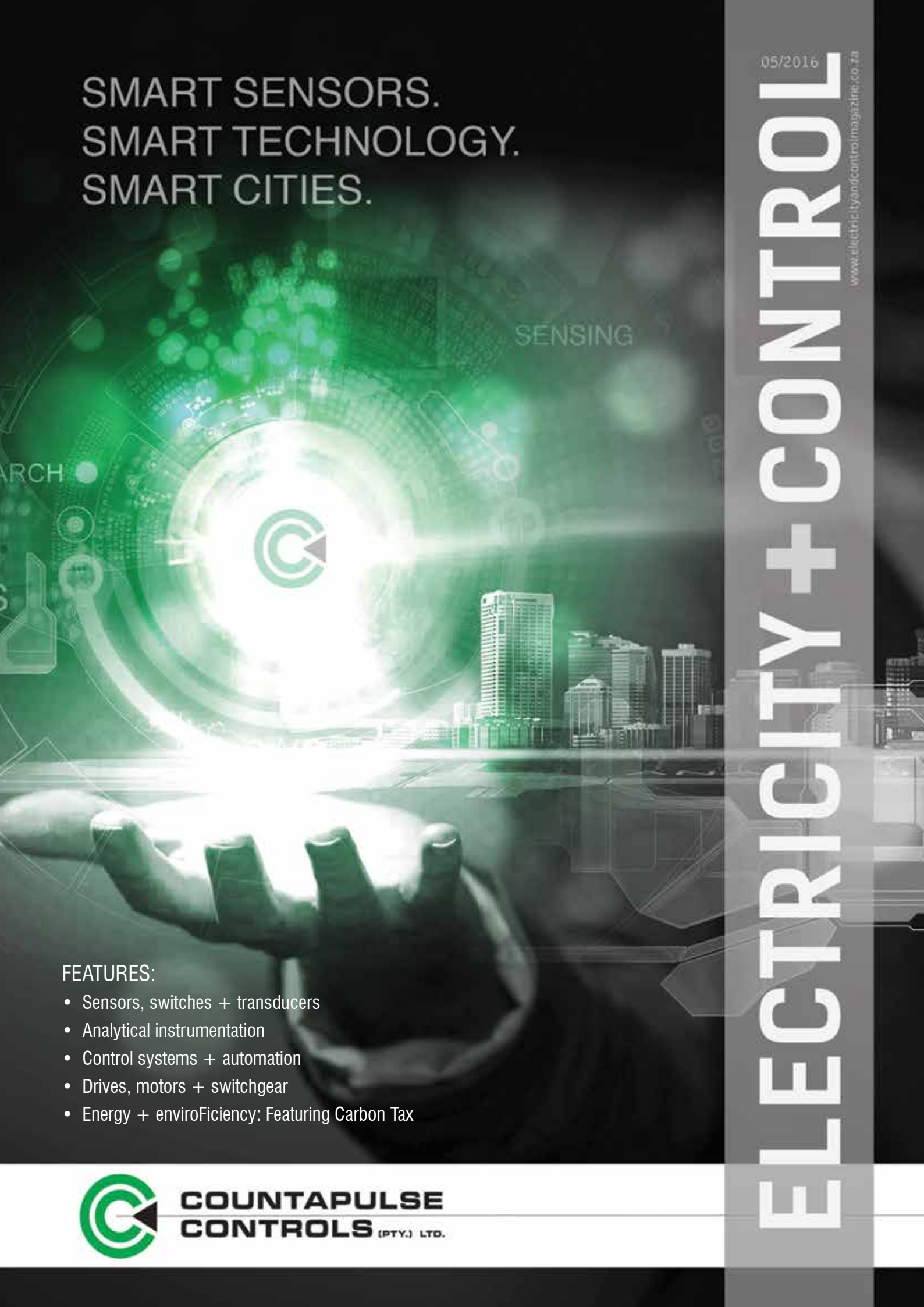

ELECTRICITY + CONTROL

05/2016
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I have been inundated with feedback relating to the April comment. I followed it up, with a bit of a foray into the life and times of South Africa, on FaceValue.

It is simply no longer possible to navigate business, and even social discourse, without measuring every decision and comment on the correct state of our nation. By this I imply the *real* state of the nation. A conversation I have with my children relates to how bad things were. We tend to view the past through rose-tinted spectacles... I doubt, for instance, that politicians were ever all-honourable and law-abiding; I doubt that service delivery was ever adequate in most places; I doubt that state-owned companies were squeaky clean and only made wise decisions that the entire population applauded. You get the point?

Some of the issues plaguing our society today remind me of interactions I have had, over many years, with researchers, professionals and educators. These conversations relate to ethics; in the profession, in research, in science, and even in one's personal life. Conversations that speak to some kind of an internal moral compass. People in question today try to justify their action or inaction with 'the law' – what the law says, or what they think it says – or does not say. I was mystified to hear a formal comment that, as there is no rule, there is no need to modify behaviour – and there are many cases of that in every country you care to imagine.

This completely misses the point. The point is that we need to be guided by ethics. When I engage educators in the context of the ethics of scientific investigation, I begin my discussion by ensuring that we all agree on what ethics are. I like to think of ethics as the principles that guide our actions in the absence of rules. In other words, even if there is no rule, no law, nothing written down, how should I behave in a given set of circumstances? I have encountered many people who have no moral compass at all (and that is why we need to have rules); and equally, I know those who need no written rules – as their personal rules are without reproach.

Two things come to the fore: The need to be seen to act beyond reproach; and the need to appreciate that the more influential you become as an individual, the more your ethics must hold sway (and be seen to hold sway) over mere rules. Rules are put in place by society for those who do not see the obvious behavioural traits that make a society great.

I find myself, as a result of these thoughts, watching behaviour and thinking through the ethics versus rules debate. You see, you would apply your own ethics whether or not anyone else was watching; and certainly whether or not you would be caught for not following them. In fact, you have a personal leeway. You cannot tell the truth all the time – sometimes it is possible to do less harm by not being entirely truthful (perhaps you can think of an example?).

But in the case of rules, your ethics may dictate how you treat the rules. I know of many people, some in fairly responsible roles, whose only consideration of the rule is if they are found to have broken it – and must face the consequence. Until this point, the rule simply holds no sway.

People in similar positions to myself take advice from lawyers on a regular basis. At no time can we allow our ethics to be violated simply because no rule exists for the matter in hand. If something seems unjust or wrong, or even inappropriate to us, then we are bound to act accordingly. If the rules suggest that we have nothing to worry about, we need to make a personal choice as to how to behave. Most of the truly great folk I know (and know of) are guided by their personal moral compass.

Watching how others behave allows us a true view of their own moral compass.

FACE VALUE

Ian Jandrell

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Billed as the intelligent eye for automation, the **Leuze LSIS 400i Smart Camera Series** is engineered for industrial image processing and can be integrated quickly and at low cost. *Read more on page 9.*

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Sensing technology from Leuze at work facilitating optimum productivity.

Smart sensors, **smart** technology, **smart** manufacturing

Gerry Bryant, Countapulse Controls

What is the role of sensing technology in the Fourth Industrial Revolution?

The Fourth Industrial Revolution is underway. The world is on the eve of major transformation with the future of industry going through a production paradigm, and significantly sensing technology is entrenched in this major shift.

This is not something made of science fiction. It is documented through numerous articles by the likes of Professor Klaus Schwab, founder and executive chairman of the World Economic Forum, and others. The roadmap report of the European Union comments on the advent of cyber-physical Internet-based systems which will offer innovative capacities that can benefit industry and other economic sectors.

General Electric first used the term Industrial Internet which was coined to describe how digital technology would be incorporated in equipment and machinery as well as in ancillary devices in all production environments.

Manufacturing facilities and plants have been teeming with these Internet 'things' or sensors for the past two decades, but the major paradigm will be Machine to Machine (M2M) communication. And significantly, this will not simply be between machines in a plant or factory but will also be between these machines and all sorts of sensing and monitoring devices and systems.

Essentially there will be integration across entire operations of Information Technology (IT) and Operational Technology (OT). OT is hardware and software that can detect or cause a change through the direct monitoring and/or control of physical devices such as machinery and processes and complete packaging lines.

M2M and HMI

Access to this level of accurate information will allow companies to focus more readily on optimising processes, reducing costs through condition monitoring and predictive maintenance and increasing productivity. All of this will, of course, have a positive impact on the bottom line and will be achieved through M2M communication and enhanced Human Machine Interaction (HMI).

Smart manufacturers are already equipping everything on the factory floor and everything that leaves the operation with sensors and other monitoring devices. Across industries the demand is now for smart machines. Smart machines are IT ready machines. These machines, equipped with sensors to monitor their functioning and performance, are able to communicate with a variety of IT systems in a language that humans can understand and act upon, if and when necessary.

Smart machines

Today, many smart manufacturing operations use smart machines. This ranges across heavy industrial sectors to the food and beverage industry to operations producing consumer goods and especially in the high-tech manufacturing sector. Eventually all machinery, not just that used in an industrial production environment, will incorporate this level of sensing and monitoring. This sensing and monitoring will

HMI – Human Machine Interface/ Interaction
IT – Information Technology
M2M – Machine-to-Machine
OSSD – Open Source Software Development
OT – Operational Technology
RFID – Radio Frequency Identity

Abbreviations/Acronyms

extend to domestic appliances including, for example, televisions, washing machines and even electric toothbrushes, all of which will be able to communicate with users.

Security

M2M communication can bring far greater security to an operation and more importantly, enhanced efficiency and productivity in production processes ranging from agricultural environments like dairy farms through to heavy industrial equipment manufacturers. M2M leverages state-of-the-art technologies to communicate without human intervention, and some of these include microelectronics, wireless, embedded and sensing devices. Interfacing these technologies allows the gathering and distribution of real time data.

Monitor and communicate

Typically the sensing technology or sensors monitor and communicate events ranging from basics like position, shaft rotation, temperature and humidity, right up to quality control functions where the sensor is able to detect out of colour or type anomalies. The sensing technology is able to convert this raw data into meaningful information which is then transmitted via the Internet interface. Sensing technology has been evolving to keep pace with the developments in the manufacturing and production sectors, and while the inherent characteristics of these devices will remain largely intact the manner in which information is transmitted will change from cable to wireless.

Another trend is where new sensor combinations are emerging with a single device capable of monitoring more than one function in an application. An example of this would be a pressure sensor that is capable of monitoring pressure, temperature and humidity. This not only reduces the overall cost of the sensor but also offers the end user a value-add sensing solution.

Another example would be the Leuze RSL 400 safety laser scanner family which incorporates two autonomous protective functions in one device. This saves end users money while still ensuring quality of performance. The device's most important feature is that it has two independently adjustable configurations and two safety-related switching output pairs (OSSDs). Together, with an operating range of 8,25 metres and a scanning angle of 270°, this feature allows two different protection tasks to be performed simultaneously with just the one device.

Miniaturisation of sensors

Miniaturisation of sensors is another important evolution for industry. While this first started within the aerospace and medical sectors, as there was a call for minute lightweight devices, it has carried across to other markets. Smaller sensors which provide the high levels of functionality, reliability and performance are in demand.

Safety in the work place becomes simple with sensing technology.

The safety of personnel is assured with Leuze sensors ensuring safe access.

take note

- Sensor technology is entrenched in the emerging Fourth Industrial Revolution.
- Essential to the process which will lead to an increased bottom line are Machine-to-Machine (M2M) communication and enhanced Human Machine Interface (HMI).
- Miniaturisation of sensors is significant in this… the smart era.

These devices can be installed in areas and on machinery which would previously not have been considered suitable due to space constraints. An example of this is the Leuze 2 Series sensors which are considerably smaller than a matchbox at only 23 mm by 12 mm by 8 mm. These throughbeam photoelectric sensors, retro-reflective photoelectric sensors and diffuse reflection light scanners are capable of operating at ranges of up to 2 metres. Designed for the detection of small parts these tiny yet powerful sensors are perfect for applications where the user has a confined space but needs a highly flexible solution and good performance.

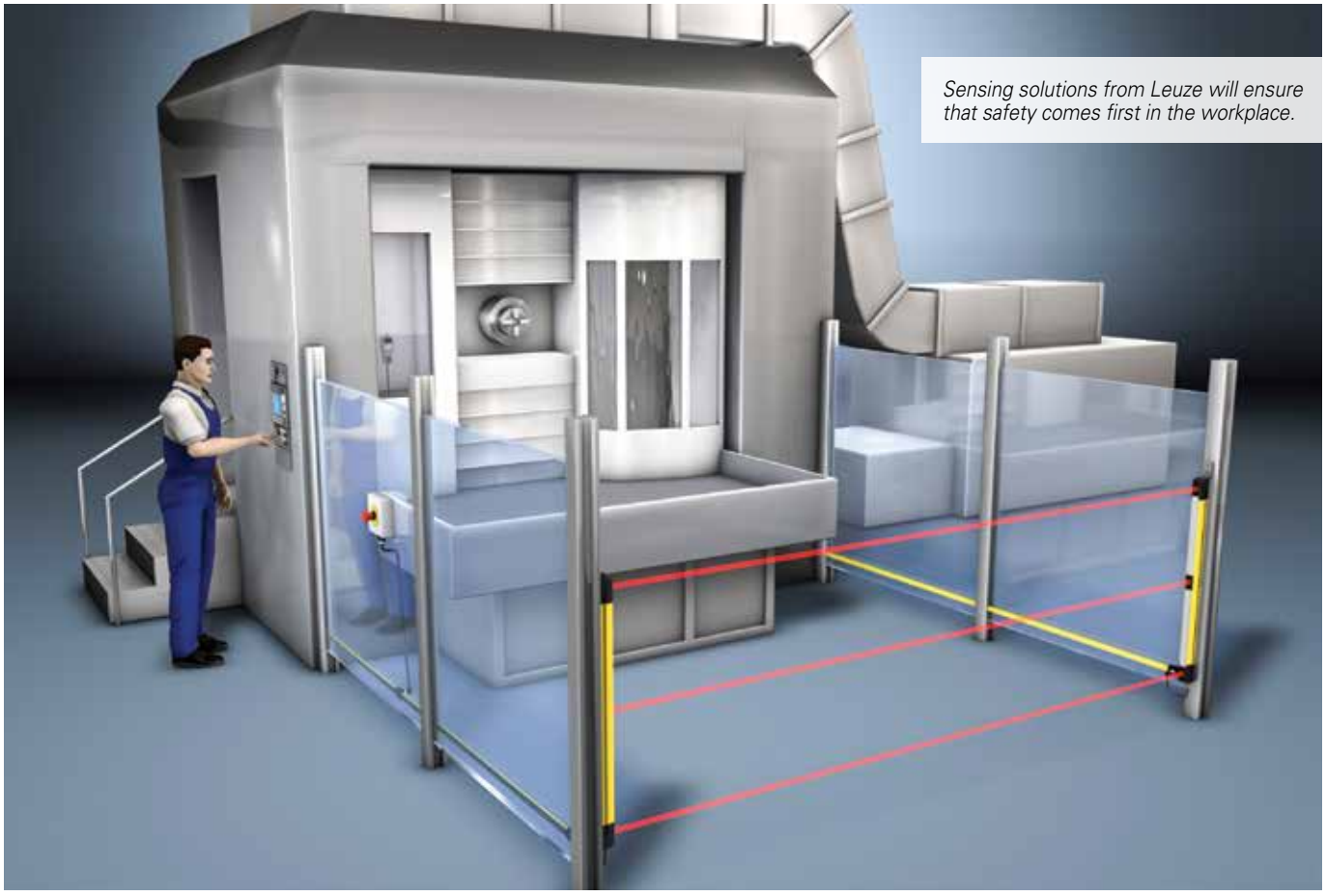
> *Across most, if not all, industries the demand is for 'smart machines' or 'IT-ready machines'.*

Conclusion

It is foreseeable that sensors will continue to play an important role across all manufacturing sectors and will remain a key component in all smart manufacturing facilities. Examples include the food and beverage where the devices will minimise the risk of hazardous or poor quality food products being sold for human consumption; the production of retail goods where sensors are used to monitor immediate environmental factors such as light, heat and moisture and in packaging facilities where quality control monitoring is enabled by leveraging specialist sensor technology. RFID will also continue to play a vital role in point-of-sale applications where individual product items are identified by barcode and RFID systems, while sensing technology applied in warehouses will allow inventories to be managed more efficiently. Automated stocktaking and reordering processes will optimise stockholding and could lead to an overall reduction providing bottom line savings.

Those companies that have already come to grips with the need to integrate IT and OT, and to embrace the role that sensing technology will play in manufacturing operations, will remain ahead of the curve as the Fourth Revolution takes hold on the world.

Gerry Bryant is the managing director of Countapulse Controls, southern African supplier of sensing, measurement, counting, switching, monitoring and positioning instrumentation. In operation for many years, the company has the full backing of its German principals and offers a complete technical advisory service for the most effective use of its products in automotive and other branches of engineering. Enquiries: Tel. 011 615 7556 or email Bryant@countapulse.co.za



Sensing solutions from Leuze will ensure that safety comes first in the workplace.

