03/2022

FEATURES:
- Control systems + automation
- Drives, motors + switchgear
- Measurement + instrumentation
- Transformers, substations + cables

ROD SOURCES

A Game Changer for Radiometric Measurements?

ELECTRICITY + CONTROL
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Motors I Automation I Transmission & Distribution I Energy Solutions I Electrical Construction

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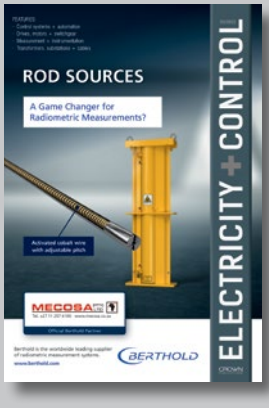

energy + information in industry

For the design of radiometric measurements, a choice must be made to use a point source with a rod detector, or a rod source with a point detector. The rod source/point detector arrangement offers decisive advantages.
(Read more on page 3.)

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It's time to pay attention to energy supply on site

Once again we have a jam-packed edition for you to enjoy – whether you read it online or in hard copy – to keep up to date with what is going on in our industry.

All the areas covered this month are important, but I'd like to focus here on transformers and substations.

As we move towards a more sustainable energy future there is little doubt that shifting electrical energy about will become more – not less – important than it is now.

Emphasis on the reliability and efficiency of each component in the system will become more critical. There are several reasons for this: first is the traditional one of trying to minimise losses between the source and the load; and second is ensuring that what precious energy we have (think alternative source over 350 km away) reaches our plant effectively.

We are also moving to a time when the way we control our systems simply will not be the same as in the past; in the past we just burnt the coal, and somewhere we used the energy as and when we wanted it.

Now there are many applications where energy really is needed on a 'when and where' basis – and our new control philosophies will need to allow for that, given our base may be significantly reduced from what it was in the past.

But even on the plant site, where the substation was typically just 'the building over there' – and it had 'stuff in and around' it, we need to relook energy performance, efficiencies and costs.

The cost of energy is now a crucial consideration in the life cycle costing and planning of any plant. Considering this, the route often taken of neglecting the stuff in the building over there 'because it just worked' is no longer an option.

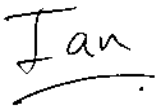
We need to be measuring and monitoring everything we can in the substation; we need to be reviewing the condition of our energy supply network – on our side; not just from the Eskom side (which we all have a feeling for).

And this is the time to delve into the condition of the transformers and associated equipment. This is the time to see why (and this is not made up) we are spending quite a bit on transformer oil – even though we are not manufacturers of transformers; it is the time to check that the circuit breakers and protection networks have sailed through the various stages of load shedding unscathed. They may have, but it's important to check.

As with all things, out of sight and out of mind is simply not an option. Be proactive and review the condition of the plant.

Let's make a commitment to ensure that our energy supply network – much of it hidden, sometimes even buried – is cared for, and that we regularly consider its condition and performance.

We'll miss it the day it fails.



Ian Jandrell
PrEng IntPE(SA), BSc(Eng) GDE PhD,
FSAAE FSAIEE SMIEEE

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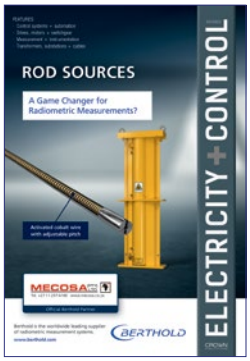
REGULARS

Rod sources – a game changer for radiometric measurements?



Radiometric measurements have been used in industrial processes for several decades. They are an important component in the successful performance of critical level, density and flow measurements. Nuclear measurement gauges work where conventional measuring technology fails. They offer outstanding measurement results under extreme conditions. High temperatures, pressures and other difficult ambient and process conditions are no problem for radiometric measurements.

When planning a radiometric measurement, the technical design is fundamental. It is created and developed based on process conditions, process geometry and customer input as well as local background radiation, site conditions, and mounting space limitations. For the design of radiometric level or bulk flow measurements, a choice must be made between two arrangements: a point source with a rod detector, or a rod source with a point detector. Due to the slightly lower purchase price, the arrangement with a point source and rod detector is frequently selected. However, the rod source (especially using Cobalt-60) and point detector arrangement offers decisive advantages in measurement quality during operation.

With a rod source/point detector arrangement, less frequent production downtime, simpler and thus more economical spare parts inventory, increased long-term stability, temperature stability and consistent process quality, all contribute to mitigating the higher acquisition costs within a short period of time.

Berthold, a global leader in measurement technologies, addresses these advantages comprehensively in a white paper and a webinar.

High-quality radiation sources

Radiometric measurement systems require a radioactive source which emits gamma radiation. The radioactive material is safely enclosed in a sealed and durable capsule, which guarantees safe handling – even under extreme measurement conditions.

With in-house source production in Bad Wildbad, Germany, Berthold produces the safest and most secure sources on the market. Customers benefit from the expertise and support the company offers in source design, sizing, handling, and replacement.

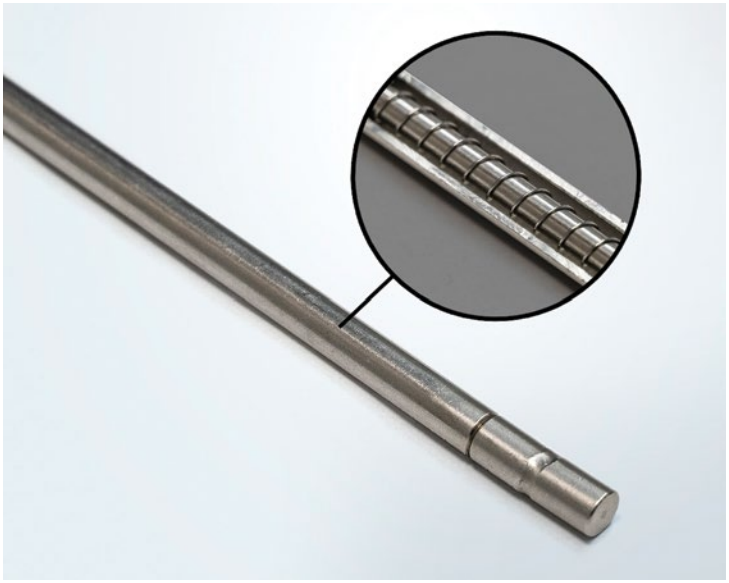
Rod sources deliver optimum measurement accuracy

The custom-made rod sources have the radioactive material distributed across the entire source length as needed, depending on the application, vessel geometry, and detector. For continuous level measurements this improves the linearity of the count rate change at the detector to change in level, when compared to standard point sources, ensuring the highest accuracy with the simplest calibration.

More detailed information on this topic is available on the Berthold website where visitors can watch the webinar and download the whitepaper.

MECOSA (Pty) Ltd is the sole business partner for BERTHOLD in Southern Africa and has cooperated with Berthold for more than 35 years. □

Rod source with point detector arrangement.



Rod source with activated Cobalt-60 wire.

For more information contact MECOSA.
Tel: +27 (0)11 257 6100
Email: measure@mecosa.co.za
Visit: www.mecosa.co.za or www.berthold.com/rod-source

Moving to digitalisation at Tiger Brands

Touching the lives of millions of South Africans over the past century, Tiger Brands produces many of the country's best known consumer brands including Oros, Energade, Hall's, Fatti's & Moni's, Jungle Oats, All Gold, and Tastic Rice. As the organisation embarks on a digitalisation drive, an overhaul of the technology management solutions at its manufacturing plants is required.

Taking a phased approach to the digitalisation rollout, Tiger Brands selected its beverages manufacturing facility in Roodekop, Germiston, some 25 km east of Johannesburg, as the first plant to be upgraded. The immediate challenges were linked to the stability of a legacy control system and the communication network in place. Additionally, the existing control and automation platform had limited capabilities in terms of batching, reporting and the tracking and tracing of materials.

Plant upgrade

The project involved upgrading the legacy plant control system with the implementation of a combined Siemens WinCC SCADA system and PM (process management) Add-ons, together with the associated network and control equipment which included communication converters, PLCs, VSDs, and ASI modules for various process areas.

As the chosen system integrator, Control Systems Integration (CSI) worked with Tiger Brands to execute the project. CSI has extensive engineering experience in the field, including expertise in the food and beverage (F&B) sector. Additionally, CSI's management team applies industry best practice and professional governance models which are implemented jointly with its team of directors, to achieve project excellence. The close collaboration between Tiger Brands, CSI and Siemens provided a roadmap to a successful project outcome.

The beverages manufacturing facility in Roodekop, Germiston, was the first plant to be upgraded.

Tiger Brands also uses Siemens Totally Integrated Automation (TIA) Portal. This offers the organisation a unified engineering platform and diagnostics for all the associated devices on site. The WinCC SCADA system and PM Add-ons provide enhanced visualisations and product traceability across the whole production line. The system also delivers consistent and specific batching to deliver more accurate throughput and quality.

Tiger Brands can now adjust recipes in a more robust manner, according to the final specified product in the new environment. This was not possible with the previous control system. Furthermore, the Siemens solution presents Tiger Brands with a manageable OPEX pricing framework providing for a long-term approach in moving Tiger Brands onto the Siemens digitalisation framework.

Managing time

The project began in December 2019 with the hardware and software procurement phase. It was completed in August the following year with the final commissioning and handover process. Thus the project was commissioned during the Covid-19 pandemic. Commissioning took place in phases as parts of the plant became available using the new Siemens technology.

Partnership approach

According to Shailen Toolsi, Lead Process Engineer at Tiger Brands, "One of the reasons for the success of this project is the collaboration between CSI, Siemens and Tiger Brands, which brings about efficient technical and sales support. We see a long-term partnership with Siemens going forward."

"We are proud to be building on this partnership with Tiger Brands to demonstrate our expertise through the digital portfolio," says Claudio Ranaudo, Senior Vice President, Digital Industries, Siemens Southern & Eastern Africa. "The future of the food and beverage industry requires production that is tailored to customer demands. Our F&B solutions provide flexibility and higher productivity and, with customisation at various sites, we can adapt our offering for the specific case as well as the entire industry. We look forward to working further with Tiger Brands to develop solutions that will enable a gateway for its digitalisation projects," he adds.

Recognising the value in the Siemens control system, Tiger Brands is currently implementing the same control system across another site. □

For more information visit:
https://new.siemens.com/za/en.html

Automated inventory management

For manufacturers, productivity is a primary goal and it has knock-on effects for resources, operational efficiency and the bottom line. Despite this, a major cause of wasted time continues to be overlooked: poor inventory management. Having the right tool available at the right time is critical for manufacturers. Francis Richt, Global Manager for Sandvik Coromant's Digital Machining Business outlines how specialist tooling software can help manufacturers improve their inventories and profits.

In a typical workshop operators can spend up to 20% of their time looking for tools, and about 15% of jobs are re-scheduled or delayed because the right tools could not be found. These findings, based on Sandvik Coromant's research among its own customers, show the extent to which poor inventory management wastes time for manufacturers. Inadequate inventory management leads to accumulated high-value inventory levels, large volumes of stock becoming obsolete or stock-outs, which often means the inventory is depleted when a certain tool is needed most. Other effects include difficulties in measuring tool performance, and higher costs for stock management and processing orders.

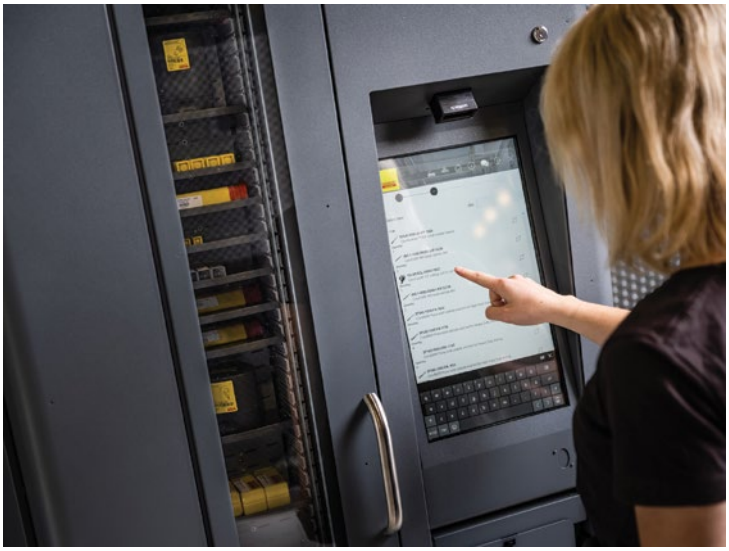
As a sector so concerned with time, manufacturing should not be wasting so much of it looking for tools and spare parts. One problem is that tool management and tool vending systems remain siloed within many organisations. In addition, most companies rely on people to inspect and replenish their tool cabinets. Many manufacturers are reluctant to embrace digitalisation because they are unsure how Industry 4.0 can fit into their established working processes – like enterprise resource planning (ERP), supervisory control and data acquisition (SCADA) and manufacturing execution systems (MES) – and win the buy-in of workers on the shop floor.

Sandvik Coromant has set itself a goal to change this within the next five years – by helping customers automate inventory management through software. In doing so, they can solve issues of poor inventory management in ways that overcome their reluctance to go digital, and benefit the bottom line.

Faster production times

In its *Digital Factories 2020: Shaping the future of manufacturing* report[1], Pricewaterhouse Coopers (PwC) observed that, "the full effect of digitalisation is only realised when companies are connected in real time to their key suppliers and critical customers." In particular, they are achieving this by using Industry 4.0 devices like sensors on production and assembly lines to capture data in real time for improved analytical capabilities and empowered decision-making. As with supply chain management, this ethos of better data capture can also be applied to managing inventories.

