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Altivar Process variable speed drives

Your process deserves more than just a drive

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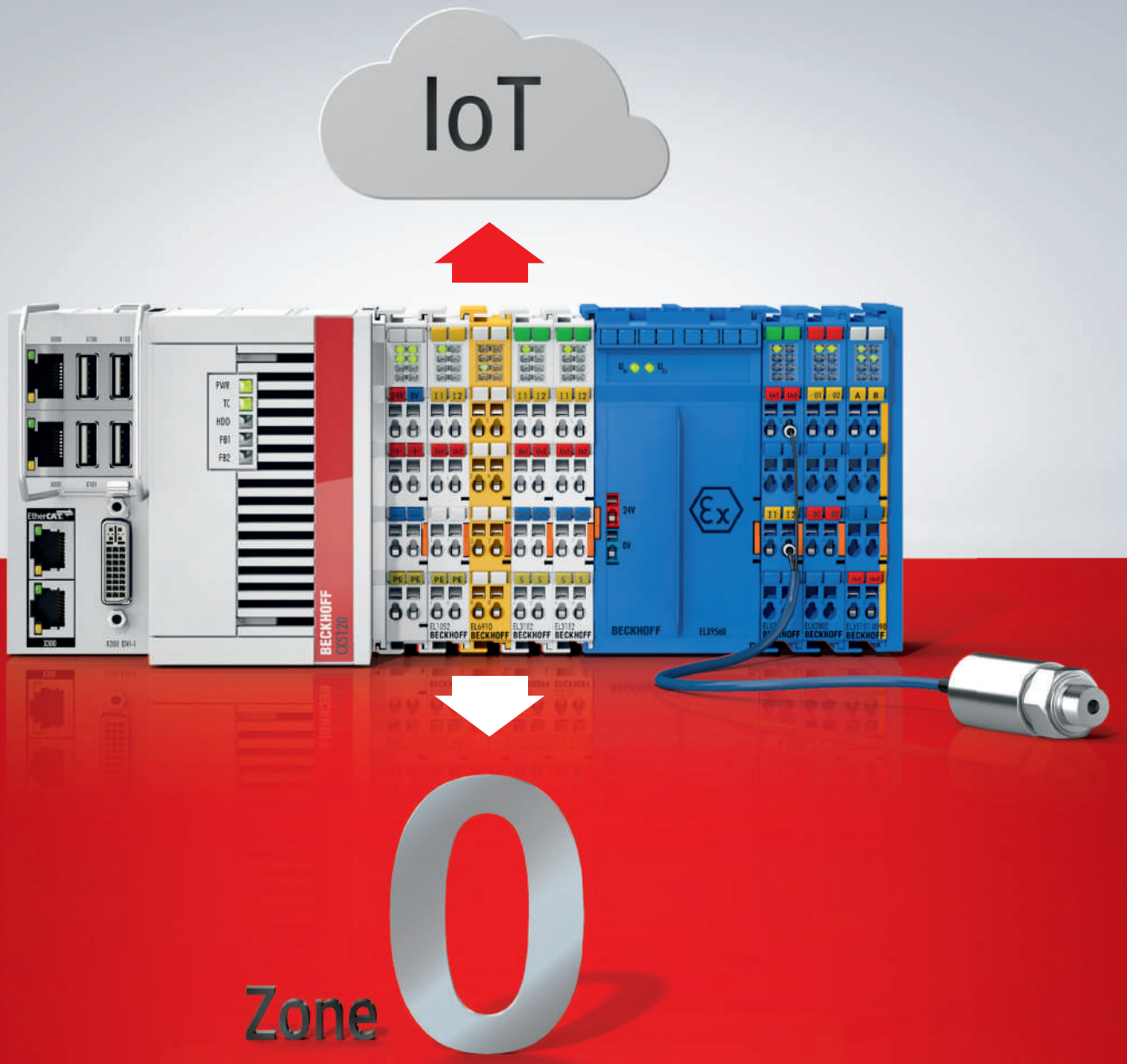

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New Automation Technology **BECKHOFF**

A comprehensive approach to addressing resource challenges

by Prof. Thokozani Majozi, University of the Witwatersrand

Prof. Thokozani Majozi

In the early 1900s a prediction was made of the human population by the turn of the century. The prediction, using some of the best tools of the time, set the population at 3,6-billion by year 2000. Strangely, the population had reached 6-billion by year 2000 – a major departure from the prediction. This triggered the question: Why did the prediction get it so wrong? The answer is simply that the prediction did not take into account that in 1914, just before the onset of World War I, two scientists, Fritz Haber and Carl Bosch, would discover a process to produce ammonia from hydrogen and nitrogen.