Wide light band to detect small and large objects

Objects can be round, angular or both, with glossy surfaces, have transparent shrink wrapped film or even be totally black, with gaps or with high ambient light levels. These Leuze sensors are ideal for when the objects to be detected or the associated environmental conditions deviate from the norm. The Leuze RK 46C.DXL VarOS retro reflective sensor (available from **Countapulse Controls**) is particularly effective in this regard as it responds to objects with the entire width of its light band, which gives it the capability to be able to handle interruptions. The wide light band allows for detection over a 45 mm to 60 mm wide area. The sensitivity and/or resolution of the sensor can be adjusted easily by means of a button located on the rear housing. And this Leuze sensor features a handy 'teach me' function which allows it to be adapted easily between two object sizes greater than 8 mm at the touch of a button. This ensures optimum flexibility of application. The use of this sensor does away with the need for expensive light barriers or multiple individual sensors. Other features include the ability to calibrate for detection of transparent, perforated or small objects as well as the ability to reliably detect even with depolarising media such as foil packaging.

Enquiries: Gerry Bryant. Tel. +27 (0) 11 615 7556 or email bryant@countapulse.co.za

Multi-functional vision sensor

A new generation of vision and barcode sensors offering multiple tools and resolution options has been introduced by **RET Automation Controls**. The iVu Plus Gen2 line, developed by **Banner Engineering**, includes integral and remote screen models for use in a wide range of inspection, machine vision and quality control applications. The vision sensors with built-in illumination are designed to solve applications that would typically require multiple photoelectric or proximity sensors. They now include a full resolution option to detect small features, as well as the capability to use multiple sensor tools in the same inspection.

Bar code readers validate twelve 1D and 2D barcode formats to support advanced traceability in all industries. They offer a coarse mode resolution setting that can provide significantly faster read rates, especially for 2D barcodes. The sensors can store and control up to 30 inspections for fast product changeover. The rugged IP67 rated housing allows use in hostile environments. Remote displays are available in both machine mountable and hand-held configurations.

An intuitive touch-screen user interface allows the user to configure, monitor and modify inspections without an external PC. EtherNet/IP and Modbus/TCP connectivity simplifies communications with many PLCs and HMIs.

Enquiries: Brandon Topham Tel. +27 (0) 11 453 2468 or email brandon.topham@retautomation.com

Isolated barrier completes 'Ex I' package

The isolated barrier model IS Barrier completes WIKA's range of intrinsically safe products. The barrier is suitable for installation in zone 2 and is compatible with all corresponding transmitters from **WIKA**.

For use in hazardous areas, intrinsically safe transmitters require a barrier. It galvanically isolates the circuit between Ex and non-Ex areas. The model IS Barrier supplies sensors, depending on a two- or four-wire system, via a power-supplying and non-power-supplying 0/4...20 mA input and also supports transmission of a HART protocol.

The current output can be operated actively or passively. The functional safety of the instrument is confirmed by the approval for SIL 2 applications.

In this way, WIKA offers a complete 'Ex I' package: In addition to the sensor and barrier, it includes the matching cables and a form containing the data for the verification of intrinsic safety prescribed by law.

Enquiries: WIKA South Africa. Tel. +27 (0) 11 621 0000 or email sales@wika.co.za

New diagnostic display for safety relays

Siemens has upgraded its portfolio of Sirius 3SK2 safety relays to include a compact diagnostic display. This allows plant status or defects such as faulty sensors or warning messages to be simply displayed. As faults can be localised much faster it reduces downtime and therefore helps to save both time and costs. There is now a new compact diagnostic display 3SK2611-3AA00 available for the Sirius 3SK2 safety relay, which offers a range of safety functions with only a minimal footprint.

The Human Machine Interface panel with its titanium coloured display and particularly bright background lighting informs the user about all events occurring in the system such as faulty sensors or warning messages. This allows faults to be more quickly localised and downtimes to be reduced. Existing projects can be simply saved and reloaded to the device once the device has been replaced. This facility for copying projects lends itself to use in series machine manufacturing. Typical applications for Sirius 3SK2 include more complex or sophisticated security applications with several emergency stop commanding devices, safety doors with locking function or also material infeed using light barrier sensors which are intended to close down above all partial applications independently. In addition, there is a function block library available for the implementation of individual requirements.

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Easier to adjust sensor parameters under virtually any conditions

VEGA has introduced a new display and calibration module, PLICSCOM with Bluetooth, which makes the adjustment of sensor parameters so much easier. VEGA is the first instrument manufacturer in its field to bring a Bluetooth solution to market. Equipped with Bluetooth 4.0 technology the user can now make adjustments without having to uninstall the sensor or even remove the sensor housing cover. This means adjustments can be made from a safe working area up to 25 m away, eliminating the need to climb up high silos in dangerous conditions or to operate in hazardous areas.

With no wiring necessary, adjustments are made using a smartphone or tablet via Bluetooth Low Energy technology. Simply download the VEGATools app which is available on IOS and Android platforms. The layout of the application follows the same logical process as PACTware. If the sensor is accessible, a magnetic pen allows contactless adjustment right through the viewing window of the closed lid. The instruments are therefore always well protected against bad weather and soiling.

The magnetic pen operation and Bluetooth communication offer another advantage: costly and involved authorisation for working in hazardous areas is not necessary. However, the best feature is the backward compatibility, which means that the Bluetooth PLICSCOM can be used on the entire installed base of VEGA plics sensors, many in operation since 2002.

Enquiries: Chantal Groom. VEGA Controls SA. Tel. +27 (0) 11 795 3249 or email chantal.groom@vega.com

Contactless connectors deliver major benefits for industrial machinery

RS Components (RS) has introduced a new range of ARISO contactless connectors from TE Connectivity. The ARISO connectivity platform is a hybrid interconnection system that is based on contactless power and data technology and enables easy connectivity over a short distance without physical connection. The connectivity system brings many advantages, such as design flexibility and reduced maintenance costs in industrial and control applications such as robotics, centrifuges, inline inspection, milling machines, high-end printers, rotating tables and moulding machines.

Unlike traditional mechanical cable connectors, ARISO connectors use an inductive magnetic coupling system between transmitter and receiver (M30 x 80 mm sized) and thereby do not require physical contact. The connectors are able to transfer data and power not only through air, but also across many different materials as well as fluids such as oil and water. They will also automatically switch off in the event of a foreign metal object coming between the transmitter and receiver.

Designed to replace complex and expensive harness constructions and slip rings to enable connectivity where connections have previously not been possible, the ARISO series comprises five contactless male and female connectors that come with enhanced design specifications. The system's use of dynamic tuning means that the connectors are able to maintain a connection and avoid misalignment problems caused by shifts in movement. This freedom of movement includes 360° rotation, angular motion or a variable degree of distance between connectors.

Enquiries: Tanya Erasmus. Tel. +27 (0) 11 691 9345 or email Tanya.Erasmus@rs-components.com

Countapulse Controls

An intelligent eye for automation

Billed as the intelligent eye for automation, the Leuze LSIS 400i Smart Camera Series is engineered for industrial image processing and can be integrated quickly and at low cost.

Use of this innovative and high performance camera technology facilitates fast and simple monitoring and identification in automated production lines. The smart cameras are used for quality control, object detection and position determination applications as well as for identification and for production process monitoring.

With a sophisticated range of features, the Leuze LSIS 400i Smart Cameras can reliably handle complex tasks. Significantly, the smart cameras offer three functions in one unit; BLOB analysis, code reading and measurement through edge scanning. Each smart camera is considered an 'all in one device' offering illumination, image processing, image and programme memory, display and display of results.

The integrated homogeneous illumination of the smart cameras over the full field of view through specially developed lenses makes an accurate working distance of up 1 900 mm possible. Compared with conventional LED illumination, the images recorded by the Leuze LSIS 400i Smart Cameras are considerably more homogenous and detailed. This enables better, faster and more reliable image processing. Engineered for optimum flexibility in individual applications, the smart cameras offer either pulsed or continuous operation with four individually switchable illumination segments.

All interfaces, Ethernet, RS232 and 8x digital I/O, are integrated and no connector units are necessary. Commissioning and operation is simple via WebConfig with any standard browser and there is no need for additional software to be installed. Incorporating well-structured software with online assistance the smart cameras are simple to operate and have an integrated display with a control panel. All cameras are resistant to shock and vibration and offer ingress protection to IP 65/67 standards and mounting is simple with dovetail or threaded holes.

The Leuze LSIS 462i Smart Camera now features an integrated measurement function which facilitates close tolerances and is a step closer to being a complete system. The ability to detect tight tolerances is particularly relevant in the engineering environment as this will prevent the scrapping of good parts or components.

The new measurement function is based on edge scanning and enables the reliable and reproducible detection and measurement of different structures. This smart camera offers the option of measuring distances and geometric shapes such as circles, lines and edges; both with high detection reliability and under a single user interface.

The standard measurement applications are numerous; whether for the electronics industry (contact gap measurement), the automotive industry (tolerance tests, quality assurance), mechanical engineering (dimensional accuracy tests) or the beverage industry (specification of label position and alignment). The ability to measure image processing is a big advantage for many tasks.

In addition to type detection, the Leuze LSIS 462i Smart Camera can be used to monitor for presence, completeness, type, position, location and orientation. It can also be used to detect differences in labelling, and operates at the high speeds associated with automatic production lines. It reads printed and directly marked 1D/2D codes with absolute reliability and, independent of contrast, even in reflected or inverted form.

The Leuze LSIS 400i Smart Camera Series is available from Countapulse Controls. The company offers access to technical support and information, as well as to its comprehensive range of innovative sensing, measurement, counting, switching, monitoring and positioning instrumentation. Customer support is available 24/7 through its technical advisory service hotline.

The Leuze LSIS 400i Smart Camera Series is engineered for industrial image processing and can be integrated quickly and at low cost.

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Website: www.countapulse.co.za

Versatile, low-cost electronic transmitter with ceramic sensor

KOBOLD Instrumentation, represented in South Africa by **Instrotech** – a Comtest Group company, has on offer their KOBOLD SEN-96 – an electronic transmitter with ceramic sensor for air, industrial, technical, gases and water and oil – designed to be installed in gas distribution plants, on gas bottles, refrigerators, compressors, vacuum pumps and in hydraulic and high-pressure water plants. The SEN96 has proven to be very safe against overload, tolerates pressure peaks very effectively, and is ideally suited for use in hydraulic systems. Typical applications are compressors, pump systems and cooling circuits.

The handy SEN96 is connected to the process with G1/4, G1/2, 1/4"NPT or 1/2"NPT threads. 23 measuring ranges which run from -1...0 bar to 0...600 bar relative pressure are available. There is a choice of 4...20 mA, 0...5 V, 0...10 V, 0,5...4,5 V ratiometric or 1...5 V analogue outputs for signal transmission. Fast, on the spot information of the measured pressure is made possible by the practical AUF type plug-on displays. Standard sensors have protection class IP65.

The wetted parts are stainless steel, ceramic and sealing material FPM. The compact and versatile SEN-96 pressure sensor offers tried and tested measuring principles with a thick film ceramic measuring cell and features very good repeatability and great reliability. The unit is ideally suited for use in industry in general, and specifically in gas stocking or machines production, in light or heavy pneumatics industry, in the refrigeration industry, and in welding and vacuum applications.

Enquiries: Tel. +27 (0) 10 595 1831 or email sales@instrotech.co.za

Next generation touch buttons

Banner Engineering has introduced its next-generation touch buttons for its industry-recognised K30, K50 and K70 multicolour indicators and pick-to-light sensors. Employing smart electric field sensing, the next-generation touch buttons provide superior immunity to false triggering caused by the build up of detergents, oils and other foreign materials, as well as exposure to direct water spray.

Available from **RET Automation Controls**, the K70 is a brand new addition to Banner's multicolour and pick-to-light sensor family. Featuring a 70 mm touch dome with a 30 mm base, the K70 touch is optimal for larger industrial applications in addition to jobs that require more visibility. The K70 is available in nine colour options and one-, two- and three-colour models for flexible performance.

The next-generation K30 and K50 offer flexible communication and simplified set-up of a single device or multi-point applications. The K50 is available in one-, two- and three-colour models, while the K30 is available in one- and two-colour models. New FDA models are also available, which are constructed from FDA-grade material and fully encapsulated for use in food and beverage applications.

"Our next-generation touch buttons are designed to provide optimal indication and lighting with excellent immunity to false triggering and superior electrical noise immunity," said Matt Hahn, Technical Marketing Engineer for Lighting, Banner Engineering. "We believe these touch button solutions will be ideal for our customer's pick-to-light, call button and general industrial applications."

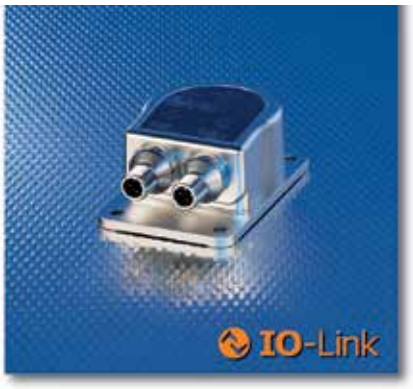
Enquiries: Brandon Topham. Email brandon.topham@retautomation.com

Port lock provides physical network access protection

Siemens developed the IE RJ45 port lock to protect open, unused RJ45 interfaces. It connects RJ45 ports mechanically to terminal devices or network components. As an additional measure, the IE RJ45 port lock can help to protect networks from unauthorised access, thereby enhancing the security of industrial production plants. A well-balanced, holistic security concept also includes physical protection measures. Open, unused RJ45 interfaces that can be used by unauthorised third parties to access networks are a well-known problem. In order to mitigate this risk, Siemens is now offering the IE RJ45 port lock which enables RJ45 ports to terminal devices and network components to be locked mechanically. The rugged design of the port lock in the form of a plug means the plug snaps securely into place at the RJ45 interface, preventing the insertion of RJ45 cables. This port lock helps to prevent unwanted use of empty RJ45 ports even on non-configurable network components. The integrated lock that can only be locked and unlocked using a mechanical key blocks the latch of the RJ45 port lock. A mechanical key is used to remove or unlock the port lock. Additional benefits include the sturdy design suitable for industrial purposes and the ease of installation which, because of RJ45's compatible design, does not require any additional tools.

Enquiries: Jennifer Naidoo. Email jennifer.naidoo@siemens.com

Robust and precise inclination sensors with IO-Link



The 2-axis inclination sensors are designed for high measurement accuracies over the whole angular range up to 360°. All functions can be configured via IO-Link.

Thanks to an active temperature compensation and high protection rating they operate reliably even at extreme ambient temperatures and rough environments.

Available from **ifm electronic ZA**, the robust sensor simplifies visualisation of operating and switching sates by clearly visible LEDs. Alternatively, JN2200 can also be used for 3-axis vibration monitoring. Up to three axes can be included into the calculation of the characteristic value.

Typical applications are the detection of structural vibration or tower vibration to ISO 4866, or machine monitoring to ISO 10816.

Enquiries: Alwyn Skelton. Tel. +27 (0) 12 450 0400 or email info.za@ifm.com

Safety-related minimum-speed monitoring

Available from **ifm electronic ZA**, the speed monitor DU110S has been developed for safety-related minimum-speed monitoring required, for example, for slip or V-belt monitoring. An application example is the industrial thermo processing equipment according to EN 746-2. In this case, safety-related monitoring of the air exchange is required. To do so, monitoring is done via the rotational speed monitoring of the fans. The speed monitor is certified to EN 62061/ SIL 3 and EN ISO 13849-1 cat, 4 / PL e even though non-safety related sensors are used as pulse pick-ups. Besides the 2-pole safety relay, transistor outputs can also be used as outputs for the status and error indication. Automatic or manual reset of underspeed is possible and can be set via wire links.

The safety speed monitor operates at extreme ambient temperatures down to -40°C.

Enquiries: Alwyn Skelton. Tel. +27 (0) 12 450 0400 or email info.za@ifm.com

Extend the life of switch hardware

ProLabs has introduced a 10GBASE-T SFP+ transceiver, which will allow data centre and network managers the ability to extend the life of their cabling infrastructure with a simple cost effective upgrade. “We are seeing a growing demand for copper transceivers throughout Africa, and Networks Unlimited will distribute the 10GBase copper transceivers by ProLabs on the continent,” says Anton Jacobsz, managing director at South Africa's leading value-added distributor, Networks Unlimited. The advantages of using 10G copper cabling include:

- Extension of the life of any switch hardware, without having to change existing infrastructure
- Simple cost effective upgrades
- Ease of use

The 10GBASE-T SFP+ transceiver pushes the limits of copper based technology, providing 10 gigabits of data transfer over distances of 30 metres or less and replaces the need for direct attach cables that have limitations up to 10 metres.

Enquiries: Morné Delport. Tel. +27 (0) 11 202 8400 or email lynne@nu.co.za

New positioner ‘eco’ series

Gebr. Müller Apparatebau GmbH & Co. KG, or **GEMÜ** for short, has added an ‘eco’ series to its range – more specifically, an eco version of its GEMÜ 1436 cPos positioners.

The GEMÜ 1436 cPos positioner has been successfully used for many years for a wide variety of applications. The various configuration options offer users a high level of flexibility. The positioner can also be adapted for use with third-party actuators. The SpeedAP function can be used to make initialisation and commissioning easier, whatever the valve type.

