FEATURES:
- Control systems + automation
- Drives, motors + switchgear
- Measurement + instrumentation
- Safety of plant, equipment + people

SIL 2/3

Safety Integrity Level

Radar (FMCW) level transmitters come with SIL certification

KROHNE

07/2022

ELECTRICITY + CONTROL

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energy + information in industry

OPTIWAVE FMCW radar level transmitters from KROHNE provide reliable and accurate level measurement, with the highest safety standards to protect staff and installations.
(Read more on page 3.)

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Integrated systems are the standard of today

What a range of topics in this month's edition of *Electricity + Control*. It should never be lost on anyone operating in our modern industry that each of these topics relates to the next one – and so on.

It has become increasingly evident that there is a growing number of industrial applications where the boundaries between, say, instrumentation, control, automation, switchgear and protection are more blurred than they once were.

There was a time when what happened in the substation was really no-one's business other than that of the team operating the substation! Also, back in the day, energy was 'cheap' and the electrical form of that energy was remarkably reliable. Indeed, back then, our utility was without question one of the world leaders.

One could also argue that, back then, instrumentation, control and automation were really related to the process itself – and seldom did the paths of process and control folk ever need to cross those of folk working on the energy system.

Remember those days? I vividly recall being in meetings where proponents of the 'two sides' would meet to begin to determine where the fault lay – as it were!

But we have long been in an environment where the cost of energy is not simply a line item – it is a crucial component that affects the bottom line of our operations.

Instrumentation that optimises the process and feeds data into the control and automation systems must now deal with every single input parameter on the plant – and energy is an increasingly important component of that.

Consider also that, in many cases, we need to have strategies in place to deal with those moments when the energy system shuts down. Some operations have backup systems in place; some don't. Now it is important to manage plant shutdown and start up – often at embarrassingly frequent intervals.

Without measuring exactly what is happening at the plant we would have no way of managing it. As we explore measurement and instrumentation, it is important to evaluate whether we are getting all the data we need to manage the plant most efficiently – and keep operations running smoothly.

If not, then we need to identify all those input parameters that now have a bearing on plant operation.

And feed that information into the plant system to be sure we can extract the best and most efficient operation – even during these rather difficult times.

Ian

Ian Jandrell

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

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CONTROL SYSTEMS + AUTOMATION

DRIVES, MOTORS + SWITCHGEAR

MEASUREMENT + INSTRUMENTATION

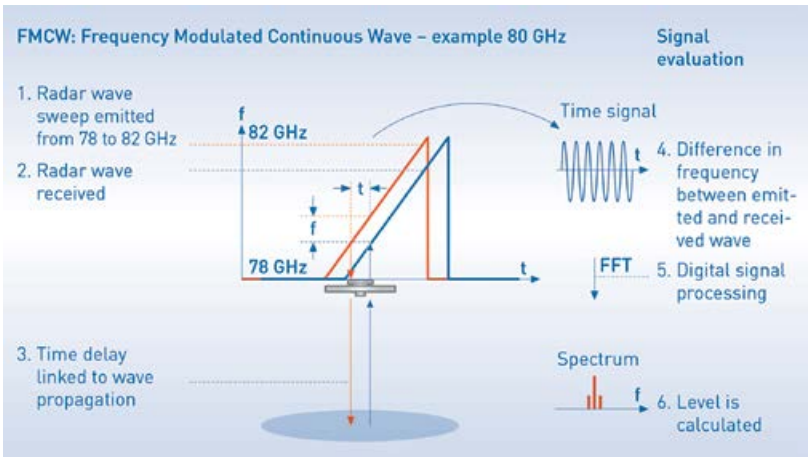
SAFETY OF PLANT, EQUIPMENT + PEOPLE

REGULARS

Continuous non-contact level measurement with FMCW radar technology

For more than 30 years, KROHNE radar level transmitters have provided clear vision for reliable, accurate and continuous level measurement of liquids and solids. KROHNE's OPTIWAVE frequency modulated continuous wave (FMCW) radar instruments cover the highest safety standards to protect staff and installations and they carry approvals respective to their applications.

- SIL 2/3-certified (SIL 3 1oo2) according to IEC 61508 for safety-related applications
- Overfill protection (WHG) and hazardous area approvals
- Drop antennas made of corrosion-resistant PP, PEEK or PTFE
- Cladded flanges, threads and antenna extensions for corrosive environments
- METAGLAS® second sealing barrier for dangerous liquids
- Measurement through tank roofs made of non-conductive material (plastic, glass)
- TBM (Tank Bottom Management) ensures reliable measurement even in empty tanks
- Flush-mounted Lens antennas and reduced dead zone for optimised storage capacity
- Small beam angle (4°) for tank internals and long nozzles
- Accuracy from ±2 mm also in processes with fast changing levels (≤60 m/min) and low dielectrics ≥1.4 (TBF 1.1)
- IP66/IP68 (0.1 barg/1.45 psig), NEMA 4X/6P
- One user interface for all applications
- Large backlit display with keypad
- Menu displayed in 12 languages
- HART®, FOUNDATION™ fieldbus and PROFIBUS PA communication
- PACTware™, HART® DD and DTM provided free of charge with full functionality
- Quick setup assistant for easy commissioning
- Three-year warranty



The FMCW measuring principle.

OPTIWAVE 7500

For the measurement of liquids in narrow tanks with internal obstructions or long nozzles, this 80 GHz radar with its reduced radar beam is the best choice. It features flush-mounted Lens antennas (no tank intrusion and insensitive to deposit) to measure the liquid level, from the flange down to the container bottom.

OPTIWAVE 3500

For liquids with hygienic requirements this 80 GHz radar offers a range of hygienic connections. Insensitive to scaling, its flush-mounted Lens antenna permits level measurement right up to the process connection. With its reduced beam angle, this radar is capable of measuring in small and narrow vessels as well as tanks with agitators. It is suitable for SIP (Sterilisation in Place) and CIP (Cleaning in Place).

OPTIWAVE 5400 / OPTIWAVE 7400

The OPTIWAVE 5400 and OPTIWAVE 7400 are 24 GHz FMCW radar instruments for liquids. They come with a range of antennas, process connections, and cladded flanges and extensions for corrosive environments. The OPTIWAVE 5400 is the entry-level device for basic application requirements whereas the OPTIWAVE 7400 is designed for harsh environments and replaces obsolete radars in high-end applications.

The OPTIWAVE 7400 offers a quick coupling system that makes it possible to remove the housing under process conditions. An optional METAGLAS® second sealing barrier provides additional safety when measuring dangerous liquids. The Horn antenna can be equipped with purging, heating or cooling systems to prevent crystallisation or build-up.

OPTIWAVE 6400 / OPTIWAVE 6500

The OPTIWAVE 6400 and OPTIWAVE 6500 are dedicated to measuring solids. The 24 GHz OPTIWAVE 6400 features the proven Drop antenna. Insensitive to product build-up, it is the perfect fit for granulates and rocks in silos or bulk storage. The 80 GHz OPTIWAVE 6500 has a flush-mounted Lens antenna. Its small radar beam is best suited for powders and dusty atmospheres, such as in high and narrow silos. □

For more information visit:
https://krohne.com/safety/#optiwave-series

Overcurrent protection terminals boost machine optimisation

Christian Jürgenhake, Product Management I/O, Beckhoff Automation

In a closed-loop society, waste has long been used as raw material for new products. It's a philosophy that Govaerts Recycling has lived by since the 1990s. But recycling entails a heterogeneous material flow that can demand the utmost from recycling machines, so it's helpful if overloads can be detected quickly – via the current consumption, for example. The company, based in Alken, Belgium, has relied on Beckhoff's automation expertise and technologies for years, notably the EL9227 electronic overcurrent protection terminals.

Govaerts Recycling started in 1995 with a great ambition to make more out of less. "Working in a gravel pit in the past forced us to face the fact that the land was being exploited," says Eddy Govaerts, who runs the company with his sister. "Our goal was to deal with raw materials in a more sustainable way, and plastic waste seemed like the perfect starting point because that's what we were getting paid for at the time."

Recycling 315 million plastic bottles

Recycling of the first plastic waste began in 1997. Today, everything from planks, posts, decking and fences to furniture and playground equipment made in Alken, Belgium, can be found all over the world. These are all tested and certified by reputable bodies and the plastic products themselves are 100% recyclable. The company now works with seven machines which, in 2021, transformed over 315 million plastic bottles into new products, and two additional plants are currently being planned to cope with further growth. All equipment is designed and built in-house by Eddy Govaerts and his team to ensure they retain complete control over the production process. Eddy Govaerts outlines his philosophy: "We want to make sure that everything we produce is of the highest quality, which means we not only have to check what goes in, but also control and understand exactly what goes on inside."

© Philippe Van Gelooven

Govaerts integrates the messages from the EL9227 electronic overcurrent protection terminals into the HMI on its recycling machines.

Reliable operation around the clock

One advantage of the Govaerts plants is that the entire production process, from grinding the plastic granulate to the final product, takes place in a single step. This means the plastic goes through one less heating and cooling cycle than in previous methods, which has the real benefits of maximising quality and saving energy.

An equally important consideration is reliable operation around the clock, which is why Govaerts Recycling continues to rely on the expertise and technologies of Beckhoff for machine automation and optimisation. As Eddy Govaerts explains, "Technology is always linked to people, because the more complex it becomes, the more support you need. Beckhoff Support Engineer Philippe Hénin is our main point of contact and understands exactly what we are doing. He also listens to our needs, which means he is ideally placed to offer proactive solutions. That's something that really sets Beckhoff apart."

A prime example of the ongoing optimisation of the machines can be found in the EL9227 electronic overcurrent protection terminals. "The step toward Industrie 4.0 is huge for us when it comes to further improving the reliability of our machines," says Wouter Thieren of Govaerts Recycling, who has been working on this issue for four years. "The more data we collect, the better analyses we can perform. This means we not only avoid problems, but also achieve a consistently higher level of quality." For Thieren, the EL9227 EtherCAT Terminals are the right fit for the Industrie 4.0 concept. "We work with a decentralised distribution of dc circuits, and by adding two terminals to each I/O segment, we can provide electronic overcurrent protection to the respective machine sections."

The overcurrent protection terminals also reveal a lot about what is happening in the machine. As Thieren highlights, "We control how much current the electronic coupling module and the power supply unit require at the

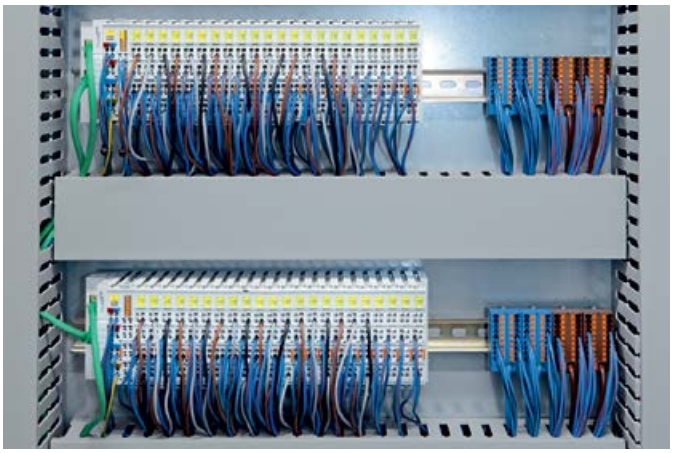
input and output. And, if there's a fault, we know exactly where it's occurring and can switch the terminals on and off remotely or via the system visualisation on our HMI."

Comprehensive diagnostics and easy integration

In the case of the EL9227 overcurrent protection terminals, Thieren relies on the version with advanced functions because of the numerous diagnostic options available. "With these EL9227s, we can perform condition monitoring for the entire 24 V dc circuit." If the current consumption changes, the machine operator can specifically target their search for the cause. "This all demonstrates the further steps we are taking towards predictive maintenance," Thieren says.

The strength of the EtherCAT Terminals lies in the hardware's combination with software and, of course, support. "With TwinCAT, Beckhoff has the right software to harness the full potential of the hardware. What's more, Beckhoff facilitates system integration because it is virtually automatic." For example, the messages from the current terminals can be easily integrated into the machine's HMI. "Our operators can then see an anomaly or fault immediately and don't have to go to the control cabinet to isolate the fault based on the LEDs," Thieren adds.

There are now so many electronics in the Govaerts machines that fast and selective protection is essential, which means thermal fuses are no longer adequate. In comparison, the EL9227 electronic overcurrent protection terminals already output a warning signal at the first sign of an anomaly, and this diagnostic alone helps to avoid a host of problems. "With this in mind, our dc circuits are perfectly fused and protected," Thieren emphasises. In addition, they comply with the requirements of DIN EN 60204-IEC, which stipulates that, as of 2020, 24 V dc circuits also have to be tested. With the EL9227 EtherCAT Terminals, Govaerts Recycling meets the requirements of the standard and benefits from an intelligent monitoring solution that can be reset electronically. □



© Philippe Van Gelooven

The advanced functions of the EL9227 overcurrent protection terminals allow Govaerts Recycling to perform high-end condition monitoring on all 24 V dc circuits.