To this day, ammonia, which is a key fertilizer, is still produced using the Haber-Bosch process. This discovery meant a significant increase in crop yields, thereby allowing significantly higher numbers of people to be fed globally. This particular chemical was a game changer.

There are many chemicals which can lay a claim to the same kind of fame. The world as we know it is shaped fundamentally by chemicals. In South Africa alone, the chemicals industry contributes almost 5% to GDP and constitutes 25% of the manufacturing sector. The chemicals industry also happens to be one of the most energy intensive. The aforementioned ammonia process uses between 28 and 33 GJ/ton ammonia produced, in the form of electricity and fuel. It becomes clear from foregoing statement that any potential solution to energy that does not embrace the contribution of chemicals is largely incomplete. Does this mean a solution that considers both energy and chemicals would be ideal in addressing the global resources challenge? Unfortunately, no.

South Africa is a 43 GWe (Giga-Watt electrical) country, with more than 90% of the electricity generated from coal, with serious environmental implications. Seldom ever considered in dealing with the latter is the amount of water that is used in generating our electricity. A typical 3,5 GWe facility requires in excess of 110 Ml/day – 25% of the amount the city of Cape Town consumes daily. Excluding Kusile and Medupi, there are 13 of these facilities in the country. This does not bode well for a country that is considered one of the driest in the world. Again, a solution that only considers electricity, i.e. energy, without taking water into account is insufficient. A substantial amount of water is also used in crop irrigation, which accounts for more than 60% of available water. The delivery of this water requires pumps that are powered by electricity. It is at this point that the nexus proves complete. A comprehensive solution to the resources challenge, therefore, would have to simultaneously consider water, food, energy and chemicals.

The key message is that there exists a need for significant investment in skills, research and technology development within the water, energy, chemicals and food sectors to bring about meaningful and positive change. To take full advantage of the inextricable link among these crucial resources would require new ways of thinking and tools to deal with the inherent complexity of the challenge.

Fortunately, we do not have to start from zero base. There is a lot to learn from leading research institutions and industry. As an example, Shell Global Innovation and R&D Organisation has invested more than US$1-billion in coming up with integrated water management solutions, with emphasis on water, energy and food nexus. Some of their successes that are worthy of mention include the use of domestic effluent as makeup for cooling towers in one of the refineries in Durban, KwaZulu-Natal, the largest zero liquid discharge gas-to-liquid (GTL) facility in the world in Qatar and a 45 000 m3/day reed bed water treatment plant in Oman.

CSIR, the largest public sector research institution on the continent, is also taking full advantage of the inherent synergies brought about by its multidisciplinary character. Chemicals, energy, water and food have emerged as some of the key areas of focus in their new strategy.

Send your comments to engineerit@ee.co.za

Front Cover Description

Your process deserves more than just a drive

Altivar process variable speed drives deliver top performance that exceeds expectations. They optimise business performance across both utility and industrial processes (0,75 kW – 1,5 MW) in a number of demanding segments. By increasing efficiency and reliability in the industrial setting, you can pass the benefits onto your customers and beyond. Said to be the world's first services-oriented drives, the Altivar process range gives you a solution to address your challenges. Altivar process drives provide business optimisation by managing increased data volumes, improving services and boosting overall efficiency.

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- National Laboratory Association (NLA)
- IFAC International Federation of Automatic Control
- SACAC South African Council for Automation and Control
- South African Electrotechnical Export Council (SAEEC)
- nmisa National Metrology Institute of South Africa
- SAIMC Progress by Control — Society for Automation, Instrumentation, Measurement and Control
- IITPSA Institute of Information Technology Professionals South Africa
- WAPA Wireless Access Providers' Association
- Society of Telkom Engineers
- FTTX Council
- ITA Information Technology Association
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Your process deserves more than just a drive

Information from Schneider Electric

Altivar process variable speed drives deliver top performance that exceeds expectations. They optimise business performance across both utility and industrial processes (0,75 kW – 1,5 MW) in a number of demanding segments. By increasing efficiency and reliability in the industrial setting, you can pass the benefits onto your customers and beyond.