It's a challenge because inventory management has many different facets. These include monitoring inventory levels and knowing when new tools need to be ordered, to ensure production is never at a standstill. One example cited in PwC's report is the Fujitsu plant in Augsburg, Germany, which uses automated shelf-life monitoring to optimise its inventory levels and prevent stock-outs. According to the report, the facility has "an interim storage facility – its 'supermarket' – and self-driving electric vehicles which are integrated into its manufacturing execution system in order to ensure a 'just in sequence' delivery of components."



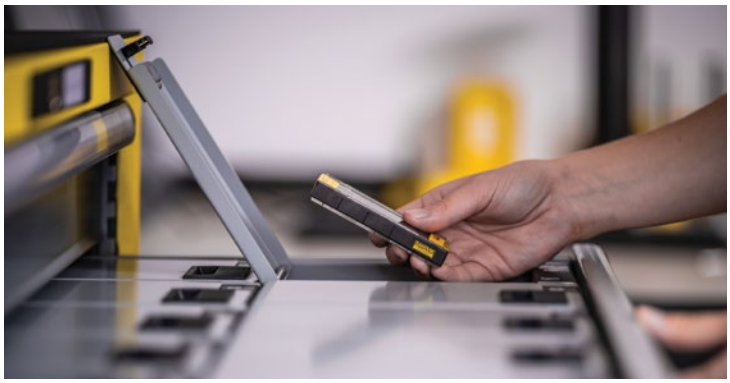
The software is designed to help manufacturers optimise tool inventories and profits.

In this case, digitalised inventory management does more than save the company's time, it supports faster production times. Better inventory management is not exclusive to large multinationals like Fujitsu. With software, smaller or mid-sized manufacturers can also automate their own multifaceted inventory management processes.

Adding value to processes

Sandvik Coromant's CoroPlus® Tool Supply is designed to add value for customers by driving automation with higher efficiency and sustainability enabled by data and insights.

CoroPlus® Tool Supply brings together hardware – specifically, tool storage – and software. The customer is supplied with a purpose-made tool vending cabinet with drawer system which combines with a powerful software platform. This is accessible through a PC or tablet. The automation software offers manufacturers an alternative to doing everything manually, and can avoid incurring a time cost when there is little time to spare. CoroPlus® Tool Supply



Automated inventory management supports higher production efficiencies and can improve production times.

is also designed to handle the many facets of inventory management, such as monitoring levels of inventory and automating tool purchasing.

Automated tool purchasing is seen as a major value-add feature. The worker who standardly manually tracks the contents of a tool cabinet can rely on CoroPlus® Tool Supply to order and replenish that tool stock automatically. The software allows workers to pick and return tools from the shop floor and supports them with the management of restocking and ongoing maintenance of the inventory – all in real time. So people and software work together.

The challenge of overcoming manufacturers' reluctance to go digital is best addressed by highlighting the benefits.

Making better decisions

Another feature of CoroPlus® Tool Supply is its Role-Based User Interfaces (RBUI). RBUIs also happen to be the latest trend in ERP software, allowing workers who repeatedly perform the same tasks to access their frequently-used applications more easily. This can be crucial to winning workers' buy-in. The Tool Supply platform includes connectivity cutting tool data through the CoroPlus offer. This connects with multiple suppliers' product databases and allows the import of correct tool information, including ISO parameters, bills of materials and spare parts. Along with the CoroPlus® Tool Supply software, Sandvik Coromant can also provide the cabinets that hold the tools.

The company sees automation as being integral to improving efficiency and sustainability for its customers. A core aspect of sustainability, and particularly of energy efficiency, is being able to analyse and predict the use of resources including the tool inventory. While Industry 4.0 is benefitting sustainability on the production line with sensors and insights, CoroPlus® Tool Supply can do the same with inventories to ensure they are optimised in terms of time-, cost- and energy-efficiency.

Over the coming years, the company envisages software like its Tool Supply becoming more widely integral to automation systems and decision-making across the manufacturing process. One example is: when planning to machine a new component, the software helps the customer decide which tool to use. Another scenario would see the software more connected to the machine and the scope of work. If the user plans to machine 50 or 100 components, for example, are there enough tools in stock, will they wear out or can the work be completed with the existing inventory of tools?

Sandvik Coromant sees this kind of automation happening, but manufacturers can already use the software to up their productivity levels. □

Part of global industrial engineering group Sandvik, Sandvik Coromant is at the forefront of manufacturing tools, machining solutions and knowledge that drive industry standards and innovations demanded by the metalworking industry. Educational support, extensive R&D investment and strong customer partnerships ensure the development of machining technologies that lead and drive the future of manufacturing. Sandvik Coromant owns over 1 700 patents worldwide and is represented in 150 countries.

Reference:
[1] https://www.pwc.com/ca/en/industries/industrial-manufacturing/digital-factories-2020.html

For more information visit: www.sandvik.coromant.com

Emergency stops for automated production lines

Shrouded E-Stop buttons prevent unintentional actuation but still allow easy access for intentional use.

Banner offers a number of variations of its popular Emergency Stop controls with durable protective shroud. The shroud has a sturdy one-piece design which ensures safe and consistent operation for the long term. It prevents accidental user actuation of the E-Stop button, but it does not impede easy access for regular, intentional interaction.

The 30 mm and flush-mount E-Stops are supplied with a pre-installed shroud, and panel-mount E-Stop kits are supplied with a shroud attachment. The shrouded designs are available for non-illuminated E-Stop models and those featuring Banner's industry-exclusive bright 360-degree illumination.

Shrouded E-Stops are adaptable to various automated systems, but they are particularly well suited for:

- Material-handling conveyor lines
- CPG packaging lines
- Automotive assembly lines.

For more information contact Brandon Topham at Turck Banner.
Tel: +27 (0)11 453 2468
Email: brandon.topham@turckbanner.co.za
Visit: www.turckbanner.co.za

Enabling project collaboration in the cloud

Following the free version of eManage which was made available last year, allowing users to upload, share and manage EPLAN Platform projects in the cloud environment, EPLAN introduced the full version of the software in September, with the release of the new EPLAN Platform 2022. The fee-based expansion stage of the cloud software offers more added value for automation engineering: master data can be accessed in the cloud as can supplementary documents, and performance is increased with additional capacity. Collaboration is at the core of the application, networking OEMs, system integrators, machine builders and operators.

Full information access

Generally, to date, if a project is shared in the cloud the schematics are visible, but not all the accompanying documentation. With the full version of EPLAN eManage, project stakeholders are provided access to all data and documentation relevant to the project, including bills of materials as well as neutral documents in Excel. These become interchangeable with a uniform foundation of data.

EPLAN Head of Engineering Solutions, Claas Schreibmüller explains: "The complete overview of customer requirements and project requirements provides more transparency for all stakeholders involved in developing a machine or plant system." Appropriate rights management ensures that data access can be precisely regulated.

Master data available

Many people are working from home these days and this is where users often bump up against system limits. While they may be able to access a project, often they cannot access the corresponding master data that is specified as a standard throughout a company for design projects. EPLAN eManage now offers the exchange of system-relevant master data, which can be easily retrieved and, as necessary, taken along according to the 'pack and go' principle. Project managers can easily make master data centrally available. Schreibmüller puts it simply:

Collaboration is at the core of the new full version of EPLAN eManage.

"Wherever the user works, all relevant master data can be accessed and does not have to be laboriously copied."

Backwards compatibility

Particular version requirements in supplier specifications or calls for proposals mean project partners are often faced with the challenge of using several different versions of EPLAN software. With the new version of eManage, projects from the EPLAN Platform 2022 can, as an example, be saved to be backwards compatible, for Version 2.9, for example. This eliminates the need to maintain multiple versions of the EPLAN software without violating contract terms and simplifies the entire workflow in the supplier environment.

More storage

With the full version of eManage, users gain additional storage capacity in the EPLAN Cloud. This is available to everyone in the company and is an active collaboration environment and not just storage capacity. It enables optimal conditions for global collaboration across national borders.

For more information contact EPLAN Software & Service.
Tel: +27 (0)11 609 8294
Email: Reyneke.J@eplan.co.za
Visit: www.eplan.co.zaCaptions

A low-risk incremental approach to smart manufacturing

Smart manufacturing strategies have been evolving over the past decade among large corporations, and many small and medium manufacturers (SMMs) might not realise that these strategies are equally applicable to them and are within reach when implemented in practical steps.

MESA, the international Manufacturing Enterprise Solutions Association, has produced a guidebook which looks at how SMMs have been implementing smart manufacturing initiatives and seeing the benefits of increased transparency and productivity, as well as the transformative benefits of higher levels of coordination and speed within the enterprise and supply chain.

The guidebook is intended for business owners and champions for digital transformation and continuous improvement among operations, engineering, quality, and IT staff.

The guidebook can be downloaded from the MESA website. For some MESA memberships it is available free of charge or at a discount. Companies looking to join MESA can do so via the website.

MESA has developed a guidebook to assist manufacturers looking to implement smart manufacturing.

For more information visit: https://mesa.org

Automation upgrade improves brick quality

A local clay brick manufacturer has upgraded one of its brickmaking plants with assistance from drive and control technology specialist SEW-EURODRIVE. Using advanced digital solutions based on Maxolution for factory automation, a new, optimised plant has been installed for the production of high quality rustic face bricks.

"The new plant, which is expected to produce 100 million bricks per year, was built on the back of growth in the local construction industry, which, going forward, is seen as a key sector for South Africa's economic rejuvenation and much-needed job creation.

"Our client is experiencing significant domestic demand and exporting its products into Africa," says SEW-EURODRIVE Field Service Technician, Juandre La Cock.

The rustication process used to make the textured face bricks is a masonry technique that involves chamfering the edges of a brick to allow the mortar joints to be set back, and texturing face surfaces using a roughened roller with blades. The process follows the extrusion of the clay to form the cross-section required, with the bricks being rusticated on three sides, including the front face and both ends.

The existing, basic rustication system was producing an unacceptable amount of waste and this led the brick maker, a longstanding client, to seek assistance from SEW-EURODRIVE. "With the introduction of an automated solution we were able to reduce wastage significantly. This has resulted in the brick maker placing an order for another three rustication systems for installation at other operations in its portfolio," says La Cock.

Describing how the problem was solved, he explains that, to produce consistently patterned surface textures, the brick manufacturer needed to be able to vary the speed of the rustication process, to run more slowly or faster according to the viscosity of the clay. The drive units for the rollers also needed to enable the rustication process to match the line speed of the extruder.

The solution comprised three servo motors with industrial gear units between each, to enable the drive speeds to be changed electronically using SEW MOVI-PLC controller software. Automatic synchronisation of the speeds, varied to match the specific clay conditions and texturing requirements, resulted in a continuous operation producing consistently textured high quality bricks.

The automated rustication system was commissioned within a standard delivery time of four to six weeks. The equipment was built in Cape Town at SEW-EURODRIVE's facility in Montague Gardens. Programming took place at SEW-EURODRIVE's offices in Aeroton, Johannesburg, where most of the equipment was pre-commissioned to limit downtime and loss of production. As a result, the time required for on-site commissioning of the system was reduced to between two and three days.

In addition, the client was supplied with a Drive Operating Panel which enables users to interface with the MOVI-PLC and change the settings as needed, to change over to a new face brick style, for example. As soon as the settings are saved, the line can again be started to produce the modified bricks continuously.

Primed for service

Most of the equipment installed at the brick manufacturing operation, from gear units to conveyor belts, is supplied by SEW-EURODRIVE. "As well as our effective solutions, it is our high standards of service that see this client returning time and again," says Service HOD, Eben Pretorius.

SEW-EURODRIVE knows that the need for an accelerated turnaround time on service or maintenance is critical for manufacturers, as every minute an operation is left standing idle equates to loss of production. "We pride ourselves on our after-sales support, which includes a 24-hour service hotline, a spare parts service, a repair service and an on-site technician service," says Pretorius. SEW-EURODRIVE technicians can also login remotely to assist clients with software problems and a field service team is on standby 24 hours a day, seven days a week to assist clients on site if the issue cannot be resolved telephonically.

The Maxolution solution for factory automation and customised machine systems, offers clients a single source of innovative 4IR-aligned technologies to meet specific applications and needs. With Maxolution for factory automation, clients can balance the need to keep their future options open to react quickly to market requirements. SEW-EURODRIVE supports smart factory designs that comprise new, flexible, adaptable, modular structures.

The company is developing its own R200-million smart component assembly factory in Aeroton. The new 26 000 m² building will also serve as the company's South African headquarters, looking after 23 countries. It is scheduled for occupation this year.

For more information contact SEW-EURODRIVE.
Visit: www.sew-eurodrive.co.za

The Maxolution solution for factory automation includes servo drives and PLC control software.

Integrated development software boosts productivity

OMRON's updated Sysmac Studio 3D Simulation Integrated Development Environment (IDE) with 3D simulation integrates and verifies the movements of robots and peripheral equipment. It can digitally reproduce the entire facility to verify the operation to the same accuracy as the actual machine. This helps companies to introduce new efficiencies to processes and production capacity.

The IDE facilitates design through advance verification. It uses simulations that meet the need for rapid changes in production sites, shorter delivery times for equipment development, high-precision assembly and simultaneous start-up of production lines at multiple sites.