The new GEMÜ 1436 cPos eco series offers customers the same highly reliable technology as the standard series.

By reducing the scope of its performance as well as its range of functions, GEMÜ has been able to significantly pare down the power electronics, resulting in an impressive price reduction of over 30%.

The ‘eco’ series was developed in response to the requirements of customers who have no need for the full range of functions and adjustment facilities.

Enquiries: Email ivona.jovic@gemue.de

Better ways to troubleshoot automation and process control loops

Technical information supplied by John Wilson on behalf of Comtest for the Fluke Corporation

Instrument and automation technicians are constantly challenged to keep instrumentation loops and I/O working at peak efficiency while using the least possible time in which to do it.

When Fluke '(further referred to as the company) first released the 771 mA Clamp Meter in 2007, technicians found that measuring loop current without breaking the circuit saved a great deal of time. Now, the new 772 and 773 models can save even more time. By incorporating the functions of a loop calibrator, these more advanced tools allow technicians to troubleshoot on the spot.

Tracing control loop problems

Often the first indication of a control loop problem comes from the operator: 'I think we have a bad valve' or 'this loop isn't responding the way it used to'. In either case, it is the technician's signal to begin troubleshooting.

The first step is to measure the 4-20 mA signal, either by breaking the loop connecting in series with a DMM, or by using an mA clamp meter like the company's 771 and verifying the loop current value. If the loop current measured is not as expected, there are three likely

DCS – Distributed (process) Control Systems
DMM – Digital MultiMeter
PLC – Programmable Logic Controller
VFD – Variable Frequency Drive

Abbreviations/Acronyms

causes: broken/disconnected/shorted wires, a bad loop power supply, or faulty instrumentation.

If no problem is found in the wires, use a DMM (or the 773 clamp meter) to check the loop power supply. If the power supply shows no output, use the 24 V loop power function of the meter to substitute for it; if the loop then works properly the source of the problem is obvious. If the wiring and the power supply both check out, it is time to check the transmitter. If you have a loop calibrator, process calibrator or multi-function clamp-on meter, use its mA simulate mode to substitute for the transmitter. If the loop performs as requested, the problem lies with the transmitter, if not, it is elsewhere.

If a final control element (valve positioner, etc.) is suspected, use the mA source/ simulate mode on the company's 772/3 to feed a signal into it while watching the local indicator for a response.

Loop malfunctions

If the problem is not a dead loop but an inaccurate one, likely possibilities include a bad I/O card on the PLC or DCS, or a bad final control element (I/P on a valve positioner, etc.). It is usually best to start by doing a field check of the transmitter, local or remote indicator or final control element.

For a final control element, use a clamp-on meter to measure loop current and compare the value to the local position indicator on the valve or other final control element.

Relay that information to the operator to verify findings. In the case of a measurement loop, use the clamp meter to measure loop current, then check with the operator to see how well the value indicated on the control panel agrees with the actual loop current.

By incorporating the functions of a loop calibrator, these more advanced tools allow technicians to troubleshoot on the spot.

This will give a quick check on the PLC or DCS I/O card that handles that particular loop. It's also possible to use the meter's mA source/ simulate mode to send a known signal to the control room; as before, compare the value as read by the operator to the actual current in the loop. Some loops show random fluctuations or intermittent faults that tend not to happen while a technician is watching. The solution here is to use a clamp meter with a scaled mA output.

In this mode the meter measures the current in the loop without breaking the circuit, and produces an identical and isolated mA output. Feed that output to a DMM with a logging function; by allowing the DMM to record over time, any disturbance will be recorded.

Field checks and plant commissioning

Start by using a clamp-on loop current meter like the company's 771 to check each loop for current in a matter of seconds, without disconnecting anything. If a loop is not working, a multifunction clamp meter can also make quick work of diagnostics. If current is not present on some loops go on to classic troubleshooting: check the wiring, the power supply, and the control system's I/O cards (by using the meter to inject a signal into the I/O, then contacting the operator to ask what he sees. If the operator agrees with what is being sent, then there may be something amiss with the transmitter –either the transmitter itself or, if this is a new installation, perhaps miswiring, the sensor's input to the transmitter.

Checking DCS and PLC I/O cards

The mA process clamp meter can be used as an accurate signal source to check the operation of input/output cards on Programmable Logic Controllers (PLCs) and Distributed process Control Systems (DCSs). For 4-20 mA input cards, disconnect the process loop and use the meter's mA source mode to feed in a known signal value (4,0 mA for zero, 12 mA for 50% using the meter's 25% step function, and 20,0 mA for 100 %) and compare it to the value shown on the operator's readout. Voltage input cards (1 V to 5 V or 0 V to 10 V) are checked in a similar way, using the meter's voltage source function.

Checking a valve positioner

Milli-amp clamp meters can be used for periodic in-field checks of electronic valve positioners as part of preventive maintenance programmes. Accounting for manufacturer-specific instructions, perform quick operational checks using the company's 772/3 as a signal source while observing the valve stem position, mechanical position indicators, or flow indicators as input changes are made.

Using the 4-20 sourcing output of a mA process clamp meter to drive a control valve open and closed when the process output from the PLC was not working. The PLC's output was disconnected at the control valve and connected the [meter] up to the control valve and ran it open and closed to verify that the I/P on the valve worked correctly.

The general method is to set the meter to the 4-20 mA source/ simulate mode and connect it to the input terminals of the valve

positioner. Set the meter to output 4 mA and wait for the positioner to settle; then vary the current in small increments between 4,0 mA and ~3,9 mA, while feeling the valve stem with your free hand to check for any sign of movement.

Adjust for zero movement between these two current settings by using the zero adjustment on the positioner. Next increase and decrease current from 4 mA to ~4,1 mA. Ensure that the valve stem just begins movement above the ~4,1 mA setting and fully closed at 4 mA. Span can be checked similarly, by setting the meter at 20 mA, ~19,9 mA and ~20,1 mA, and linearity can be checked by using the meter's 25% step function.

Checking loop isolators

To check a loop isolator, apply a mA input signal to the device and measure its 4-20 mA output using the clamp-on current measuring function. This two channel simultaneous source or measure function in the 773 can also be used for valves that report their position using 4-20 mA.

Checking VFDs

Variable Frequency Drives (VFDs) are used to power motors, blowers and fans in process applications as well as conveyor systems and machine tools. Control inputs are generally voltage (1 V to 5 V or 0 V to 10 V) or current (4 mA to 20 mA). A mA process clamp meter can feed in a signal to simulate a normal input while the technician observes the result.

Quick calibration

While not classified as loop calibrators, today's mA process clamp meters boast accuracies of 0,2%, and can be used for quick calibration checks, while cutting down on the number of instruments needed. For example, checking a process transmitter on the bench normally requires (aside from a pump and separate pressure standard) a loop power supply and an instrument for reading the transmitter's 4-20 mA output. But with today's mA process clamp meters it is possible to both power the transmitter and read the output. This tiny little thing allows that function to be carried out without having to drag out a separate power supply.

Conclusion

These mA process clamp meters can save instrumentation and automation technicians a great deal of time in trouble shooting, because they can replace a number of separate instruments. The technician no longer has to spend 15 minutes going back to the shop to get an instrument, because the one instrument he takes with him will do all the necessary functions. Instead of carrying two tools, he now has one tool for doing all 4-20 mA loop calibrations and troubleshooting – very convenient.

take note

- Measuring loop current without breaking the circuit saves time.
- Advanced tools incorporate a loop calibrator – saving more time.
- One tool performs 4-20 mA loop calibration and allows technicians to troubleshoot on the spot.

John Wilson specialises in Metrology and Accreditation consultation and training. He is a Senior member of the SA Institute of Electrical Engineers, a Fellow of the Society for Automation, Instrumentation, Measurement and Control. John has over thirty years' experience with Fluke products (including having worked directly for Fluke) and has practical experience in different fields of metrology and electronic design. John has recently presented ECSA CPD Point Approved Seminars on this subject at Comtest's Linbro Park Offices.
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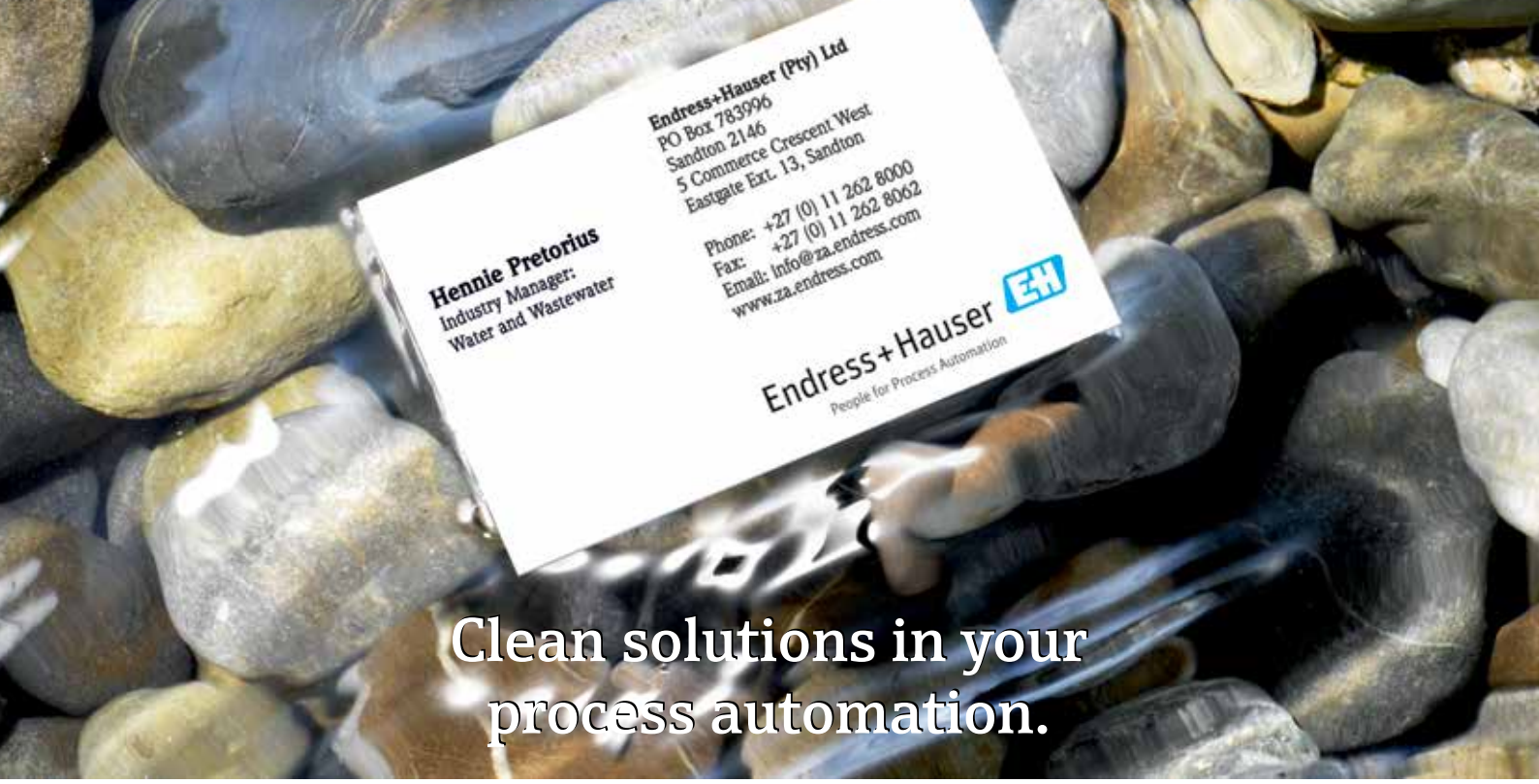

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People for Process Automation

CIP – Clean-In-Place
COD – Chemical Oxygen Demand
FDA – Food and Drug Administration
FFA – Free Fatty Acids
IR – Infrared
PAT – Process Analysis Technology
POV – Peroxide Value
TPM – Total Polar Material
UV – UltraViolet

Abbreviations/Acronyms

Power of light in industrial process management: **Spectroscopy**

Günter Pinkowski, KROHNE Optosens

Process Analysis Technology (PAT) is an essential prerequisite for the management and control of processes which is optimal, both technically and economically.

Optical spectroscopy is a well-established method for quantifying compositions. It allows to maximise the performance of a system, for example, the so-called 'space-time yield': In addition to the use of 'classical' process measuring technology (flow, level, temperature, etc.) PAT tools are increasingly being used to achieve this aim. The requirements for PAT are very different; batch processes require a temporal extension of the measurements across all concentration ranges. The composition of the substance on the probe changes constantly. In continuous processes, however, the same composition or the same concentration often appears in only one point in the production chain and the measurements take place according to the various process steps. The ideal state of always knowing all relevant information or data would mean a great expense even in a small plant. With well-placed PAT measuring points, on the other hand, a higher level of control technology can be achieved and previously unused potential realised.

> *The ideal state of always knowing all relevant information or data would mean a great expense… even in a small plant.*

KROHNE has developed the OPTIQUAD optical spectroscopy systems for applications with milk, wastewater and edible oil and fat. Typical applications include the continuous measurement of protein, fat, lactose and total solids in milk products, chemical oxygen demand (COD) in the wastewater flow of dairies or cheese factories, as well as free fatty acids (FFA), total polar material (TPM), peroxide value (POV), moisture, dirt and other values in edible oil and fat processing.

The OPTIQUAD uses optical spectroscopy to measure the contents of milk products continuously and without contact. In the process, light of varying wavelengths is coupled into the product through an optical window. The system simultaneously determines the values of up to four optical effects (transmission, scattering, fluorescence and refraction) which manifest in different ways depending on the substances in the product, and then uses them to calculate for example in dairy applications the amounts of protein, fat, lactose and total solids. The measurement is tailored to the application with up to 12 wavelengths from UV to IR. The measuring cycle lasts only a few seconds. Typical applications for dairies include strategically increasing the protein content in cheese making milk/vat milk, standardising the fat content in drinking milk or setting a constant ratio of fat to protein in cheese production.

Unlike bypass devices which are sometimes costly to clean, the OPTIQUAD M measures without contact directly in the pipeline: the system is connected to the process via a standard VARINLINE process connection (nominal sizes DN 40 to DN 150). The measuring section is FDA-compliant and is cleaned using CIP. There is no need for daily recalibration thanks to the long-term stability of the optical measurement, which requires no moving parts. In addition, operating and maintenance costs are lowered as there is no need for chemicals, reagents or cleaning products. Operating the device requires no special knowledge.

take note

- Optical spectroscopy is an established method for quantifying compositions.
- Optical spectroscopy systems have been developed for applications with milk, wastewater, edible oil and fat.
- The OPTIQUAD uses optical spectroscopy to measure the contents of milk products continuously and without contact.

Günter Pinkowski is managing director of KROHNE Optosens, a KROHNE subsidiary dedicated to optical systems, and has been working in the field of optical spectroscopy for more than ten years.
Enquiries: Email g.pinkowski@krohne.com or J.Alexander@KROHNE.com

New relative humidity probe that hands control to the user

Michell Instruments, represented in South Africa by **Instrotech** – a Comtest Group company – has introduced the new HygroSmart HS3 advanced interchangeable relative humidity and temperature probe. It is 100% configurable, giving users maximum flexibility. It also allows for alterations to RH measurements, to keep step with changes or developments in the process.

Users can set the zero/span range, output signals and choose from five output parameters (including dew point). All these changes and settings are made on a PC via the application software. The unit can also be ordered directly from Michell with the probes fully configured to unique, individual specifications.

The new probe ensures zero process downtime by keeping maintenance to a minimum with an interchangeable sensor. When recalibration is due, the old HygroSmart HS3 sensor is simply exchanged for a new, freshly calibrated one. This simple procedure allows for the probe to remain installed, and takes only a few seconds to carry out. Using the replaceable sensor ensures that the HygroSmart HS3 probe has a low life-time cost, when compared to fully disposable probes. Alternatively, minor calibration adjustments can be easily made on any installed HS3 probe, with a 5-point digital trim adjustment via the application software to ensure maximum accuracy without needing to replace the sensor.

Enquiries: Tel. +27 (0) 10 595 1831 or email sales@instrotech.co.za

Entry level vibration monitoring system

By monitoring vibration, the condition of rotating machinery can be effectively determined. A vibration monitoring system can give early warning of impending failures and therefore prevent failure, reduce forced outage, maximise utilisation of assets, increase the lifetime of the machine, and at the same time, reduce maintenance cost.

Engineers at **R&C Instrumentation** decided to put together an entry level vibration monitoring system for applications where it is not cost effective to install expensive vibration and condition monitoring hardware and software.

The system consists of a loop powered vibration transmitter connected to a process indicator. The process indicator has programmable alarm relay outputs with a separate 4-20 milliamp re-transmission output. The indicator also doubles as a 24 Vdc power supply for the vibration transmitter. The vibration transmitter is fastened to the equipment to be monitored by means of an 8 mm mounting stud. Simply drill and tap an 8 mm hole and screw the transmitter into it. The system is supplied complete with Process Indicator, vibration transmitter and 2-pin MIL connector.