Said to be the world's first services-oriented drives, the Altivar process range gives you a solution to address your challenges. Altivar process drives provide business optimisation by managing increased data volumes, improving services and boosting overall efficiency. These capabilities mean:

- *Real-time intelligence:* Access to energy use and process information anywhere, anytime.
- *User friendliness:* Simplifying work in harsh environments, performing upgrades, retrofits, or new installations.
- *Green Premium product:* Energy savings of up to 25%, using green and ethical materials and enabling increased recyclability, fully compliant with RoHS-2 and REACH.
- *Tailored engineering:* Seamless integration into plant structures dedicated to specific processes.
- *Smart services:* For a stronger ROI and optimal value of your installations

The latest addition to the family of drives is the Altivar Process Modular (APM). The APM ranges from 110 kW – 1200 kW, and are locally assembled by Schneider Electric's partners, meaning that they are available with short delivery turnaround times.

The APM has all the benefits of the Altivar Process. It also gives flexibility for end-users in terms of late load changes in the design and installation phase of a project. Customers can keep 80% less critical spares with a module and will be able to improve the "uptime" of their operation.

Achieve sustainable energy efficiency without extra costs

Energy management success relies on the ability to access a single system of records that permits timely analysis and reporting. Altivar process drives embed an accurate power measurement feature (error rate below 5%) and provide information on consumed energy compared to production. In addition,

Fig. 1: Altivar process modular variable speed drives deliver top performance that exceeds expectations.

they detect power drifts and inform you in real time via a customisable alarm management system.

Designed to ensure the continuity of your process and optimise maintenance costs, Altivar process drives incorporate innovative power technology and advanced communication capabilities. These functions help you enhance performance throughout the life cycle.

Minimise your total cost of ownership

Through system and equipment condition monitoring, Altivar process drives allow you to anticipate system failures and take the necessary steps to avoid them in real-time.

Save time on design of new projects and process upgrades

Altivar Process drives offer compactness, openness, and collaborative engineering. In tandem with unmatched harmonic solutions, they allow you to deliver secured and correctly sized projects at optimised costs. Within the product range, there are several advanced cooling systems available to meet your needs.

Build efficient panels at the right cost – fast

Thanks to highly advanced cooling systems with improved airflow management, Altivar process drives offer the same compact footprint regardless of the protection level you require (IP23 or IP54). What's more, thermal qualities remain unaffected.

Install and run equipment easily, from any location

Commissioning is fast thanks to embedded FDT/DTM technology and an easy-to-use graphical interface for function settings. Pump curves are easy to make and only require five points, via different user interfaces such as graphic display terminals and SoMove setup software for PCs. Simply download in open format for spreadsheet programs (CSV).

Operate intuitively with real-time intelligence

Altivar process drives enable you to save time on recording and tracking production details manually by automatically transforming basic data into process information.

Choose the right maintenance approach to avoid costly downtime

Condition-based monitoring brings a simple answer to maintenance challenges as it enhances both energy and asset management. Altivar process drives offer condition-based monitoring and maintenance for your assets.

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City Power falls victim to hard-hitting ransomware attack

Johannesburg residents woke up to bleak news on 25 July, with City Power stating via Twitter that the power utility had been hit by a ransomware attack. City Power explained that the attack compromised its web server, databases, applications and network. This essentially meant that until their IT department could resolve the issue, customers could not buy electricity, upload invoices or access the City Power website.

"It may also affect our response to some outages as the system to order and dispatch material is affected," the City Power tweet stated, adding that their IT department was cleaning and rebuilding all affected applications. This latest attack is testament to the proliferation of cyber attacks on state utilities, governments, and businesses of all sizes.

According to Aaron Thornton, MD of local IT consultancy Dial a Nerd, ransomware is one of the most commonly employed forms of cyber attack today. Cybersecurity Ventures predicts there will be a ransomware attack on businesses every 14 seconds by the end of 2019, up from every 40 seconds in 2016.

"Ransomware is a malicious software virus that infects a computer, network or data," Thornton explains. "During the infection, your computer will either be locked or your data encrypted and held hostage… and the only way you can regain access is by paying a 'ransom'." He adds that although malware such as ransomware is not a new phenomenon, it has become increasingly widespread and invasive in recent years.