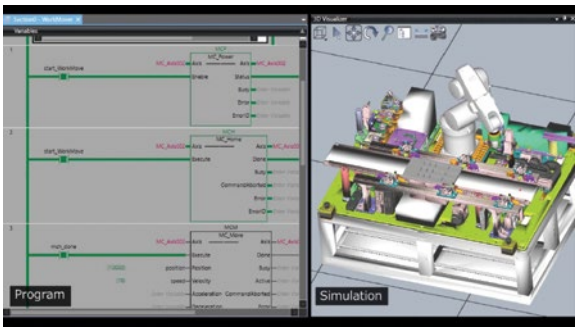
The new Sysmac Studio 3D Simulation can be purchased by simply adding optional licences for simulation functions to the Sysmac Studio programming software of OMRON's flagship NJ/NX Series automation controllers.

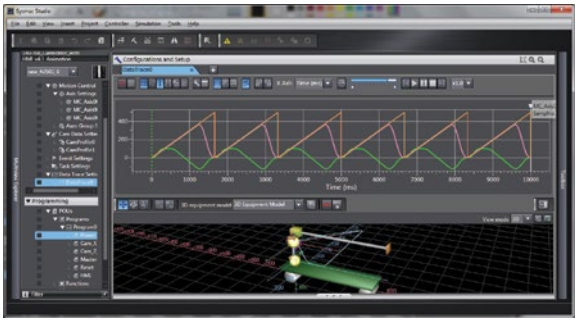
Josep Lario, OMRON EMEA Product Marketing Manager for Software, IPC and Visualisation, says: "Conventional simulators use dedicated software, which is expensive and requires specialist expertise. If the software is different from the controller, it's difficult to match the simulation results with the actual machine operation."

Lario adds: "This is the first IDE in the industry to control and verify robots and other peripheral equipment in a single operation. This enhances the efficiency of facility design and shortens the time needed to confirm the production capacity of the equipment, start-up and modifications."

Main features:

- A single software platform for logic, motion, sequencing, sensing, safety, drives, vision and HMI
- Fully compliant with open standard IEC 61131-3
- Supports ladder, structured text and in-line ST programming with a rich instruction set





The updated software helps meet the need for fast changes in production sites and shorter equipment development times.

- Includes CAM editor for easy programming of complex motion profiles
- One simulation tool for sequence and motion in a 3D environment
- Advanced security function, with 32-digit security password.

For more information contact Omron Electronics.
Tel: +27 (0)11 579 2600
Email: info_sa@omron.com
Visit: www.industrial.omron.co.za

Valve automation for plant control systems

Valve manufacturer GEMÜ is expanding its product range for automation components in the processing industry, introducing new electrical position indicators and combi switchboxes. The new electrical position indicators GEMÜ 1240, 1241 and 1242, and the combi switchboxes GEMÜ 4240, 4241 and 4242 provide for reliable recording of valve end positions, supporting effective process automation – also in potentially explosive areas.

An integrated sensor on the GEMÜ electrical position indicators and combi switchboxes records the end position of the process valves and transmits it to the plant control system with a signal. With combi switchboxes, the process valve can also be actuated with the integrated pilot valve. The process valve and automation components are optimally adapted to each other. The entire system is pre-set and tested, saving users time and effort in logistics, installation and documentation.

The new electrical position indicators and combi switchboxes can be combined with single-acting or double-acting linear actuators or quarter turn actuators and are therefore suitable for diaphragm, globe and diaphragm globe valves as well as for ball valves and butterfly valves. Users can benefit from designs with simple proximity switches or micro-switches, and GEMÜ also offers programmable solutions with 24 V, AS-Interface, DeviceNet and IO-Link interfaces for process automation.

Designs with ATEX, IECex or NEC approvals are available for potentially explosive areas.

The new automation components enable users to achieve reliable monitoring of the installed valves, especially for plants with strict safety or quality requirements. GEMÜ also supports customers in the automation of their plants in external process environments.

For more information visit: www.gemu-group.com

Electrical position indicator GEMÜ 1242 und combi switchbox GEMÜ 4242.

Mads Warming, Danfoss Drives.

Making the case for an energy-neutral water sector

Expanding water treatment globally is not only a key enabler for creating a better world for humankind, it can also contribute to combatting climate change and reducing carbon dioxide and greenhouse gas emissions. And digitalisation, intelligent automation and efficient drives can play a central role. This was the perspective presented by Mads Warming, Global Head: Water & Wastewater, Danfoss Drives, speaking at the 11th annual Sustainability Summit held as a live virtual event in South Africa last year.

Warming said that currently, only about 20% of all wastewater globally is treated, which means around six billion people have access only to untreated water.

The United Nations (UN) Sustainable Development Goal (SDG) 6 defines improvement targets for clean water and sanitation. SDG 6.2 sets the objective of improving the proportion of wastewater treated globally from 20% to 60%, by 2030.

Achieving this objective would bring with it a multitude of health improvements, and would play an important role in reducing the greenhouse gas (GHG) load.

Typically, the key components in water treatment emissions are methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). CO_2 results from the energy consumed, and the term 'greenhouse gases' encompasses all three components.

Warming highlighted that: "Perhaps unexpectedly for many, the GHG effect of letting the wastewater escape untreated into the surrounding environment is far more detrimental than that of additional energy consumption resulting from new wastewater facilities."

According to the International Water Association (IWA), untreated wastewater running directly into the environment generates a GHG footprint roughly three times higher than when the same wastewater is dealt with in a traditional wastewater facility.

With assistance from Danfoss, Aarhus Water in Denmark transformed the water treatment facility of the Aarhus borough of Marselisborg to energy neutrality.

"The good news is we already have the right technology needed to move forward to achieve energy neutrality, and an additional one-third reduction in GHG emissions can be gained by using digitalisation and applying variable speed drive (VSD) control," Warming said.

"Furthermore, VSDs are playing a critical role in helping the water sector to reduce energy usage. And there is an excellent reason for this, as water and wastewater facilities are extremely energy intensive. The International Energy Agency (IEA) states that four percent of all electricity used globally goes towards water and wastewater handling facilities alone. The IEA also says between 30 and 50 % of the electricity bill of a local government authority is typically related to these operations."

The world's first energy-neutral catchment area

With assistance from Danfoss, Aarhus Water, the second largest water service company in Denmark, has succeeded in bringing the entire water cycle (drinking water and wastewater) in a local catchment area into energy neutrality.

Aarhus Water's aim was to transform the water treatment facility of a catchment area in the centre of Aarhus – a small borough called Marselisborg, with a population of 200 000 people – into an energy producer, at the same time achieving energy neutrality for the drinking water supply, wastewater pumping and wastewater treatment.

Marselisborg is a traditional city area in a relatively flat geographic region, where water supply is based on groundwater, which is on average pumped from 35 m depths, and traditional household wastewater treatment.

It has become the world's first energy-neutral catchment area.

The approach adopted by the utility and Danfoss was based on a two-step strategy:

- Reducing energy consumption throughout the water and wastewater facilities to the lowest possible sensible level, and
- Increasing energy production from the wastewater facility.

On the water supply side, energy savings have been obtained by splitting the city into pressure zones, where, based on pressure transmitters and VSDs, pressure is regulated to optimal levels in each zone. This offers a reduction in energy usage and has the added benefit of having brought leakage down to between only six and eight percent.

The Marselisborg wastewater facility has been upgraded with more energy-efficient equipment and, in particular, with advanced real-time process control based on online sensors. Other key elements include VSD drives on all rotating equipment; carbon harvesting; highly efficient components (such as bottom aeration and high-speed blowers); and a CHP installation (generating electricity and heat).

The experience from this and other facilities indicates that, of all improvements obtained over the years, more than 70% of the energy reduction/improvement is obtained from better process control, through digitalisation, where the VSDs can play a key role.

Advanced VSDs support digitalisation

With its newest water-dedicated VSD, Danfoss has placed greater support behind digitalisation. Edge computing technologies integrated into the VSD provide intelligent, condition-based monitoring of equipment such as pumps and fans, based on vibration and load-envelope detection.

To illustrate how it works, using the example of a pump: the VSD creates a baseline for power consumption and vibration as a function of the pump speed, based on one day, for example, or one week's operation. Having established the baseline, the VSD can detect anomalies and report them. As well as monitoring power consumption patterns, it monitors motor windings. This condition monitoring functionality helps water facilities run more cost-effectively and reduce energy consumption.

The VSD also offers other digital functions which contribute towards operational efficiencies with a lower GHG footprint. For example, a standard integrated de-ragging function automatically prevents pump clogging.

"Digitalisation and control using VSDs have been proven to be key enablers in achieving the goals of reducing water loss, cutting energy consumption and delivering better quality of water. Danfoss is ready to help by replicating the success of Marselisborg in other cities around the world," Warming said. □

For more information visit: www.danfoss.com

Drives can cut energy costs significantly

The growing need to reduce energy use and CO_2 emissions, and cut operational costs at the same time, is seeing unprecedented levels of interest in energy-efficient technologies – including low and medium voltage drives – across sub-Saharan Africa, according to power and automation technology group ABB.

Drives have significant potential for energy-saving across a range of industries, including power, water and wastewater, cement production, mining, metals and pulp and paper. By controlling the speed and torque of motors, drives can reduce energy usage by between 30% and 50%, significantly improving energy efficiency. Drives can be used to adapt the motor speed to the actual need, which optimises energy consumption and reduces the environmental impact associated with wasteful energy use.

ABB Product Marketing Manager Sean McCree says while financial decision makers are generally attracted by the potential of drives to save costs and reduce energy consumption, electrical engineers are realising major benefits through greater network reliability, reduced maintenance demands and increased longevity of mechanical equipment.

"There's a growing demand for energy-efficient products in the sub-Saharan market; products that take into account the region's specific requirements, from the voltage level to protection design, to ensure the drives can work optimally in a variety of complex, harsh industrial environments. At the same time, clients are looking for products that are easy to operate and maintain," says McCree.

ABB's ACS580MV drive offers higher efficiency, cost-effectiveness, and ease of implementation in industrial applications.

ABB recently relaunched its ACS580MV drive in the local market, offering higher efficiency, cost-effectiveness, and ease of implementation to the industrial sector, with applications specifically for pumps and fans. Built-in energy calculators, including used and saved kWh, CO_2 reduction and money saved, help users monitor and fine-tune processes to achieve optimal energy use.

The ACS580MV is fully compatible with the ABB Ability condition monitoring services, which allow customers to obtain real-time data about the status and performance of monitored equipment from any location. The drive is supplied 'ready to connect' to the ABB Ability condition monitoring services, which simplifies on-demand remote support.

"Since the launch of the 3.3 kV voltage range, we have seen significant growth in local order intake from existing and new customers. This is a clear indication that the market has realised the product is well positioned to offer value backed by a well-established local service team," says McCree.

For more information contact ABB.
Visit: www.abb.com

Fault-finding and redesign to rectify motor vibration

Rob Melaia, Engineering & Technical Executive, Marthinusen & Coutts

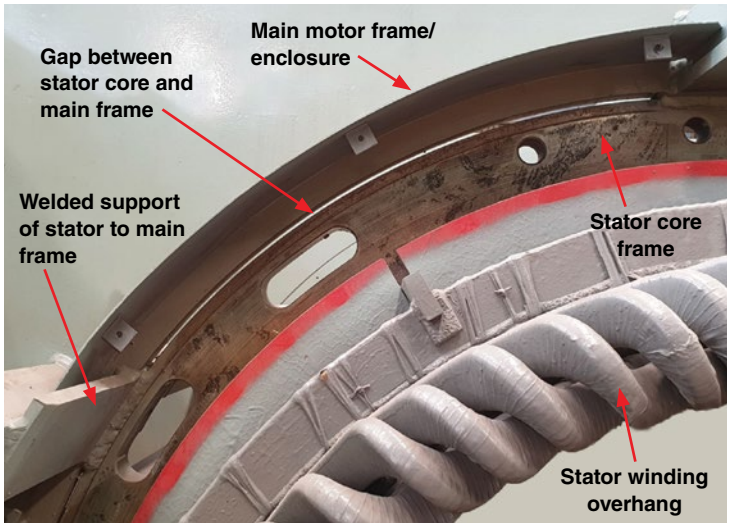
In early 2020 a large South African petrochemical company asked Marthinusen & Coutts (M&C) to establish the cause of excessive vibration in a 17 MW 11 kV 4-pole synchronous motor which is used to drive a gas compressor. The investigation process proved intriguing.

The motor, designed and manufactured by a reputable Europe-based OEM, had been in operation for 13 years. No vibration problems had occurred in the early stages of its operation, but first became noticeable about five years ago and deteriorated in subsequent years, eventually becoming so severe that the motor could no longer be used and was sent to M&C for investigation and repair.

Resonance anomaly

The investigation started with several non-destructive tests, but these failed to indicate the cause of the problem. Subsequent investigations however showed a resonance anomaly, as the motor's resonance frequency was found, through specialised resonance test procedures, to be extremely close to the motor's operating speed, even to the extent of impinging into that range at times – depending on ambient conditions.

The originally intended speed range for the motor was 1 200 to 1 500 rpm, and the resonance frequency reading was between 1 200 and 1 300 rpm. This clearly could not have been the intention of the OEM at the time of manufacture, as the resonance frequency of a motor is required to be well clear of its operating speed. In addition, the resonance frequency is supposed to be higher than the motor's rated speed, which would have meant it should be around 1 800 rpm or more.



In this close-up view of a portion of the stator core fitted into the main motor enclosure, one of the welded connections as modified by M&C can be seen on the left.

While conducting the investigations and tests that revealed this irregularity in the motor's resonance frequency against its operating speed, M&C also identified during testing a looseness of the stator core supports to the main stator enclosure, which should not be present in a healthy motor.