Enquiries: Tel. +27 (0) 11 608 1551 or email info@randci.co.za

Improved speed, precision in analysis of light elements

SPECTRO Analytical Instruments has upgraded the SPECTRO xSORT handheld X-ray fluorescence (XRF) spectrometer – delivering improved speed and precision in the analysis of light elements. The design, performance, and simple operation of the SPECTRO xSORT handheld spectrometer make it ideal for performing Positive Material Identification (PMI) for infrastructure integrity testing at refineries, power plants, and petrochemical complexes –as well as scrap metal analysis and sorting in the recycling industry.

The SPECTRO xSORT Alloy model delivers grade identification in seconds. The even more powerful SPECTRO xSORT AlloyPlus analyses most alloys in two seconds, and identifies alloys based on light elements such as aluminum, magnesium, silicon, phosphorus, and sulfur in seven seconds. Advantages include: Ease of Use: With SPECTRO xSORT, operators don't have to switch methods between samples, or bother with helium flushes or vacuum systems. Its compact, one-piece 1,64 kg (3,62 lb) design is optimized for easy use in the field, even in tight or less accessible spots. Built-In Protection and Calibration: A shutter that automatically closes the measurement window between analyses –to protect internal components –also functions as the sample material for unique, automatic iCAL standardisation. All calibrations loaded into SPECTRO xSORT are always ready for use.

Enquiries: Email spectro.info@ametek.com

New diaphragm pressure gauge for hygienic processes

From hygienic case design to small process connections, **WIKA** has tailored its new PG43SA-S diaphragm pressure gauge to the requirements of sanitary applications. With this, there is now a mechanical measuring instrument available for safe pressure monitoring in hygienic applications. Its measuring principle, with a flush welded diaphragm, enables mechanical pressure transmission, whereby the risk of product contamination through a transmission fluid is eliminated. As a result of its high overpressure safety, the instrument can also withstand critical process conditions. The operational flexibility of the PG43SA-S is supported through a large selection of small process connections - for example, to DIN 32676 (clamp) or to DIN 11864. Tested in accordance with 3-A Sanitary Standards, the pressure gauge with hygienic case is CIP, SIP and washdown capable. It can thus be cleaned reliably and time-efficiently. An easily accessible zero adjustment on the top of the case enables calibration if needed.

Enquiries: WIKA Instruments. Tel. +27 11 621 0000 or email sales@wika.co.za

Tasteful water: Iron control optimised

Drinking water not only has to be free from harmful substances and tolerable but must be aesthetically pleasing and tasteful. At concentrations commonly found in drinking water, dissolved iron is not harmful to human health.

However because it impairs water taste and colour, local authorities stipulate strict containment limits for iron. Elevated iron concentrations can also lead to build-up of deposits and settling of microorganisms in distribution systems and household water supplies. This is undesirable for consumers and utilities responsible for treatment of water for industrial processes, as iron deposits can cause corrosion or encrusting of pipes, turbines and vessels leading to expensive repairs or even complete system replacement.

With the **Endress+Hauser** Liquiline System CA80FE, waterworks and plant managers can rely on high-precision online monitoring of iron.

The analyser uses the standardised ferrozine method to deliver regulation-compliant measured values and features detailed logbooks that allow comprehensive documentation of the iron values. Plant managers are well prepared for audits and can prove compliance to water authorities at any time.

Iron removal is achieved by oxidising iron to form iron oxide hydrate which is insoluble and can be removed by filtration or sedimentation. Liquiline System CA80FE monitors the iron removal online and delivers measured values fast – helping to optimise the control of air blowers and thus save energy in the oxidation process. Fast measurements also help plant operators to detect potential process disturbances quickly and advanced diagnostics with remote access support them in prompt analysis and remedy.

Liquiline System analysers are designed with highly precise dispensers for reagent and standard dosing guaranteeing reduced consumption and low operating costs. Automatic cleaning and calibration functions ensure that the analyser and its sample preparation and reagents work reliably and without manual intervention over a longer period of time. Maintenance tasks can be carried out easily and with minimal tools, reducing maintenance costs and increasing process uptime.

Liquiline System shares the user-friendly operation that plant personnel already know from other online analysis parameters such as pH or chlorine - operating errors are virtually eliminated.

Its integration into process control systems is also seamless via Modbus, PROFIBUS and EtherNet/IP digital fieldbuses.

Enquiries: Jan Swart. Tel. +27 (0) 11 262 8000 or email Jan.Swart@za.endress.com

Miniaturised infrared thermometer for plastic film

Temperature is a key physical variable for ensuring quality in the production of plastic film. The application of non-contact temperature measurement technology poses the challenge that films with a thickness of less than 1 mm are transparent for standard IR thermometers and consequently are not able to be measured. Optris, German manufacturer of non-contact temperature measurement equipment, has developed the CT P3 infrared thermometer, which measures in a narrow spectral range of 3,43 µm, in order to enable a precise temperature measurement of thinner films made of, for example, PE or PP.

Available from **Instrotech**, he Optris CT P3 is a miniaturised and robust pyrometer in a solid casing, which is suited for retrofitted parts and OEMs. Without cooling, it can be used in environments of up to 75°C and has protection class IP 65.

The electronics (420 g) are separate from the sensor head (200 g) and have easily accessible programming buttons along with an illuminated LCD display. Selection options for the analog outputs are between 0/4-20 mA, 0-5 V, 0-10 V, thermic element version K or J. The digital outputs optionally available are USB, RS485, RS232 interface, relay outputs, CAN bus, Profibus DP or Ethernet.

Enquiries: Instrotech sales team on 010 595 1831 or sales@instrotech.co.za

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In Conversation With

Crown Publications editor, Peter Middleton, talks to ABB South Africa's Chief Executive Officer, Leon Viljoen, about his Africa-wide outlook and emerging technologies to carry the continent towards smarter, more connected and more reliable infrastructure.

Peter Middleton

Leon Viljoen

African solutions: C&I, microgrids and smarter plant services

Kusile is ABB's flagship project at the moment and that is 'going extremely well'. Having been awarded the Control and Instrumentation (C&I) project for all six units of the Kusile Power Station in eMalahleni, Mpumalanga in March 2015, ABB has already successfully conducted the Factory Acceptance Tests (FATs) that were proving impossible for the original contractor just 18 months ago.

Eskom re-issued tenders for the Medupi and Kusile C&I at the end of 2014 and ABB won the Kusile C&I contract. "Given the lost time, the C&I is now on the critical path for Unit 1 and electrical Balance of Plant (eBoP) of the power station, so considerable effort was put in to meet the deadlines. So we are very pleased that the FATs were successfully completed during November and December last year," says Leon Viljoen.

"Internationally, ABB is Number One in C&I. We are unique in this field in that we don't manufacture the mechanical equipment such as boilers and turbines, so we have the ability and experience to customise control solutions that are robust and flexible, regardless of which OEM's equipment it involved," he suggests.

In addition, ABB has already successfully integrated its control system into a small unit at Maasvlakte Power Station in the Netherlands that uses the same Hitachi boiler and Toshiba turbine as those used for Kusile and Medupi. "This reassured Eskom that we could do this," Viljoen suggests.

Another global C&I reference for ABB is the Sadara Integrated Chemicals Project in Saudi Arabia. "While we are locally known for our power solutions, our global revenue is higher in automation than in power. People often miss this."

On the power side in South Africa, ABB has reached the final testing stage of the turnkey electrical eBoP solution for the Ingula pump

AHC	– Asset Health Centre
C&I	– Control and Instrumentation
eBoP	– electrical Balance of Plant
OEM	– Original Equipment Manufacturer
PV	– PhotoVoltaic
REIPPPP	– Renewable Energy Independent Producer Procurement Programme

Abbreviations/Acronyms

storage power station, where it was responsible for the design, engineering, supply, installation and commissioning, including the service and auxiliary transformers, dry-type distribution transformers and medium- and low-voltage switchgear.

The first unit of Ingula (Unit 3) was successfully synchronised to the grid on March 6, 2016, making an additional 333 MW of peaking capacity available. With all the civils now complete, full commercial operation of the four-unit, R25-billion pump storage project is now expected by January 2017, adding 1 322 MW of peaking capacity and significantly reducing the need to run the expensive diesel-driven open-cycle gas turbines.

"We also expect to see Kusile Unit 1 begin to generate power later this year. From there on, Eskom's capacity constraints should begin to ease," Viljoen notes.

> *As the machine specialist, this company has a central service role to play over the lifetime of plant equipment.*

Microgrids and renewable solutions

According to Viljoen, the price of renewable power generation technologies has come down tremendously. "We see from the last round of wind and solar in the REIPPPP, that these technologies are now much more cost effective than they were when the programme began."

The problem with renewables is the effect they have on the grid. In a traditional grid the amount of harmonics is small and do not impact on the quality of supply. With wind that is intermittent and brings a lot of harmonics into the system, one can destabilise a system that is not very robust.

Describing a success story in Kenya, Viljoen says that a wind farm was connected onto a weak grid. To overcome variability problems, ABB is installing a flywheel to absorb and supply energy to counter the surges and harmonics caused by the wind farm on the grid. "These sophisticated stabilisation technologies now exist, enabling us to overcome most grid connection problems for renewables," he notes.

The REIPPPP has proved to be an excellent model in terms of regulation, rules and technical specifications. Now that we have this programme, big wind and solar farms can be established very quickly, which has led several countries north of our border to investigate this route.

Zambia, for example, is importing additional power through Mozambique, which is generated from diesel turbines on a ship and this is costly. Solar farms – that can be quickly constructed – are much cheaper at today's prices and a much better option compared to diesel generation solutions.

What do your microgrid solutions comprise?

ABB is harnessing its power inverter technology, along with its control, automation and instrumentation expertise to develop smarter microgrid solutions to better harvest renewable energy. "In our Longmeadow facility, for example, we have had to install diesel generators for back-up power to keep us going during outages and/or load shedding. But to reduce the running costs and the carbon footprint of burning diesel, we are adding PV panels onto our roof, along with battery storage to give us a full microgrid solution for this key facility," Viljoen reveals.

Describing the concept, he says that microgrids involve multiple connected technologies that, together, meet electrical demand in the most convenient, environmentally friendly, and energy and cost efficient ways possible. They make sense wherever a diesel generator is being used. The idea is to minimise the amount of fuel used by the generator. Not only is the diesel fuel expensive but also, in some places in rural Africa, it is hugely expensive to get fuel to the site. It is not a simple matter of filling up cans or ordering a delivery, fuel often has to be sent to remote mines and industrial sites via tankers that have to travel for many hours on poor roads.

"So by installing PV for use during the day, along with battery storage to extend its use into the morning and evening, the diesel generator is only required at night as a last resort – and this now makes economic sense," he says.

"In terms of battery storage technology, ABB has recently partnered with Samsung for the development and supply of battery technology in the renewable space. Samsung is putting large amounts of money into more cost-effective and longer lasting renewable battery storage and I believe this will soon be making microgrid solutions even more cost effective".

A view of the nearly completed Unit 1 boiler at Kusile, the site of ABB's flagship control and instrumentation (C&I) project.

What place has software in plant services and smart monitoring?

For ABB, software is integrated into everything we do. Almost all of our equipment is associated with software in some way and, through a recent agreement with Microsoft, we are aligning our solutions to take full advantage of the Internet of Things.

"Even for Kusile, the C&I information from our system is readily available and, while analysing it is not yet part of the project scope, information collected can easily be passed to our analytics systems for close and ongoing condition monitoring," says Viljoen.

Sensors are now much less expensive. It even makes sense to include them in low voltage motors across a plant to enable us to monitor individual sub-systems. There is significant interest in this approach for critical processes such as those the petrochemical companies employ.

How has the central destination for machine data changed your analytics?

While it is now easy for all OEMs to collect data from machines and send it to a central place, what you also need is the analytics to determine what the data actually means. "It is here that ABB can play an important role. We are the world leaders in transformer technology, for example, so if we get data from transformer oil – which can now be collected using built-in sensors – we can determine exactly what is going on."

Availability and reliability are the key deliverables when using the Internet of Things to keep track of equipment. As soon as a machine shows signs of deterioration, it is often best to scale down the process and sacrifice some production until the necessary maintenance can restore the system to its full potential. The system condition is under better control, maintenance is better planned and visibility is high – any manager anywhere can get an indication of the state of plant assets at any time. Going forward, all of our assets such as substations, switchgear, drives, motors and transformers, will have condition-monitoring sensors installed.

Total asset management software solution

Off the back of an acquisition of a specialist asset management software development company, ABB has established Enterprise Software, an asset management business unit to drive this new aspect of its business. The unit is supporting the total asset lifecycle through three key connecting components: the Asset Health Centre (AHC) as an asset performance management solution; Ellipse as an enterprise asset management system; and Service Suite as the mobile workforce management solution.

The AHC takes in data from equipment and analyses it through performance models or algorithms developed to codify years of industry

experience to determine the asset's true condition.This information is then passed onto the Ellipse system, which determines what action needs to be taken, what replacement parts are required and when the repair needs to be done. If technical personnel are needed, the scheduled information is passed onto Service Suite, which allocates personnel and interacts with the maintenance team through the repair, capturing progress and status reports until the process has been finalised and the plant returned to full health.

Through the Health Centre, the condition of all assets can be analysed and accessed at any time, promoting reliability. "This is how modern plants will be managed in the future and, along with the associated service responsibilities, it is likely to become central to our offering going forward," Viljoen predicts.

Conclusion

Since ABB is the machine specialist, it has a central service role to play over the lifetime of plant equipment. "Customers are losing skills and the new technology enables us to work together with plant operators to proactively manage plant reliability and maintenance.

Viljoen says that ABB's OEM engineering expertise provides a strong knowledge set in analytics. The company has the software systems and the expertise to roll out very strong OEM equipment packages, supported by monitoring, analytics and service support to maximise reliability, availability and equipment life.

take note

- ABB won the Control and Instrumentation (C&I) contract for Kusile Power Station after the tenders were re-issued by Eskom at the end of 2014.
- Factory Acceptance Tests (FATs) were successfully completed in November and December 2015.
- The C&I is currently on a critical path for Unit 1 and electrical Balance of Plant (eBOP) of the power station.

advertorial

World Power Products… 'REINVENTION'

The challenges and pressures of the shifting economy in South Africa made the new management of World Power Products (WPP) realise that change was necessary in a business that seemed stuck in its past… to one that reflects today's economy and management style. The business needed to become smarter, streamlined and ultra efficient.

WPP is a company that specialises in the manufacture of high-precision, custom sheet metal products as well as standard mild steel and stainless steel enclosures and cabinets. When Jan Görtzen (Managing Director) and Igmar van Rie (Factory Manager) took over the running of WPP two and a half years ago, they began instituting the transition from an establishment that had seen success, surviving more than half a century, into the dynamic company that it has become. Jan joined the company two and a half years ago, while Igmar has been with WPP for eight years.

Reinvention

Jan and Igmar use 'Reinvention' to describe the exciting roller coaster journey that the company experienced during the change. Jan says: "With 285 people on five different sites in different parts of the area,we needed to consolidate the business. He adds: "Essentially we had to examine, analyse and change the way everything was done. We have now consolidated the entire business (machinery and floorspace) on two adjacent properties and lowered the staff complement. Streamlining means that we have better control over the factory processes and expenses which has led to tremendous savings". WPP is able to deliver top quality, custom products, faster turnaround times at the best prices. Jan and Igmar identify the following secrets to the company's success:

1. Guaranteed quality

With more than 50 years' experience in sheet metal manufacturing, the company's skills and knowledge are firmly established and top quality is a given.Their technically qualified team of experts is able to take care of any project from design through to final delivery. The team will generate all manufacturing drawings and the bill of material ready to be handed to the factory for production.

2. Competitive pricing

The 'Reinvention' of WPP has made it possible to keep prices extremely competitive.

3. Short lead times

The WPP customer base is mainly in the Gauteng area of its purely South African market. But what are the turnaround times? "From excessively long turnaround, our turnaround for large volumes is within two to three weeks. Says Igmar: "We're open to customers' needs on delivery!"

What sets WPP apart?

The range of processes carried out on the premises sets WPP apart… laser cutting, punching, bending, welding, powder coating, assembly, gasketing, CHC milling and turning, plating, die casting and plastic injection moulding. Custom designed products and components account for 70% of production and the remainder is focused on the company's standard line of products which consists of stainless steel and mild steel enclosures, cabinets, locks and hinges. All enclosures are manufactured on WPP's premises. Pride in its work – with spotlessly clean factories – gives World Power Products the edge.

Managing change

Jan says that the right management in times of change is important. Management needs to:

- Know the teams' strengths and weaknesses.
- Demonstrate leadership by taking tough decisions.
- Encourage innovative thinking.
- Acknowledge that reinvention is not easy.
- Train staff to be more skilled and useful in their roles… thereby improving the business and the lives of individuals.
- "Take your team with you… every step of the way".

Watch this space!

As part of the 'reinvention' the company will be introducing a new range of standard enclosures geared at the entry level market as well as looking to moving into the renewable energy sector. WPP… most certainly, a space to watch.