The attack on City Power should undoubtedly serve as a strong warning to business leaders, and individuals, to take immediate steps to secure their online environments and IT infrastructure. "The first is to practice proper email management," cautions Thornton. "Avoid opening any suspicious-looking emails. Be cautious of clicking links or opening attachments in emails you are not familiar with. This is the easiest way for malware to infect your electronic device."

In addition, always use reputable anti-virus software. Some ransomware strains have been so creative as to mimic anti-virus software interfaces and fool the victim to "run a security scan". With this in mind, be sure that you use a trustworthy security software provider.

"The number one piece of advice that anti-ransomware specialists offer is to back up all data, outside of your own local area network (LAN)," adds Thornton. "It is critical that you can recover an entire system and that your backup is isolated from your network to keep it safe from the infection."

Contact Dial a Nerd, Tel 010 007-0012, contactus@dialanerd.co.za

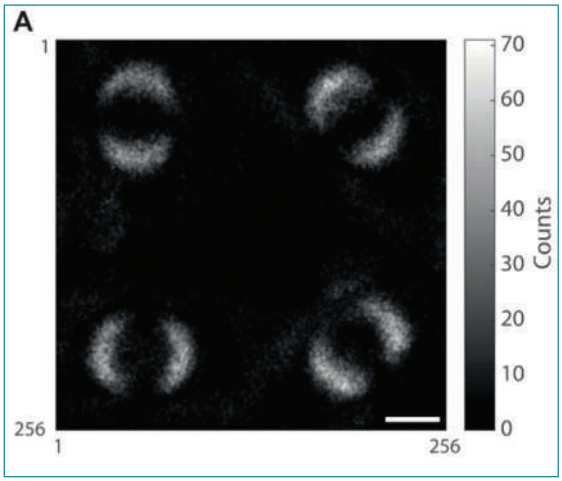
Scientists unveil image of quantum entanglement

For the first time ever, physicists have managed to take a photo of a strong form of quantum entanglement called Bell entanglement – capturing visual evidence of an elusive phenomenon which a baffled Albert Einstein once called "spooky action at a distance".

Two particles which interact with each other – like two photons passing through a beam splitter, for example – can sometimes remain connected, instantaneously sharing their physical states no matter how great the distance which separates them. This connection is known as quantum entanglement, and it underpins the field of quantum mechanics.

Einstein thought quantum mechanics was "spooky" because of the instantaneousness of the apparent remote interaction between two entangled particles, which seemed incompatible with elements of his special theory of relativity.

Later, Sir John Bell formalised this concept of nonlocal interaction describing a strong form of entanglement exhibiting this spookiness. Today, while Bell entanglement is being harnessed in practical applications like quantum computing and cryptography, it has never been captured in a single image.



In a new paper published in the journal Science Advances, a team of physicists from the University of Glasgow describe how they have made Einstein's spookiness visible in an image for the first time. They devised a system which fires a stream of entangled photons from a quantum source of light at "non-conventional objects" – displayed on liquid-crystals materials which change the phase of the photons as they pass through.

They set up a super-sensitive camera capable of detecting single photons which would only take an image when it caught sight of both one photon and its entangled "twin", creating a visible record of the entanglement of the photons.

Dr Paul-Antoine Moreau of the University of Glasgow's School of Physics and Astronomy is the paper's lead author. Dr Moreau said: "The image we've managed to capture is an elegant demonstration of a fundamental property of nature, seen for the very first time in the form of an image. "It's an exciting result which could be used to advance the emerging field of quantum computing and lead to new types of imaging."

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STEM skills development top of mind

As South Africa faces a critical shortage of skills in the fields of science, technology, engineering and mathematics (STEM), and youth unemployment is at an all-time high, closing this gap has become a vital imperative. In a bid to both tackle youth unemployment and seek innovative solutions to the STEM skills crisis in South Africa, the third Annual STEM Conference & Career Expo will be taking place from 4 – 5 October 2019 at the Ticketpro Dome in Johannesburg.

While the overall rate of unemployment in South Africa remains high at 27,6% in the first quarter of 2019, more alarming is the rate of unemployment among South Africa's youth, who account for 63,5% of all unemployed people. This is according to an article posted by Stats SA in May 2019, which also notes that unemployment rates for youth graduates, traditionally a more resilient statistic in the face of unemployment, also showed a sharp increase to 31% in Q1: 2019 as compared with 19% in Q4: 2018.