The next step was to remove the inspection covers of the motor for a close examination of the stator and its support structure to the main enclosure. A key discovery was finding that the OEM had applied a highly unorthodox method of fixing the stator to the main frame. Instead of following the normal procedure of employing a heat-shrink interference fit to bond the complete outer diameter of the stator to the frame, the OEM had used about eight small, welded brackets for this purpose.

We deduced that the OEM, having discovered that the required resonance frequency could not be achieved if the stator was firmly fixed to the frame in the normal way, installed the brackets instead, as a more flexible way of doing this for the express purpose of changing the resonance frequency to ensure it would not coincide with the motor's rated speed. Fortunately, the motor had never been operated under its originally intended variable speed capability. The measure that was applied failed to fix the resonance frequency higher than the motor's speed range, but it at least achieved the necessary objective of fixing the resonance frequency sufficiently below the rated speed so as not to cause operational problems.

A machine design fault

We deduced further that the OEM's failure to achieve the desired resonance frequency by means of the proper fixing procedure was due to a design flaw in the motor. The method the OEM had adopted to circumvent this problem had, however, revealed its shortcomings over time.

An additional discovery we made during our investigations into the problem was that there were cracks in the support structure between the stator and the main frame. We deduced that the cracks in the support structure – which, as noted above, consisted of the small welded brackets used as an improvised solution to address the resonance problem the OEM had apparently encountered during manufacture – had been caused by the welds of the brackets having been subjected to excessive strain during years of operation.

We then carried out the necessary repairs to return the

motor to service. These had to be done with the customer's express permission, since they were of necessity a compromise – as was the case with the original manufacture of the motor.

We welded new sections on the stator support structure, because we could not access many of the cracked sections to weld them. After re-assembling the motor we verified that the vibration had improved substantially but the resonance frequency was consequently located very close to the rated speed, due to the increase in stiffness we had added to the structure. On our test base we proved that with the resonance located lower than running speed no problems would occur on site, since the site base is more flexible than our test base.

An offbeat add-on solution

This being a compromise solution, we could not provide a 100% guarantee of reliability on the work done. The client asked if any further measures could be taken to assure a full guarantee of successful operation first time on site. In response we offered an offbeat add-on solution which, when tested and proven effective, enabled us to provide, with confidence, the assurance the client sought.

The add-on solution entailed providing a made-to-measure removable 7.5 tonne mass of steel temporarily fitted onto the top of the motor. This mass further reduced vibration of the motor and lowered its resonance frequency by a small but sufficient margin to guarantee correct operation on site. It was made removable because the customer wanted first to try running the motor without this additional measure.

Chargehand Alwyn de Bruin monitors the final tests on the 17 MW motor at M&C's large motors test facility in Cleveland, after completion of repairs to the motor's stator.

The success of our investigation and repairs was demonstrated when the motor was put into service after an unplanned breakdown. It operated with lower vibrations than it had operated at for over a decade – and this without the 7.5 tonne mass added! □

For more information visit: www.mandc.co.za

Innovation and growth in drive technology

Drive specialist NORD DRIVESYSTEMS continues on its course of growth. With innovative new products and comprehensive investments – the largest to date in the company's history – it saw a close to 18% increase in sales for 2021, compared to the previous year. Additional advanced drive solutions are planned to be brought to market in 2022.

Last year, the family-owned company based in North Germany launched four products that set new standards in the sector. The patented DuoDrive marks a new milestone. As an innovative geared motor which integrates the high-efficiency IE5+ synchronous motor into a single-stage helical gear unit housing, it sets new standards in terms of efficiency, installation space and version reduction. The new decentralised NORDAC ON frequency inverter and the additional sizes for the IE5+ synchronous motor and the NORDAC PRO SK 500P control cabinet inverter have been developed with the focus on customer benefit and energy efficiency, and ensure significant performance improvements in their areas of application. With the cancellation of most trade fairs in 2021, these new products have been presented only in digital form. In 2022, NORD DRIVESYSTEMS anticipates opportunities to stage live presentations.

Last year, the company invested primarily in locations and logistics. Additional facilities were brought into operation in Germany, Poland and the USA, and the starting signal was given for a new production plant in China. Completion of a new administration building at the company's headquarters in Bargteheide is planned for this year.

[Source: NORD DRIVESYSTEMS]

The high-efficiency portfolio from NORD includes: the NORDAC ON frequency inverter, the integrated geared motor DuoDrive and the IE5+ synchronous motor.

During 2021 NORD DRIVESYSTEMS also increased the number of employees in the NORD Group to around 4 700 and continued to focus on providing reliable support to customers, finding solutions, building its worldwide presence and diversification across industries and regions.

For 2022, the company is looking to grow further and to develop more new products in cooperation with its customers.

For more information contact NORD DRIVESYSTEMS. Visit: www.nord.com

Keeping ladle cranes moving

Columbus Stainless, a member of the Spanish based Acerinox S.A Group of Companies, is the only fully integrated, technologically advanced, single-site stainless steel producer in Africa. The plant – located in Middelburg in Mpumalanga – produces a wide range of austenitic, ferritic, utility and duplex grades of stainless steel suitable for many applications and supplied to various final customers, distributors, engineering shops and mines in South Africa and globally.

"We have been operating for more than 50 years," says Stef Du Toit, Columbus Stainless Cranes Engineer. "To remain successful in what we do, we have ensured our facilities can keep up with demand and experience minimal downtime. This means working with the right technology partners."

For more than 20 years, Columbus Stainless has worked with Nidec Control Techniques to ensure its operations run smoothly. Most recently, the Nidec team used its expert engineering capabilities to upgrade the main hoist of the steel plant ladle cranes.

"These gantry cranes are critical production cranes which carry between 110 and 115 tonnes of molten steel in ladles along the steel making plant. The two main hoist motors are synchronously locked together," explains Derek Coetzee, Head of Engineering at Nidec Control Techniques. The motors' control technology needed to be replaced to ensure the facility would remain future-fit and to avoid breakdowns caused by obsolete technology.

Nidec was awarded the turnkey contract to upgrade the variable frequency drives with redundancy features – a project usually awarded to a crane company. "We were entrusted with this project based on our strong track record and longstanding relationship with Columbus Stainless. We had the suitable technology, and we made sure we got the right skills on board to deliver the crane load capacity in line with the customer's requirements," says Coetzee.

A custom engineered solution

He explains further. "An interesting aspect of this project was that our solution needed to be able to fit into the same space as the existing system. Our compact technology put us ahead of our competitors and we were able to engineer a system which could meet the demands of the facility while not disrupting existing structures."

The specific Nidec Control Techniques products used for this application included two Unidrive M700 units connected in parallel, with each driving a 250 kW 8-pole IMfinity premium efficiency induction motor.

"The M700 ac drive is a high-performance motor control system providing exceptional control flexibility in high specification industrial applications. Combined with motors which are designed to satisfy most requirements in a demanding industry, we are confident this solution will help to see Columbus remain an industry leader," comments Bruce Grobler, Regional Manager of Nidec Control Techniques. A door-mounted HMI provides full diagnostics for the system.

Nidec takes pride in its complete turnkey solutions, through which it provides standard and customised drives. It handles small machine automation projects up to complete automation and electrical solutions.

"With this project, we took into account the operational needs of the client and proposed a solution which would see the operation succeed now and into the future. Furthermore, commissioning went smoothly. Our accredited personnel always ensure the reliability and safety of equipment, and complete installations in compliance with local technical regulations and safety standards," Grobler adds.

Built for the long-haul

The ladle cranes at Columbus Stainless have been operating for about 25 years, and still have many years of service life ahead – if supported by the right technology.

The M700 is Nidec Control Techniques' flagship drive and has been used in other areas of the Columbus Stainless plant. Stef Du Toit comments that the local availability of the technology is an added bonus. "The drives are critical to our production efficiency and it is important we minimise downtime as far as possible. The availability of spares and support in-country is a huge benefit to us." □

Compact technology in high-performance drives and motors met the requirements of the facility without disrupting existing structures.

For more information visit: www.nidec.com

A servo motor alternative to pneumatic cylinders

The electric cylinders in Beckhoff's AA3000 series are ideally suited to operate as direct drives for linear applications with high process forces and speeds. The advantages in terms of force, dynamics and compactness are combined with the advantages of servo technology such as controlled positioning, safe holding at a standstill and high energy efficiency.

The integrated mechanism of precise roller bearings, ball screw and guide provides for a backlash-free, purely translatory motion. This results in compact dimensions. At the shaft end of the spindle there is an external thread on which conventional adapters such as ball heads or clamping hooks from the pneumatic/hydraulic range can be mounted.

The first product of the new series is the AA3033 electric cylinder, which is available in two variants:

- with 12 500 N peak force, 3 700 N continuous force and 0.5 m/s maximum speed, or
- with 6 250 N peak force, 1 850 N continuous force and 1.0 m/s maximum speed.

The flange size of the electric cylinder is based on ISO 15552 and has bolting points on both sides in case, for example, an application requires a swivel bolt connection. This compatibility makes the conversion

AA3000 series electric cylinders deliver the dynamics, precision and functionality of a servomotor.

from pneumatic to electric drive technology particularly easy. In addition to the high resolution, the safe 24-bit multi-turn encoder installed offers the advantages of one cable technology (OCT) and the electronic identification plate for fast and simple commissioning. In addition, the electric cylinder enables uncomplicated access to process data, which can be used to optimise process performance quickly and easily. Other spindle pitches or a backlash-free holding brake are available as options.

For more information contact Beckhoff Automation.
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Email: danep@beckhoff.co.za
Visit: www.beckhoff.co.za

Motors and VSDs for Kamoa-Kakula, DRC

Zest WEG is supplying an extensive range of motors and variable speed drives (VSDs) for the second phase of the Kamoa-Kakula project, one of the world's most exciting new copper developments, located on the Central African Copperbelt in the Democratic Republic of Congo (DRC).

Phase 1 saw Kamoa-Kakula produce its first copper concentrate on 25 May 2021, and is expected to produce 200 000 tonnes of copper in concentrate annually. Phase 2, now in the advanced stages of construction, will result in a doubling of production capacity. Future phased expansions will over time see a mining rate set to process 19 million tonnes per annum.

For the first phase of the project, Zest WEG was also the key supplier for this range of electrical equipment. Joe Martins, Mining Sector Specialist for Zest WEG, says the mine's scope of supply for the second phase is a repeat of the first. The first phase was supplied in 2020 with WEG medium voltage VSDs and WEG high voltage motors to drive the mine's primary and secondary mills in the concentrator plant.

"We began to manufacture these long-lead-time items in 2019 and delivered two medium voltage VSDs and two 3.3 kV motors for the mine's 7 000 kW primary ball mill and its 7 000 kW secondary mill," says Martins. "Our high voltage motors and medium voltage VSDs were also selected to drive the two 1 200 kW high pressure grinding rolls (HPGRs) in the plant.

"WEG high voltage motors and automation solutions drive the underground ventilation fan applications, providing fresh air to the underground mine workings," he adds.

All these large items are designed to specification, manufactured and tested in WEG's Brazil facilities. Due to Covid-19 travel restrictions, the factory acceptance tests were conducted virtually, with special processes being developed to allow thorough inspection and comment online. The testing of the equipment for phase 2 – also conducted in a virtual environment – was completed in the third quarter of 2021.

Significantly, Kamoa-Kakula will be among the world's lowest greenhouse gas emitters per unit of copper produced, and Zest WEG's energy-efficient motors and automation solutions will contribute to this.

One of the WEG high voltage motors being lifted into position on site at Kamoa-Kakula.

A number of WEG low voltage motors were installed in phase 1 (left) and are also being supplied and installed in phase 2 (right).

The first phase order included over 700 WEG low voltage IE3 premium efficiency motors, supplied to various local and international original equipment manufacturers, and installed throughout the concentrator plant. These motors drive equipment such as the rock breakers, conveyor drives, flotation cells, thickeners, slurry pumps, winches and other mechanical OEM packages.

Where processes within the plant required variable speed control, WEG low voltage VSDs were selected to provide the speed and control necessary for this equipment. Martins says that by selecting WEG low voltage VSDs in combination with WEG low voltage motors, Kamoa-Kakula will benefit from a 36-month warranty period.

"An important part of the energy efficiency strategy was for the plant to standardise on our IE3 premium efficiency motors – rated according to the IEC 60034-30 international standard," he says. "With a class leading energy efficiency rating, this means reduced carbon emissions and greatly reduced operational energy costs."

Additionally, Zest WEG is supplying the Kamoa-Kakula Project with a new 20 MVA, 33 kV/11 kV mobile substation, which is currently being manufactured in South Africa. The substation will provide stepped down power, and can be moved to supply power to different areas in Kamoa-Kakula's mining site.

"Underpinning the performance of our equipment at the mine will be high levels of service and support from Panaco, our Value Added Reseller (VAR) in the DRC," says Martins.

He emphasises that VARs appointed by Zest WEG are much more than distributors. "Panaco, as our VAR in the DRC, is a 100% locally owned business, specifically chosen to promote and support the wide range of Zest WEG's offering in the region. Its team includes technical specialists and the company's operating methodologies and culture are closely aligned with ours. This will assist in supporting our current installed base, client network and growth expectations in the region."

For more information contact Zest WEG.
Visit: www.zestweg.com

On the path to the process

Dr Monika Heisterkamp, Director Marketing, Endress+Hauser Liquid Analysis
Dr Andreas Meyer, Business Development Manager, Endress+Hauser Liquid Analysis

Dr Monika Heisterkamp, Endress+Hauser Liquid Analysis.