Enquiries:
World Power Products
Tel. +27 (0) 11 680 5524
Email:info@wpp.co.za
Website: www.wpp.co.za

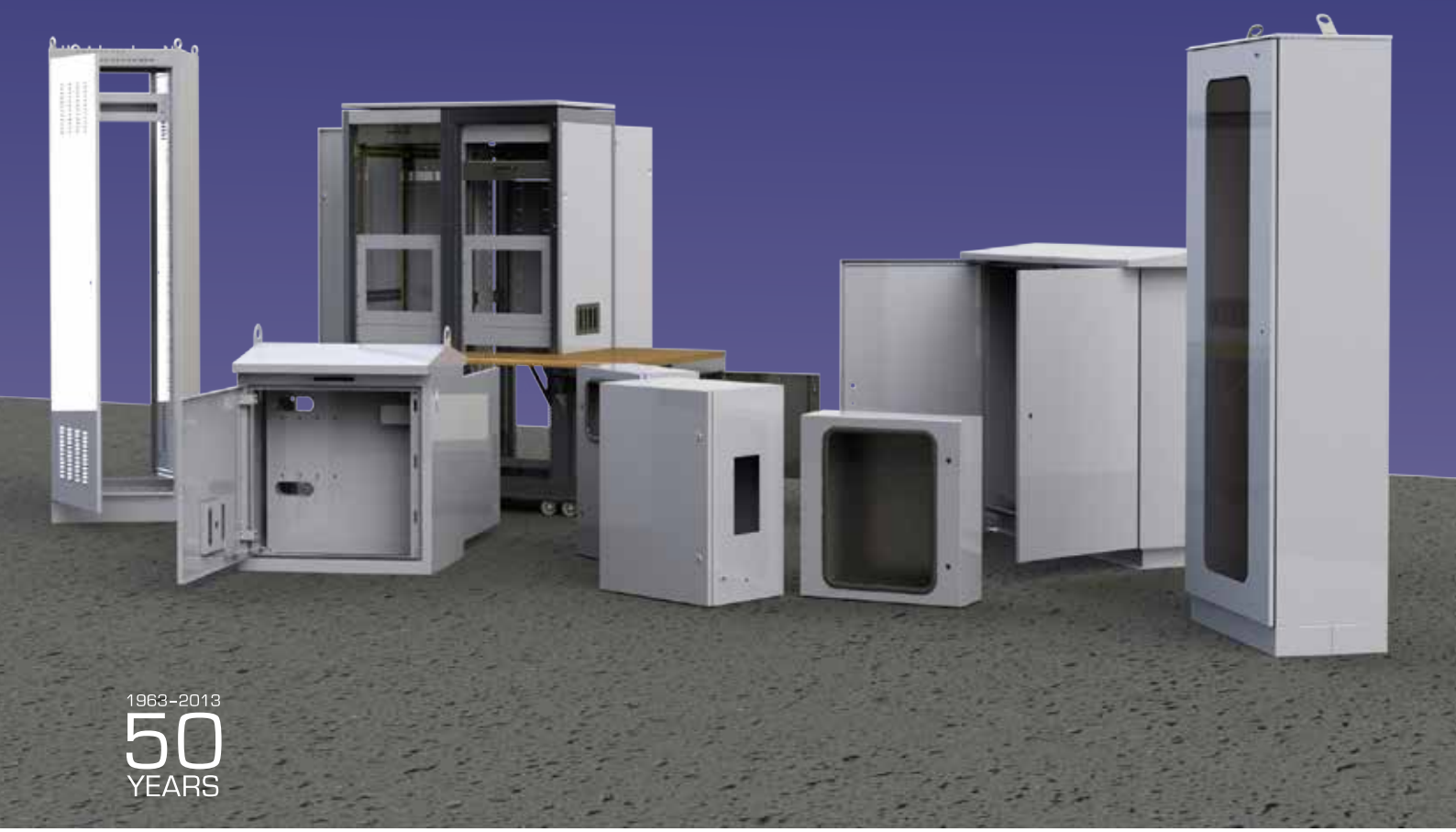
"Of all the industries in which we're involved…Electrical is where WPP belongs".

Igmar van Rie (Factory Manager), Samuel Maluleke, Jan Görtzen (Managing Director) and Elias Mtshali.

Unmatched steel manufacturing services

We specialise in custom enclosures as well as our own line of standard products.

For more information please visit our website or contact us directly.
www.wpp.co.za **(011) 680 5524** **info@wpp.co.za**



world power products
excellence in sheet metal fabrication

- Large factory capacity.
- Main processes include: laser cutting, punching, bending, welding, powder coating, plating, tool making, milling and turning.
- Various standard products: enclosures, cabinets, locks and hinges.
- Stock available on all standard products.
- Versatile applications across all industries.
- Guaranteed quality workmanship (ISO 9001-2008).
- Short lead times on special orders.
- Highly competitive pricing.

Virtualisation and dynamic IT loads

Bruce Grobler, Schneider Electric

Without question, IT virtualisation – the abstraction of physical network, server, and storage resources – has greatly increased the ability to utilise and scale compute power.

Indeed, virtualisation has become the very technology engine behind cloud computing itself. While the benefits of this technology and service delivery model are well known, understood, and increasingly being taken advantage of, their effects on the Data Centre Physical Infrastructure (DCPI) are less understood. This is according to the white paper, *Virtualisation: Optimised power, cooling, and management maximises benefits*, by Schneider Electric. In its research, the company states that virtualised IT loads, particularly in a highly virtualised, cloud data centre, can vary in both time and location. In order to ensure availability in such a system, it's critical that rack-level power and cooling health be considered before changes are made.

The paper demonstrates how the sudden – and increasingly automated – creation and movement of Virtual Machines (VMs) requires careful management and policies that contemplate physical infrastructure status and capacity down to an individual rack level. Failure to do so could undermine the software fault-tolerance that virtualisation imbues to cloud computing. Fortunately, tools exist today to greatly simplify and assist in doing this.

Variation in electrical load

The research further shows how electrical load on the physical hosts can vary in both time and place as virtual loads are created or moved from one location to another. As the processor computes, changes power state or as hard drives spin up and down, the electrical load on any machine – virtualised or not - will vary. This variation can be amplified when power management policies are implemented, which actively powers machines down and up throughout the day as compute needs change over time. The policy of power capping, however, can reduce this variation. This is where machines are limited in how much power they can draw before processor speed is automatically reduced. At any rate, since data centre physical infrastructure is most often sized based on a high percentage of the nameplate ratings of the IT gear, this type of variation in power is unlikely to cause capacity issues related to the physical infrastructure particularly when the percentage of virtualised servers is low.

Virtualised environment

A highly virtualised environment, such as that characterised by a large cloud-based data centre, however, could as per the white paper study have larger load swings compared to a non-virtualised one. And, unless they are incredibly well-planned and managed, these could be large enough to potentially cause capacity issues or, at least, possibly violate policies related to capacity headroom. The study also reveals that increasingly, managers are automating the creation and movement of VMs. It is this ability that helps make a virtualised data centre more fault-tolerant. If a software fault occurs within a given VM or a physical host server crashes, other machines can quickly recover the workload with a minimal amount of latency for the user. Automated VM creation and movement is also what enables much of the compute power scalability in cloud computing.

Power, cooling problems

Ironically, however, this rapid and sudden movement of VMs can also expose IT workloads to power and cooling problems that may exist which then put the loads at risk. Data Centre Infrastructure Management (DCIM) software can monitor and report on the health and capacity status of the power and cooling systems. This software can also be used to keep track of all the various relationships between the IT gear and the physical infrastructure.

Servers installed in racks

Essential knowledge for good VM management includes knowing, which servers, both physical and virtual, are installed in a given rack, along with understanding each associated power path and cooling system. This knowledge is important because without it, it is almost impossible to be sure virtual machines are being created in or moved to a host with adequate and healthy power and cooling resources. The white paper maintains that relying on manual human intervention to digest and act on all the information provided by DCIM software could quickly become an inadequate way to manage capacity, considering the many demands already placed on data centre managers. The

take note

- Virtualised IT loads can vary in time and location.
- It is critical that rack-level power and cooling health be considered before changes are made.
- Virtual Machines (VMs) require careful management and comprehensive policies.

Abbreviations/Acronyms

DCIM	– Data Centre Infrastructure Management
DCPI	– Data Centre Physical Infrastructure
IT	– Information Technology
VM	– Virtual Machine

risk of human error is linked to manual intervention, a main reason for downtime.

IT load changes

Human error, as examined in the white paper, is likely to take the form of IT load changes without accounting for the status and availability of power and cooling at a given location. Automating both the monitoring of DCIM information (available rack space, power, and cooling capacity and health) and the implementation of suggested actions greatly reduces the risk. There is however DCIM software available today that provides real-time, automated management. The two-way communication between the VM manager and DCIM software and the automated action that results from this integration, is what ensures physical servers and storage arrays receive the right power and cooling where and when needed. A VM is created or moved to a different physical server typically because there are not enough processor, memory, or storage resources available at a given moment and location. But the white paper points out that an effective management system can directly cause VMs to move based also on real time, physical infrastructure capacity and health at the rack level. When DCIM software is integrated with the VM manager, VMs can be safely and automatically moved to areas known to have sufficient power and cooling capacity to handle the additional load.

> *Virtualisation has become the technology engine behind cloud computing.*

'At risk' VMs

Conversely, the analysis illustrates how VMs can be moved away from racks that develop power or cooling problems. For example, if there's a power outage at a rack, a cooling fan stops working or there is a sudden loss of power redundancy, the VM manager can be notified of the event and the 'at risk' VMs can be moved to a safe and 'healthy' rack elsewhere in the data centre. All of this happens automatically in real time without staff intervention. DCIM software integration with a VM manager is a key capability for ensuring that virtual loads and their physical hosts are protected. In turn, service levels will be more easily maintained and staff will be freed from having to spend as much time physically monitoring the power and cooling infrastructure. The research demonstrates how this integration becomes even more critical as power and cooling capacities are reduced or rightsized to fit a newly virtualised or consolidated data centre. The less "head room" or excess capacity that exists, the less margin for error there is for placing virtual machines. Maintaining a highly efficient, leanly provisioned data centre in an environment characterised by frequent and sudden load shifting requires a management system that works automatically in real time with the VM manager.

Conclusion

The white paper highlights that it should not be forgotten that IT policies related to VM management need to be constructed so that power and cooling systems are considered. This must occur in order for the DCIM software integration with the VM manager to work as described above. Policies should set thresholds and limits for what is acceptable for a given application or VM in terms of power and cooling capacity, health, and redundancy. Virtualising a data centre's IT resources can have certain consequences related to the physical infrastructure, concludes research by Schneider Electric, and f these impacts and consequences are ignored, the broad benefits of virtualisation and cloud computing can be limited or compromised, and in some cases, severely so.

Bruce Grobler is the vice president for Schneider Electric's southern African IT business unit. He joined Schneider Electric in 2009 as automation and drives sales manager in the company's industry business unit. Prior to this, he spent more than 10 years gaining experience in both the computer software and electronic manufacturing industries at Siemens and Citect. Bruce has a national higher diploma in electrical engineering, along with a Business Management Diploma from the University of Johannesburg (previously the Technikon Witwatersrand). Enquiries: Tel. +27 (0) 11 254 6400 or email chetan.mistry@schneider-electric.com

OEE in a Box – 'out of the box' – solution for mining

Schneider Electric, a global specialist in energy management and automation, has announced the launch of 'OEE in a Box', an innovative, out-of-the-box, consultant-led optimisation solution designed to help mining companies identify and break the key production bottlenecks that are constraining their operations.

Built on Schneider Electric's operational management software, Ampla, and leveraging the organisation's deep expertise in the optimisation of production processes, OEE in a Box brings together consulting expertise and optimisation technologies to target high impact opportunities for improvement in the mining production process. OEE in a Box measures the industry-wide metric Overall Equipment Effectiveness, or OEE, at the equipment or area bottleneck of the production process. By benchmarking the availability, performance, and quality of the most critical area in the overall process, it enables managers to optimise overall throughput and effectiveness by quickly identifying the key causes of efficiency losses through the process. Availability considers the loss of efficiency related to actual operating time as a percentage of planned production time, while performance takes into account the rate of production in a given time frame compared to expected targets. Finally, the quality of output from the production process is considered in order to provide an overall picture of the effectiveness of the production process as a whole, because ultimately increased throughput can only be beneficial if it also results in increased product recoveries. Clinton Macdonald, manager of Integrated Planning and Optimisation Solutions at Schneider Electric Southern Africa, explains that, "One of OEE in a Box's differentiating factors is that the solution is consultant driven. A Schneider Electric mining consultant assists in identifying and confirming the production bottleneck so that when the optimisation software is deployed, it is targeted at an area of the process where it will have the greatest impact."

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UPS offers reliable protection to SMEs

Schneider Electric, a global specialist in energy management and automation, has expanded its Galaxy 300 Uninterruptible Power Supply (UPS) system, which now includes 60 kVA and 80 kVA models. Ideal for small and medium businesses, commercial buildings and technical facilities with small server rooms, the Galaxy 300 60 kVA and 80 kVA UPS systems provide effective and reliable three-phase power protection to prevent downtime and data loss for mission critical applications in a robust, simple-to-install and cost-effective configuration. The new UPS systems also enable users to lower operational and cooling costs with power efficiency and total harmonic distortion of current at less than 3,5% with full load. "There was a need expressed by our low- and medium-level power users for a system that offered greater power availability, reliability, manageability and convenience," says Bruce Grobler, vice president of the IT Business for southern Africa at Schneider Electric. "Serving a range of organisations, the addition of the 60 kVA and 80 kVA models, the Galaxy 300 10 to 80 kVA UPS portfolio directly answers customer and partner requirements by offering a best-in-class UPS with simplified installation, management and maintenance features, as well as enhanced efficiency and ease of use via an intuitive interface."

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Six questions to ask when securing your IoT

Industrial applications across the globe are being transformed by connecting a greater number and wider range of 'things' that create tremendous opportunities to innovate and drive out inefficiency. However, as your organisation creates an Internet of Things (IoT) strategy, you should answer these important security questions:

1. How do I determine whether a device is a candidate for IoT? As more devices are embedded with smart sensors and gain the ability to communicate, these things then become the tools we use for better understanding complex processes. They can help create smarter machines that can then be better controlled, thereby increasing efficiency. All these devices are linked through wired and wireless networks using the same network technology as the Internet, so securing the architecture from attacks, data authentication and access control become increasingly more important.

To determine if your device should be connected to the IoT, simply ask, 'What is the value of having it on the network?' Just because you can connect something, doesn't mean you should. If the value of connecting is greater than the risk, then it is a likely candidate. If you do decide to put it on the network, make sure it uses standard EtherNet/IP technology and conforms to IP standards and best practices. This helps deliver data in a consistent manner and allows various levels of security technologies to be used.

2. What can I do to protect the control systems from a potential flood of IoT communications and threats? We all have seen or been in nasty traffic jams caused by roads that weren't changed to accommodate the rising population in that area. That iswhat your network can look like without careful planning. By 2020, it is estimated that 20 billion devices will be IoT-connected. Do your homework and put a proper plan in place that not only addresses your needs today, but also looks ahead to the future. No one product, technology or methodology can fully secure industrial applications. It takes a Defense in Depth (DiD) approach to address both internal and external threats. This approach uses multiple layers of security including physical, policy and technology.

As an example, verify that all unused ports are locked either programmatically or physically using lock-out connectors; put your controller into "run mode;" and use passwords. These are things that can be done today. In addition, you can put policies in place to control human interaction with your systems whether they are internal or external, on-site or in remote operations. Authenticate who is on your network, authorise what they can do, and then account for what they are doing on your network. Use best practices for segmenting your networks: Establish domains of trust, and use network infrastructure technologies such as VLANs, VPNs, firewalls, ACLs, and passwords to limit who and what has access on your network.

Segmenting your network into smaller VLANs also can help maintain them and provide a level of isolation. For example, this segmentation helps avoid taking your entire network out due to a problem on one machine line. With the IoT comes great opportunity, but it's not without its challenges. However, you don't have to do it alone. Help is available for you, such as the Industrial IP Advantage (www.industrial-ip.org), an online community that can provide the information you need to successfully deploy your industrial information architectures.

3. How is cyber security for IoT and industrial control systems security different? There is no major difference. A good cybersecurity plan includes prevention: setting policies and procedures to reduce risks, and resolution — what to do if there's a security breach. This is fundamentally the same for industrial control systems (ICSs), and in fact might be even more important, because downtime of operations can be very costly to the company.

4. How should IoT and ICS cyber security be managed? To truly gain the advantages and opportunity the IoT promises, you need to accept the convergence of IT and OT network infrastructures. This allows you to manage the entire network using the same technologies and personnel, helping to reduce assets and training –one staff instead of two, with one common objective instead of two disparate ones.

However, this isn't a simple journey; better collaboration between departments, facilities and suppliers will need to happen. Many plant networks never were designed to connect with the enterprise, so a comprehensive assessment is a good start to developing your strategy and execution plan.