For more information visit: www.beckhoff.com/en-za/

Gartner® Magic Quadrant™ ratings for MES

Rockwell Automation, a global company dedicated to industrial automation and digital transformation, has been named a Visionary for its FactoryTalk® ProductionCentre, and Plex Systems, a Rockwell Automation company, has been named as a Leader for its Smart Manufacturing Platform, in the Gartner® Magic Quadrant™ evaluation of Manufacturing Execution Systems (MES).

Rockwell Automation sees its positioning in the 2022 Gartner Magic Quadrant as a reflection of the fast-growing market reach and industry recognition for its overall MES portfolio. It offers customers across a wide range of industries the benefits of an evolving 'greater than the sum of its parts' solution.

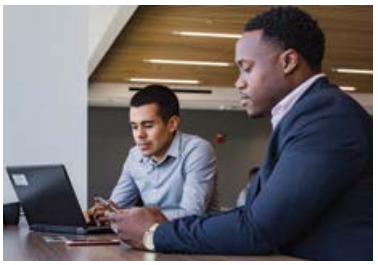
Brian Shepherd, Rockwell Automation Senior Vice President, Software & Control, said: "We welcome the recognition of Rockwell's MES portfolio in the 2022 Gartner Magic Quadrant report." He noted that the interpretation of MES functionality by Gartner now expands beyond the traditional definition to include all plant-level functionality between enterprise-level business operations, engineering systems, and plant automation.

"We're proud to see the Rockwell FactoryTalk solution recognised as a Visionary for its game-changing orchestration of MES functions," Shepherd continued. "We believe the positioning of Plex as a Leader also showcases the impact and value the Smart Manufacturing Platform delivers to customers. This recognition of Rockwell Automation's comprehensive portfolio by Gartner further demonstrates the synergy between these offerings."

Rockwell Automation's complete operations management portfolio includes Plex Systems and FactoryTalk ProductionCentre solutions with capabilities including MES, QMS, Supply Chain Planning, Production Monitoring, and Asset Performance Management. FactoryTalk ProductionCentre offers the deep features and functionality required by highly regulated industries.

Plex offers the only single-instance, multi-tenant software as a service (SaaS) manufacturing platform operating at scale, serving over 700 customers and managing more than eight billion transactions per day. Together, the Rockwell Automation operations management portfolio provides optimum solutions for a wide range of customers to achieve their operational digital transformation journey.

For more information contact Rockwell Automation Africa.
Email: mjunius@ra.rockwell.com
Visit: www.rockwellautomation.com



Rockwell Automation and Plex Systems have been recognised in Gartner's Magic Quadrant evaluation of manufacturing execution systems.

The future of process automation

Looking to the future of process automation ABB recently released a white paper entitled: *The DCS of tomorrow: ABB's process automation system vision*, which outlines how it sees process automation systems evolving to support industries as they undergo digital transformation and shift to sustainable energy sources.

Through the past century, automation systems became central to empowering industries that provide the basic building blocks of our everyday lives – energy, power, water, metals, minerals, chemicals, and transportation – to scale to the needs of a growing population. And for nearly 50 years, the distributed control system or DCS – a digital platform for automating and operating large plants – has been instrumental in enabling safe, efficient and reliable 24/7 operations for process and energy industries.

ABB has been a global market leader in distributed control systems for 22 consecutive years, maintaining a leading share of around 20% of a market worth an estimated $14 billion.

At the core of controlling and supervising complex processes, the DCS will continue to provide the essentials for safe and reliable operations, while evolving its functionality to serve the needs of accelerating digital transformation and the energy transition. It will combine an ability to scale and serve new market conditions by adapting to new technologies, including the provision of standard interfaces for third-party connectivity.

ABB foresees a modular automation architecture that will evolve to address customer needs, becoming more open, interoperable and flexible, while maintaining the same high level of reliability, availability, safety and security to which users have grown accustomed.

- The DCS of the future will be embedded in a digitally-enabled environment that facilitates enterprise-wide secure connectivity and collaboration among people, systems and equipment.
- New business models will be feasible through readily downloadable application subscription services.
- Machine learning and artificial intelligence will speed issue resolution and promote remote, autonomous operations that keep people out of harm's way and mitigate against human-induced error.
- The generation joining the workforce will leverage the familiar benefits of digitalisation without having to sacrifice the reliability, availability and security that current systems provide.

Evolving process automation systems will continue to enable some of the most complex infrastructures in the world.

Peter Terwiesch, President, ABB Process Automation, said: "With the DCS of tomorrow, we will accelerate innovation while maintaining the reliability and continuity for which we are known. This white paper is a blueprint for automation systems intended to future-proof industries for decades to come. Many of the industries we serve are energy- and material-intensive, and strive towards more sustainable production. As they increasingly integrate renewables into their energy mix, we will provide the automation to support that."

ABB's world-leading distributed control systems combine process control, electrical control, power management and safety management. They enable collaboration, allowing for improvements in engineering efficiency, operator performance and asset usage.

"ABB automates, electrifies and digitalises some of the largest and most critical operations in the world to meet the needs of our growing society, helping customers make a world of difference," said Terwiesch. "These sophisticated, interconnected systems work in the background, yet are essential for nearly everything we use in our daily lives. Our future automation offerings will continue to be central in this."

For more information visit: www.abb.com

Remote access into industrial automation solutions

OMRON has introduced the RT1 Series for remote access in its line-up of industrial automation solutions. The turnkey solution enables remote corrective maintenance without costly and time-consuming on-site visits. With remote access, users can view and control interfaces, troubleshoot equipment, and install updates.

The RT1 Series from OMRON, powered by Secomea, encompasses all software and hardware components needed for efficient, easy, and secure remote maintenance. It complements OMRON's offering of industrial automation solutions and markedly increases machine uptime as well as reducing the need for site visits and reducing CO_2 emissions associated with machine troubleshooting and maintenance.

OMRON's goal is to offer a full service for its customers for every aspect of their production architecture. The remote access solution extends OMRON's automation platform to ensure customers can respond remotely to any issues that may arise at production sites running 24/7.

For more information visit: www.industrial.omron.co.za

Compact drive technology in a robust metal housing

ELM72xx: directly integrated in the EtherCAT I/O system

The ELM72xx EtherCAT Terminals:

- full-fledged servo drives in a robust metal housing
- output current of up to 16 A at 48 V DC
- metal housing for optimum heat dissipation at high outputs
- directly integrated in the EtherCAT I/O system
- increased power and functionality
- optimal shielding in case of electrical interference
- convenient connector front end and One Cable Technology (OCT)
- selectable safety range: STO or comprehensive Safe Motion function package

Scan and learn all about compact drive technology

New Automation Technology **BECKHOFF**

Next generation automation solutions

At the recent Hannover Messe 2022, Schneider Electric, a leader in the digital transformation of energy management and automation, introduced version 22.0 of its EcoStruxure Automation Expert, further enhancing the capabilities of the software-centric universal automation system.

EcoStruxure Automation Expert v22.0 offers the consumer-packaged goods, logistics, water and wastewater sectors next generation automation capabilities and operational flexibility including:

- Expanded libraries for segment functions and energy management devices
- Enhanced user experience (UX) in the build time tool
- Fortified built-in cybersecurity
- Support for additional engineering input formats, including DEXPI (ISO 15926 based) and Excel
- Language support and enhanced documentation in seven languages widely used internationally.

Importantly, the solution also provides end-to-end digital continuity through close integration with AVEVA applications. EcoStruxure Automation Expert can connect to AVEVA Engineering and import plant design data for automated bulk engineering. It also enables scalable visualisation for the enterprise control room through integration with the AVEVA System Platform.

Decoupling automation software from hardware

EcoStruxure Automation Expert provides increased flexibility and control by enabling automation software to be separated from the hardware; this gives enterprises the freedom to break their dependency on proprietary industrial automation.

Beijing Jingkelun, a high-tech business specialising in the research, development and construction of green, intelligent, cold chain storage, selected EcoStruxure Automation Expert to meet continuously fluctuating market challenges. The business wanted to react to market opportunities and changes in real time while also decreasing commissioning and maintenance costs. In addition, it wanted to leverage new technologies to advance service and capabilities and protect its installed base investments.

Quanjiang Wang, General Manager, Beijing Jingkelun, said: "EcoStruxure Automation Expert provides us with the digital thread through our operations that we need

Schneider Electric has introduced its next generation EcoStruxure Automation Expert.

to become as efficient as possible. By decoupling hardware and software, we can analyse, edit, or update systems effectively and provide our customers with the level of flexibility they need. EcoStruxure Automation Expert, with its open, vendor-agnostic approach, has changed the very nature of automation software."

With EcoStruxure Automation Expert, Beijing Jingkelun achieved:

- 30% savings on commissioning time and ease of maintenance
- Holistic system management of heterogeneous systems through orchestration
- Locked access to function blocks source code
- Efficient 'wrap and reuse' of automation objects.

Universal automation digital ecosystem

As well as providing digital continuity and seamless integration with complementary software, EcoStruxure Automation Expert enables different entities, internal or external, to work together to create the best solution to solve specific market challenges.

As a universal automation solution and part of an ecosystem that works similarly to an app store for automation, EcoStruxure Automation Expert enables vendors, end users and OEMs to share a common automation software layer across their technology. This technological collaboration is driving the development of portable, interoperable, 'plug and produce' automation solutions that industrial enterprises can integrate easily, irrespective of brand.

Fabrice Jadot, Senior Vice President, Next Generation Automation, Schneider Electric, said: "In today's highly volatile market, Industrial flexibility and sustainability are as important as ever. With EcoStruxure Automation Expert, industrial enterprises are driving engineering efficiency, effectiveness, and ongoing resilience in their operations."

For more information visit: www.se.com

Electra Mining Africa 2022

After two years of restrictions, exhibitions and events are now re-opening globally. Good news for local industry is that Electra Mining Africa will go ahead as a live in-person event this year. The exhibition and its line-up of conferences and free-to-attend seminars will take place from 5 to 9 September at the Expo Centre, Nasrec, in Johannesburg. Exhibitors are ready to showcase their latest innovations, technology, products and services at Southern Africa's biggest mining, electrical, automation, manufacturing, power and transport trade exhibition and the collective industries are looking forward to this year's event.

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

Robust HMI devices with all-round IP67 protection

The new HMI series from Turck Banner enables cabinet-free operating and installation at operating temperatures between -20 and +55 °C.

The TXF700 Series for the first time offers an ultra-robust HMI series with complete all-round protection to IP67. With its high degree of protection, the modern HMI platform allows for flexible and slim mounting as, unlike previous solutions, it does not require installation in protective housings or control cabinets.

The brilliant TFT displays are protected by a glass front and the HMIs feature a capacitive touch screen that supports multi-touch capability and gesture control. This allows the latest operating concepts from the world of smartphones and tablets to be brought to the rugged environments of industrial automation. The TXF700 HMIs are available with display sizes from 12 cm to 54.5 cm and with a resolution of up to 1920 x 1080 pixels.

With the new HMI/PLC series, Turck Banner has further expanded its extensive IP67 portfolio. The devices can be used wherever there are no particular Ex protection or hygiene requirements, particularly in machine and system building, the packaging industry, as well as in the intralogistics, mobile equipment and automobile sectors.

The new TXF700 series offers ultra-robust HMIs for industrial applications.

The TXF700 can be used for visualisation and, if required, can be used also with Turck Banner's TX VisuPro, without CODESYS as an IIoT gateway or edge controller. Besides the conventional HMI protocols for connecting to controllers, such as those from Siemens, Beckhoff or Rockwell, TX VisuPro also supports MQTT or OPC-UA as server and client. The TXF700 HMIs can communicate simultaneously with up to eight protocols. This gateway function thus also enables data to be exchanged between different controllers or terminal devices.

For more information contact Turck Banner.
Tel: + 27 (0)11 453 2468
Email: katrina.sutcliffe@turckbanner.co.za
Visit: www.turckbanner.co.za

Innovative companies need innovative suppliers

Nidec Control Techniques has been a supplier to AccuTech Weighing Services for over a decade. This successful working relationship demonstrates the importance of shared goals in fostering industrial innovation.

Africa is known for its abundance of natural resources. It is also home to a growing, urbanising and modernising population. Meeting the needs of businesses and consumers in this dynamic landscape requires local companies to embrace technology to gain a competitive edge, enabling process efficiencies and improved productivity. Taking this approach, AccuTech Weighing Services is leveraging the products and support of Nidec Control Techniques in order to offer quality equipment to end-users in the agricultural, mining and food and beverage industries. This contributes to a thriving supply chain characterised by reliability and consistency, which has enabled resilience through today's difficult times.