Dr Andreas Meyer, Endress+Hauser Liquid Analysis.

Process analytics provides information about the composition of substances in media in control processes by using a wide range of physical and chemical principles. It forms the critical basis for process optimisation. Laboratory measurement processes have evolved in the direction of process analysis measurement methods over several decades. The stated goal of this transfer is to develop compact field instruments comparable to conventional field instruments.

Conductivity and pH measurements, well established for some time now, have become an indispensable aspect of many plant operations. More technically sophisticated spectroscopic methods still have a long way to go before they reach broader use in process applications.

In the highly regarded *NAMUR Process Sensors* roadmap, process analytics has an important role. The current *Process Sensors 2027+* roadmap is an enhancement of previous technology roadmaps and indicates a promising future for optical processes in particular. The aim of process analytics is to optimise engineering processes, such as quantitative assessment of the reaction progress. Although users are eager to see process analytics deployed more widely, the solutions need to be economically feasible and to justify the costs for procurement, commissioning and maintenance.

Compared to conventional field instruments for measuring parameters such as level, flow, pressure, temperature, pH and conductivity, the costs for complex process analytics are much higher. The investment costs for optical spectrometers can quickly add up to several hundred thousand euros, nearly half of which is swallowed up by commissioning and maintenance. Reducing these costs will decrease the economic feasibility threshold, responding to the requirements of the NAMUR roadmap.

Optical processes are on the up

Given the significant amount of data they contain, optical processes such as infrared, UV/VIS or Raman spectroscopy are attractive technologies for process analytics applications. The relatively new Raman spectroscopy technology has captured an increasing percentage of the market over recent years. And for good reason: compared to near infrared (NIR) spectroscopy, the Raman technique delivers significantly more – and more specific – information. However, one particular challenge in analysing the spectra is calibration.

Simple process sensors are calibrated to traceable standards. The difficulty arises when the measurements are application-specific and the concentration of a specific substance in a medium depends on numerous measurement parameters, such as from a spectrum. In this case, a so-called multivariate calibration is required, in which regression or chemo-metric models based on numerous measurements have to be created and regularly verified. Ideally, these models can be pre-built for similar applications and adapted to real applications with just a few measurements.

The evolution to field instruments

The extensive selection of measurement processes makes it possible to manage a wide range of analysis tasks in the lab. Flexibility and a higher degree of automation are the key to being able to carry out comparable measurement tasks efficiently and process samples in

The Memosens Wave CKI50 and Liquiline CM44P transmitter enable robust inline colour measurements and the combination of all relevant parameters for respective applications.

The Memosens Wave CAS80E and Liquiline CM44 transmitter supply the relevant measurement values in real-time, enabling seamless analysis of potable and surface water quality.

The Rxn5 Raman process analyser is a turnkey solution for quantitative measurement of chemical composition.

greater numbers. Lab information and management systems (LIMS) provide reliable processing and documentation. Generally speaking, such lab instruments are set up separately, optimised for the lab and not integrated into the process control system. The major downside is that the samples from the process can change while being drawn, during transport and through the corresponding delay. The time lag of several hours or even days means the lab analysis is often no longer current. Operators have no chance to carry out timely corrective measures or regulations while the process is running.

Compact field instruments, on the other hand, are designed especially for direct use in the process. In respect of ingress and explosion protection, as well as hygiene, their performance is exemplary. They are integrated into control systems and can handle complex calculations. The requested measurement value is available in real-time and can be regenerated with a repetition rate required for process dynamics and used for control purposes. As a further factor, the field instrument also supplies the status of the measurement value and the system.

That means the measurement unit allows intervention in the process control system. As all the components are integrated into the sensor or transmitter, installation and maintenance requirements are reduced, and can be driven down further through an automatic cleaning or calibration unit. Self-diagnostics simplify operation and, in the best case, provide predictive maintenance information. The integration of internet-capable devices in cyber-physical systems creates further optimisation potential.

Stepping into the future

Taking the first step in the direction of field instruments often involves a modified laboratory instrument. A somewhat more compact version of a laboratory spectrometer is connected to the process via optical measurement probes and longer fibre-optic lines. A separate industrial PC assumes responsibility for the data analysis and system integration. The required 'climatisation', including explosion protection, can be implemented either in a climate-controlled cabinet or a separate analysis enclosure. Commissioning and overall investment costs can nevertheless quickly add up to six figures.

One step closer to the process involves spectrometers in a significantly more robust mechanical version, which are equipped with an integrated explosion protection function. These instruments no longer have to do with modified laboratory equipment but are specially designed devices characterised by streamlined commissioning. Because they still require climatisation, however, they are far removed from a compact field instrument solution.

Another important milestone on the path to the process is the integration of an industrial embedded computer with direct connectivity to the control system. This approach offers more process compatibility through an extended operating temperature range. Users can install the solution close to the process. However, connectivity to the process medium still requires optical measurement probes and fibre-optic lines. These types of already highly integrated systems stand out due to much faster commissioning and simple operation.

New technologies make it possible

Making the decisive step in the direction of compact field instruments calls for newer or different technologies for the spectrometer components. The elimination of fibre optics and the integration of measurement probes in an inline spectrometer promises a more streamlined solution. The use of cost-effective standard components from conventional field instruments such as field enclosures, embedded computers, displays or compact transmitters offers further savings potential. By exploiting every possibility, manufacturers can deploy process spectrometers as compact field instruments that are much simpler to use and, importantly, can be operated at a lower cost.

An example is the compact Rxn5 Raman process analyser for measuring gas. This mechanically robust instrument fulfils all explosion protection requirements and features solid state cooling and an embedded computer. The autonomous Rxn5 is not dependent on an external infrastructure. Chemo-metric models are already pre-built for many applications or they can be created for a specific application if needed. With this compact, integrated solution, users can easily and cost-effectively carry out transfer custody measurements of liquid natural gas (LNG) flows, for example. While this analyser is on its way to becoming a field instrument, the spectrometer components still correspond largely to those of a conventional laboratory spectrometer with a fibre-optic connection to the process, which is the reason for its large and heavy design.

Towards the finish line

Endress+Hauser has developed process spectrometers that take full advantage of the opportunities innovative technologies offer. These instruments simply constitute an enclosure, a process connection and an integrated measurement probe. External fibre-optic lines are superfluous. A microprocessor autonomously controls the sensors, analyses the data and outputs the process parameters, including the status. Extensive processing power puts intelligent data analysis within reach. The process spectrometer is connected to a standard transmitter

that enables simple connectivity to a process control or cloud system and conversely permits remote access to the sensors and service data. The process spectrometer is evolving into an IIoT field instrument.

The Memosens Wave CAS80E UV-VIS-based spectrometer offers reliable real-time measurement of relevant analysis parameters such as chemical and biological oxygen demand (COD/BOD), turbidity, nitrate and spectral absorption coefficient (SAC) in a single instrument. The CAS80E is optimised for beverage and surface water, wastewater, industrial wastewater and utilities applications and can be quickly adapted to specific applications with pre-installed analysis models.

The Memosens Wave CKI50 process spectrometer detects colours by using spectroscopy in the visible range of the electromagnetic spectrum. It outputs the colour in a three-dimensional colour space model in the form of CIE L*a*b* values. That means colours, colour variations or the accuracy of the expected colour can be determined. The mathematical analysis models required to analyse the spectroscopic results are stored in the instrument.

Both spectrometers are as compact and easy to install as a sensor. With Memosens technology, they can be connected to the new generation of the Liquiline CM44 transmitters via plug and play and combined with all other Memosens sensors.

Summary

Without process analytics, there can be no process optimisation. As the ground-breaking *Process Sensors* roadmap from NAMUR confirms, users have long sought wider deployment of process analytics. However, this assumes easy commissioning, simple operation and maintenance that requires little effort. Before process spectrometers can evolve to genuine field instruments, know-how from different areas is required, from laboratory, automation and process control technologies. The biggest challenge lies in combining expertise from all these disciplines. If this happens, then a spectrometer could be like any other field instrument. The first promising developments are already on the market. □

For more information visit: www.endress.com

Reed level sensor: a flexible measuring range

A float-based level sensor with a reed chain is a widely used and comparatively economical solution for continuous level measurement in vessels. Users can define its measuring range flexibly within a given scope. When considered for application, there are a number of factors to be taken into account.

With a reed-chain level sensor, the guide tube contains a defined number of reed contacts, depending on the measuring range. These are combined to form a measuring chain. The contacts react to the magnetic field of the float, which moves within the guide tube in line with the liquid level.

Accuracy depends on distance

The accuracy of this energy-free level monitoring instrument depends, in turn, on the distance between the individual contacts: the smaller it is, the more accurate the measurement. Each level sensor in WIKA's RLT series, for example, enables measuring ranges with contact distances between 3 and 24 mm. However, a reed chain cannot be stretched along the entire length of the guide tube. This is because there are 'dead bands' at both ends of the tube, that is, sections the float does not detect due to design constraints (as shown at right).

Defining the measuring range

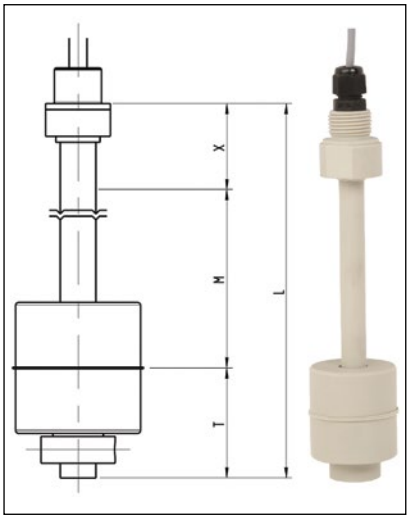
The measuring range of a level sensor therefore lies between the two dead bands specified in the data sheet. Within this range, it can be freely defined. However, it is not necessary to use the maximum possible measuring range in all applications. The exact adaptation of the number of contacts to the measuring task also has an economic advantage – as the reed chain is one of the most expensive components in a level sensor.

Dry run monitoring

For dry run monitoring in an oil tank of a compressor, for example, only the lower part of the guide tube is needed for the measurement. In this case, the upper measuring point of the application (100% mark) is set correspondingly low. It marks the distance to the sealing face of the process connection. The measuring range is thus defined by the following equation:

Measuring range length M = guide tube length L – dead band T – 100% mark X

Consequently, the measuring range for detecting a maximum level is determined starting from the sealing face. In this case, the guide tube can be adapted to the length of the measuring range.



The graphic shows how the maximum possible measuring range (M) with an air-handling series level sensor is defined: Guide tube length (L) minus dead band (T) and 100% mark (X).

For more information contact
WIKA Instruments.
Tel: +27 (0)11 621 0000
Email: sales.za@wika.com, visit: www.wika.co.za

The Fluke 709 and 709H mA loop calibrators are designed to be easy to use and produce high-quality results.

Precision current loop calibrator with HART communication

The Fluke 709 and 709H mA loop calibrators, available from Comtest, are designed to save time and produce high-quality results. The calibrators are built around a user-friendly interface with a Quick-Set rotary encoder knob. This tool reduces the time it takes to measure, or source, current and power up a loop. The protective holster fits easily into a technician's hand and the large backlit display is easy to read, even in dark, cramped worked areas.

Hart communications

The 709H adds HART communications and supports a select set of the HART universal and common practice commands. This makes the 709H an affordable, compact loop calibrator and a powerful HART communication troubleshooting tool. In the communicator mode, the user will be able to read basic device information, perform diagnostic tests, and trim the mA output on most HART enabled transmitters. Previously this could be done only with a dedicated communicator, a high-end multifunction calibrator, or a laptop computer with HART modem. Fluke 709H enables almost any technician to service and support HART devices.

In addition, the 709H provides for logging of HART data in the field. Once recorded by the 709H in the field, the 709H/TRACK software can upload the HART configuration of up to 20 HART devices in the plant and output data in either .csv or .txt format.

Data logged mA loop measurements and HART data can be recorded from a particular transmitter for troubleshooting and loop tuning. The data log feature offers selectable capture with recording intervals of 1 to 60 seconds and a logging capacity of 9 800 records or 99 individual sessions. Each data sample contains the 709H mA measurement, all four process variables, and the standard status conditions.

Key features include:

- Best-in-class accuracy at 0.01% reading
- Compact rugged design
- Intuitive user interface with Quick-Set knob for fast setup
- 24 V dc loop power with mA measure mode (-25% to 125%)
- Resolution of 1 µA on mA ranges and 1 mV on voltage ranges
- Built in selectable 250 Ω resistor for HART communications
- Simple two wire connection for all measurements
- Variable step and ramp time in seconds
- Valve test (source and simulate defined mA values with % keys).

With a built-in HART modem the 709H can perform a range of commands. Stored configurations of HART devices in the plant enable technicians to access key device parameters, allowing for better troubleshooting, calibration and maintenance of plant assets.

Fluke Calibration produces the broadest range of electrical, RF, temperature, pressure and flow calibration instruments and software available. Its products are used in standards and calibration laboratories as well as industrial, plant and commercial facilities around the world.

For more information contact Comtest.
Tel: +27 (0)10 595 1821
Email: sales@comtest.co.za
Visit: www.comtest.co.za

Level monitoring in any application

In tanks or silos, monitoring liquids, bulk material or individual objects, level and distance measurement using ultrasound is reliable and accurate. However, even if there is no direct contact with the medium, aggressive vapours and fumes can adversely affect the functioning and life of a sensor. ifm's new full-metal ultrasonic sensor is designed to withstand such harsh environments. From the diaphragm to the connector, the sensor is completely enclosed in high-grade stainless steel. Thus, it is resistant to external influences and provides an extended service life.

ifm's robust ultrasonic sensor, enclosed in stainless steel, can be used in harsh environments.