"At the same time, South Africa is grappling with a crippling skills shortage in the STEM arena and we now find ourselves at a critical juncture in the country's social and economic trajectory that demands our urgent attention. As highlighted by the Presidency, the Fourth Industrial Revolution is upon us and we need to be ready and equipped to leverage and unlock its opportunities for a prosperous and economically sustainable South Africa," says Amalia Hendricks, STEM Conference & Career Expo director.

"This is a time of tremendous opportunity for the youth and stakeholders, including corporates and government agencies, who wish to stake their claim in the future of the country; we have a burning need for STEM skills in both the public and private sectors and we have an abundance of young STEM graduates eager to make their mark in the workforce. As a key matchmaker in this realm, STEM Conference & Career Expo brings STEM graduates and business together to erode barriers to riding the 4IR wave," she adds.

Who should attend?

Attendees are made up of prospective and current university students as well as STEM graduates from all major tertiary institutions across South Africa looking for exciting career opportunities. Grade 12 learners are also invited to gain exposure to both STEM careers and university readiness seminars. Attendees gain invaluable access to recruiters from top STEM businesses in SA, career opportunities, learnerships and bursaries, STEM career advice and information.

Who should exhibit?

Any and all businesses connected with and whose survival and prosperity depends on science, technology, engineering and mathematics should participate, not only to communicate their exciting career opportunities, but to showcase to future industry leaders what a resilient, forward-thinking business in STEM looks like. Exhibitor stakeholders include secondary schools, extra-curricular STEM education and training suppliers, universities and their departments, Government departments and agencies, and STEM-oriented recruitment agencies.

The STEM Conference & Career Expo is rooted in a vision for a truly prosperous and resilient South Africa that actively seeks solutions to its challenges.

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IoT entrepreneurship programme serves up smart solutions to SA

SqwidNet hosted its second IoT Entrepreneurship Programme (IoT)E pitch day on 19 July 2019. Seven finalist groups, selected from a group of 60 prospective entrepreneurs and ICT business owners over the course of a year, presented their ideas to a panel of potential investors with the goal of making a tangible difference to society.

The finalists included Inobeshon, Jonga Systems, tekSolve, devXpress, The Awareness Company, Mkazi Concepts, and Line of Sight Technology. Line of Sight Technology is a healthcare technology solutions provider with the goal of improving access issues and achieving the third Sustainable Development Goal – good health and wellbeing – through systems that strengthen and support healthcare. The company presented its Smart Med Box that helps people to manage medication adherence, thereby reducing illness recurrence and improved control over personal health.

The Jonga Systems solution is an IoT premises-monitoring tool that provides deeper home security using motion sensor devices, push notifications, and programmable contact numbers and an audible alarm to scare off the intruders. The Awareness Company presented a software solution that takes the influx of data into the organisation and transforms it into stories that are easily understood and interpreted into action. Mkazi Concepts presented a network of Hand Hygiene Monitoring devices to streamline hand hygiene compliance using sensors, network connections, and a cloud platform. The solution supports healthcare and hygiene control and reduces the burden of associated infections in healthcare facilities.

TekSolve brought an intelligent gas monitoring solution enabled by Sigfox and configurable with alerts and notification settings. The easy to install solution, stores data in the cloud, comes with an intuitive web interface and is suited for both home and industrial use cases. Inobeshon presented its inoLogistics product that comprises of two core modules – an inventory management module and a logistics systems module. These operate using proprietary software and firmware designs alongside the Sigfox network and enhance the seamless management of inventory across warehouse and transportation. Finally, devXpress addresses the challenge of power limitations across the country using a low-cost, IoT-enabled, low-voltage device.

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Conference and training event for wireless providers

Bookings are now open to delegates wishing to attend the Wireless Access Providers Association's WAPALOZA Conference & Training event, being held in Pretoria from 16 – 18 September 2019. "In addition to the three-day conference, which focuses on the Fourth Industrial Revolution, TV White Space and 5G, we also have an information-packed three days' worth of high-quality training," says Tim Genders, chairman of the Wireless Access Providers Association (WAPA).