In the business-to-business market, a company's ability to offer reliable and consistent products and services is critical. Delays in meeting customers' needs can have negative and far-reaching implications for the wider supply chain and their end customers. The case of AccuTech illustrates this point. If AccuTech were to have failed in meeting its customers' needs through the pandemic, it could have left many people in dire straits. However, working with an expert team and dedicated suppliers, like Nidec Control Techniques, AccuTech ensures that it consistently delivers excellence to its clients across Africa.

AccuTech Weighing Services supplies semi-automatic weighing and bagging equipment to the agricultural, mining and food and beverage industries.

Delivering custom-made machinery

Headed by CEO Brett Hillidge, AccuTech Weighing Services is one of the largest, if not the largest supplier of technological semi-automatic weighing equipment to the grain milling industry in Africa. The company has also grown to include bagging equipment and now caters for the wider agricultural, mining and food and beverage industries.

In its 30-year history, AccuTech has worked with many suppliers to find the right drives, PLCs (programmable logic controllers) and panels to use in its equipment. For the past 15 years, it has chosen to work with Nidec Control Techniques products. Hillidge explains: "When you are working with weighing and packaging of materials, precision and reliability are absolutely key. Getting it wrong can have serious implications for the bottom line and customer satisfaction. We cannot compromise on this. At the same time, we are manufacturing equipment for wide-ranging applications and we are dedicated to delivering customised machines for our various clients. With all these factors in mind, we have to select our technology suppliers carefully."

Bruce Grobler, Vice President Middle East & Africa, Nidec Control Techniques, says, "We have enjoyed our longstanding working relationship with AccuTech. We strive to exceed expectations and doing so requires a careful understanding of our customers' needs. We know how important it is for AccuTech to get the right products and services from us – consistently and reliably."

AccuTech makes use of a range of Nidec Control Techniques products depending on the application. Orders include the M400, incorporating an on-board PLC which can execute Machine Control Studio (IEC61131-3) programs for logic and sequencing with real-time tasks – removing the need for additional PLCs. This drive is suitable for heavy industrial applications and ensures high performance from AccuTech's machinery.

The company also makes use of Commander C200 and C300 ac drives. These are simple and compact ac motor speed controllers that meet advanced requirements in a range of applications and provide an optimum user experience. Hillidge says, "We find these simple to set up, starting with just four parameters. It is a straightforward installation and commissioning process, and is one of the reasons we keep choosing Nidec Control Techniques products."

In addition, Nidec Control Techniques offers a five-

year warranty on its products. “We are confident that we offer high quality products for any application. However, if something should go wrong, we are there on demand to swap out faulty equipment,” says Grobler. “In this way, we are putting our money where our mouth is.”

Understanding urgency

“They say ‘time is money’ and it’s true. As an OEM, it is very important for us to deliver on time. This means we have to partner with companies who share that commitment. A mutual understanding of urgency has made it an easy decision to keep working with Nidec Control Techniques. The company delivers and swaps out parts as and when we need them, and is always ready to send us extra support if we run into a problem. Their speed and availability are invaluable, and that means we can pass the benefit on to our customers, too,” says Hillidge.

AccuTech Weighing Services takes pride in the way it operated throughout the turbulent Covid-19 business environment. It has now delivered over 16 500 machines to clients around Africa. “There are many business opportunities for us as Africa continues to develop and modernise. Food, agriculture and mining are key industries which stand to benefit significantly from innovation and automation. We deliver quality equipment in support of this, and look forward to continuing this work with the support of our dedicated suppliers,” says Hillidge.

In South Africa, Nidec Control Techniques represents and distributes Control Techniques drives and associated control equipment. As a leading provider of industrial automation solutions, Nidec Control Techniques has a presence across the country. □

For more information visit: www.controltechniques.com

Assisting industrial recovery in KZN

After the severe floods experienced in eThekwini and surrounds in April, hard-hit businesses are struggling to recover and minimise the damage to the bottom line. In the industrial and manufacturing sector specifically, the lost production time presents a significant threat to business health. Considering this, Nidec Control Techniques has arranged a dedicated team to help businesses in the region get their operations up and running with urgency.

The company’s Vice President Middle East & Africa, Bruce Grobler, says: “It is estimated that the floods in KwaZulu-Natal will lead to a 1.8% GDP loss for eThekwini, with a recovery time of three months. But businesses simply cannot afford to wait that long to get things back to pre-flood operating levels.”

Grobler says when he read that 38% of affected business are in the manufacturing sector, he knew swift action was needed. Leveraging Nidec Control Technique’s extensive partner network, Grobler arranged the KZN relief team with the support of Durban-based distributors, Feedback Electronics. “We’ve worked with Feedback Electronics for decades. We are pleased that, together, we can support the KZN area with a service team ready to visit affected sites and offer technical expertise.”

Nidec’s dedicated service team has already been on hand at a number of sites. The team has worked on several pump stations since the floods, to ensure water supply is uninterrupted, where possible, following severe damage to infrastructure. In the food and beverage sector, the team has undertaken audits and assessments to get strategic operations up and running with urgency.

The automotive sector was also impacted, with many large automotive companies reporting a trail of destruction at their plants in the south of Durban. “For plants facing such a huge level of devastation, we have done extensive site assessments to help businesses identify critical needs. You could call this a technology triage of sorts, where we help form a plan to address urgent fixes that can get the plant up and running as soon as possible,” says Grobler. “At the Durban harbour, too, the service team has assisted in crisis management by completing retrofits and upgrades to various cranes that were damaged by the floods,” he adds.

“We encourage any affected businesses to contact us for help. Our team has a strong track record of being fast and effective for customers in need. We have high stock availability, backed by solid after-sales support that will ensure customers get the solutions they need, up and running with no time wasted. We understand the devastation that many industrial businesses are facing, and we are here to help,” says Grobler. □

A team from Nidec and Feedback Electronics is assisting businesses affected by the KZN floods to get up and running again quickly.

VSDs enable energy savings and higher productivity

Industrial motor-driven loads can be divided into two main categories: Variable Torque (VT) loads and Constant Torque (CT) loads. It is estimated that about 80% of industrial motors are used in VT applications such as pumps, fans and most compressors, and 20% in CT applications such as conveyors, mixers, mills, winders and positive displacement pumps. According to the International Energy Agency, only 23% of industrial motors are fitted with VSDs. Rikus Botha, Head of Business Development at ElectroMechanica, takes a closer look at how VSDs can benefit CT and VT applications.

Botha points out that VT applications are frequently oversized to ensure future expansion of a system is possible, or to counter design uncertainties and other anomalies in industrial processes and systems. The mechanical design of systems will typically cater for the maximum load, making the system much stronger than it needs to be. As a result, the electric motor is also oversized to be able to drive the maximum load according to the design, and decreasing the likelihood that the electric motor will ever be required to run at full speed (rpm).

Real-world industrial VT application requires a means of control to match (increase or decrease) the installed system capacity or supply (including oversize) to the actual system demand requirements (flow or pressure of the output). This means that the inherent spare capacity or oversize in the system needs to be either reduced or increased, depending on system demand requirements. Instead of reducing the speed of the electric motor to match supply and demand, more than 70% of VT systems are controlled by means of mechanical throttling, using valves, vanes or dampers to increase or decrease the system output.

Theoretically, in VT motor loads the requirement for torque (Newtons/metre), and hence current (Amps) of the motor, increases with the square of the increase in speed (% of full speed in rpm). The voltage (Volts) of the motor varies in proportion to the speed (% of full speed in rpm). Hence, reducing the speed of the motor, reduces the consumed power (kiloWatts) by the cube of the speed change. This relationship is known as the Affinity Law, or the Cube Law. As an example, enabling the electronically controlled reduction of the speed of an electric motor with a VFD (variable frequency drive, or VSD, variable speed drive) in VT applications by 10% (to 90% of full speed) can in turn reduce the electricity consumed by the motor by more than 25%.

Variable speed drives introduce advantages in variable torque and constant torque applications.

Consider an analogy: mechanical throttling in a system is similar to an imagined hypothetical motor vehicle (system) without an accelerator pedal, where the only means of reducing or increasing the speed of the vehicle is by applying a mechanical brake and/or using a clutch (valve, damper or vane control). The engine (electric motor), once started, will accelerate the vehicle (VT load) to full speed (100%) determined and limited by the inherent power capacity (kiloWatts) of the engine. With the brakes and clutch as the only means to control the speed of the vehicle, if the speed of the vehicle (system demand) needed to be reduced by 20%, the engine (electric motor) would still consume the same amount of fuel (electricity) as at 100% speed. This is because the brakes and/or clutch achieve the 20% speed reduction essentially through introducing an opposing frictional force to the engine (or electric motor). This manifests in the form of heat (dumped flow or pressure), additional wear on

components and maintenance costs. This practice is simply inefficient and a complete waste of energy. It does not yield any fuel (electricity) savings. In contrast, adding an accelerator pedal (VSD) to be able to reduce the speed of the engine (the electric motor) will dramatically reduce fuel (electricity) consumption and reduce overall wear and maintenance costs.

Applying a variable speed drive to VT and CT motor loads has the potential to result in energy savings as well as productivity improvements. However, optimal energy savings are most achievable in VSDs applied to VT motor loads, and productivity improvements and reduction in maintenance costs are possible in both VT and CT loads. Either way, a VSD solution applied correctly has the potential to pay for itself in terms of capital cost and operational expenditure for its economic life through the reduction in electricity usage. Furthermore, VSDs also remove the need for mechanical throttling and the associated maintenance costs as well as reducing mechanical wear on the motor and other machinery in systems through their superior soft-starting capabilities. □

For more information visit: www.mv.em.co.za

MV variable speed drives

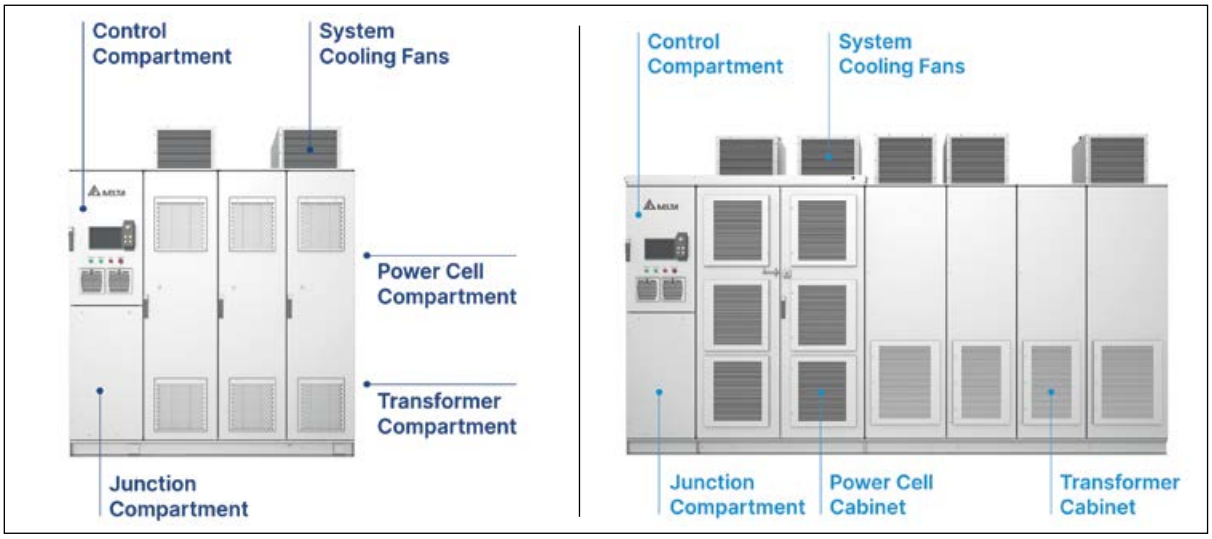
ElectroMechanica (EM) has been the exclusive distributor of the Delta Industrial Automation range of products in the SADC (Southern Africa Development Community) region since 2006. It supports the product portfolio through its stockholding, training, technical backup and System Integrator partners.

The newly launched Delta MV drives, the MVF23 and MVF20 series, are suitable for VT and CT electric motor loads in industry. The proven cascaded H-bridge topology and switching technology employed in the MV VSD solution enable near-sinusoidal output motor waveforms, reducing motor losses, vibrations, torque pulses and overheating. This capability ensures that the MV VSDs are widely suitable to be matched with new or existing induction, slip-ring or synchronous motors in retro-fit applications where direct-on-line systems are converted.