The robust full-metal ultrasonic sensor delivers continuous non-contact level measurement and object detection in any application, regardless of the environmental conditions. It is resistant to aggressive media and operates over a long range of up to 2 500 mm. It handles digital or analogue measured values.

With IO-Link included, the measuring range can be set, and measured values and diagnostic information can be transmitted digitally. Feedback on the echo quality provides for alignment of the sensor to be optimised during installation and means functional reliability can be continuously monitored.

For more information contact ifm South Africa.
Tel: +27 (0)12 450 0400
Email: info.za@ifm.com
Visit: www.ifm.com

Vibrating limit level detectors

The KOBOLD NSV vibrating level monitors, available from Instrotech, are used to measure low-density (powdery), fine-grained bulk solids, such as plastic granules, cement, and food products like flour, sugar and animal feed. The devices operate on the vibrating fork principle. The fork, specifically designed for use in bulk solids, vibrates continuously, and when it is covered by a medium, the vibration behaviour changes. When the device detects this change, it is displayed on a red LED. An additional relay output is provided for signal transmission.

The NSV limit level detectors are ruggedly and compactly constructed of stainless steel and are insensitive to humidity in materials. They can be mounted from either the top or the side of a bin, so they are suitable for protection against overfilling, as well as signalling minimum level accurately. Mountable evaluation electronics are well protected at the top of the device, ending in a protection class IP 65 plastic terminal box.

Specific versions with elongated neck pipe of up to 3.0 m, make it easy to install vibrating forks of varying heights. The devices have no mechanical moving parts and are thus virtually maintenance-free. The NSV level monitors can be used in explosion-proof areas according to ATEX II 1/2 D Ex tD A20/A21.

Key features:

- Special lengths up to maximum 3 000 mm
- No calibration necessary
- Insensitive to moisture
- Compact installation
- Stainless steel fork 1.4305
- Relay output
- Suitable for low bulk densities from 60 g/l
- Suitable for ATEX applications.

For more information contact Instrotech.
Tel: +27 (0)10 595 1831
Email: sales@instrotech.co.za
Visit: www.instrotech.co.za

The KOBOLD NSV limit level detectors operate on the vibrating fork principle.

Failsafe networking for high-level grid stability

Jan Aulenberg, MSc, Product Manager in network technology, Phoenix Contact Electronics GmbH, Germany

Photovoltaic systems have to play their part in ensuring high-level grid stability and supply reliability. Ethernet-based networking ensures the failsafe transmission of diagnostics data and control commands between the various installed inverters, transformer stations, grid connection points, and monitoring systems – via cable-based or wireless communication.

As a renewable energy, photovoltaics (PV) are making a considerable, sustainable contribution to meeting the globally increasing demand for energy. Planning, constructing and managing large PV systems demands extensive expertise and experience. Zebotec GmbH, based in Konstanz, Germany, has established itself in this field over the past 15 years, to become one of the world's leading independent system integrators for control systems in photovoltaic power stations. Zebotec is a part of the BayWa r.e. Group which, in 2009, brought together various companies from within the field of renewable energies. With its headquarters in Munich, the Baywa r.e. Group's range of activities includes, among other things, the design, construction and marketing of PV power stations in the solar project management sector. In these projects, Zebotec's responsibilities include the systems for monitoring and control technology and the construction of efficient Ethernet networks for networking system sections and for data exchange.

VLANs prevent interference in communications

The Ethernet networks installed in the photovoltaic systems are used to transmit the diagnostics data recorded in the inverters, the weather stations, the temperature sensors mounted in the transformer stations, and the energy measuring devices. Forwarding the control data for grid feed-in in particular, places high demands on the failsafe performance of this communication because, if the receiver does not receive the control values reliably, this may lead to the system feeding into the power grid without control, which would in turn put grid stability at risk.

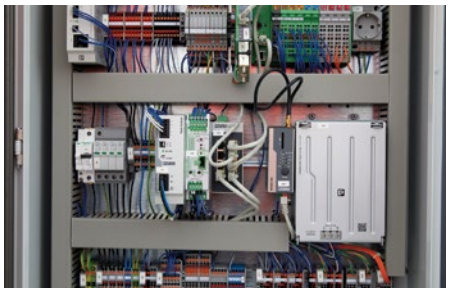
Special considerations have to be taken into account when networking the individual transformer stations. A good example of this is in the 45 MW ground-mounted system in Oosterwolde de Boer, the Netherlands, realised by Zebotec and the Dutch subsidiary of BayWa r.e., GroenLeven. Firstly, there are large distances to be bridged between the stations in this system, and secondly, the Ethernet cables have been laid in cable ducts with very little clearance to the ac and dc cables in the system. Due to this proximity, electromagnetic interference (EMI) could arise if classic twisted-pair copper cables were used and, in the worst case, could result in loss of data. To prevent this, the copper cables would have to be equipped with special shielding or laid separately. Due to the length of the cables and the possibility of EMI influences, Zebotec decided to use fibreglass cables which, because of their immunity against electromagnetic interference, proved to be an installation-friendly and error-tolerant solution.

Zebotec installed managed switches from Phoenix Contact at the central grid connection point to increase the stability of the network further. The Ethernet transmission of the transformer stations connected in several lines comes together here. In this topology, each line is configured as a separate virtual local area network (VLAN). This prevents the various system sections from being able to exchange data inadvertently – and further, prevents unnecessary data streams and improves communication efficiency.

Special considerations had to be taken into account when networking the individual transformer stations installed in the ground-mounted system.

The 2200 series Managed Switches incorporate various redundancy mechanisms and security functions.

The Bomhofsplas photovoltaic system, which floats on a gravel quarry near Zwolle in the Netherlands.



The FL WLAN 5100 WLAN components can be configured as clients, repeaters, or access points.

Omnidirectional antennas are installed on the transformer station.

Zebotec also sets up redundant network structures, particularly in large systems and usually in the form of a ring topology via RSTP (Rapid Spanning Tree Protocol) to achieve a higher level of failsafe performance. This concept ensures data transmission between all system sections, even in the event of a connection failure in one fibreglass line. Zebotec uses FL SWITCH 2200 series Managed Switches here to ensure the required redundancy functionality.

Connecting floating transformer stations to the grid

Zebotec faced another challenge in a new type of PV system that presents further networking requirements. Alongside its work on large free-standing systems, the company recently started working with BayWa r.e. on photovoltaic power stations on bodies of water. Where these are not intended for tourism or for ecological management, such unused lakes are being transformed into efficient photovoltaic systems – and offer considerable advantages: they contribute, for example, to reducing CO_2 emissions, generate high yields due to the water cooling effect, and prevent conflict by providing an alternative to the need to take up land. The 27 MW floating system anchored to the lake bed of the Bomhofsplas gravel quarry close to the city of Zwolle in the Netherlands, presents a case in point.

The siting of the PV system on the lake would have made cabling the transformer stations and grid connection point complex and expensive. Zebotec therefore decided on wireless Ethernet networking: the WLAN clients installed in each transformer station establish connections with WLAN access points mounted in stations close to the shore. The transformer stations, which are themselves far from the shore, are coupled via repeaters to an access point to ensure consistent communication. Here, the high-level reliability and robustness of the WLAN components used was a key factor. Zebotec decided in favour of using the FL WLAN 5110 devices from Phoenix Contact.

Werner Neff, CEO of Zebotec, recognises the durability and reliability of the Phoenix Contact components and systems.

These industrial-grade devices can be configured as WLAN clients, as repeaters, or as access points. This provided Zebotec, as the system integrator, with the flexibility first to construct the control cabinets for all transformer stations to be identical, and then to configure the final WLAN network topology once installed in the respective system. Two omni-directional antennas are installed on each transformer station to exchange data between the FL WLAN 5110 devices. Due to the greater distances involved, Zebotec used directional wireless antennas to connect the access points to an FL WLAN 5110 installed at the central grid connection point on land. All the antenna cables are protected with surge protection equipment from Phoenix Contact to protect the photovoltaic system.

Future projects

As a system integrator Zebotec has experienced excellent performance with the managed and unmanaged switches and the WLAN components from Phoenix Contact. “This was one of the reasons we decided in favour of these infrastructure components, because the devices are ‘industrial-grade’, and therefore robust enough to satisfy our demands on high-level availability,” says Werner Neff, CEO of Zebotec. The company also plans to install the networking concepts described in future photovoltaic power stations.

The same applies in respect of control technology. Zebotec has been using AXC 3050 and ILC 191 series controllers as well as bus couplers from the Inline product family for processing the diagnostics and control data within its PV systems for years. As a Phoenix Contact solution partner in the field of renewable energies, Zebotec is also one of the first companies in the world to use the new, open PLCnext Technology control platform. □

For more information visit: www.phoenixcontact.com

Resolving the 'trouble' with RTUs

At utility substations, Remote Terminal Units (RTUs) are critical components used for monitoring circuit breaker positions, alarms, voltage/current, temperatures, and additional data from various wired sensors. They can also control breakers, tap changers, and capacitor banks. However, for many utilities, RTUs remain a trouble spot. As RTUs age, reliability issues, unforgiving software, lack of vendor support for older product lines, increased training time, and diminishing availability of replacement parts can make RTUs an ongoing and time-consuming issue for substation technicians.

In the USA, NovaTech Automation is assisting a major Midwest utility in its multi-year replacement of all remote terminal units at its substations.

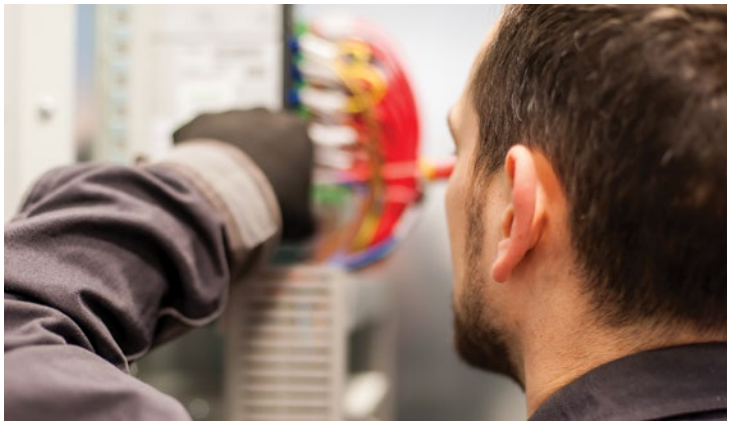
"I get more trouble calls related to RTUs than I should," says the senior supervisor at a Fortune 500 electric and natural gas utility that serves the power needs of seven states in the Midwest. "I need my RTUs to work reliably because my field engineering team doesn't have the time to keep coming back to resolve trouble calls and investigate why an RTU is not functioning properly or has stopped working."

Despite using RTUs from several known providers, the reliability issues became so frequent that the engineering team decided the best course of action was to start upgrading all the RTUs across its entire network.

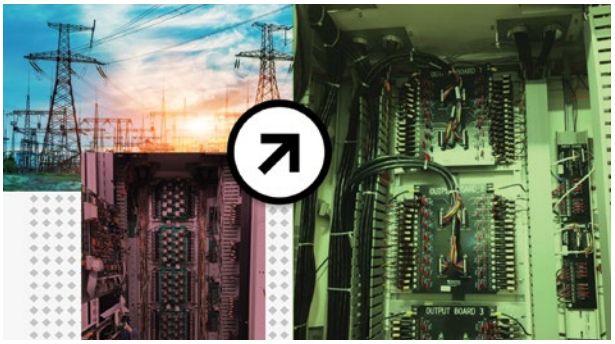
"Some of our RTUs started having software and hardware failures," says the senior supervisor. "They were not very old, maybe ten years. We had one unit where the screen froze, and the software and the configuration were corrupted. The RTU vendor told us the only thing we could do was to rebuild the database, which we did, completely."

While the engineering team had the knowledge and experience to resolve the issues, it was another task for already thin resources. The team at the utility already has extensive responsibilities that go beyond substation installation to include programming and telecommunication systems. "We manage more or less everything that goes from the main control centre to the handoff at the end device in the substation," he adds.

A further factor that contributed to the utility's decision to replace its RTUs was the fact that another of its RTU vendors



One of the engineers at work on the installation of new RTUs.



When the Midwest utility found its legacy RTUs becoming unreliable and overly demanding on maintenance time, it turned to replacing all the units across its network.

announced it would no longer support its existing software. This would require the utility to replace the software and re-train the team. "The training for the new software would have cost $30 000 for one week of in-person training," says the senior supervisor.

As a result, the team started to explore other options on the market. This led them to an RTU manufacturer that sold them on the promise of a newly redesigned platform. The vendor brought in a new RTU for an initial test. "It just didn't work," says the senior supervisor. "For an installation job that was supposed to take about two and a half hours, we ended up putting the old RTU back in place thirteen hours later because the vendor could not get the replacement unit running."

Adopting a higher level of scrutiny of the claims made by other RTU vendors, utility personnel then began discussions with Pennsylvania-based NovaTech Automation, a leading substation automation provider. The company proposed its OrionLX automation platform as an RTU replacement. The NovaTech OrionLX-based RTU, including the I/O system, the Alarm Tile Annunciator, Maths & Logic routines, and IED data access, is configured via the NovaTech Configuration Director (NCD), a licence-free tool used for Orion models. NCD eliminates most of the effort typically entailed in configuration by providing pre-configured pick lists for over 250 commonly applied intelligent electronic devices (IEDs).

