. It is designed to deliver portability, reduced set-up time, increased safety and better productivity.

All ratio and winding resistance tests, such as three-phase turns ratio, three-phase winding resistance, auto vector detection and heat-run tests, can be carried out with a single three-phase lead-set connection. The instrument performs DC resistance measurements on all high and low side windings without the need for reconnection or a separate switch box.

The MWA330A features Kelvin clamps with adjustable jaws that can open to 100 mm and banana plug inputs for connection to terminal blocks. This eliminates the need for special lead sets and minimises operator error. The unit also features a bright 12″ touch-screen display, PDF report generation, PC interface via USB and an in-built printer.

TechRentals
www.techrentals.com.au

SINGLE-BOARD COMPUTER

The MIO-5393 single-board computer (SBC) is powered by a 9th generation Intel Xeon/Core processor. With a compact 3.5″ design, this SBC offers a wide range of I/O functionality as well as domain-focused features like CANbus. The small form-factor design functions in broad operating temperature ranges (-40 to 85°C), making it suitable for diverse applications that require high processing speeds, including military defence micro-servers, AOI machines, passenger information systems and outdoor kiosks.

The new-generation SBC doubles USB speed by utilising USB 3.2 Gen 2 (10 Gbps). With a built-in Gen9LP graphics engine, the MIO-5393 supports three simultaneous displays with 48-bit LVDS, HDMI (up to 4k at 30 Hz) and DisplayPort (up to 4k at 60Hz). The MIO-5393 also supports up to 32 or 64 GB memory size dual-channel DDR4 2400 MHz RAM and features an M.2 M-Key 2280 slot for supporting NVMe/PCIE high-speed PCIe SSD storage.

The MIO-5393's built-in iManager 3.0 integrates power sequence control to improve reliability and enable GPIO, hardware monitoring, smart fan control and watchdog timer functions. Also supported by iManager 3.0 are domain-focused features like high-speed RS-232/422/485 up to 1 Mbps, I^2C (100 kb/400 kb/1 Mb) and CANBus.

Advantech Australia Pty Ltd
www.advantech.net.au
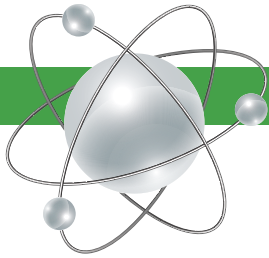
Human–robot collaboration for improved welding seam inspection

Robots are being deployed in more and more situations, many of which involve collaboration between humans and robots — for example, relieving humans of onerous tasks in the workplace. The challenge now is how best to integrate the robot into the working environment and how to operate it. In a joint project with Volkswagen, the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, HHI will demonstrate the advantages that the use of human–robot collaboration (HRC) can bring to the inspection of welding seams in the automotive industry.

Flawless welding seams are a critical quality criterion in automotive engineering. In the future, welds will be inspected by a human–robot team, with each contributing its specific skills and expertise. Controlled by gesture and voice commands, the robot will hold and manoeuvre the specific components into position, while the employee marks and records any defects in weld quality.

The joint research project EASY COHMO (Ergonomics Assistance Systems for Contactless Human-Machine Operation) draws on the many years of experience that Fraunhofer HHI has accumulated in the fields of 3D capture, 3D information processing and 3D visualisation. This system for the visual inspection of welding seams on key components in automobile production offers a great example of how HRC can function in the industry. In the coming years, this technology will be providing concrete assistance with inspection procedures at Volkswagen.

The inspection process has remained unchanged for decades. First of all, each component has to be manually fixed in a rotary positioner so that it can be inspected from all angles. Inevitably, this involves the employee having to assume unergonomic positions, which may lead to repetitive strain injuries. Furthermore, only a short time is set aside for this complex procedure, which can have a negative impact on the quality of inspection.

At present, employees are free to conduct the inspection in their own manner. This inevitably results in a non-standardised procedure that makes it more difficult to recognise systematic defects on the basis of different inspectors' observations. In addition, any such defects often go unrecorded or have to be laboriously entered into a separate system via a keyboard and mouse.

In the future, this inspection process will be interactive, with robots used to hold heavy components and manoeuvre them into a position in which employees can inspect them in an ergonomic manner. Such robots will have at least six axes and will therefore be able to move, turn and tilt a component in every possible direction. The robot will automatically remove a component from the line and present it for inspection. The employee will interact with the robot by means of explicit and implicit gestures, thereby steering the component into the desired position. Employees can concentrate their attention on identifying defects and, as a result, will overlook fewer defects.

The middleware developed by Fraunhofer HHI coordinates the various sensors that serve to capture the overall work situation. Based on the employee's position and gestures, the software calculates the required movement of the robotic arm. This also ensures user safety: for example, whenever the employee ceases to look directly at the component, the software halts the robotic arm as a precaution.

The robot presents the workpiece in an ergonomic position to enable easy inspection. Image ©Fraunhofer HHI.

"The robot can also be set to respond to personalised instructions," said Paul Chojecki, project manager at Fraunhofer HHI. "Our new perceptual interface is able to process a user's individual gestures and voice commands. This means the system can be quickly customised to a workstation's specific requirements."

Gestures are used to mark, categorise and confirm defects on the component. By the means of precise object tracking and projector-based augmentation, employees are provided with an interface directly on the component in their working space. This offers an efficient and intuitive way of generating a digital 3D record of any defects in the welding seams. By contrast, the current inspection procedure lacks any systematic record of defects, because there is very little formalised exchange of information between different employees. With the new procedure, any defects can be immediately entered into the system and then statistically evaluated. This means that systematic defects are more rapidly identified and can thereby be eliminated at the welding stage.