The MVF23 and MVF20 series consist of multiple low voltage modular power cells connected in series (cascaded) to achieve the required motor voltage output, integrated with an in-panel low harmonic phase-shifting transformer which can also be used as a step-down transformer to match supply and motor voltages where required. This high-efficiency phase-shifting transformer meets IEEE-519 compliance and ensures overall system efficiency >96.5% with the inherent power factor correction capability of the VSD also ensuring an input supply power factor >0.96 throughout the electric motor load range.

The MVF23/20 can be supplied as standalone solutions or to be integrated with an overarching PLC/SCADA system with any of the major CI protocols available (ProfiNet, Profibus DP, DeviceNet, ModBus RTU).

All MVF23 or MVF20 VSD solutions sold by ElectroMechanica are engineered to order in partnership with Delta Electronics application engineers, taking supply and application requirements into account. All solutions are individually tested to 100% load and capacity, and according to the relevant end-user standards, in Delta's MV factory and testing facility in Jiangsu, China. EM invites customers to attend Factory Acceptance Tests or facilitates attendance virtually. □



The MVF23 Series MV VSD is a compact all-in-one solution available in standard output configurations of 3.3 kV and 6.6 kV from 36 A to 215 A – or 160 kW to 2 000 kW with voltage step-down capabilities from 13.8 kV.

The MVF20 Series MV VSD is an in-line design solution available in standard output configurations of 11 kV, from 36 A to 350 A – or 560 kW to 5 500 kW with voltage step-down capabilities from 13.8 kV.

More efficient electric motors drive savings and sustainability

The efficiency of electric motors can play a key role in reducing users' running costs, reducing energy demand, and helping South Africa meet its climate change goals. However, without legislation in place to drive energy efficiency in industry, motor users need to better understand how much they can benefit from shifting to higher efficiency IE3, IE4 or IE5 electric motors.

Zest WEG Sales Manager for Electric Motors, Francois Labuschagne, says many countries have legally enforced the use of certain efficiency classes of motors in pursuit of global targets to slow the pace of climate change, but not South Africa. Labuschagne points out that as much as 40% of the power consumed on the national grid is to drive electric motors. This means any improvement in motor efficiency would significantly reduce the total electricity load, and help reduce carbon emissions from coal-fired power generation.

He makes the point too that, even without being legally required to do so, motor users have a strong commercial incentive to install high efficiency motors. "This is because a motor's purchase price typically makes up only about 2% of its lifecycle cost over 10 years. With another 3% of this cost consumed by maintenance, a full 95% of the cost of running a motor goes to the energy it uses."

This makes it clear that reducing the energy consumption is the best way of saving costs on operating motors. One of the challenges though, is that many companies incentivise their procurement departments to save money on upfront capital purchases – rather than on the longer term cost to company.

"When a buyer does not understand where motors' real costs are incurred – that is, in the energy consumption – they will continue to pursue false savings by choosing products with the lowest capital cost," Labuschagne says. "The small amount saved upfront is quickly lost through higher running costs."

As a global manufacturer of electric motors, WEG has advanced efficiency in its motors over decades – introducing innovations which position it well to meet current and future market trends. Supporting energy efficiency in South Africa, Zest WEG offers its IE4 super premium efficiency motors from 37 kW upwards at the same price as the IE3 premium efficiency units.

A typical HVAC fan application.

"We have recently taken another important step in our efficiency and sustainability journey, offering the market our new IE5 motor – and taking our motors into the ultra-premium energy efficiency class," he says. "These motors are well suited for fan applications and have great potential in the agricultural sector, for example, in environments such as chicken farms."

Using smaller fans in these applications can give users the opportunity to install multiple units where they previously had only one large fan. As temperature conditions change throughout the day, one or more of the fans can be switched off completely, further reducing energy consumption.

"We are excited about the new electronically commutated motor, which is supplied with an integrated variable speed drive (VSD) and can be locally or remotely controlled," Labuschagne adds.

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

More efficiency in warehouse automation

With e-commerce booming, so too is warehouse automation. Flexible warehouse systems are also in demand in large grocery chain warehouses and require environmentally friendly, sustainable and intelligent drive concepts. Drive specialist NORD DRIVESYSTEMS is familiar with the industry's requirements and offers a range of suitable drive solutions, customised for warehouse logistics and an optimum balance between investment, operating and maintenance costs. With motor efficiency class IE4 and system efficiency class IES2, the drive units achieve high efficiencies – especially in the partial load and speed range. The latest generation IE5 permanent magnet synchronous motors achieve even higher energy efficiency and significantly reduce energy consumption. The constant torque over a wide speed range allows for a targeted version reduction. This minimises administrative expenses, and enables leaner manufacturing, logistics, storage and service processes.

[Image: NORD DRIVESYSTEMS]

The NORD range of products presents a modular, scalable system for warehousing applications.

For more information visit: www.nord.com

MEDIUM VOLTAGE DRIVES

HIGH PERFORMANCE RELIABLE DRIVES

MVF23 SERIES | MVF20 SERIES

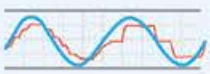
Optimal Reliability

- System efficiency > 98.5% (excluding phase-shifting transformer)
- Near unity powerfactor (input) throughout the motor speed range

High Efficiency

- System efficiency is higher than 98.5% (excluding phase-shifting transformer), saving energy and reducing carbon emission.

Scan the QR or visit **mv.em.co.za** to develop a customised MV VSD solution



Lower Harmonics

- Multi-pulse phase-shifting rectification technology reduces grid current, harmonic content effectively and meets IEEE 519-1992
- Multilevel voltage output and starting current control reduces impact on the motor.

Small Footprint

- The compact structure can reduce the requirements for site space

ElectroMechanica

DELTA

Adrian van Wyk, Managing Director, Referro Systems.

Variable speed drives for mine retrofit

As part of the upgrade of electrical technology at a major iron ore mine in the Northern Cape, Referro Systems has been awarded a multi-million rand order. The mine has chosen to work with Referro Systems for the supply of variable speed drives (VSDs) for various applications in its operations, including pump, conveyor and multi-motor load sharing applications of up to four motors controlling various plant-critical overland conveyors. The order is part of a 50/50 change-out of aging technology where the more crucial systems are being upgraded, with plans for the balance to be replaced over the longer term.

As industrial automation technology continues to advance, mines and other industries that make use of it and have come to rely on such technologies have to keep up with newer developments to gain improved capabilities.

Adrian van Wyk, Managing Director of Referro Systems, says, "Through upgrade, retrofit, or re-engineering, today's leading industrial enterprises are those that are equipped with the most efficient and reliable technologically advanced solutions. As distributors for many of the best electrical, automation and global software and hardware brands, we can ensure that the change-out at the mine is completed with the most suitable products for each application, with quality and value for money at the fore."

The upgrade has become a necessity for the mine as many of the current drives have become obsolete. In other cases, the scarcity of parts means repairs and maintenance become prohibitively expensive and no longer beneficial to the mine's bottom line. "Supply chain disruption due to the pandemic has also caused havoc with the availability of some components which are crucial to mining applications," van Wyk adds.

From pumps to fans, conveyors and more, VSDs are key components in many of the mine's operations. "In the mining environment, speed, synchronisation and torque are crucial. Heavy loads, long run-times and the high-power nature of mining mean drives must deliver high performance and be of the best possible quality. The drives also need to be hardy, considering the environments the equipment is required to operate in, which typically present the dust, moisture and vibration inherent on mines," van Wyk says.

Referro will equip the mine with compact, efficient, high-performance Allen-Bradley PowerFlex 750 Series VSDs by Rockwell Automation, replacing the obsolete 700S and 700H series. Van Wyk notes, "Allen-Bradley PowerFlex 750 Series is packed with the latest feature-rich capabilities and functionality which benefit the client with high performance and reliability, reducing downtime, and providing improved diagnostic capabilities and data analysis, lower operating costs and lower input costs."

Beyond supplying the new equipment, Referro will be on hand to offer the mine additional support, training and maintenance over the lifetime of the products.

"We are proud to maintain this installed base of products supplied by Referro to one of the largest iron ore mines in the Northern Cape. We have been working with our client since 2000, offering products, engineering services and support – and we look forward to continuing this relationship as the mine moves forward with modernisation," says van Wyk.

For more information contact Referro Systems.
Tel: +27 (0)12 349 1297
Email: info@referro.co.za, visit: https://referro.co.za

Gear units, motors and drives for wastewater treatment

Wastewater treatment plants (WWTPs) in the Western Cape are being upgraded as part of a broader global initiative to fight pollution in the world's oceans. The 26 plants involved were built in the 1950s and '60s and are clearly in need of modernisation. The plants are all to be expanded and rehabilitated as part of a €2.0 billion investment in the province's water infrastructure.

SEW-EURODRIVE is supplying industrial gear units (IGUs), motors and drives to a number of OEMs involved the programme as well as directly to one of the largest plants. This plant currently treating 72 Ml/day, is undergoing a R1.7 billion upgrade and the upgraded plant will include additional capacity to treat a further 18 Ml/day.

Sales Manager at SEW-EURODRIVE, Willem Strydom says, "At this plant, a mostly new, modern waterworks is being constructed – critically to prevent recurring overflows of untreated sewage into the sea, and to deliver more energy-efficient and reliable performance."

According to Strydom, SEW-EURODRIVE's product portfolio of industrial gear units has been widely specified for use by several of the contractors on the project, "but our direct role is for the supply of 20 units for each of the new aeration tanks on the plant."

Aeration, he explains, is the fourth stage of the treatment process. "The first stage involves bar screening, which removes large pieces of debris and solid objects. A further screening stage then removes finer solids, before the water is passed into primary clarifiers, which remove inorganic solids floating on top of the water and those that settle to the bottom of the tank.

"The wastewater, which then contains mostly fine organic matter, is subsequently passed through a bank of aeration tanks, where oxygen and activated sludge combine to 'consume' the organic contaminants in the water, converting them into carbon dioxide and water."

Once the water has passed through a series of aerators, it looks as clear as drinking water, but it still contains fine suspended solids, so it is passed into a secondary clarifier. Coagulants are added to bind

Continued on page 17

the particles, which then settle, leaving relatively pure water at the top of the tank. "From there, the water goes through stage six for chlorination and disinfection and, after testing and analysis, it can be safely discharged or recycled," Strydom adds.

MC Series drives

"For the aeration drives for this WWTP upgrade, we were approached by one of the local treatment plant OEMs in 2018. Through this OEM, we are supplying 20 units. Although these are not complete turnkey solutions, we are assembling them as pre-engineered drives with the gearboxes, motors and couplings mounted onto custom-designed baseplates. Once they are on-site, it is then easy to couple each drive to the aeration impeller," Strydom says.

Central to the 20 aeration units is SEW-EURODRIVE's MC Series range of parallel shaft industrial gear units, which have been specifically designed for aeration and mixing applications. Of the 20 units, ten are 75 kW units, four are 55 kW and the remaining six are 90 kW drives.

"A key feature of the MC units is their extended bearing distance (EBD), which is purpose designed for shaft loading from agitating, mixing and aerating applications. Such applications transfer high axial and radial loads back into the gearbox. EBD helps to stiffen the shaft to resist these loads, significantly reducing the radial movements imposed on the seals, bearings and gears. This results in better reliability, less wear and longer life," Strydom says.

Other key features include:

- An especially compact parallel shaft design
- A one-piece robust mono block, which enables horizontal, vertical and upright assembly
- An optional 'Drywell' seal, which reliably prevents oil leakage from the output shaft
- Easy customisation with the range's modular concept to achieve optimal gear ratios
- Additional optional equipment such as motor adapters, belt drives and backstops.

"Following the water shortage in the Western Cape in 2018, when cities in the region were just 90 days away from turning off the taps, municipalities in all provinces are looking to modernise wastewater treatment infrastructure. We are currently involved in several new opportunities," Strydom adds.

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

SEW EURODRIVE is supplying equipment for the upgrade of wastewater treatment plants in the Western Cape.

Dr Andreas Meyer, Endress+Hauser.

Colour measurements: from lab to process

Colour measurements are used for quality control and safety in a number of process industries, such as life sciences, food and beverages, chemicals and petrochemicals. In many cases, samples are taken from production to the lab where they are analysed and quality checked for the batch release. Shifting this step directly to the process enables real-time monitoring and control, across the entire production process. It calls for compact, robust and process-suitable instruments.

Dr Andreas Meyer, Business Development Manager, Endress+Hauser Liquid Analysis, points out that that colour identification is an important quality control and assurance parameter in almost every industry. For consumers, consistent colour is a sign of the expected product quality and for product recognition. When colours deviate from this expectation, the assumption is that the product has changed – usually for the worse.

Fluctuating base product quality

There is a growing trend towards production of day-to-day products based on natural ingredients and substances. This is especially true for the food industry. These ingredients are often affected by the natural influences of the weather, particularly sun and rain, which affect the quality and colour of the end product. In order to satisfy consumers' expectations, the colour needs to be adjusted during production. If a variety of products is involved, such as in the beverage industry, many different colours come together quickly, and have to be monitored and (re) produced to achieve the end colour.