5. Who should be responsible for providing IoT cyber security? Just as there's no one product, technology or methodology to fully secure your control system, there's no one provider either. Each needs to keep security in mind when providing products or solutions for your business. This should include your entire supply chain. Network owners need to design their networks using validated designs and best practices and plan for who, what and when information will be available on the network.

ICS providers should offer control systems that follow global standards and regulatory security requirements and have common, secure design requirements in their product developments.

OEMs or equipment builders should follow best practice designs in their machine networks as well. Their machines should integrate easily into their customers' operations, meeting IT security policies and OT performance objectives. This integration also allows the machine builder to drive even more value to their customers. For example, with the ability to establish secure remote access from anywhere in the world, customer machine downtime and travel expenses are minimised.

6. What is the role standards play in managing IoT cyber security? Standards are critical to realising the promise of the IoT. Without them, these 'things' aren't going to connect in a consistent fashion, meaning more work for everyone. The standards help validate that technologies and methodologies are proven and provide greater interoperability. They can also help users put these 'things' on the network so the data gets to where it needs to be at the right time, and gets there securely. Solution providers can help you better secure your network with existing products and solutions built on these standards. Following these standards will allow better evolution of your infrastructure. With a properly designed network that can accommodate evolving standards and technologies, you can avoid those future traffic jams.

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Induction motor rotor bars

Henry du Preez, Consultant

The rotor of an induction motor is a critical component and has a major influence on the motor performance. The motor designer determines the motor characteristics with the design of the rotor and rotor bars.

Change the bar profile and or material and the performance characteristics will change. This is an important factor which the repairers of electric induction motors must note. They need to take care that when they repair an induction motor rotor they must ensure that the same material and configuration in all respects is the same as per the original design. Changes can be made but these must only be carried out after careful consideration as to the effect this will have on the operating characteristics of the motor. Induction motor characteristics are typically as indicated in *Figure 1*.

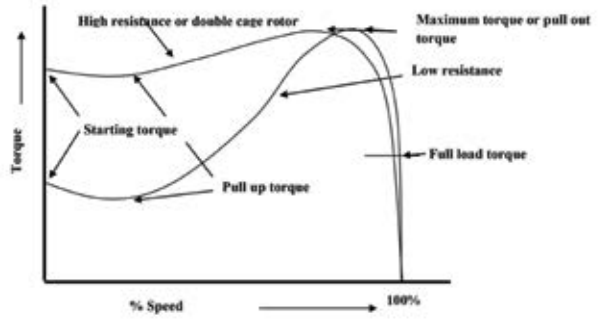

Figure 1: Typical induction motor speed torque curve for two types of rotor.

Changing the design of the rotor by replacing the brass or other high resistance bars on the outer cage of a double cage rotor will affect the starting torque or current, efficiency and characteristic of the motor.

Induction motor rotor construction

Induction rotors are usually constructed from laminated steel – generally the inner portion of the stator stamping which effectively reduces waste. The rotor lamination is either pressed directly on the shaft or spider in the case of larger machines.

Cast aluminium rotor bars

The cage type induction motors have a variety of possible construction methods. The most common in low voltage motors is the cast aluminium type. This type of construction has many advantages; the construction is relatively easy and cost effective for manufacture. Complex rotor bar shapes are relatively easy to obtain.

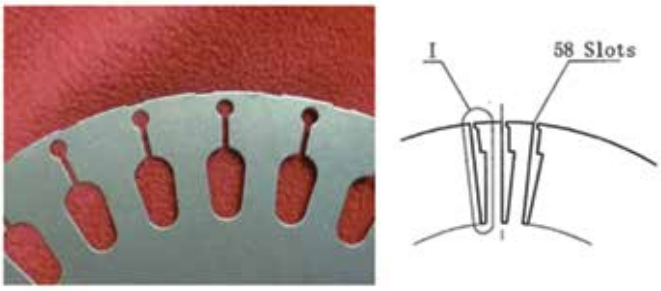

Image 1 and Figure 2: Cast aluminium rotor punching.

Typical cast aluminium rotor punching

Practically any cast aluminium bar shape required by the motor designer can be accommodated as the only requirement is the die for stamping the laminations, and the practicality for ensuring a good solid aluminium casting. Cast aluminium rotor bars can be practically any profile as the bars are cast into the slots and will fill any shape punched into the laminations. Limitations are predominantly designing that the flow of casting aluminium can fill the slots and end-ring cavity without any cavities or blow holes. Cavities, cracks or blow holes will affect the performance of the motor.

Copper rotor bars

Copper bar rotors can take many forms. The bars can be simple sections such as round, square, or rectangle but can also be wedge, tear drop, keyhole etc. in cross section.

Some manufacturers use double cage construction which would consist of the inner cage (usually copper) and outer cage, which would generally be an alloy such as brass – but could be any other complex alloy.

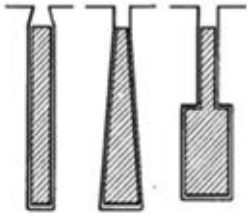

Figure 3: Typical solid copper rotor bars.

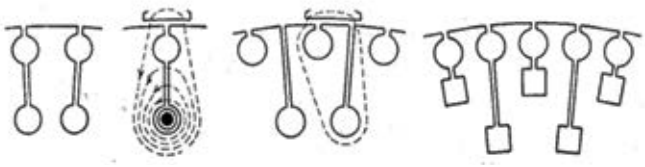

Figure 4: Typical double cage rotor bar configurations.

In *Figure 4*, the solid copper and the double cage copper/brass configurations are only a few of the possible arrangements, square, oblong, rectangular or other sections are possible. Generally, the outer cage in a double cage configuration is a brass alloy; other alloys with a suitable resistance (conductivity) can and are used at the motor designers' discretion.

Image 2: Double cage with deep bar inner cage.

Image 3: Double cage.

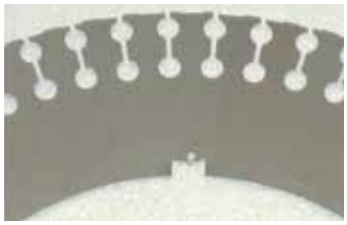

Image 4: Typical double cage rotor punching.

Image 5: Deep bar single cage.

Cast aluminium rotor bars can be practically any profile as the bars are cast into the slots and will fill any shape punched into the laminations. It is important that the rotor bars are tight in the slot otherwise they will vibrate, resulting in work hardening and premature failure. Some rotors, generally only in larger ratings motors, have the bars wedged with two opposite wedges under the bar to ensure a tight fit.

Material	Melting Point	Density Kg/dm^3	Coefficient of expansion a/ 10 – 6	% Conductivity
Silver				100
Aluminium	658	2,6	23,8	55
Brass	900	8,4	18,5	23 – 29 Dependent on alloy
Copper	1083	8,8	16,5	94

Table 1: Relative properties of common materials.

Some rotor failures

Image 6: Aluminium rotor stalled overheating.

Image 7: Alternative view of Image 6.

Image 8: Overheating of connections. showing lamination damage.

Image 9: Fractured rotor bar.

Image 10: Fractured rotor bars.

Image 11: Fractured rotor bars.

Image 12: Core burning due to broken rotor bar.

Image 13: End-ring burnt/sheared off.

Image 14: End ring sheared off.

Image 15: View of rotor.

Image 16: Poor Brazing and fractured bar.

See Image 16: You can see the marked bar is lifting due to the fact that the brazing failed. The bar to the left of the marked bar has failed mechanically just before it enters the end-ring and is also lifting. This indicates that the motor was operating after the failure and due to burning of the laminations at the end of the core where the broken bar exits the slot and mechanical abrasion the slot has enlarge to allow the bar to lift. If left running enough it would lift sufficiently to catch the stator laminations and the stator windings.

Broken rotor bars

It is important to note that an induction motor can and will run with a number of broken rotor bars but the performance will be effected in a number of ways. If a copper rotor bar breaks the damage can result in a major failure, damaging the stator winding and, in time, the stator core. Even in the case where the stator winding and core are not damaged it could result in server rotor core damage; this is as a result of bar currents flowing through the core and burning the core. A motor will run with one or more rotor bars broken, but, depending on the type of rotor construction, the consequences could be different. One broken bar on a copper bar rotor could result in the motor being damaged so badly it could be a write-off; the rotor bar could lift and dig into the stator core and/or winding. Cast aluminium rotors do not generally damage the stator as the aluminium seldom comes out and damages the stator but I would not like to say this is an impossibility. See *Images 6, and 7*: This occurred due to a stall condition the rotor got so hot the aluminium melted and run into the stator winding.

> *Rotor bar failures are a major concern as they affect the performance of the motor.*

Broken rotor bars in cage induction motors can produce axial vibrations on the motor frame at specific frequencies. When a bar breaks in a cage induction motor, two scenarios exist. The first scenario is based on the assumption that no current flow in the rotor bar. In this scenario the bar approaches an open circuit and a magnetic disturbance exists around the bar. This disturbance travels with the rotor and occurs in a localised portion of the air gap. The magnetic disturbance produced by the broken rotor bar links with the stator coils, resulting in an induced current in the stator. If you consider the backward rotating component of the fundamental harmonic of the magnetic disturbance, it is evident that this component rotates at 2 x slip frequency with respect to the stator. This can be seen in the current spectrum and is use to indicate broken rotor bar when the current wave form is analysed. (There are instruments on the market using this to indicate rotor bar failures of machine in service.)

The second scenario is when a bar breaks and the current still flows in the bar by means of inter-bar currents. The current enters the bar at the healthy end, and flows along the length of the bar and leaves the bar through the core and flows to the adjacent health bars. (This often results in burning of the laminations at the site where the current enters the laminations, due to the high resistance or the connection and lamination resulting in localised heat.) This invariably occurs in large induction machines. In *Images 9, 10 and 12*, you can clearly see the burning of the lamination and the erosion of the slot in the laminations resulting in a loose bar which could lift and damage the stator core and windings. The presence of axial vibration components indicates that a cracked or broken bar with inter-bar currents is present in the motor. As the fault worsens, burning of the core occurs and the inter-bar current decreases owing to the increase in the contact resistance.

As the inter-bar currents decrease, the adjustment bars carry more and more current and the fault spreads rapidly to the adjustment bars because of the increase in bar temperature associated with increased bar current. Rotor bar problems reduce the starting and running torque in the motor and therefore increase the run-up time of the motor increasing the rotor and stator temperature, this increase in temperature worsens the rotor condition and could lead to a reduction in stator insulation life. It is particularly bad in the case of frequent starting operation of the motor. Owing to the difference in expansion aluminium rotors suffer from deterioration in time as the motor ages resulting in a decrease in the torque characteristics of the motor.

Causes of broken rotor bars

The most susceptible region for broken rotor bars is at the joint or the bar and end-ring.

- Bars in the region between the core and end-ring are exposes to large accelerating and decelerating forces. These forces stress the bars and fatigue is the result causing fractures
- When the motor is started, the current migrates to the top of the bar due to the skin effect. This current migration creates a temperature gradient over the depth of the bar because the top of the bar heats faster than the bottom of the bar
- This uneven expansion stresses the bar and joints causing failure
- Manufacturing defects are a further cause of failure of the bars and joints
- Poor brazing causes weak spots and possible failure. Uneven heating prior to brazing can also result in increased stresses in the bars and joints
- Thermal stresses are a common cause of broken rotor bars. Heating of the rotor during starting can lead to continual expansion

take note

- The rotor of a motor is a critical component.
- The rotor has a major influence on the motor performance.
- Test and inspections on the rotor bars can and should be carried out when a motor is opened.

and contraction of the bar, which leads to further stressing of the bar and joints

- During stalled conditions the majority of the input power goes to the rotor resulting in over-heating of the rotor possible resulting in a meltdown as shown in Images 6, 7, 12 and 13
- Unbalance voltage supply system and harmonic can cause excessive heating of the rotor due to negative phase sequence and high frequency currents in the rotor

Testing of rotor bars

There are a number of ways to test for broken rotor bars some in operational tests others static:

In operation:

Current signature
Vibration

With the rotor in a lathe or balancing machine:

Induced voltage/current (the use of a search coil near to the surface of the rotor spinning in a magnetic field and the resultant wave form in the search coil displayed on an oscilloscope)

Static with rotor on an inspection trestle:

- o Visual (Copper bar rotors) and server cases of cast aluminium rotors
- o Growler and noting the current as the rotor is turned or as the growler is moved from bar to bar around the rotor.
- o Note: A 50 Hz growler with a search coil will indicate an induced voltage or the current method is an indication as to the condition of the bars but may not penetrate to the bottom bars in a double cage arrangement
- o Passing a current through the bars by connecting a power source between the end-rings and checking the magnetic flux pattern

Conclusion

Rotor bar failures are a major concern as the effect the performance of the motor and any defect in the rotor bars whether Cast Aluminium, Copper Bar, Double Cage type or any other will get steadily worse and if not detected and rectified could result in a very serious motor failure. (Bar could lift damaging rotor core, stator core and windings). Test and inspections on the rotor bars can and should be carried out when a motor is opened for any reason. Vibration and current signatures will assist in indicating and potential rotor problems, and these can be dealt with at a convenient time as soon as possible. It is not possible to repair a cast aluminium rotor bar failure and a replacement is recommended.

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Understanding ac motor control models

Norman Maleka, SEW-EURODRIVE

The basic characteristics of control models based on the example of SEW-EURODRIVE frequency inverters, which cover the entire power and application range – from basic standard, to the toughest technical requirements.

Up until the 1970s, dc motors were just about the only option for step-less adjustment of speed and torque in industrial applications. Traditional dc motors are prone to wear, which generates both mechanical loads and servicing costs. Ac motors, on the other hand, are far more robust and virtually maintenance-free.

They were, however, far less easy to control, especially when ac control engineering and power electronics were still in their infancy – at a time when there were no digital signal processors and both power MOSFETs and IGBTs were at best theoretical concepts.

Open and closed loop control of ac drives has now become indispensable and is still enjoying highly impressive growth rates in electrical drive engineering. Inverters with Voltage/frequency (Vf) control are ideal for simple applications such as pumps, fans or basic materials handling technology. They are used to drive moderately dynamic ac motors and are essentially based on the proportional adjustment of voltage and frequency. This keeps the flux in the machine constant and maintains the maximum torque. Since the rated flux generates the highest torque per kg of machine, the raw materials used – steel, copper and insulating materials – are at their most effective.

From the motor perspective, the controlled inverter takes the form of an adjustable socket for mains voltage and mains frequency. This means it is also possible in principle to operate several smaller motors simultaneously with one inverter. Thanks to their straightforward principle and easy handling, frequency inverters with V/f control are ready to use in a short time. This has therefore become the standard control mode, without speed feedback.

SEW-EURODRIVE uses a mode based on V/f control in its MOVITRAC LTE-B, MOVITRAC B and MOVIDRIVE B frequency inverters for installation in control cabinets, and also in MOVIMOT, MOVIFIT FC and MOVIPRO SDC decentralised drive controls.

During project planning for an electric drive system, it is vital to identify the application's control accuracy requirements. If these requirements are transparent and specified, the tailored drive system can be assembled from the necessary components – the gear unit, motor, encoder, inverter and controller.

> *Since the late 1970s, many control models with different names have been developed for ac motors.*

Conclusion

The key objective is to include the right components for the specific control quality requirements while also optimising costs. If the requirements are set too high or too low from the outset, this results in unnecessary additional outlay. SEW-EURODRIVE regards itself as a specialist in helping customers select the ideal drive components.

take note

- Until the 1970s, dc motors were almost the only option for step-less adjustment of speed and torque in industrial applications.
- Ac motors are more robust and virtually maintenance-free.
- Open and closed loop control of ac drives has now become indispensable.

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Aluminium three-phase 380 V and 525 V motors for industrial applications

The main benefit of the **Bauer** range of aluminium electric motors is that it is far more lightweight than its cast-iron equivalents due to the aluminium casing and end shield, Lewis Hiepner, product manager: electric motors at BI, comments.

"This MS range of aluminium three-phase 380 V and 525 V motors has been supplied successfully to the South African market for the past decade," Hiepner points out. A main feature is the multi-mount design, with the added benefit of being able to change the feet on-site. This gives the customer the option of having the terminal box on the top or on the left or right hand side, depending on the specific requirements. In addition, Bauer motors can be fitted with an external brake of either an ac or dc type.

The ac brake type is specifically for instant stopping when the power is switched off. Applications include bottling plants where accuracy in the stopping position is critical. Dc brakes, on the other hand, are slower in reaction time. This is due to the brake's power going through a rectifier in order to convert ac to dc, with a resultant delay. Typical applications include overhead cranes, where stopping accuracy is not as critical.

All Bauer motors conform to the relevant IEC standards, as well as being designed for S1 duty. This means that the motors can run continuously for 24 hours under normal load conditions. Another feature is the Class F insulation, with a 'B' temperature rise (80°C plus a maximum ambient temperature of 40°C, giving a total of 120°C). The manufacturing process use a vacuum pressure impregnation system in the insulation. The motors are also IP55 weather-proof, meaning that they can withstand normal weather conditions, provided that the cable termination to the terminal box is carried out correctly. The Bauer range is also water, dust and even vermin proof.