The system features a large number of sensors combined with multimodal controls based on an enhanced middleware, along with customised operating instructions and machine learning. It is an approach that could well bring the breakthrough for further HRC applications — and also expand the scope of collaboration and interaction between humans and robots. Further areas of use include milling machines, for instance, or interactive robotic assistants in non-industrial settings — such as in the healthcare or services sectors.

The joint project EASY COHMO is part of the 3Dsensation research alliance and is financed by the German Federal Ministry of Education and Research (BMBF) as part of the government funding program Zwanzig20 – Partnerschaft für Innovationen.

Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute
http://www.hhi.fraunhofer.de

AS I SEE IT

DIGITAL TECHNOLOGIES SUPPORT THE FUTURE OF INDUSTRIAL MEASUREMENT

Over the years, digital technologies have rapidly transformed several industrial processes, including instrumentation. Digitalisation ensures accurate measurement, and it remains at the forefront of enabling process engineers to improve the efficiency and controllability of their plants.

Instrumentation is one of the most critical components of a process plant. For example, instrumentation performs an indispensable role within all process industries in Australia, including mining, oil and gas, water and wastewater, and manufacturing. These industries specifically need to maintain a high level of measurement accuracy, for process control efficiency and safety as any faults could potentially result in colossal damages.

The global process automation and instrumentation market is projected to reach a whopping $95.5 billion by 2024, according to research firm Markets and Markets. While automation has expanded the possibilities of leveraging technology to advance industrial processes, accurate instrumentation further improves these automated processes.

Process engineers can leverage digital measurement technologies to advance their processes' efficiency. In traditional analog instruments, data is represented through varying electrical signals, often resulting in a mismatch between data being transmitted and received, whereas with digital devices, it is expressed in a uniformed manner of ones and zeros, resulting in increased accuracy and elimination of incorrect readings while saving time.

Digital instruments allow the combining of multiple process values into one signal, providing more comprehensive process information. For instance, chemical analysers and level detectors that can also provide temperature sensing.

As technology gains traction, instruments are increasingly connected, and data-driven. While plenty of data can be collected from these connected devices, data analysis is the key to turn it into valuable information. As data is being continuously collected and is easier to access, it can be analysed to accurately trace potential faults and their root cause. Comprehensive analytics makes it easier to make the right decisions, thus helping to en-sure maximum productivity even when there's a shortage of workers.

Data on the health of equipment and other parameters can also be analysed to enable to enable predictive maintenance, helping process engineers implement maintenance activity before a potential fault occurs. This improves reliability, equipment availability and performance. Further analysis can also ensure the shifting maintenance of regimes to condition-based frequency and away from time-based.

Overall, the power of digital technologies offers a better view of, and higher control over, plant operations. Digital instrumentation can be integrated into the larger process of digitalisation at a company, leading to the creation of a digital ecosystem. This will enable better decision-making regarding several other vital factors, such as optimised cost and enhanced productivity.

With a multitude of changes occurring, several companies are still intimidated by the idea of adopting newer technology processes. The key to overcome this is to initiate the change from a single process that can be easily digitised. Companies can also extract the most out of existing instruments — many existing instruments offer a raft of additional data apart from its primary role.

The culture of digitalisation will continue to be an integral part of improving performance and expanding the possibilities of heightened efficiency, safety and reliability. It also forms the foundation to ultimately build a digitally enabled plant.

Neil Wold oversees ABB's Measurement and Analytics marketing and sales team in Australia. Neil has more than 35 years of extensive experience in the industrial instrumentation and process automation sector. He joined ABB in 2019 and holds formal qualifications across instrumentation, controls and applied sciences.

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INTRODUCING

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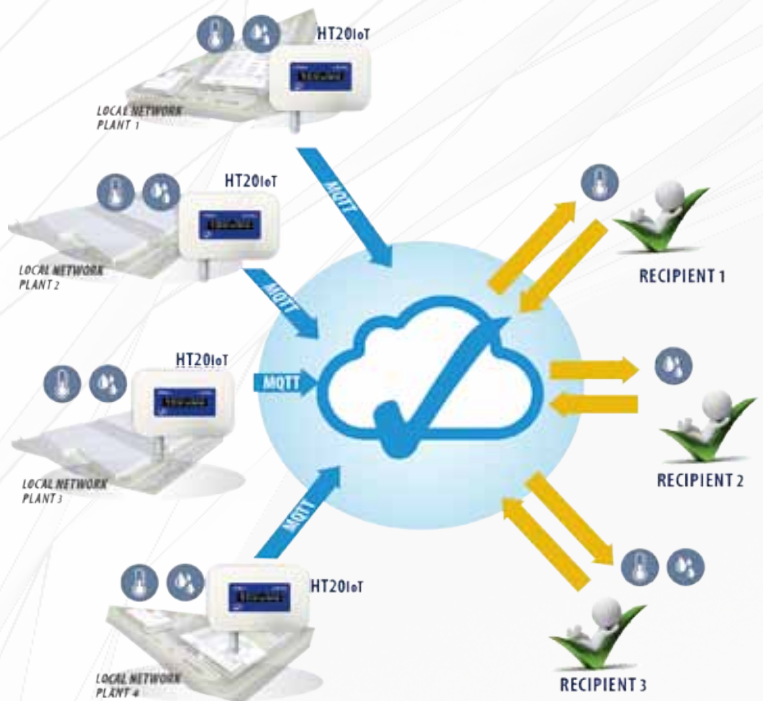
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