Increased safety in production

If a lot of different products are manufactured in a factory, colour control is not the only important aspect. Safety in filling of the product is also critically important. The right product must go into the right bottle. Incorrect filling can sometimes have severe consequences. Liquid cleaners, for example, can only be used in the area for which they are intended and permitted. Improper product filling can quickly become a health hazard.

The Memosens Wave CKI50 and Liquiline CM44P transmitter enable robust inline colour measurements, combined with other relevant parameters for respective applications.

One of the defining criteria here can be the colour. However, if different products have the same colour, in beverages for instance, such as regular and non-alcoholic beer, colour determination alone is not adequate. Additional parameters, such as conductivity, have to be measured. Colour control also plays a role in product changes or cleaning. Colour measurements can be used to detect whether the line contains residue from a previous product or a pure new product.

Memosens Wave CKI50 process spectrometer

The CKI50 process spectrometer from the Memosens Wave family detects colours by using VIS spectroscopy. It scans the 380 nm to 830 nm wavelength range of the electromagnetic spectrum and outputs the colour in the form of CIE L*a*b* values. CIE L*a*b* is a three-dimensional colour-space model in which every colour location is defined by the coordinates L*, a* and b*. A norm governs the determination of the distance between two colours. When a colour value is input, the distance to the target value is determined in the process control system after every measurement. Assuming the value is close to the defined location, then everything is alright. If not, countermeasures need to be implemented. The Memosens Wave CK150 can determine colours, colour variations or the accuracy of the expected colours. The mathematical analysis models required to analyse the spectroscopic results are stored in the instrument.

The compact, robust spectrometer combines probes and spectrometers in a single device. Optimal adaptation to various process conditions and simple and robust process integration provide for inline measurements in different industrial conditions. The CK150 uses the Memosens protocol to connect to the Liquiline transmitter, and the CIE L*a*b* values are forwarded to the process control system.

Expanded process control

The Memosens Wave CKI50 is based on the Memosens technology, introduced by Endress+Hauser in 2004 and continually enhanced since then. This digital technology, which has become an industry standard, forms the basis for the flexible integration and combination of different sensors into process control technology. Memosens allows users to select sensors, such as for conductivity, that are tailored to the needs of the individual application. As the Liquiline transmitter automatically detects and supports the connected sensor types, the required measurement system can be assembled on this platform with a modular approach. □

For more information visit: www.endress.com

Top quality drinking water through ozone treatment

Drinking water is the most important food of all. And its preparation entails complex processes. To oxidise and disinfect drinking water, ozone is often mixed in during the course of treatment. Because of its high reactivity, ozone must be produced, transported and added to the water on-site, under strict safety regulations. In such applications, Vega's pressure transducers make an important contribution to the continuous processing of top quality drinking water.

Christian Langensiepen, Product Management, VEGA Grieshaber KG refers to the water supply system in Baden-Württemberg, one of the largest and most far-reaching water supplies in Germany. It supplies 250 cities and municipalities with about 90 million cubic metres of drinking water each year. Top quality and a high level of security of supply are priorities in the management of the regional water supply system.

At the beginning of the 20th century, the population in the central Neckar region was already growing rapidly as industrialisation progressed. The far-sighted plan at the time was to bring drinking water from the Danube valley at the city of Ulm, via the Remstal, to Stuttgart. This laid the foundation for the regional water supply system.

Plants for the conversion of river water to drinking water include a raw water pump, which draws the water directly from the river, a pressure pipe from the pumping station to the waterworks, and the treatment facilities in the waterworks. At peak times, up to 2 300 litres of river water per second can be converted into drinking water. The injection of highly active oxygen (ozone) for oxidation and disinfection during drinking water treatment represents state-of-the-art technology.

Ozone oxidises dissolved and particulate organic matter and kills or inactivates existing microorganisms. Ozone is always formed when some form of energy decomposes molecular oxygen (O_2) into individual oxygen atoms (O), which then react with molecular oxygen (O_2) to form ozone (O_3). This can occur through UV radiation, lightning strikes and via high voltage electrical discharges.

The production process takes place in pressurised reactors, where electrical energy is applied to convert oxygen into ozone. The resulting gas mixture flows into an ozone collecting pipe. The maximum ozone concentration is about 180 g/Nm^3 at an operating pressure of 1.3 bar.

In pressurised reactors, electrical energy is applied to convert oxygen into ozone which is used in the production of safe drinking water.

Injectors feed the ozone into the water, and mixers distribute the tiny ozone bubbles evenly through the water volume. The water remains for a few minutes in large containers during which time oxidation and disinfection take place.

To ensure that pressure measurement in the ozone collection pipe and at other important measuring points is absolutely safe and reliable, the engineering department decided to use Vegabar 82, the pressure transmitter with a ceramic CERTEC® measuring cell and a 'second line of defence'. This is an additional process separation by means of a gas-tight feedthrough above the process connection. Although the measuring cell is permanently resistant to ozone, the second line of defence provides an extra layer of protection against leakage of ozone from the pipeline through the pressure transmitter.

In this way Vegabar 82 plays an important role in safe ozone generation as well as in the continuous production of top quality drinking water.

For more information contact VEGA Controls SA.
Tel: +27 (0)11 795 3249
Email: info.za@vega.com, visit: www.vega.com/en-za

Air gap sensor ensures accurate position monitoring

The SDP air gap sensor from ifm measures air gaps with high repeat accuracy in the micrometre range. It detects the distance between the surface and object and outputs it as an absolute value. The sensor reliably detects even a flat position on the surface, the so-called 'zero gap'. Since the gap is calculated on the basis of pressure and flow, the measurement remains consistently accurate at all times within the usual operating pressure range between 1 and 3 bars, irrespective of pressure fluctuations, or the number and diameter of the nozzles. It presents gap value, flow and pressure information at a glance.

The robust self-cleaning measuring channel also withstands purge air pressure. This eliminates the need to switch between flushing and measuring and has the further advantage of ensuring that the measuring element is cleaned and malfunctions due to contamination are prevented.

The SDP air gap sensor ensures consistently accurate position monitoring, based on pressure and flow.

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

New developments in multiphase level detection

Magnetrol-AMETEK recently launched the Genesis™ Multiphase Level Detector introducing new developments in detection, measurement and control.

Multiphase level measurements are used across all process industries. They are especially significant in the oil & gas and petrochemical sectors due to the value derived from effectively separating water and hydrocarbon.

Although level instrumentation has come a long way in measuring diverse liquids, multiphase level measurement remains a towering challenge and presents a considerable opportunity.

The new Genesis™ Multiphase Level Detector incorporates several significant engineering accomplishments and provides profiler performance at a competitive cost without the regulatory burdens and HSE concerns that typically come into play.

It is designed to measure multiple phases in applications with thick and dynamic emulsion layers: vapour phase, total level (for example, hydrocarbon liquid), top of emulsion layer, bottom of emulsion layer (for example, water level), sediment.

Key features of the new level detector include:

- 24 V dc input with four (4) 4-20 mA outputs (including HART) for convenient control of total level, top of emulsion, water level, and sediment
- Concurrent top-down and bottom-up signal generation
- Proprietary, innovative software algorithms to interpret signals
- Changing media characteristics have no effect on level measurement
- No need to calibrate or move levels in the vessel
- Four-button keypad and graphic LCD display allow for viewing of configuration parameters and performance curves
- Proactive diagnostics to schedule maintenance and mitigate unplanned shutdowns
- And more.

Measuring dynamic conditions in difficult processes, such as de-salters and separators, can be done with Magnetrol's Genesis™ Multiphase Level Detector.

For more information visit: www.magnetrol.com

Compact infrared camera for the metals industry

The Optris PI 1M IR camera provides for fast temperature measurement.

The Optris PI 1M IR camera, available from Instrotech, is especially suited to measuring the temperature of metals, as these exhibit a distinctly higher emissivity at the short measurement wavelength of 1µm than at measurements in the previously conventional wavelength range of 8 to 14 µm.

The new infrared camera provides temperature measurement in an IR picture or IR video, which presents a lot of information, quickly captured in just one millisecond.

The imaging sensors allow for a large dynamic range in temperature measurement, so there is no need for the relatively many and narrowly defined sub-ranges previously required. With its two-dimensional temperature recording, the Optris PI 1M pyrometer enables intelligent temperature measurement.

It offers a temperature measurement range from 450 to 1 800°C and thus meets most demands in the fields of metal production and processing.

The Optris PI 1M IR camera features: highly flexible CMOS detector with an optical resolution of up to 764 x 480 pixels, large temperature measurement range (without sub-ranges) of 450°C to 1 800°C, frame rates of up to 1 kHz for fast processes, real-time output of middle pixel at a set-up time of 1 ms, includes licence-free analysis software and full SDK.

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

Fast pressure control in industrial applications

WIKA's high-speed pressure controller can perform three-point pressure calibration in less than 10 seconds.

WIKA's model CPC3050 high-speed pressure controller is the newest device in Mensor's line-up of precision pressure controllers and can perform end-of-line three-point verification in just ten seconds.

With an innovative regulator, the CPC3050 is designed for fast pressure control in industrial environments. It can perform 25% pressure increments in under four seconds with a 0.020% FS accuracy.

The CPC3050 maximises throughput in industries such as oil and gas and automotive manufacturing – and can be used wherever speed and accuracy are needed, for example: in aerospace, aviation, pharmaceutical and power generation industries. It is available in high-pressure and low-pressure versions with customisable ranges, a 10:1 range limit ratio, and auto-ranging, so it can fit into most factories for end-of-line testing and sensor verification.

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

Diaphragm valves for water level control

Standard pilot-operated globe control valves are often specified for level control. But, they are not suitable in some installations:

- In low pressure installations (below 1.5 bar dynamic pressure)
- When dirt particles in the water might clog small openings
- Where they might be subject to vandalism.

Peter Telle of Ultra Control Valves says in such cases, diaphragm valves offer several advantages.

- They have a wide range of operating pressures: 0.5 bar to 6 bar inlet pressure is typical. The inclusion of a ratio-reducing valve upstream allows for higher inlet pressure if needed.
- They are available in sizes from 100 mm to 1 600 mm
- They can be installed inside the reservoir, below water level, which reduces the risk of vandalism
- They can be fabricated to suit reservoir piping configurations; this reduces costs when retro-fitting to existing pipework
- They are installed and commissioned by the factory team.

The required level is set at the sensing element. This can be adjusted. When water enters the sensing element, the head of water charges the diaphragm. This causes the valve to close.

Diaphragm valves can face up or down. This makes them very versatile. Other uses include:

- Canal flow regulation for raw water in irrigation schemes
- Discharges into holding or balancing dams in irrigation schemes: the diaphragm valve controls the inflow as well as closing when the dam is full
- Flow control into raw water and wastewater treatment works
- Top and bottom inlets for reservoirs
- Bottom outlets from dams (the diaphragm valve has good energy dissipation characteristics)
- Actuation and control for automatic spillway scour and canal gates.

Diaphragm valves need no maintenance, which makes them especially suitable for remote sites and the sometimes harsh African conditions.

Flow can be controlled automatically, as described above, but diaphragm valves can also be fitted with a small electric actuator and connected by telemetry to allow for remote adjustment.

For more information contact Ultra Control Valves.
Email: peter@ultravalves.co.za
Visit: https://www.ultravalves.co.za

Identifying safe electrical equipment for use in Ex areas

Eldon Kruger, Marketing Director, Pratley.

Pratley is a long-established manufacturer of electrical apparatus for use in hazardous and non-hazardous industrial applications, which it supplies locally and internationally. The company has developed extensive expertise in the demands placed on electrical termination equipment used in hazardous areas. It shares its expertise with the industry through regular seminars, and through its ongoing product developments. Leigh Darroll spoke to Marketing Director Eldon Kruger, about the seminars and the critical factors to be considered in specifying electrical equipment for Ex areas.

Kruger is a recognised authority in the field and is the current President of the SA Flameproof Association (SAFA). He facilitates the seminars, which are available free of charge and are hosted at the Training Centre at Pratley's head office in Krugersdorp. The seminars are presented primarily for plant managers, engineers and operators wanting to learn more about the requirements for equipment in their operations, or to refresh their knowledge on safety standards applicable to hazardous areas. They are also helpful for electricians in training and wanting to become master installation electricians. Kruger notes that many plant operators are unsure of how their plants are classified in terms of the Ex classifications, and consequently are uncertain of the safety ratings that should apply for the electrical equipment in use or to be replaced in the plant. It is a complex field but critical to the safety of plant and people in many industry sectors.

According to the South African National Standards (SANS) and the International Electrotechnical Commission (IEC), a hazardous area is where there is a risk of explosion, due to the presence of flammable dusts or explosive gases or vapours. To ensure the health and safety of employees working in such hazardous areas, it is critical that all electrical equipment used does not pose a risk of ignition in operation or in the event of any failure.