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Drives for Masama wellfields

Rockwell Automation recently supplied medium voltage drives and soft starter motors for Masama wellfields – located about 80 km northeast of Gaborone in Botswana. The hardware was installed in February 2015 and commissioned in June, with the wellfields commencing operation in September 2015. The completion of the Masama wellfields means an additional 20 Ml/day will supplement the existing 60 Ml/day supply of water that is delivered through the North South Carrier 1 pipeline. It represents a significant milestone in the country's ability to attain long-term water security. The Rockwell Automation scope of the project was mainly as product vendor, and related equipment design and commissioning. The company supplied two PowerFlex 6000 MV ac drives (1 150 kW, 6,6 kV) that will automate the pump system that transfers water from holding tanks to the North South Carrier 1 pipeline. Ducting for the drives was engineered-to-order to maximise airflow over the drives to deal effectively with the heat. Allen-Bradley SMC Flex Soft Starters were also supplied, one for each of the 32 boreholes. The soft starters will play an integral role both in providing motor protection and in optimising the energy consumption of the wellfields. Rockwell Automation has been involved in previous phases of the 360-km North South Carrier pipeline. The PowerFlex 6000 supplements the Rockwell Automation MV drive range, providing a cost-effective, fit-for-purpose drive for new and retrofit centrifugal fan and pump applications rated up to 10 kV.

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Carbon Tax in South Africa

Silvana Claassen, CES Carbon & Energy Solutions and Justine Bolton, Bright Green Solutions

This article touches on factors that drive the implementation of climate change mitigation measures such as the carbon tax; the objective of the carbon tax; its design; and what can be done to reduce one's tax-liability.

Over the past six years there has been a lot of speculation and uncertainty on whether or not a carbon tax would be introduced in South Africa. And if so, when this would happen. The ongoing debate between supporters and opponents of the carbon tax commenced when the National Treasury released a discussion paper on 'The Carbon Tax Option' in 2010. Subsequently, proposed implementation dates have been delayed several times.

With the National Treasury's closure of comments on the draft carbon tax bill on 15 December 2015, it is safe to assume that the carbon tax will come into force; the only question is when?

Why Carbon Tax?

In 2014, South Africa was number 13 on the list of world's largest greenhouse gas emitting economies in terms of its absolute emissions. South Africa emitted 476 $MtCO_{2e}$ of greenhouse gases in this year. China featured on top of this global list and the United States was ranking second [1]. South Africa's high ranking can be attributed predominantly to a history of cheap coal-fired electricity, resulting in South Africa's economy to rely heavily on an energy- and therefore carbon-intensive industry.

> *The carbon tax is based on the 'polluter-pays'-principle in the form of a price that companies have to pay for each ton of CO_{2e} that they emit, as a result of their activities.*

Increased global pressure to reduce greenhouse gas emissions calls for a transformation to an economy that is less driven by carbon. Also, South Africa is a developing country, similar to most countries on the African continent. Increasingly, studies are pointing in the direction that developing countries will be most affected by the adverse consequences of climate change [2]. Negative impacts are already felt like the recent drought which can be partly attributed to climate change, according to experts at the University of Cape Town. It is therefore to the benefit of the entire continent's long-term perspectives that effective policy is in place to mitigate and adapt to the negative effects of a rising average global temperature.

Border Carbon Adjustment

If not addressed domestically, South African export-goods are at risk to be penalised for its carbon content through a so-called 'Border Carbon Adjustment'.

These are taxes imposed by importing nations in order to prevent carbon-leakage as a result of their own policies. Hence, unless South Africa is taking its own measures to reduce the carbon intensity of its export-goods, this could have a negative effect on its export-market and therefore on its entire economy.

In 2009, at COP15 in Copenhagen, South Africa pledged to reduce its emissions below 'business as usual' by 34% in 2020 and 42% in 2025. This is aligned to the targets presented in South Africa's Intended Nationally Developed Contribution (INDC) which was submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in September 2015. South Africa's INDC stipulates to achieve emissions levels of between 417 – 633 $MtCO_{2e}$ over the period 2025-2030, without taking into account the CO_2 captured by the Land Use, Land Use Change and Forestry (LULUCF) sector. This translates to a 20 – 82% increase in the 1990 emissions level. Although this target represents a substantial range, based on the current policy projections, South Africa would not be able to make it [3].

Hence, in order to achieve what it pledged to do as a nation to contribute to keeping the average global temperature rise below 2°C, as well as to mitigate the associated risks, South Africa has to implement drastic measures.

The carbon tax is among the instruments of a mix of measures that are proposed to do so. Moreover, if acted upon now, measures can still be implemented in a relative gradual way which would reduce the need to hastily implement instant and ill-designed measures to reduce emissions in the future.

CDM – Climatological Dispersion Mode
COP – Conference Of the Parties
DOE – Designated Operational Entity
INDC – Intended Nationally Developed Contribution
LULUCF – Land Use, Land Use Change and Forestry
UNFCCC – United Nations Framework Convention on Climate
VCS – Verified Carbon Standard

Abbreviations/Acronyms

take note

- In 2014, South Africa was number 13 on the list of the world's largest greenhouse gas emitting economies in terms of its absolute emissions.
- Increased global pressure to reduce greenhouse gas emissions calls for a transformation to an economy that is less driven by carbon.
- Effective policy must be in place to mitigate and adapt to the negative effects of a rising average global temperature.

What is the Carbon Tax?

The carbon tax is based on the 'polluter-pays'-principle in the form of a price that companies have to pay for each ton of CO_{2e} that they emit, as a result of their activities. The proposed implementation trajectory is characterised by phases and allowances in order to facilitate companies to progressively adapt to the implications of this regulation.

The first phase features a carbon price of R120,00 for each ton of CO_{2e} emitted. Depending on the sector, a business will receive a basic tax-allowance of between 60% - 100% on its total emissions. This means that at maximum 40% of a company's emissions are taxable. A 100% tax-allowance is applicable to the agricultural-, residential- and LULUCF- sectors during the first phase. Only 'direct' scope 1 emissions are taxed and include emissions associated with fossil fuel combustion, fugitive emissions and emissions related to industrial processes. Indirect emissions such as the use of electricity and emissions associated with activities along a company's supply chain are not covered by the tax as it is.

Next to the basic allowance, companies can further reduce their tax-liability by utilising one or more of the allowance-schemes which come with the implementation of the tax.

A maximum of a 95% tax-free allowance of total greenhouse gas emissions can be achieved. The applicability of a specific allowance depends on:

- A company's sector: Schedule 2 of the draft carbon tax bill comprises an overview of sectors and allowances applicable, including the allowance-maximum per scheme
- The emissions-source: combustion of fossil fuels; fugitive emissions; emissions associated with industrial processes
- Trade-exposure
- Performance in terms of measures implemented to reduce carbon emissions and/or participation in the carbon budget system during or before the tax period [4]

On top of these allowances, a company can decide to offset its taxable greenhouse gas emissions by purchasing carbon credits. At maximum, 10% of total greenhouse gas emissions can be compensated by this proposed mechanism. Although the exact structure of the carbon-offset mechanism is not yet defined, it is likely that only carbon credits that are generated outside of the tax-net will be eligible for reduction of tax-liability through this scheme. Consequently, an interesting question is whether or not the waste, LULUCF, and residential sectors fall within the tax-net, although receiving a 100% allowance; or that they are exempt from carbon tax, and therefore outside of the tax-net?

The current forecasts predict the introduction of the carbon tax in January 2017, with its first phase ending on 31 December 2021 [5].

Carbon Tax Revenue

A carbon tax is a popular instrument among policy makers to reduce carbon emissions at lowest costs. However, without the effective recycling of the revenue it falls short in terms of stimulating and accelerating the development of and transition towards a low carbon economy [6]. Around the world carbon taxes have been enacted or proposed. This has resulted in many research being done on the topic.

An important outcome of these studies, is the suggestion that tax should be revenue-neutral, e.g. by using the revenue to stimulate research into zero-carbon technologies to replace the conventional carbon-intensive systems that are currently at the basis of South Africa's economic activity [6].

Or by subsidising the parties that are most affected by the proposed tax, in their efforts to replace their dated processes with clean technology. In this way the adjustment costs and investment constraints that companies are facing are taken into consideration which may stimulate the biggest polluters to switch to cleaner technology and consequently accelerate the transition to a low carbon economy. As it currently is the only revenue recycling proposed is to use some of the carbon-tax revenue to sponsor the 12l energy efficiency tax rebate [7].

It is with no surprise that arguments, often brought up by opponents of the carbon tax, are those suggesting that a price on carbon emissions will slow down economic growth. Interestingly, the impression occurs that without the current economic depression, South Africa would have experienced disruptive energy- and water- shortages.

In turn this suggests that it will be the negative consequences of climate change themselves that will halt the economy from expanding if not addressed; instead of measures to mitigate these adverse impacts such as the proposed carbon tax.

Conclusion

Keeping in mind that the ultimate goal of a carbon tax is to decarbonize a country's economy, it is evident that the parties most effected are those with the highest carbon emissions. However, the design of the South African carbon tax as it currently is, allows affected companies to reduce their tax-liability significantly to a maximum of 95%. Moreover, the design of a carbon tax regulation should not only involve taxing but rather focus on spending too. In order to facilitate the objective: A transition to a low carbon economy.

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Silvana Claassen has been an environmental consultant since 2006, focusing on sustainability and waste and working for both industry and governmental institutions. In 2011, when she relocated to South Africa, she started specialising in climate change and energy. As an auditor at a UNFCCC accredited Designated Operational Entity (DOE), Silvana performed validation and verification assessments of CDM-, VCS-, and Gold Standard- projects. Then, as a carbon advisor at a small advisory firm in Sandton, Silvana provided strategic advice related to an array of matters on carbon- and energy-management. Her clients included Small- and Medium-Enterprises as well as major international corporations, predominantly in the manufacturing-, mining- and waste-sectors. At the beginning of 2016, Silvana established her own consultancy named 'CES Carbon & Energy Solutions', through which she works in close cooperation with Justine Bolton; director of 'Bright Green Solutions' (BGS). Both companies are based in Johannesburg. Through this collaboration, CES and BGS are able to offer integrated solutions on the interconnected topics: carbon, energy, sustainability and corporate social responsibility.

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Sanitising 5 000 litres of water a day

On UN's World Water Day (22 March 2016), clean tech company Watly opened an Indiegogo campaign to fund their award-winning solar technology. The Watly 3.0 thermodynamic computer uses solar energy to sanitise over 5 000 litres of water a day, as well as generating electricity and connectivity. The development of Watly 3.0 follows the successful trial of a smaller machine, Watly 2.0, in Abenta Village, Ghana.

Watly will provide the three pillars that modern society needs to prosper: Water, power and connectivity. The machine combines the three functionalities to make each one more efficient, delivering a level of service that would possible without them working in unison. Watly combines two major technologies: photovoltaic and thermal solar.

Feeding contaminated water (including ocean water) into the machine, Watly uses solar heat collected by super-efficient vacuum-tubes to vaporise and therefore sanitise the water. This process includes the use of graphene technology. The photovoltaic panels located on the roof, generate instead off-grid electricity to power the internal electronics of the machine as well as being used for recharging external devices such as mobiles phones or portable computers.

During its 15 years of service, one Watly can save as much as 2 500 tons of greenhouse gas emissions (CO_2), equivalent to 5 250 barrels of oil, purify millions of litres of water and generate 1 GWh of free electricity. A Watly system can be controlled using the connectivity it provides meaning that settings can be adjusted to cope to any changes in climate or environment. One Watly is standalone machine, but two or more Watly become a network. This network can power entire cities and countries, servicing millions of people, while benefiting the planet earth.

Marco A. Attisani, Chief Executive Officer and Founder of Watly, comments: "Our experience in Ghana was truly eye-opening: we knew the potential of our prototype Watly, but seeing it transform a village by providing easy access to basic resources made us really proud about what we are doing. On our planet we still have one billion people lacking clean water, two billion without electricity, and around five billion without connectivity. In this technological age, when we have so much capacity to provide solutions to these basic problems, these numbers are not acceptable anymore."

Having won the most prestigious award sponsored by the European Union, 'Horizon2020' allowed the company to build the first pre-industrial version of Watly 3.0, to be presented in September 2016. The company is now launching a crowd funding campaign to give individuals the opportunity to contribute to the transformative technology.

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Siemens South Africa purchases two BMW i3s.

Multinational engineering conglomerate Siemens South Africa, has introduced two BMW i3s to its vehicle fleet as part of its goal to reduce its fleet fuel consumption and overall carbon foot print by 2030. Tim Abbott, Managing Director of BMW Group South Africa, handed the keys of two BMW i3s with range extenders (REX) to Sabine Dall' Omo, Chief Executive Officer of Siemens Southern and Eastern Africa, at their Midrand Head Office.

"Since its successful market launch in South Africa in March 2015, a total of 124 BMW i3s have been delivered to customers. In addition, BMW South Africa is working with various partners to roll out public charging infrastructure for electric vehicles across the country. Internationally, Siemens has been one of the key players in developing solutions and charging infrastructure products for electric vehicles. Therefore, we are pleased that they have opted for BMW i3s to reach their sustainability goals," says Abbott.

Sabine Dall' Omo explains that the two vehicles can be used by Siemens employees to do customers visits in the Gauteng region, a visual showcase of our commitment to sustainability. However, the vehicles will form the basis for a much bigger goal.

"Siemens aims to be the world's first major industrial company to achieve a net-zero carbon footprint by 2030. The company plans to cut its carbon dioxide (CO_2) emissions – which currently total about 2,2 million metric tons a year – in half by as early as 2020. To achieve these goals, Siemens will invest some €100 M over the next three years in order to reduce the energy footprint of its production facilities and buildings.

To reduce its CO_2 emissions over the long term, the company will also apply three additional levers. First, we will use distributed energy systems at our production facilities and office buildings to optimise energy costs. Second, we will systematically employ low-emission vehicles and e-mobility concepts in our global car fleet. And third, we will move toward a clean power mix by increasingly tapping sources of energy –such as natural gas and wind power – that emit little or no CO_2," Dall' Omo explains.

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Tim Abbott, Managing Director of BMW Group South Africa, handed the keys of two BMW i3s with range extenders (REX) to Sabine Dall' Omo, Chief Executive Officer of Siemens Southern and Eastern Africa.

Turbine rehab at Van Eck power station

After a comprehensive feasibility study NamPower decided to embark on a project to rehabilitate the aging 120 MW coal-fired Van Eck power station. The project will see the restoration of three turbines, four generators and four boilers culminating in much needed increased local power generation capacity.

Marthinusen & Coutts, a division of ACTOM, commenced work on all three turbines in 2012 with the aim of increasing the reliability and efficiency of the power station to meet its original design output of 120 MW.

The first two units are already performing according to specifications. Targeted completion of the remaining two units is end November 2015 and end January 2016 respectively.

The scope of work for Marthinusen & Coutts comprised the complete refurbishment of three of the 30 MW turbines and the overhaul of one turbine. "A typical coal-fired power plant has multiple generating units, each with its own steam generating boiler. Essentially, steam turbines are the heart of coal-fired power plants. The refurbishment of the turbines will see these units brought back to OEM specifications by overhauling all major components," Mike Chamberlain, operations executive at Marthinusen & Coutts explains.

The first step in the rehabilitation process involved a thorough on site assessment of the turbines by Marthinusen & Coutts' engineers to determine the existing condition of the aged equipment. This assessment included the HP and LP cylinders, shafts, diaphragms, lubrication systems, emergency stop valves, steam chests and governors.

In order to provide an accurate analysis, the team completely disassembled the turbines on site. The customer was then provided with a comprehensive report on the work which would be required to bring these turbines back into service. "An important aspect of the repair process is when parts no longer meet the original equipment manufacturer's standards; these are refurbished, replaced or remanufactured so the components once again comply with OEM specifications ensuring ongoing operational safety and efficiency. In this instance, the governor valves were refurbished by Marthinusen & Coutts and the turbine blades were replaced. Furthermore, machining and polishing was done on most components to restore the surface finish," says Chamberlain.

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With 57 years of extensive experience, Marthinusen & Coutts was ideally positioned to undertake the turbine refurbishment work at Van Eck power station.

Flexible mobile E-House solution

ABB has supported Sasol to minimise process downtime for routine maintenance with a range of medium-voltage solutions. Sasol, the international chemical and energy company, has implemented an innovative and flexible ABB solution utilising the power of UniGear Digital switchgear, Relion protection relays and sensor technology installed in a lightweight E-House, mounted on a mobile truck trailer.

At Sasol's Secunda petrochemical plant in South Africa, ageing substations needed to be refurbished. Sasol was looking for a solution to minimise capital losses due to the production downtime required for the switchgear replacement.

Bruno Melles, managing director of ABB's Medium Voltage Products business, said: "The effective cooperation between Sasol and ABB led to the successful completion of this project and we look forward to building on this in the future. The unique flexibility of our Relion protection and control relays installed in our innovative Unigear Digital Switchgear formed the core of this modular E-House, which provides stable power supply in a range of challenging conditions." To meet the requirements set, ABB offered a mobile E-House based on the UniGear Digital solution. The backbone of this solution is the UniGear ZS1 switchgear equipped with IEC 61850-embedded Relion 615 series protection relays and ABB's advanced sensor technology.