After testing the new RTU to validate its performance, the utility chose to replace its existing units with the NovaTech Orion line (LX, LX+, LXm, and now Orion I/O) together with the company's Distributed Discrete I/O (DDIO) and

Combination I/O (DCIO) modules and advanced I/Os.

As part of the project, NovaTech worked with the utility to custom build and configure an OrionLX unit to function identically to one of the brands of RTUs it was replacing.

The team used the NovaTech Configuration Director to configure the new RTU essentially to mirror the performance of the unit it was to replace, including communicating using the existing proprietary protocol. The replacement units have the same number of serial ports, so installing the unit only required plugging the serial cables into the corresponding port number on the new OrionLX once the configuration was completed.

"The wiring requirement was minimal, so it was as close to plug-and-play as you could ask for – and the new unit came online quickly and worked as expected," says the senior supervisor, adding that the utility has now replaced six of its units in this way.

Regarding the RTUs with the software that would no longer be supported, the utility is currently phasing out those units as well.

"We still have probably a dozen of those left," said the senior supervisor. "In the next few years, we will have completely converted to the new RTUs across our entire system."

He adds that early in the NovaTech RTU evaluation, one issue did arise when lightning struck a couple of the new units. According to the senior supervisor, "the lightning blew them apart. We received an alarm from the unit saying the power supply was dead and needed to be replaced, but we were running a redundant power supply, and the Orion units remained online and functional."

Training and maintenance

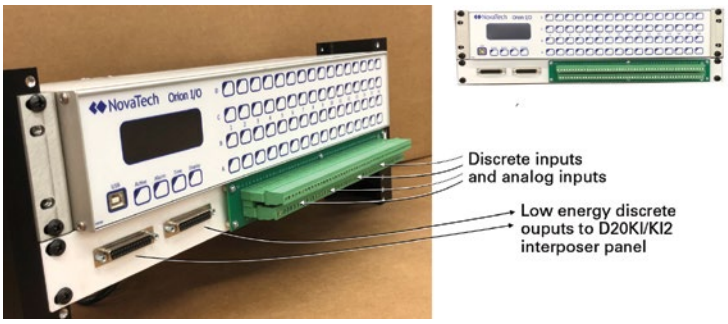
In addition to improving reliability and performance, the utility sought a solution that eliminated the other 'trouble' associated with RTUs: the training time required for technicians to program and install the new units. In this regard, the NovaTech RTUs were 'technician friendly' and training time was minimal.

"I was able to show apprentices how the software works and, after an hour, they could take an assignment sheet with all the items needed and program the RTU," says the senior supervisor. "That doesn't mean they have a full understanding of everything the unit is doing yet, but they can program it."

Ease of maintenance figures highly too. "It probably took me a year to figure out all the little bugs about the software of the previous RTUs. It was very unforgiving. Troubleshooting required going through multiple tables and layers – and there was no indication of why an RTU was offline, only that it was offline. What we appreciate about the new RTUs is you can review the error log to diagnose the specific problem that is occurring."

Based on the positive experiences to date, the utility continues with its rollout of replacement RTUs. Other utilities have contacted the team to understand how they addressed issues with an RTU conversion.

"I'm glad I didn't resist change when we were considering replacing the RTUs that were causing us trouble," says the senior supervisor. "With our confidence in the reliability of the new RTUs, and standardising on solutions from a single provider, our engineering team can focus on improving our network infrastructure in other ways without being constantly drawn back to performance issues." □



The utility team selected NovaTech's Orion RTUs together with the company's I/O modules to replace troublesome legacy units.

Based in the USA NovaTech operates worldwide with field offices in Europe and a further network of regional integration and engineering partners across most major markets. In South Africa NovaTech is represented through ACTOM.

For more information visit: www.novatechautomation.com

Misleading claims on flameproof junction boxes for Zone 0 applications

Dr Geof Mood, Technical Director, CCG Cable Terminations

In the December 2021-January 2022 issue of this publication, in an article titled *Flameproof junction boxes*, the author made a series of incorrect and misleading statements. The author also made a dangerously incorrect claim about the suitability of installing an Ex d flameproof enclosure with Ex e terminals in a Zone 0 area. If any installers believed the claims and installed the product accordingly they would at the least be negligent of their obligations for installing electrical equipment in hazardous areas and potentially criminally responsible for any resulting explosion and loss of life.

The claim was that by installing Ex e terminals inside an Ex d junction box, the installer would achieve the two levels of independent Ex protection required for a Zone 0 installation. This is erroneous.

The actual wording of the claim made was: *"However, with the inclusion of increased safety terminals inside a flameproof enclosure, the termination's rating is pushed up to Zone 0 (two independent levels of protection via EPL Gb, per SANS/IEC 60079-14/26) which means it can be installed in an environment where there is a constant hazard."*

The important words to take note of are: *"two independent levels of protection".*

The certification of any Ex e terminal (including the author's own terminals) always contains the following words in the Schedule of Limitation: "The terminals may only be used inside a previously approved Ex enclosure with a minimum IP rating of IP54."

This means quite clearly that the terminals only become certified Ex e when they are inside a suitable Ex enclosure (usually Ex e) and putting them inside an Ex d enclosure with an IP rating of IP54 or better would satisfy this requirement. However, this does not make the level of protection provided by the Ex e terminals independent of the Ex d protection provided by the enclosure as they depend directly upon the Ex d enclosure for ingress protection and protection against impact in order for the terminals to achieve Ex e certification. The combination of any Ex d enclosure with any Ex e terminals will therefore only provide one level of protection, not the two independent levels of protection required for use in Zone 0 as claimed by the author.

If further proof is needed, the certification number of the author's own Ex e terminals ends with the letter 'U'. This means these terminals are certified only as components and therefore must be re-assessed as part of an Ex assembly. To quote IEC 60079-0: "The symbol "U" is used to identify that the equipment is incomplete and is not suitable for installation without further evaluation." This is not the language used of a product providing an independent level of protection and is in conflict with the author's advice.

The author compounds the earlier incorrect statement by adding the following: *"The important point to remember, if you are advising anyone on such an installation, is that this termination is now suitable for Zone 0 applications, with minimal additional consideration."*

My response to this is twofold. Firstly, if you are giving advice about Zone 0 installations you should really know the Ex standards and what is required (and so should the person specifying the installation). The specifier should also examine the certification of the products being used in such a safety-critical application.

The photographs show the environmental effects on a flameproof junction box.

SANS/IEC 60079-14 clause 4 states: "It is necessary to ensure that any installation complies with the relevant equipment certificate as well as with this standard and any other requirements specific to the plant on which the installation takes place."

Secondly, regarding the words *"with minimal additional consideration"*, when it comes to installing electrical equipment in Zone 0, or in any zone for that matter, there are many "additional considerations".

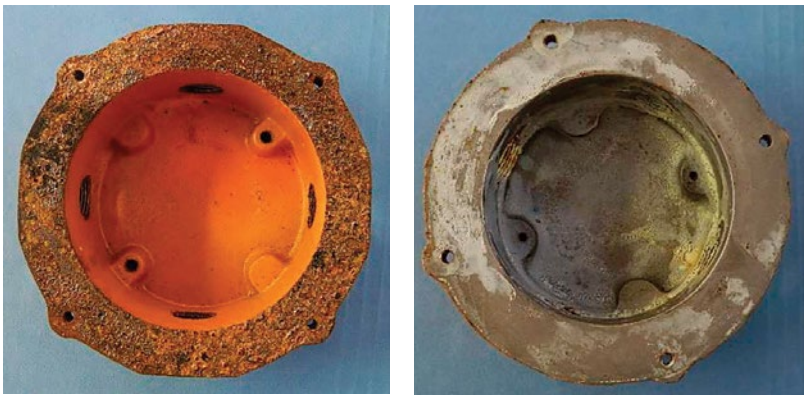
SANS /IEC 60079-14 Scope states: "Where the equipment is required to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional protection requirements may be necessary."

In clause 4 the standard goes on to say: "Consideration should be given to obtaining

information for maintenance and repair to meet the requirements of IEC 60079-17 and IEC 60079-19 respectively. "…documentation relating to the suitability of the equipment for the area and environment to which it will be exposed, e.g. temperature ratings, type of protection, IP rating, corrosion resistance;"

Clause 5.9 of the standard says: "Electrical equipment shall be selected and/or installed so that it is protected against external influences which could adversely affect the explosion protection." And lists corrosion, chemicals, condensation and moisture as some of the influences to consider.

The specifier/installer must consider the effects of hazardous gases or vapours on the integrity of the installation with regard to the performance of the flame path, the IP seals, and the terminals themselves. (This is evidenced in the photos, shown below left, of a similar failed junction box that was installed in a Zone 1 area.)



Left: Corrosion of a flame path on a cast iron junction box after testing to ASTM B117-03 and ISO 6988 standards. Right: A good quality flameproof junction box which has been specially treated with a corrosion-resistant metallurgical process after testing to ASTM B117-03 and ISO 6988 standards.

Flameproof junction boxes made of cast iron are highly susceptible to corrosion, especially if the flame paths are unprotected. On the other hand, good quality Ex d flameproof junction boxes would have their critical flame paths treated with a metallurgical process that resists corrosion. In addition, they would have IP seals made from hydrocarbon resistant polymers that seal on the outer rim of the flame path which give additional protection to the flame path from corrosion. They would also have captive high tensile stainless steel screws which would not get lost at the time of installation. Unlike zinc coated steel fasteners, high tensile stainless steel fasteners would not weaken over time due to corrosion. This is critical as the fasteners need to secure the lid against explosive pressure for the lifetime of the installation. Such good quality junction boxes would also have been independently tested for resistance to environmental corrosion to ASTM B117-03 and ISO 6988 standards.

Another important consideration is the fact that an installation in a Zone 0 environment could suffer from the risk of an explosive gas mixture (which is always present or present for long periods) or liquid migrating through the interstices of a cable to an area with a lower level of Ex protection, leading to an explosion. (Sceptics may think that this cannot happen, but the infamous Torrens Island explosion shows it does happen, even when only in Zone 1 in which an explosive mixture is present only for a relatively short period, compared to Zone 0 where it is always present). SANS/IEC 60079-14 clauses 9.3.2 and 10.6.2 are clear on how to address this risk.

In summary, the installer or specifier of Ex equipment should not be taking dangerous, subjective advice from a manufacturer but should objectively read the certificates and the installation standards and should certainly not believe that putting an Ex e terminal inside an Ex d enclosure will give the level of protection needed for Zone 0 applications. □

Dr Geof Mood is the Technical Director for CCG Cable Terminations (Pty) Ltd. He holds a doctorate in mechanical engineering and sits as an independent expert on a number of IEC Standard committees, including the Maintenance Team for IEC 60079-14.

In line with professional publishing practice Electricity + Control *offered the author of the original article right of reply to the comment from Dr Geof Mood of CCG Cable Terminations. The invitation was declined.*

50 MVA mobile substation destined for Guinea

Leveraging its in-house expertise and local manufacturing capability, Zest WEG recently custom-designed and manufactured one of the largest mobile substations built to date in South Africa.

Bernard Mitton, Engineering Team Leader for Integrated Solutions at Zest WEG says the 50 MVA mobile substation – destined for Guinea – includes a dual voltage rated mobile transformer produced by WEG in Brazil. The substation will be commissioned early in 2022.

"This is a full turnkey project procured by Robustrade in Dubai for the utility company of Guinea: *Electricité De Guinée*," says Mitton. "Our in-house team coordinated the electrical, civil and mechanical designs, as well as the engineering solutions for the customer."

The full project includes three trailers of equipment and will allow the end-user to step down power from the main national grid at various geographic points as required. High voltage power is tapped from existing overhead line with a specifically designed and manufactured tee-off solution connecting the supply into the mobile substation, where it is stepped down from 110 kV or 60 kV to 20 kV or 30 kV depending on requirements.

"From the 50 MVA mobile substation, the supply is distributed to a 30-20 kV mobile switching station, containing an incomer and five feeders," Mitton says. "Mini-substations can be fed directly, or a cable can feed to a junction box in the field, usually where there is an existing cable in the ground."

As part of the project, Zest WEG designed and supplied a cable reel trailer with all power and control cabling needed for the mobile transformer and mobile switching station. Included on this trailer are 30 kV field junction boxes to assist with the cable connection between cables already installed and the supply cables from the mobile switching station. These boxes allow for up to three feeder cable connections. The advantage of this design, Mitton notes, is that the junction box becomes a termination point. The termination ends of the on-site cable do not need to be redone, all that is necessary is a bolt-on connection.

"This mobile substation solution is suitable for temporary and permanent installations, so it can be used in a range of applications," he adds. "For emergencies, it can replace an existing substation transformer in the event of failure, and for standby applications it can handle temporary overloads at substations."

It can also be put to use during routine maintenance, to manage the loads of existing substations being maintained, repaired or inspected. This minimises the delay in taking out the unit due to load and other system constraints. In addition, the mobile substation can be used to provide power for large project sites or key mining sites.

Mitton highlights that the design and construction of solutions for mobile applications, including mobile generators, is one of Zest WEG's strengths. The expertise

The 50 MVA mobile substation, which includes a dual voltage rated transformer, will be commissioned on-site early in 2022.

and capability within the business enables it to custom-design the units to suit specific requirements. None of the mobile solutions the company has provided to date has been identical to another.

"We have gained valuable experience from many years of designing, manufacturing and supplying mobile solutions in modular configurable designs – mainly for customers in Africa and Latin America," he says.

"These are not off-the-shelf products; each solution is custom-engineered to comply technically with the user's specifications and integral requirements, the respective operational environment, logistical requirements and the safety of the operating personnel."