Kruger notes, for example, sawmills as hazardous areas where dust creates a risk of explosion. The same is the case in grain silos, in sugar refineries and in powdered milk processing plants, among others. Dust is also a particular hazard in coal mines. Explosive gases or vapours are mostly prevalent in petrochemical plants and, for example, in LPG facilities or other gas handling plants.

He cites a few examples, all in countries other than South Africa, of incidents that have caused fatalities and destroyed plants. Kruger says South Africa is fortunately very well regulated and there have not, as yet, been any

Pratley's electrical laboratory is one of the most advanced on the continent.

fatal incidents here resulting from the use of incorrect electrical equipment in Ex areas. He also emphasises that we cannot become complacent and that it's important to understand how incidents happen: for instance, once ignited, gas burns very quickly; dust explosions typically occur in a unique mix of dust of a particular product, where particles rubbing together create a static electrical spark. He adds that many people underestimate the force – and impact – of a dust explosion.

Understanding the classification of Ex areas

The seminars cover how to identify hazardous areas (Ex areas) and what to look for in specifying electrical equipment for these areas.

- Hazardous areas are defined by three main criteria:
- The type of hazard
- The likelihood of the hazard being present in flammable concentrations
- The (auto) ignition temperature of the hazardous material.

Different zones are classified according to the potential source of ignition, and the likelihood of the hazard being present in flammable concentrations. Zones 0, 1 and 2 refer to the presence of explosive gases or vapours, and Zones 20, 21 and 22 refer to zones where there is a presence of explosive dusts.

Zone 0 denotes a constant hazard; Zone 1 an ongoing risk of an explosion occurring during the course of normal operations; and Zone 2, a risk arising only in the event of abnormal operational situations occurring. The same applies with respect to dust Zones 20, 21 and 22.

T-ratings

T-ratings present a further qualifying classification relating to the auto-ignition temperature of the hazardous material. T-ratings indicate the Temperature Class of a hazardous area and electrical apparatus to be used in the area. A junction box, for example, needs to be of a design and material that will ensure it does not heat up to the extent that it presents an ignition risk. Temperature ratings range from T1 (< 450°C) to T6 (< 85°C), where T6 is stipulated for use in the most dangerous areas, for example, in zones coded Gas Group IIC gas - Carbon Disulphide, which has an auto-ignition temperature of 90°C.

In specifying electrical equipment with respect to temperature ratings, consideration needs to be given to the heat generated by the electrical equipment itself during normal operation, as well as the ambient temperature. Will the equipment be placed close to a furnace, for example? This would affect the heat dissipation properties of the equipment, and therefore the T-rating to be specified.

In addition, safety-critical electrical termination equipment like flameproof – Ex d – junction boxes, which Pratley manufactures, must be designed to contain the pressure of an explosion should there be one. The junction box must incorporate a specific flame path, and all the cable gland entries serve as flame paths as well. Kruger points out that Ex d flameproof junction boxes need to be able to withstand a pressure up to 30 bar or higher – to be able to contain the force of an explosion. When we consider that the pressure in car tyres would typically be around 2 to 2.5 bar, we get a better sense of how high the pressure rating of junction boxes is – and of the risk that has to be contained.

There are then further qualifying codes for electrical apparatus which indicate different protection concepts or methods of protection. Ex i, for example, indicates intrinsic safety; Ex d indicates flameproof equipment; Ex e indicates increased safety. SANS 10108 sets out the definitions for electrical apparatus for use in hazardous areas.

The Ex en Envirobox from Pratley.

A Pratley Ex d flameproof cast iron junction box.

Marking of electrical equipment

Kruger emphasises that the marking of electrical equipment for hazardous areas is fundamental to identifying what can be used where. All Ex equipment has to be marked to provide the particular information that supports its safe use. ATEX, SANS, and IEC classifications, codes and markings all vary slightly and equipment needs to be marked in respect of the standards that apply in geographies where it will be used.

Unless the plant operator knows what he or she is looking for, equipment markings can raise a lot of confusion. In the seminars, Kruger presents some examples to explain the coding.

Ex db II B T4 Gb Ta = 53°C
IP 68
S-XYZ/03796 (X) (U)
Max Dissipated Power = 3.65 W
In this example,

- Ex – indicates that the product is Explosion Protected
- Further protection is denoted by the db protection concept, which indicates that the product is flameproof and suitable for use in Zone 1.
- And so on, with each element conveying a specific meaning.

It is easy to see how confusion arises – and essential that plant operators should understand the markings on electrical apparatus.

Kruger adds that the IEC, about two years ago, introduced another measure of safety which applies to mechanical equipment. Although this further measure of safety is

The Pratley head office in Krugersdorp, west of Johannesburg.

not yet in use in SA, the SABS is looking at adopting applicable international standards for mechanical equipment to be introduced in due course.

Inspection authorities and test certificates

There are a number of different inspection authorities and test houses that deal with Ex equipment in South Africa, and are authorised to issue IA certificates confirming the use of Ex equipment. Each certificate carries a unique number and will include particular prefixes and suffixes denoting specific qualifying factors.

In the marking example on the previous page,
S-XYZ/03796 (X) (U) – is the IA Certificate Number.

It indicates that:
This product was tested by the XYZ Test Laboratory for surface use.
(X) – means there is a special condition that needs to be complied with
(U) – means the junction box is a component or is incomplete and needs to be fitted with other specific complementary components.

Maintenance of Ex equipment

The code of practice for Ex equipment inspection processes stipulates that inspections should be conducted within a period not exceeding two years, or as otherwise indicated by the risk assessment applicable to any given installation.

Inspections range through different levels.

- Visual inspections are conducted to confirm that the correct equipment is being used in the correct zone, with the correct markings – applicable to that zone.
- Close inspections are conducted to take a closer, hands-on look at equipment, checking connections and ensuring that it is in good working order.
- Detailed inspections entail taking the equipment apart to inspect it thoroughly and decide on repair or replacement, as may be needed.

Maintenance inspections are for the most part done in-house. However, Kruger says certification testing should be carried out on all new equipment, or replacement equipment, or where changes are made or equipment is repaired. □

Hazardous Locations seminars

In summary, the seminars presented by Pratley offer plant engineers, operators and others the knowledge to:

- Identify Ex areas
- Identify Ex equipment
- Choose the right equipment
- Understand the hazards to be aware of
- Conduct due maintenance and inspection.

With a better understanding of hazardous locations, they can avoid using the wrong equipment in the wrong zones, or in many instances, over-specifying – to cover all possibilities in terms of the range of legislation and regulations that relate to safety in the workplace.

The seminars cover the theoretical knowledge base in the morning and delegates have the chance to visit the Pratley test laboratories in the afternoon. Pratley manufactures and tests all its products and components in-house. The main test laboratory is one of the most advanced laboratories on the continent and is rated highly by industry. In the separate polymer test lab, all materials used in the manufacture of Pratley products (advanced rubbers used in flameproof seals, for example) are tested.

Additionally, a practical session in the afternoon offers delegates the chance to fit an Ex cable gland. This gives plant engineers and operators a hands-on understanding of what is involved, how a cable gland functions, and what to look out for to ensure a correct fit. They then have a better idea of what they may be asking technicians to do on-site.

Kruger says, from Pratley's perspective, it is important to share this knowledge with industry broadly – and particularly to pass it on to younger players or others new to the field. Pratley has delivered seminars for many organisations, including Sasol, Natref, various mines and for the SA Navy.

Regulations and standards applicable to Ex areas include:

SANS 10108: The classification of hazardous locations and the selection of equipment for use in such locations
ARP 0108: recommended practice – Regulatory requirements for explosion-protected equipment
SANS 60079-0: Explosive Atmospheres. Part 0 – Equipment General Requirements
SANS 60079-1: Electrical Apparatus for Explosive Gas Atmospheres Part 1 – Flameproof Enclosures "d"
SANS 60079-7: Electrical Apparatus for Explosive Gas Atmospheres Part 7: Increased safety "e"
SANS 60079-10: Electrical Apparatus for Explosive Gas Atmospheres Part 10 – Classification of Hazardous Areas
And more.

As well as being the current President of SAFA, Kruger sits on a number of Technical Committees of the SABS – TC 065, which deals with specifications for Ex equipment in SA, specifically the SANS 60079 suite of standards; and TC 066, which deals with cables, and covers cable glands for non-hazardous areas.

For more information visit: www.pratleyelectrical.com

Tackling alarm obsolescence in hazardous facilities

Obsolescence management in critical alarm systems continues to be a problem for many businesses, especially those in the petrochemical, oil and gas sectors, which, under best practice guidelines such as the EEMUA 191 standard, are required to use annunciator systems. This is made more difficult by the fact that, in many cases, facilities are still equipped with alarm annunciator systems that are no longer supported because the manufacturers went out of business decades ago.

Here, Gary Bradshaw, Director of remote monitoring and critical alarm specialist Omniflex, explores the problem of alarm obsolescence and suggests that upgrading to new SIL- (safety integrity level) rated systems might be easier than many plant managers expect.

Globally, petrochemical, oil and gas facilities follow the best practice for critical safety, health and environmental (SHE) alarms outlined by EEMUA (Engineering Equipment and Materials Users Association) 191. This standard was developed in 1999 with input from the British Health and Safety Executive (HSE) to provide comprehensive guidance on designing, managing and procuring effective alarm systems. The international standards for the management of alarm systems for the process industries, ISA 18.2 from the International Society of Automation and IEC 62682:2015, are aligned with EEMUA 191.

One of the key conclusions of the EEMUA 191 guidance is that critical alarms should be easy to understand, promoting quick and effective operator responses. This is where the traditional hardwired alarm annunciators play a role.

Alarm annunciators are panel-based alarms that are hardwired directly into relevant safety-critical processes, where each window relates to a fixed alarm point from the sensor. If an abnormal event is detected, the relevant window on the panel lights up and the alarm emits a sound, immediately giving operators the necessary information to act. However, when conducting site visits, it is common to see alarm annunciators still in use that were first installed in the 1980s and 1990s. For example, Highland, Rochester, Robinson, Bristol Babcock, Clifford & Snell, Sentry and Londex systems all are no longer manufactured or supported. As a result, many sites have to contend with obsolescence issues.

Upgrading obsolete alarms

On sites that have not updated the original alarm systems that were installed decades ago, physical alarm annunciators need to be updated in line with current regulations and safety guidance, and all the critical SHE alarms that operators must respond to should be displayed.

There are three key considerations that plant managers need to address when they look at updating alarm annunciators. Firstly, they need to determine which alarms are classified as SHE safety alarms and ensure that these are directly hardwired into the processes. This is essential because networked alarms can be susceptible to network or power outages, so, if the network goes down, the plant will lose all the alarms on that network. If alarms are individually hardwired and one wire is lost, the plant loses only one alarm, and if this alarm is detected from a normally closed/open to alarm contact, a wire break would still be seen as an alarm on the annunciator window.

Best practice guidelines for critical safety call for alarms that are easy to understand and promote quick and effective operator responses.

Secondly it is important to have each of the alarm windows on the annunciator panel permanently dedicated to a specific process, providing pattern recognition and familiarity for the operator, and, in turn, improving responsiveness. Operator response times are critical, which makes it important that alarm displays should maximise the operator's ability to respond quickly to abnormal events.

Finally, having all the alarms suitably prioritised using an easy-to-understand system, such as colour coding each window to match the priority of the alarm it represents, is another important step. This means that, in situations where multiple alarms alert, operators can quickly identify their priority, further improving the chances of responding effectively.

The upgrading of out-of-date alarm systems need not be costly or disruptive. Modern industrial alarm specialists can engineer upgrade solutions off-site and design them specifically to fit existing space, reducing installation time and any associated downtime.

In industries like petrochemicals, oil and gas, where ongoing operational safety is one of the primary day-to-day concerns, plant managers should reassess the suitability of their alarm systems and how they conform to EEMUA 191 and SIL standards. For those needing assistance, Omniflex offers a consultancy service free of charge, where one of its specialist engineers will visit the site to perform a survey and evaluate the existing obsolete and legacy alarm systems before discussing the most suitable replacement options with the plant manager. □

For more information visit: www.omniflex.com

Health and safety in the workplace

For organisations looking to gain a clearer understanding of their responsibilities and liabilities in terms of employees' health and safety, Louise Woodburn, General Manager, and Natalie Pitout, Innovation Manager at KBC Health & Safety, outline the benefits of working with a health and safety training provider. A division of Workforce Holdings, KBC provides health and safety training across a number of industrial sectors.

From left: Louise Woodburn and Natalie Pitout, KBC Health & Safety.