The switchgear was placed in a prefabricated metal enclosure, an E-House, which was then installed on a truck trailer. Installing the solution on the truck trailer means that it can be relocated to wherever it is needed, swiftly and efficiently. This mobile E-House provided the flexible power supply solution required by Sasol.

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WEG Transformers Africa – growth continues

WEG Transformers Africa, a division of **Zest WEG Manufacturing**, is determined to continue growing its share in both the South African and African transformer markets. Louis Meiring, chief executive officer at Zest WEG Group Africa, says the acquisition last year of Heidelberg-based TSS Transformers facilitated immediate access to additional facilities as well as best-in-class technical skills. "Upskilling ourselves in this critical market sector and increasing our local manufacturing base was a strategic move that will see greater involvement from Zest WEG in this industry," Meiring says.

WEG Transformer Africa (WTA) operates two major facilities and is poised to reinforce its position as a leading African manufacturer of electrical equipment. The last two years has seen the recapitalisation of the WTA Wadeville operation. Andre Mans, Chief Operations Officer of WTA, says: "Today, WTA Wadeville is a modern operation that boasts best-in-class production and manufacturing capabilities."

WTA Wadeville produces standard distribution, power and special application transformers ranging from 50 kVA to 10 MVA in voltages up to 66 kV with off-load tap switch or on-load tap-changers. Known for its responsiveness to customer specific needs, the facility also has the engineering expertise and capability to manufacture special transformers for mining, industrial, rectifier/traction, converter and thyristor drive applications. WTA also manufactures a range of mini substations. The Heidelberg facility was acquired in the third quarter of 2015 and boasts an impressive 45 000 m² footprint. The modern facility is capable of locally manufacturing power transformers up to 40 MVA in voltages up to 132 kV as well as mini substations and moulded circuit breakers. This modern facility houses what is considered to be the best privately operated oil sampling laboratory in South Africa.

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Lessons African countries can learn from the South African REIPPP

Celine Paton, Consultant for Energy & Environment, Frost & Sullivan Africa

Following global trends leaning towards a more sustainable future, governments in most African countries have established increasingly ambitious Renewable Energy (RE) targets for their power sector. However, with the notable exception of South Africa and the hydro power sector, not much has materialised thus far. The South African Renewable Energy Independent Power Producer Programme (REIPPP), implemented since 2011, has proven to be a large success for the country, with 6,3 GW of RE procured by Eskom since its inception. This totals approximately 15% of South African installed power generation capacity. At the end of 2015, more than 2,2 GW , of the 6,3 GW new procured power, had been commissioned and injected daily into the grid.

Design of SA REIPPP

Many best-in-class international advisors were involved in the design of the South African REIPPPP and assisted the Department of Energy's IPP office with implementing global best practices. South Africa has succeeded in creating a highly competitive RE market; however, has taken about 15 years to reach this goal. The South African Government announced its commitment to support and promote the development of RE through a White Paper on Energy Policy published in 1998. Thanks to a large global uptake of solar PV and wind projects, and a gradual decrease in their production costs, the competitiveness of the RE power sector has improved considerably. With South Africa paving the way towards the inclusion of RE power on a larger scale, other African governments have started to show interest in solar and wind power. Additional contributing factors include: inefficiency of hydro power in drought periods, the need for greater power generation diversification, energy security and urgency in addressing a growing power gap.

The lessons

There are many lessons that can be learned from the South African REIPPPP. These will, however, require adjustment in order to take into consideration the key peculiarities of these countries. Comparatively, given their respective size, no other countries in sub-Saharan Africa (with the exception of Nigeria) can expect the same economies of scale – in terms of new power supply needs – as those required in South Africa. Implementing project finance structures into small RE projects is a costly exercise and often non-viable. Until recently, international private developers have been reluctant to implement small- to medium-size solar and wind power projects. This can attributed primarily to lengthy negotiations, often taking place with utilities and governments, combined with an inadequate legislative framework. This has consequently led to an increase in transaction costs that are unsustainable. To address these issues, new programmes supported by Development Finance Institutions (DFIs), like the IFC Scaling Solar Programme and the KfW GET FiT Programme in Uganda, have recently been developed. These DFI-funded programmes are also offering the possibility to implement successive rounds of competitive bidding – yet at a smaller scale – as well as to bridge a capacity gap at government level in order to negotiate bankable power purchase agreements with the private sector.

There is a plenitude of 'smaller' opportunities across the region, but investors will need to find an efficient way to finance them (e.g. portfolio approach). Most sub-Saharan African countries lack the local funding resources to finance large-scale RE power projects. There are a lot of international funding sources available to promote electricity access in sub-Saharan Africa for example, especially for clean technologies, but these are often tied with constraining or costly conditions. However, the context is evolving positively with new creative funding sources and support offered by DFIs, such as the IFC and KfW. Other key factors include:

- The need for a strong support from the government at various levels towards their (often poorly financed) state-owned power utilities and through the implementation of a clear and stable legislative and regulatory framework promoting private investment
- Insufficient grid capacity and lack of financial resources from utilities to strengthen and expand their power network also creates a major stumbling block
- Governments should aim to align electricity tariff affordability with the economic benefits achieved thanks to the new RE power projects
- There must be a buy-in from the local community. For more successful RE projects to be commissioned, strong engagements between project developers and local communities living in the vicinity of such projects must take place

Conclusion

The technology that will be adopted must be consistent with the needs and capacities of the country concerned, creating a sustainable and affordable electricity generation mix. Given their variable energy output, and until we find new ways to store it efficiently, RE technologies should be accompanied by other (more conventional) technologies like gas-to-power and greater regional grid integration, a path that South Africa will eventually follow in the near future.

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Beckhoff Automation – 10 years of success in South Africa

This very exciting celebration took place from the 7 – 9 March in Cape Town, Port Elizabeth and Durban and culminated on the 10 March with an 'Oktoberfest in March' celebration at Gilroy's Brewery in Muldersdrift, Gauteng.

It was proudly hosted by the South African team, including presentations by Kai Ristau (Head of International Export) and Kenan Aktas (Area Sales Manager), both from Beckhoff Automation GmbH & Co. KG in Germany, as well as by Kenneth McPherson, Managing Director of Beckhoff Automation in South Africa.

The festivities took on the form of a Champagne Breakfast at all the coastal venues. At the 'Oktoberfest in March', everyone was greeted by German waitresses and served Gilroy's hand-crafted, international-award-winning beer. (The Gilroy brewing process is characterised by no filtration, no artificial carbonation and no preservatives – something very special to experience.) Both events kicked off with McPherson welcoming all and appreciating the relationships that had led to Beckhoff's success over the past 10 years in SA. Ristau then gave a review and an outlook of Beckhoff globally. Thereafter McPherson gave away a few "Secrets to Beckhoff's Success in SA". Aktas rounded up the presentations with an insightful presentation entitled 'Automation in Focus… What's New and What's Coming Up'. Beckhoff Automation is leading the pack as far as realising Industry 4.0 and IoT in the market is concerned. Many projects have been implemented with this futuristic concept, many years ago by Beckhoff already. "Our convergence effort started as early as 1985 with the beginnings of PC Control. This has continued consistently, right up to the introduction of TwinCAT 3 with Visual Studio integrated and the newest products to use production data for IoT and Industry 4.0" said Hans Beckhoff, Managing Director of Beckhoff Automation GmbH & Co. KG, in a recent interview in Germany.

The week of celebrations were super successful and cemented Beckhoff's focus on personal relationships and partnerships with their clients. Beckhoff sincerely thanks every one of those who attended and celebrated this special occasion with us.

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Kenneth McPherson, Michelle Murphy, Dane Potter, Shaun Potter, Tanja Weissbach, Mike van der Walt, Brendan van der Westhuizen, Adam Carless, Aimée Schumacher, Andrew Reinhold and Rodney Grobler.

Crown Publications' new deputy publisher

Wilhelm du Plessis has been appointed as the deputy publisher of Crown Publications, a position left vacant when Karen Grant became Crown Publications' publisher. He has been the editor of one of Crown's flagship publications, *Construction World*, for almost eight years. Du Plessis has been in the media for 15 years and has been publishing manager and group editorial manager in both the custom and customer publishing fields. Before that he was a university lecturer and has a master's degree in linguistics. "It is an exciting time," says du Plessis, "to be in business-to-business publishing. Although it has been largely protected from having to go the online route (as opposed to customer magazines), it has a window of opportunity to find the perfect balance between print and on-line publishing. I look forward to assisting Karen Grant during this next and challenging phase".

Enquiries: Email admin@crown.co.za

Crown Publications publisher, Karen Grant with deputy publisher Wilhelm du Plessis.

2016SAEEC Call for Papers

The Board of the Southern African Association for Energy Efficiency (SAEE) invites you to submit an abstract for consideration to speak at the 2016SAEEC. All potential speakers' abstracts will be reviewed by the Technical Programme Committee based on this submission. The 2016SAEEC features a convention agenda with seminars and an exhibition on a variety of current topics and a comprehensive overview of 'Energy Efficiency at Work'. You will have an opportunity to share your knowledge gained within your sector of energy efficiency.

The 2016SAEEC features a convention agenda with seminars and an exhibition on a variety of current topics and a comprehensive overview of 'Energy Efficiency at Work'. You are invited to share your knowledge gained within your sector of energy efficiency.

The deadline for abstract submissions is 15 June 2016 and should be 250 words max.

Enquiries: Email support@saee.org.za

Tough and tougher… says CESA

The Consulting Engineers South Africa (CESA) Bi-annual Economic and Capacity Survey for the period July to December 2015, indicates that times are tough and getting tougher with industry confidence the lowest in 16 years. The report indicates that the consulting engineering industry will have to adapt to a low growth environment as the outlook for infrastructure spending is hampered by poor economic growth, lower than expected revenue by government, international economic instability and price volatility, and low private sector confidence.

Three key factors continue to influence the global outlook these are the gradual slowdown and rebalancing of the Chinese economy; lower prices for energy and other commodities; and the gradual tightening of US monetary policy.

Chris Campbell, CESA Chief Executive Officer, believes, "Government needs a strong focus on the implementation of more of its strategic infrastructure projects as detailed in the National Development Plan in order to mitigate the decline in the economy and improve investor confidence." He further reiterated that "Engineers in South Africa stand ready to partner with government in eradicating the leakage from the fiscus, not only through water which does not reach domestic households, but also through poorly spent monies or corrupt practices which have led to payment for poor quality and even non-existent services in the infrastructure space."

Probably the most critical concern, and most significant downside risk to inflation and economic growth, for the domestic economy is the fear of a further sovereign credit rating downgrade and its effect on the industry. A lower credit rating means the cost of borrowing for the South African government will escalate, which means more tax payers money will be used to finance debt, with less available to spend on critical economic and social infrastructure. Currently government expects that 3,6% of GDP per annum will be used on interest expenditure, estimated at around R260 billion per year, equal to total public sector infrastructure allocations a year.

Fee earnings – softer growth outlook

Consulting Engineering fee earnings in the last six months of 2015 increased by around 6%, against an expected decrease of between 2% and 3%. Larger firms reported muted growth of 2% on average for the last six months, while stronger growth was reported by medium and smaller firms (up by 31% and 11% respectively).

Industry confidence levels – lowest in 16 years:

Confidence levels fell to its lowest level in 16 years, and were significantly weaker in the last six months of 2015, compared to expectations in the June 2015 survey.

Gross fixed capital formation slow in medium term:

Gross Fixed Capital Formation (GFCF) as a percentage of GDP averaged at 20,7% in 2014, but slowed to 20,6% in the 1st quarter of 2015, compared to an average of 21,1% in 2013.

Transformation of the industry:

The appointment of Black executive staff (including Black, Asian and Coloured) increased and there has also been a steady improvement in the appointment of women at an executive level.

Industry challenges – procurement the biggest challenge

Regulation issues, including the procurement of consulting engineering services, are among the biggest challenges faced by the industry. Procurement is currently based on price and broad-based black economic empowerment (BBBEE) points, with functionality or quality having a minimum threshold, thus being largely price driven. This is affecting tender prices, as firms sometimes tender below cost in view of the diminished availability of projects. A further challenge to the industry is to find a way to standardise the procurement procedures applied by the different government departments. Procurement procedures should be standard for the country, or at least for the specific tier of government.

Unrealistic tendering fees remain a concern for members; the quality of technical personnel is argued by some firms to have deteriorated, putting greater risk on the built environment sector; skills shortage is regarded as one the most significant institutional challenges; fraud and corruption is affecting the ethos of our society. CESA is aware that members are under pressure from contractors and corrupt officials, to certify payment for work not completed.

Unlocking greater private sector participation is seen as a critical element to fast track delivery which will support engineering fees and as such engineering development in the industry

For a copy of the CESA Bi-annual Economic and Capacity Survey visit http://www.cesa.co.za/node/21

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Chris Campbell, CESA Chief Executive Officer.

SMC Pneumatics partners with the JAG Foundation to make a difference

SMC Pneumatics South Africa has announced its sponsorship of the JAG Foundation's under 13 Sevens rugby teams in Bonteheuwel on the Cape Flats, commencing from April 2016. Throughout the season, 15 teams from 15 primary schools in the community will battle it out in a selection of tournaments as part of a programme aimed at improving the lives of youths in crime plagued areas.

The JAG Foundation plays an active role in high-risk communities and provides invaluable mentoring, coaching and knowledge in these areas thanks to programmes designed to offer children an alternative life-path to gangsterism, drugs, and violent behaviour.

"Alcohol and drugs are the root cause of almost all of South Africa's ills such as gangsterism, crime, HIV/AIDS, domestic violence, broken homes and unemployment to name a few. By reaching out to the youth in these communities and by providing them with fun, healthy activities we give them a new purpose," JAG Foundation's Barry Clarke explains.

"To a large part, the ills of society are viewed as the 'norm' and we use community projects such as that of JAGRugby as an attainable opportunity to create a new life path" adds Barry.

More than just an escape, the JAG Foundation is a catalyst for change with programmes such as JAGBullyProof, JAGRugby, JAGRunners and JAGRiders all striving to enrich communities and create a sense of 'togetherness'.

SMC Pneumatics South Africa's General Manager, Adrian Buddingh, resonated with the cause and believes that SMC is a like-minded partner. "The JAG Foundation's work has always been near to my heart and our team truly believes in the work that they do," Buddingh says. "In reaching out to the youths of today, we ensure the future of tomorrow and play a key role in enriching lives".

By providing 180 much-needed jerseys as well as contributing to escalating transport costs to ensure the children's safety to and from games, SMC hopes to make a visible difference. SMC Pneumatics will also be riding for a cause at various cycle events throughout the year wearing JAG Foundation branded outfits to help raise awareness.

Enquiries: Email sales@smcpneumatics.co.za

Adrian Buddingh (SMC Pneumatics South Africa), Mr Meyer (Klipfontein Primary) and Barry Clarke (JAG Foundation).

Bizz Buzz

Endress+Hauser completes takeover of Analytik Jena

Endress+Hauser has completed the takeover of German analytical instrumentation provider Analytik Jena. The remaining minority shares of Analytik Jena were legally transferred to Endress+Hauser on 30 March 2016 following the entry of the transfer resolution in the commercial registry that was previously adopted at the extraordinary general meeting in February. The process will now be finalised with the agreed-upon cash payout to the minority shareholders. Endress+Hauser gained control of publicly-traded Analytik Jena AG in 2013, most recently holding 96,6% of the shares. The goal of the acquisition is to eventually be at the side of both companies' customers from the lab to the process, giving support from product development to production.

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Master Power Technologies establishes a branch in Namibia

Master Power Technologies, power solution and data centre specialist, has recently opened a branch in Windhoek Namibia, as part of its plan for growth in Africa. The operation officially opened on 1 March 2016 This office will complement the Master Power branches already successfully operating in Zambia (Kitwe and Lusaka) and Mozambique, with additional African countries earmarked to benefit from a direct Master Power presence. Master Power's aim is to expand in Africa so clients have easy access to the quality products and technical expertise Master Power has to offer.

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Total Outcomes for Smart Payment receives certification

Itron Total Outcomes for smart payment received Standard Transfer Specification (STS) certification, the only globally accepted open standard for prepayment systems. Itron Total Outcomes for smart payment is Itron's global cloud-based offering, which provides prepayment vending and customer management software-as-a-service and managed services. The offering streamlines the deployment of Itron's smart payment solutions, from keypad meters to smart payment meters, for electric and gas utilities. Itron Total Outcomes for smart payment is the first multi-commodity prepayment offering to be certified by the STS Association.

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Power & Electricity World Africa 2016

The 19th Power & Electricity World Africa was held at the Sandton Convention Centre, Johannesburg on 15 and 16 March 2016. Current trends and innovative technologies in the power and electricity sector were introduced, displayed and discussed... giving industry professionals opportunities to meet and network.

Chris Galloway and Bruce Smith, Allbro.

Gilbert Legote and Gordon Hunt, Bambanani.

Edward Chan, Susan Xu and Ethan Ho, Sky Resources Group.

Daniela Gelderblom, Devika Datadin, Steven Pereira and Tsakani Maswanganyi, Cummins.