The mobile substation for the Guinean utility includes innovative design features such as the integration of several functions into a compact, modular design. New technologies such as hybrid circuit breakers have been employed, along with disconnectors, earthing switches, ring-type current transformers, inductive voltage transformers and surge arresters.

"All the functionalities are included in a single prefabricated solution, and space requirements for switchgear bays are reduced through integration of components," says Mitton. "The substation's transformer was specifically designed and manufactured by WEG in Brazil for mobile applications."

The modular design simplifies on-site installation, as all equipment has been prefabricated, pre-wired and pre-tested before shipping.

"This enhances the reliability of the solution, which translates into high availability and lower maintenance needs," he says. "It also simplifies the transport, logistics and commissioning."

The order for the mobile substation was placed just before South Africa went into its first Covid-19 lockdown in early 2020, so the project had to be managed under challenging conditions. The factory acceptance testing of key components, for instance, could not be done in person due to travel restrictions – so it was done successfully through virtual platforms across different time zones.

For more information visit: www.zestweg.com

Standing firm with local and international growth

An aerial view of the Pratley head office and main facility in Krugersdorp, west of Johannesburg.

Well-known South African company Pratley, which operates a range of divisions serving different market sectors, including manufacturing and mining, saw growth locally and internationally through 2021.

Shipping and supply-chain issues have led to a global shortage of a range of items and commodities. In this context, CEO Andrew Pratley comments: "The world is shopping around at present and we have seen fairly substantial international interest in all our products."

Exports showed significant growth for Pratley in 2021, with the company having appointed new distributors in Europe and the Middle East. It has a policy of maintaining a 95% ex-store service level, which contributed to its success.

On the electrical side, it launched a new range of flameproof cable glands which make use of Pratley's Taper-Tech® flame-seal technology. "We believe these glands are game-changers in the market," says Andrew.

In addition, Pratley's electrical division has some innovative products in the pipeline, planned to launch in the first half of this year. These build on Pratley's foundation of research and innovation.

The electrical division of Pratley is a global leader in electrical termination equipment, particularly cable glands, junction boxes and related accessories for hazardous locations. "In keeping with our policy, the types of products we produce tend to be unique and highly innovative, with features and benefits that out-perform others on the market. We invest a lot in research and development in this area, and have our own advanced in-house electrical testing laboratory and personnel," Andrew highlights.

He says challenging times have proved also to be times of rapid innovation and opportunity.

"We have managed to streamline processes and improve product formulations or designs. We also have our incredible employees, who have contributed to our strong growth in adverse times. We are fortunate to be in a relatively strong position going into 2022 and looking to the future," he says.

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Steve Flynn, Sales and Marketing Director, ESET Southern Africa.

Will 2022 see more sophisticated cyberattacks?

Steve Flynn, Sales and Marketing Director, ESET Southern Africa

After two years of unrelenting, unexpected events, how will 2022 stack up against what is becoming a much more sophisticated approach to cybercrime? While there has been an unprecedented increase in the adoption of cloud technology, 2021 saw entire industries held back after major cyberattacks. By the end of an eventful year, many organisations entered the festive season with some form of threat from the Log4J vulnerability hanging over their heads too. Awareness is, in effect, a form of prevention and understanding the emerging trends which set the tone for the year ahead in cybersecurity can only help build appropriate defence mechanisms.

As the world continues to move towards the increasingly common distributed workforce and the steady shift towards the cloud, ESET, a global leader in cybersecurity, says with increases in targeted ransomware attacks there has been a greater demand for reliable end-point security. Despite the concern that remote computing has caused, it does present an opportunity for many organisations to modernise their infrastructure and move more of the workloads into the cloud. The result, in many instances, is a more reliable, recoverable and scalable infrastructure, not only for its clients but for ESET too.

The cloud is the limit

Gradually, organisations are moving their infrastructure off-premises as they opt for more reliability and the scalability offered by cloud solutions that can adapt to the needs of the business.

Employees are returning to work, but it seems likely that the new workplace will accommodate hybrid working patterns, necessitating particular security arrangements. A greater emphasis on protecting end-point devices is required as security to the edge is only reasonable in on-premises solutions. In 2022, every organisation will need to evaluate their return to work policies and ensure the security measures they have in place suit the needs of a hybrid workforce and the protection of their data. In many instances, existing security technologies are inapplicable.

Cyberattacks on small businesses had a significant impact in 2021. Upwards of 60% said they could not recover financially from a severe cyber or ransomware attack. And the serious cyberattacks on the Department of Justice and South African parastatal, Transnet, showed that large organisations too, can suffer irreparable harm.

Consequently, there will be increasing demand for high-quality, reputable security software for laptops, which are the backbone in many small and medium-sized businesses, and for end-user mobile devices.

ESET LiveGuard is a feature that adds a layer of cloud-based protection specifically designed to mitigate threats that are new by intelligently moving them to a protected cloud-based sandbox, virtually eliminating any threat of malware or suspicious scripts unknowingly being opened.

In the partner landscape, ESET provides efficient tools to enable its partners to equip their customers with the best solutions, support and cloud-based security products.

System-driven efficiencies

The pandemic continues to unsettle activities that partners and clients relied on previously: face to face meetings and engagements, training and other on-premises support. Support services and training – typically delivered in-person in the past – will continue to be facilitated online, as has become the norm, but systems at some organisations still need to be adapted to allow for this.

The benefit of this shift to online-based interactions is that many organisations, including ESET, have found new ways of providing customer support, training and business development, forcing a critical review of many systems and processes.

This will improve efficiency and efficacy in how ESET engages with its partners, clients and customers.

Recently, IDC MarketScape acknowledged ESET for its continued reinvestment of its profits into software development, core threat research, and threat hunting. The acknowledgement recognises the cornerstone of ESET's established position as Europe's favourite cybersecurity brand – and it is fast becoming a significant player in South Africa, too.

Looking ahead

Organisations large and small saw – to some extent – the effects of not having adequate protection in place. Cyberthreats are sophisticated and cybercriminals will continue to hold businesses and individuals to ransom, acquire data, or steal funds. Cybercrime is increasing unabated.

It is expected that sophisticated attacks are going to become more personalised, which will drive a greater need to protect vulnerable proprietary applications from attack.

Organisations cannot operate today without some form of a protective solution in place, irrespective of where the infrastructure is located or what devices it is on.

For more information visit: www.eset.com/za

The next ICT generation

In the internships and training space of Information and Communications Technology (ICT) Prudence Mabitsela has established Dynamic DNA as a leading training and skills development company. Dynamic DNA strives to empower Africa's new ICT generation by facilitating employment for more youth in ICT businesses which, it believes, can propel Africa into the future, bridge the skills deficit in our workforce, close the gender divide, and help reduce unemployment.

Mabitsela, the 26-year-old founder and Managing Director, focuses particularly on empowering young women in ICT and shares three ways companies can participate in this opportunity.

Learnerships

The challenge in learnerships is twofold: firstly, companies have to deal with the administrative challenges associated with SETA applications, learnership hiring, management of the learner, training, reporting, administration, document records, auditing and the successful absorption or placement of the learner.

For companies, employing young, highly skilled individuals means hiring employees with the necessary skills to add value to their businesses and improving their B-BBEE score, gaining tax rebates, and importantly, transitioning sustainably into the digital economy.

"Our role as facilitators of these learnerships benefits both parties. For companies we handle the full suite skills development solution from hiring, to the SETA administration, reporting, mentoring, training, and placement – alleviating the burden of learnerships which is often an inhibitor to the process," says Mabitsela.

"Secondly, a challenge we hear businesses often face when it comes to employing young team members is that the education they have received is incomplete in terms of soft skills, such as communication and etiquette, to properly equip them to be productive members of a team.

"On the other hand, there are ambitious, technically qualified, young workers who – due to inexperience – are unable to get a start in the industry."

Dynamic DNA's learnership programme offers young learners the chance to pursue a career in the ICT sector, with a particular focus on upskilling and facilitating workplace placement for its graduates. In addition to providing technical skills, the company focuses on practical and soft skills such as communication skills, work etiquette, time management, presentation skills, and other elements essential to creating fulfilling careers.

Dynamic DNA graduates can build innovative solutions across multiple technologies. They learn the skills to design and build agile applications in a complex business environment, making them a valuable asset to the workforce.

Prudence Mabitsela, founder and MD of Dynamic DNA.

4IR4Her

Mabitsela is leading from the front in empowering women in ICT through the 4IR4HER movement. "The Fourth Industrial Revolution – 4IR – with its rapid changes in technologies, industries, and societal patterns due to increasing interconnectivity and smart automation, can be seen as a democratising force. It opens the space to provide women with the opportunity to compete in the knowledge economy. However, this can only happen if adequate attention is given to existing gender divisions and equal opportunities are made available," she says.

The non-profit 4IR4Her brings together young women and women in technology and presents 4IR tech opportunities in streams like Robotics, Artificial Intelligence and Cybersecurity, enabling young women to equip themselves with key skills for the future. Currently there are 15 women in the programme.

"A crucial part of the learning journey is to be paired up with an entrepreneur who is successful in the tech or business space, to learn the key lessons you can never be taught from a book: how to manoeuvre through your day as a businesswoman, how to diversify revenue streams if you are self-employed, what do you do when you see risks in your business, what contingency plans you need and so on."

Pay your device forward

In another initiative, with the shift in education to hybridised digital learning and training, Dynamic DNA, in partnership with COMETSA Friends & Supporters Club (NPO) and Kaya FM, launched a campaign to enable learners from disadvantaged communities to access online training. The campaign calls to individuals and corporates to 'Pay Your Device Forward' and donate new/old devices such as laptops, smartphones, WiFi routers and tablets to enable continuous skills development for disadvantaged youth.

"ICT skills are among the scarce skills, greatly needed to build our economy. Businesses and the ICT sector can help drive youth employment through technology skills training if they choose to do so," Mabitsela says.

For more information visit: www.dynamicdna.co.za

SAICE can assist in ensuring sustainable solutions

Professor Marianne Vanderschuren, President of SAICE.

Vishaal Lutchman, CEO of SAICE.

Following President Cyril Ramaphosa's 2022 State of the Nation address, Professor Marianne Vanderschuren, President of the South African Institution of Civil Engineering (SAICE), reiterated the organisation's call on government to continue to engage the available resources, entities and professionals in mapping out the far-reaching plans that he outlined in his address to the nation. "With 15 000 members SAICE has the capacity to tap into their knowledge, skills and wisdom to move towards a sustainable, resilient and economically viable future," she says.

"As a learned society SAICE is pleased that government has already proactively approached us to support it with the implementation of some of the projects that have been proposed, and we will continue to enhance and take that engagement forward," says Vishaal Lutchman, CEO of SAICE.

He previously indicated that SAICE's strong network – supported by its platform SAICE Connect – means the institution can assist the state in recruiting technocrats who are primed to guide infrastructure portfolios to success. "We have made great strides in partnering with the public and private sectors; we have empowered engineers to form connections between entities and this can be leveraged by government," Lutchman says.

With reference to the use of block paving for rural roads, Vanderschuren cautions that although there are advantages to using these materials, the risk of floods, as mentioned by the President, could easily result in a road washing away. "The theft of materials, as we see in the rail sector, among others, could also become an issue." Furthermore, the lack of maintenance that we see around the country, could result in unusable infrastructure, soon after implementation.

SAICE was pleased to hear the President speak about climate change and the Paris Agreement. During the last Conference of Parties, COP26, significant international funding was committed to South Africa, creating the potential to change the energy industry. "However, we must ask what has happened between 2015, when South Africa signed the Paris Agreement, and now. The development of South Africa's renewable energy industry should already have advanced to production at much higher volumes," Vanderschuren says.

She adds: "The President is correct that electric vehicles and the development of a green hydrogen pipeline are on the agendas of many countries around the globe. These are certainly options for the future. The question arising, however, is: have we properly investigated what this means in the South African context, with the obvious challenge of limited electricity supply? A further question is: if we are going to invest in both, would we then need two types of energy distribution systems and at what cost?"

President Ramaphosa spoke of the need for capacity building and referred to the scarce skills list. SAICE welcomes the fact that civil engineering features prominently. However, many young South African engineers are leaving the country, due to a lack of work. How quick can the turnaround on projects be, through the investments mentioned?

Lutchman emphasised that employment remains a critical priority for South Africa and for the civil engineering sector. "It is estimated that up to 20 civil engineers leave our country every month in search of greener pastures where there is a more reliable stream of projects. We cannot afford this draining of expertise."

One of the major concerns with regard to the President's State of the Nation address, was the minimal reference to maintenance. With the country's challenged infrastructure, this should be at the top of the agenda, says Vanderschuren. "The President mentioned that this requires capacity in municipalities. To date, a lack of capacity has paralysed many municipalities, leaving citizens without services. While government builds capacity, we need interim measures to ensure that investment in civil infrastructure and its maintenance is monitored and audited. How about identifying infrastructure auditors who assist the municipalities, while they build capacity?"

SAICE would also like to see plans that identify building codes and standards to minimise the need for maintenance. "Instead of infrastructure failing three months after completion, we must build to last. We need to work on standardisation for durable infrastructure – and we need to monitor the implementation of those standards."

She adds there are still many questions that need answers. "If the President commits to the capacity building and education as suggested in his address, scenario planning will need to be done, unpacking what different future scenarios could look like, and what the advantages and areas of concern are on the journey ahead. This is the type of evidence-based planning that SAICE expects and we have the capacity to assist government in this regard," Vanderschuren says.

For more information visit: www.saice.org.za

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