With regard to occupational health and safety practices, South African companies tend to fall at one or the other end of the spectrum – those that take it very seriously and comply fully with legislation, and those with no protocols or regulations in place and no understanding of their liabilities in terms of non-compliance with the Occupational Health and Safety (OHS) Act.

There are currently more than 200 pieces of subordinate legislation that support the OHS Act, which regulates health and safety in all organisations, from office environments to more hazardous areas like industrial plants and construction sites.

Workplace safety is mainly the responsibility of the employer, who must ensure the health, safety and welfare of their staff. Some worksites come with greater risks than others, but even the safest workplaces need all staff to help manage risks. Non-compliant organisations expose themselves to three key risks.

Financial, legal and personnel risks

Firstly, they face potential financial implications resulting from insurance claims for injuries sustained at work, as well as from non-compliance-related penalties. The amended OHS Bill, expected to come into effect within the next 18 months, will provide for spot fines of R50 000 being issued for non-compliance. This can have a significant financial impact on companies.

Secondly, organisations have a legal obligation to comply with health and safety regulations. Liability rests with the business owner. Ignorance of the law is not an accepted defence in court, so it is up to the company to ensure it has the right information and can demonstrate its compliance with legislation.

Thirdly, employers have a moral obligation to protect the wellbeing of their workers, making sure the workplace is safe, and that employees' health and safety are not put at risk. Companies need to identify and mitigate hazards on a continual basis in order to reduce risk, accidents and injuries.

Employees' responsibility

At the same time, employees must take reasonable care for their own health and safety, as well as for the health and safety of others. They need to comply with any reasonable instructions, policies and procedures given by the employer, business or controller of the workplace.

This highlights the importance of training, including refresher courses, for employees, to instil and reinforce awareness about workplace hazards, how to control them and how to work safely. Some companies view training as a once-off, tick-box exercise, but this carries the risk of complacency setting in and does not keep pace with continually changing risks in a workplace.

Ensuring that health and safety training is an ongoing programme will assist with creating constant awareness, teaching employees to be constantly aware and vigilant and to identify hazards and assess risks on a daily basis.

Because South Africa's OHS Act is underpinned by so many different and non-specific pieces of legislation, many companies do not have the understanding of which laws they are required to comply with. It is also quite common for organisations to misunderstand risk assessment: this is often done superficially and does not identify all existing risks. In turn this affects the quality of policies, procedures and training that are put in place.

Outsourced services

This is where the services of an outsourced provider can make a difference. A reputable and accredited company can deliver training, assist with risk solutions, provide gap analysis and make recommendations to establish a holistic check system that ensures health and safety compliance.

A reputable provider that understands the legislative framework of the OHS Act can help organisations to highlight the key risks within their business and manage their liability. While many companies do not understand the impact of the law, professional training providers can work with them to guide them on their journey to compliance.

Even organisations that have a well-established health and safety strategy in place should consider partnering with a training provider that can continually improve policies and procedures, as well as delivering customised programmes to ensure a holistic programme. □

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

Proximity detection systems in surface mining

Risk assessments and the use of appropriate PDS and CPS systems are fundamental to operating trackless mining machines safely.

Risk assessments by surface mines are fundamental to operating trackless mining machines (TMMs) safely, and are a requirement of the Mine Health and Safety Act.

"It is significant that we see mines continuously conducting risk assessments on their mobile vehicles and traffic management systems," says Anton Lourens, CEO of Booyco Electronics, South Africa's leading developer of proximity detection systems (PDS) and collision prevention systems (CPS). "Such risk evaluations are essential in identifying appropriate risk mitigation responses and technology for each site."

Speaking from his extensive industry experience, Lourens says surface miners have largely implemented Level 7 PDS and CPS systems, which can warn of possible collisions. They have also embraced Level 8 systems, which can identify and advise on corrective actions. Further testing is being conducted on Level 9 systems, which come with a controlled 'slow-down and stop' engineering control intervention.

"The groundwork for this progress has been laid by years of collaboration between the Minerals Council of South Africa, mining companies, PDS suppliers and original equipment manufacturers," he says. "The process has allowed the available technologies to be reviewed carefully, with the necessary recommendations being made to the regulator – the Department of Mineral Resources and Energy."

Industry has also made significant headway in the testing of PDS technology, Lourens says. Simulation testing has been conducted by the Vehicles Dynamic Group at the University of Pretoria, in a process developed by the Minerals Council. This testing demonstrates the capabilities of PDS solutions so these can be submitted to the stakeholders.

Booyco Electronics has conducted multiple tests as part of its continuous improvement in the performance of its systems. This has allowed the company to progress to single and multiple machine tests on mine sites. The tests are ongoing at some surface mines, with positive results. Another important step forward has been the integration of the CPS systems with OEM equipment, says Lourens.

"Industry recently adopted the ISO 21815-2 (2021) standard, which deals specifically with how a CPS solution should integrate with OEM offerings," he says. "This allowed for a common interface between all CPS suppliers and the different OEMs."

As mines conduct their risk assessments in preparation for applying PDS, Lourens points out that the risks of vehicle-to-vehicle and vehicle-to-pedestrian collisions should both be fully considered. He notes that many surface operations seem to place more focus on using PDS to mitigate vehicle-to-vehicle risk. This may be due to mines applying mitigation strategies such as traffic management, fixed barriers or pedestrian walkways to address vehicle-to-pedestrian risk.

"By creating a separation of people from moving machinery, part of the risk can certainly be mitigated," he says. "However, with the development of our systems from Level 7 to Level 9, today's CPS offerings make them a more comprehensive solution."

To ensure that mines around the world can make the most of CPS solutions, Booyco Electronics collaborates with a number of technology partners – or system integrators – in various regions to help mines apply CPS effectively, bridging the gaps in different areas of expertise to promote safety and efficiency.

For more information contact Booyco Electronics.
Visit: www.booyco-electronics.com

IR inspection windows allow for safe electrical inspection and thermal measurement.

Key advantages of infrared inspection windows

Infrared (IR) inspection is widely used in electrical maintenance programmes. IR windows make the inspection procedure safer and more cost-effective than 'hands-on' inspection. However, certain key aspects need to be considered to get the best out of the maintenance programme. R&C Instrumentation highlights 10 important points.

- An IR window is an inspection point designed to allow infrared radiation to transmit to the outside environment. Simply, it is a data collection point for a thermal camera.
- An IR window does not provide shielding in case of an electrical explosion, or arc flash. It will, however, significantly reduce the likelihood of such an event because the electrical panels do not have to be opened.
- Wherever possible, polymer windows should be used rather than crystal windows. Crystal can shatter and is moisture absorbent, so it will fail over time, unlike polymer.
- Emissivity is one of the most important variables. When installing IR windows it is crucial to standardise the emissivity of the targets while the gear is open.
- Every camera has a field-of-view defined in degrees across a horizontal/vertical axis. Obstructions, such as phase dividers or cables inside the cabinet may decrease the actual field-of-view.
- As much information as possible should be gathered while equipment is de-energised, and a complete IR inspection should be done at the end of the window installation to establish a benchmark/baseline for future inspections.
- UL50 is the only standard that applies to IR windows, although it is more a classification than a standard. All other standards cited may have a bearing on some aspect, or use of a window.
- IR windows allow for inspections to be done with the electrical cabinet panels closed, so technicians or maintenance personnel are not exposed to energised components and the elevated hazards/risks they present.
- IR windows are safe to use, they eliminate risk where possible, provide for a systematic approach to data collection during inspection, and are cost-efficient.
- IR windows can save plant operators time and money, leading to a return on investment within the first or second inspection cycle.

By facilitating closed-panel inspections, the use of infrared windows eliminates 99.9% of arc flash triggers and completely eliminates injuries caused by accidental human contact to energised equipment during infrared inspection. IRISS infrared windows, available from R&C Instrumentation, are made of polymer rather than crystal, which means they are shatterproof and they can be manufactured in any shape or size.

For more information contact R&C Instrumentation.
Tel: +27 (0)11 608 1551
Email: sales@randci.co.za, visit: www.randci.co.za

Keeping electrical workers safe

The Fluke 376 FC True RMS AC/DC Clamp Meter with Fluke Connect allows for safe testing of electrical equipment.

It's the foundation of any electrical safety programme: limiting the exposure of workers to the electrical hazards of shock and arc flash. Using test leads and clamps to probe a live panel when troubleshooting and performing routine maintenance always exposes workers to danger. Electrical personal protective equipment (PPE) is a last line of defence and should not be relied on as the primary method of protecting electricians and technicians. Safe work practices, including the use of non-contact test tools that do not require electrical workers to place themselves in harm's way, should be considered first in electrical safety.

Supporting non-contact test tools, Fluke Connect®, introduced in 2014, added a level of efficiency and collaboration for maintenance and troubleshooting in manufacturing, commercial and retail facilities. Technicians can monitor real-time results from more than 20 different Fluke test tools from a smartphone. The information can also be shared securely, in real time, with authorised team members in other locations.

In addition, test results and maintenance data can be collected through the Fluke Connect app and stored by asset in secure Fluke Cloud™ storage. That means troubleshooting and maintenance staff can access the data in the field to compare new measurements to baseline measurements and identify problems more quickly.

Thus, using Fluke Connect technicians can identify and diagnose problems quickly and share the related data securely, with the people they have given permission to view it.

The Fluke 376 FC True RMS AC/DC Clamp Meter with iFlex and the Fluke 902 FC True-rms HVAC Clamp Meter allow technicians to access tight places and work around large, awkward conductors, and they can transmit measurements to a smartphone or tablet for later, detailed analysis. The measurements can be uploaded to the cloud. Technicians can combine

Continued on page 29

Safety controllers for brewery valves

SICK Automation Southern Africa recently provided a safety controller solution to South African Breweries (SAB) at its Rosslyn plant where the relay controllers for the valves in the brewhouse kettle section, which needed repair, were found to have been discontinued. The relay controllers were experiencing intermittent breakdowns, but the manufacturer no longer provided support or spares for the range. Further, there was no documentation nor drawings for the existing controllers in the client's application and this made repair attempts futile.

SICK installed the CE-certified SICK Flexi Soft safety-rated controllers as the relay solution. This offers fail-safe conditions and incorporates additional design modularity, allowing for straightforward expansion and reduction. It provides increased control intuitively, compared to the previous relay, and its programmable flexibility allows for customisation into any application. Flexi Soft resolved the control and monitoring function of the brew kettle valves and helped decrease wastage by optimising production processes and runtime.

The challenge presented by the lack of documentation was resolved by reverse engineering the application, which allowed for Flexi Soft to be adapted to the SAB-specific system. Chris McDaniel, Engineer at SICK Southern Africa says, "Without electrical drawings or standard operation procedures to reference, this was quite an achievement." SICK engineers also included an innovative button-controlling functionality, negating the need for SAB to update the controller via PLC.

SAB's brew kettles operate 24/7, barring scheduled weekend maintenance downtime. To ensure the processes remained uninterrupted, SICK and SAB engineers planned their work per kettle, conducting the installation only during scheduled downtime. "We worked in the short windows of opportunity provided during maintenance intervals," McDaniel explains, "and we managed to complete the project in two months."

In addition, product training for SAB's engineers and operators forms part of the SICK solution. "We're a local supplier and we retain stock of all our controllers, which is a benefit for our clients," McDaniel adds. "As well as having sufficient Flexi Soft stock on hand, we provide aftersales support with all our solutions and this is available 24/7."

The SICK Flexi Soft safety controller can be programmed via software. With its modular hardware platform, it provides a tailored and efficient solution for numerous safety applications. It has a wide range of available modules, which include main modules, gateways, digital and analogue input/output modules, motion control and relay modules. The licence-free Flexi Soft Designer configuration software enables intuitive programming, fast commissioning, and continuous diagnostics down to the automation level. Functions to enable safe controller networking, safe series connection, or safe drive monitoring reduce costs and boost productivity.

SICK Automation recently provided SAB with Flexi Soft safety-rated controllers for the valves at its Rosslyn plant brewhouse.

For more information contact SICK Automation Southern Africa.
Tel: +27 (0)10 060 0558
Email: Grant.Joyce@sickautomation.co.za
Visit: www.sickautomation.co.za

measurement data from multiple Fluke Connect test tools to create and share reports from the job site via email, and collaborate in real time with colleagues via ShareLive™ video calls or email, increasing productivity in the field.

The 376 and 902 clamp meters also decrease the number of instances in which technicians will need to wear personal protective equipment when working on high voltage/current panels. The technician can simply turn off the panel, verify the panel is de-energised using standard safety procedures, place the clamp and sync it to a smartphone with the Fluke Connect app, close the panel, re-energise it, and take measurements from a safe distance.

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

A new heat engine – as efficient as a steam turbine

Jennifer Chu, MIT News Office

Engineers at MIT and the National Renewable Energy Laboratory (NREL) in the US have designed a heat engine with no moving parts. Their new demonstrations show that it converts heat to electricity with over 40% efficiency – a performance better than that of traditional steam turbines.

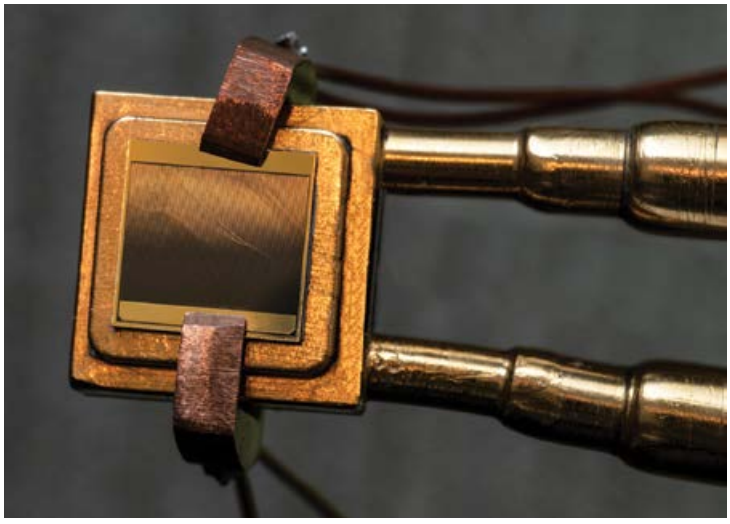
The heat engine is a thermophotovoltaic (TPV) cell, similar to a solar panel's photovoltaic cells, that passively captures high-energy photons from a white-hot heat source and converts them into electricity. The TPV cell can generate electricity from a heat source of between 1 900 and 2 400°C.

The researchers plan to incorporate the TPV cell into a grid-scale thermal battery. The system would absorb excess energy from renewable sources such as the sun and store that energy in heavily insulated banks of hot graphite. When the energy is needed, TPV cells would convert the heat into electricity, and dispatch the energy to the power grid.

With the new TPV cell, the team has now successfully demonstrated the main parts of the system in separate, small-scale experiments. They are working to integrate the parts to demonstrate a fully operational system. From there, they hope to scale up the system to replace fossil-fuel driven power plants and enable a fully decarbonised power grid, supplied entirely by renewable energy.

"Thermophotovoltaic cells were the last key step towards demonstrating that thermal batteries are a viable concept," says Asegun Henry, the Robert N Noyce Career Development Professor in MIT's Department of Mechanical Engineering. "This is an absolutely critical step on the path to proliferate renewable energy and get to a fully decarbonised grid."

Henry and his collaborators recently published their results in the journal Nature. Co-authors at MIT include Alina LaPotin, Kevin Schulte, Kyle Buznitsky, Colin Kelsall, Andrew Rohskopf, and Evelyn Wang, the Ford Professor of Engineering and Head of the Department of Mechanical Engineering, along with collaborators at NREL in Golden, Colorado.



[Image: Felice Frankel]

The thermophotovoltaic cell (1 cm x 1 cm) was mounted on a heat sink designed to measure the TPV cell's efficiency.

Jumping the gap

More than 90% of the world's electricity comes from sources of heat such as coal, natural gas, nuclear energy, and concentrated solar energy. For a century, steam turbines have been the industrial standard for converting such heat sources into electricity.

On average, steam turbines reliably convert about 35% of a heat source into electricity, with about 60% representing the highest efficiency of any heat engine to date. But the machinery depends on moving parts that are temperature-limited. Heat sources higher than 2 000°C, such as Henry's proposed thermal battery system, would be too hot for turbines.

In recent years, scientists have looked into solid-state alternatives – heat engines with no moving parts – that could potentially work efficiently at higher temperatures.

"One of the advantages of solid-state energy converters is that they can operate at higher temperatures with lower maintenance costs because they have no moving parts," Henry says. "They just sit there and reliably generate electricity."

TPV cells offered one exploratory route towards solid-state heat engines. Much like solar cells, TPV cells could be made from semiconducting materials with a particular bandgap – the gap between a material's valence band and its conduction band. If a photon with a high enough energy is absorbed by the material, it can kick an electron across the bandgap, where the electron can then conduct, and thus generate electricity – doing so without moving rotors or blades.

To date, most TPV cells have reached efficiencies of only around 20%, with the record at 32%, as they have been made of relatively low-bandgap materials that convert lower-temperature, low-energy photons, and therefore convert energy less efficiently.

Catching light

In this new TPV design, Henry and his colleagues looked to capture higher-energy photons from a higher-temperature heat source, thus converting energy more efficiently. The new cell does so with higher-bandgap materials and multiple junctions, or material layers, compared to existing TPV designs.

The cell is fabricated from three main elements: a high-bandgap alloy, which sits over a slightly lower-bandgap alloy, underneath which is a mirror-like layer of gold. The first layer captures a heat source's highest-energy photons

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Educating future generations

In South Africa, where unemployment is at an extreme high and many school-leavers struggle to pursue studies at tertiary institutions due to a lack of finances, the contribution from the private sector, in the form of bursaries among other things, helps young people realise their aspirations of studying further and becoming more employable. One example of this is the Enel Green Power South Africa (EGP RSA) Bursary Programme.

Education is fundamental to building a successful life, yet too many youths miss out on being able to obtain a qualification from a tertiary institution. When EGP RSA conducted research in the communities in which it operates, the company discovered the urgent need for access to education and made a commitment to offering assistance.

Globally, Enel Green Power generates electricity from renewable sources, including geothermal energy, hydropower, solar energy and wind power. In South Africa, it manages 12 wind and solar plants. It is here that the company feels it can best contribute to education – within its host communities.

Lizeka Dlepu, Head of Sustainability at EGP RSA says, "Young people being unable to further their studies due to financial constraints is one of the biggest social challenges of our time. Our aim, therefore, is to provide deserving students with funds to attend tertiary education institutions to give them the chance of a brighter future.

"The bursary programme took root when we conducted a community needs assessment and asset mapping study in one of the areas where EGP RSA is working. During the focus group discussion, we discovered that a lot of talented youth were sitting at home after matriculating because the family or household did not have the financial resources to send them to a training college or university. Some were working as seasonal workers on the farms around their hometowns," Dlepu adds.

The bursary fund sponsors fees, accommodation and provision of an allowance for a selected group of students. So far, 35 students have benefitted from the programme. The criteria for eligibility for the bursary include:

- Youths who reside within a 50 km radius of, or within the same district in which one of the EGP RSA plants is located
- Families with an income of not more than R350 000 per year
- Woman- child- or pensioner-headed families
- School-leavers who qualify to enter an institution of higher learning.

Lizeka Dlepu, Head of Sustainability at EGP RSA.

EGP RSA believes the value of the bursary programme extends beyond the granting of bursaries. Dlepu says, "We believe it will help increase the number of educated people who can then act as role models within their communities. It also assists in decreasing South Africa's skills gap and helps to make young people more employable."

The company sees education as key in creating a viable future for humanity and the most effective weapon in eradicating poverty. For this reason, EGP RSA's focus is on helping the next generation acquire skills that are essential in enabling them to meet the opportunities that lie ahead of them.

"To us, sustainability means value-creation, which is developed using a model where we integrate economic, environmental, social and governance goals into our business plan. In this way we create long-term value for all stakeholders, including our host communities," says Dlepu.

In future, EGP RSA plans to encourage previous beneficiaries of the bursary programme to contribute to a monthly fund – to pay it forward for fellow members of the community. Until then, eligible students are encouraged to apply to the bursary fund and begin the journey of obtaining the necessary qualifications to pursue a rewarding career.

For more information visit:
www.enelgreenpower.com/countries/africa/south-africa

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and converts them into electricity; lower-energy photons that pass through the first layer are captured by the second and converted, to add to the generated voltage. Any photons that pass through this second layer are then reflected by the mirror, back to the heat source, rather than being absorbed as wasted heat.

The team tested the cell's efficiency by placing it over a heat flux sensor – a device that directly measures the heat absorbed from the cell. They exposed the cell to a high-temperature lamp and concentrated the light onto the cell. Over a range of 1 900 to 2 400°C, the new TPV cell maintained an efficiency of around 40%.

"We can get a high efficiency over a broad range of temperatures relevant for thermal batteries," Henry says.

The cell in the experiments is about one centimetre square. For a grid-scale thermal battery system, Henry envisions the TPV cells would have to scale up to about 10 000 square feet (about a quarter of a football field) and would operate in climate-controlled warehouses to draw power from huge banks of stored solar energy. He points out that infrastructure exists for making large-scale photovoltaic cells, which could be adapted to manufacture TPVs.

"There's definitely a huge net positive here in terms of sustainability," Henry says. "The technology is safe, environmentally benign in its life cycle, and can have a tremendous impact on abating carbon dioxide emissions from electricity production."

This research was supported, in part, by the US Department of Energy.

For more information visit: https://web.mit.edu

Investigating e-taxis for SA

As the fuel price hits historic highs, commuters are feeling the impact in increasing transport fares. The typical South African commuter already spends up to 40% of their income on transport and the minibus taxi sector, still dealing with the impact of the past two years on its operations, is feeling the pressure of continuing fuel price increases. Relief could come from electric minibus taxis. Privately-owned minibus taxis are ubiquitous in sub-Saharan Africa and reportedly carry more than 70% of daily commuters.

Over the past five years GoMetro, a global mobility management technology company with its head office in Cape Town, has collected data on taxi operations across South Africa. With a view to advancing e-mobility development locally, GoMetro has convened a project team of innovative companies and research institutions to launch a demonstration project that will test the first electrically powered minibus taxi in SA starting in January 2023.

The project team involves GoMetro, Mix Telematics, HSW, ACDC Dynamics, and various entities within Stellenbosch University's Faculty of Engineering. The team will conduct extensive testing of the e-minibus in and around Stellenbosch and plans to conduct an educational roadshow across the country's nine provinces during the course of 2023, putting the electrification of the minibus taxi sector firmly on the national agenda.

A number of viable electric minibus taxi models from various markets have been identified, the first of which will be in SA by the end of the year. The acceptance and practicality of the model will be tested with taxi owners and drivers, to identify the use-cases and conditions where electric minibus taxis would be best used.

"Taxi drivers and owners are very interested in the idea of an electric minibus taxi," says Justin Coetzee, CEO of GoMetro. "We have built valuable relationships with a number of taxi associations, and the increasing fuel price is a serious concern among owners, drivers and riders, as there does not seem to be any relief in sight. The industry has acknowledged that business as usual will not suffice – and that change is needed."

The aim of testing different models over the coming months is to establish which vehicle will be best suited to the South African public transport industry, and where the range capabilities of the vehicles best align with the spectrum of operations offered by the minibus taxi sector. In addition to testing the vehicles, the project team plans to engage with the automotive sector and with policy makers to encourage proactive discussions with government around the reduction of duties and the adoption of electric vehicles in the transport sector.

Minibus taxis move millions of people daily, helping to get South Africa to work.

Catherine Lewis, Executive VP of Technology at MiX Telematics says, "We are excited to be part of this pioneering initiative. MiX Telematics is at the forefront of innovation in leveraging new technologies to improve fleet operations and efficiency. We have seen the adoption of electric and hybrid vehicles increasing exponentially in Europe and look forward to learning how we can support these solutions in the South African context."

Professor Thinus Booysen, Research Chair in the Internet of Things at Stellenbosch University, will lead the team of testing experts. "The informal taxi sector must transform to EVs, but little is known about their energy requirements. This unknown is overshadowed by our energy scarcity and coal dependence on the electricity supply side. Through this collaborative project we aim to be prepared for and carefully manage this exciting transition," says Booysen.

Dr Bernard Bekker, Associate Director of Stellenbosch University's Centre for Renewable and Sustainable Energy Studies (CRSES), says the future electrification of the transport sector in South Africa raises significant technical and regulatory challenges related to integrating electric transport into our existing grid infrastructure. "These challenges are in many ways unique to South Africa, where minibus taxis will potentially represent a much larger proportion of the future electrical fleet than, for example, in Europe or the USA. The availability of a real-life electric minibus taxi to inform our research activities will provide valuable inputs into addressing these challenges."

Mario Maio, Founder and Managing Director of ACDC Dynamics says, "In this research project ACDC Dynamics will share its capabilities to supply battery charging networks across the country. We are proud to be part of the change that will be brought to the industry."

Ryan Webb, Managing Member, HSW, says, "We are committed to bringing manufacturing local. The Western Cape has all the technical skills and resources to set up manufacturing facilities in support of this initiative."

Electric vehicles (EVs) are seen as a route to decarbonising the transport sector globally and slowing climate change. As EV sales increase in the global north, some vehicle manufacturers plan to stop production of combustion engines as early as 2030, but in sub-Saharan Africa the transition to EVs is moving slowly. This research project aims to accelerate the transition to cleaner and greener mobility.

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