The training sessions, which vary from one to three days in duration, have been carefully selected by the WAPA management committee to ensure comprehensive coverage of those areas in which both WAPA members and potential members can most benefit. The training sessions include:

- Zero to hero: Understanding wireless.
- Zero to hero: Understanding fibre.
- Cambium Certified ePMP technical training.
- Mimosa training.
- Mikrotik Certified Network Associate training.
- Radwin and Ubiquiti training.

WAPA believes that this event is a positive step towards fulfilling the mandate of Minister Stella Ndabeni-Abrahams who has challenged industry to develop skills to connect South Africa.

The conference and training sessions are complemented by an expo which will allow sponsoring WAPA members to display their solutions to the market. WAPA management committee member, Paul Colmer, says that there are a still a limited number of valuable sponsorship opportunities available. "Act fast, because these sponsorships, which are a cost-effective way in which to increase your brand exposure, are going fast. If you would like to find out more about those packages still available, contact the WAPA Secretariat."

Full details on the training programme are available at www.wapaloza.co.za.

Contact Wireless Access Providers Association,
secretariat@wapa.org.za

Ultra-small nanoprobes for human-machine interfaces

Machine enhanced humans – or "cyborgs" as they are known in science fiction – could be one step closer to becoming a reality, thanks to new research from the University of Surrey and Harvard University. Researchers have conquered the monumental task of manufacturing scalable nanoprobe arrays small enough to record the inner workings of human cardiac cells and primary neurons.

The ability to read electrical activities from cells is the foundation of many biomedical procedures, such as brain activity mapping and neural prosthetics. Developing new tools for intracellular electrophysiology (the electric current running within cells) that push the limits of what is physically possible (spatiotemporal resolution) while reducing invasiveness could provide a deeper understanding of electrogenic cells and their networks in tissues, as well as new directions for human-machine interfaces.

In a paper published by Nature Nanotechnology, scientists from Surrey's Advanced Technology Institute (ATI) and Harvard University detail how they produced an array of the ultra-small U-shaped nanowire field-effect transistor probes for intracellular recording. This incredibly small structure was used to record, with great clarity, the inner activity of primary neurons and other electrogenic cells, and the device has the capacity for multi-channel recordings.

Dr Yunlong Zhao from the ATI at the University of Surrey said: "If our medical professionals are to continue to understand our physical condition better and help us live longer, it is important that we continue to push the boundaries of modern science in order to give them the best possible tools to do their jobs. For this to be possible, an intersection between humans and machines is inevitable. Our ultra-small, flexible, nanowire probes could be a very powerful tool as they can measure intracellular signals with amplitudes comparable with those measured with patch clamp techniques; with the advantage of the device being scalable, it causes less discomfort and no fatal damage to the cell (cytosol dilation). Through this work, we found clear evidence for how both size and curvature affect device internalisation and intracellular recording signal."

Professor Charles Lieber from the Department of Chemistry and Chemical Biology at Harvard University said: "This work represents a major step towards tackling the general problem of integrating 'synthesised' nanoscale building blocks into chip and wafer scale arrays, and thereby allowing us to address the long-standing challenge of scalable intracellular recording. The beauty of science to many, ourselves included, is having such challenges to drive hypotheses and future work. In the longer term, we see these probe developments adding to our capabilities that ultimately drive advanced high-resolution brain-machine interfaces and perhaps eventually bringing cyborgs to reality."

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New school for data science and computational thinking

Stellenbosch University (SU)'s new School for Data Science and Computational Thinking was officially launched on 29 July 2019 at a function at the Stellenbosch Institute for Advanced Study. Aiming to be a world-class institution for data science and computational thinking in and for Africa, the newly established school will work across SU's ten faculties with multi- and inter- and trans-disciplinary collaboration. It will also span the entire academic project, from under- and postgraduate training to research and specialist consultation.

Dr Wim Delva, acting director of the School for Data Science and Computational Thinking.

Speaking at the launch, SU rector and vice-chancellor Prof. Wim de Villiers described the School for Data Science and Computational Thinking as a game-changer in higher education, both in South Africa and beyond. "Through our new School for Data Science and Computational Thinking, Stellenbosch University is ready to enhance South Africa's competitiveness in the Fourth Industrial Revolution. The school provides a single platform for collaboratively advancing knowledge in service of society – in an interdisciplinary way."

De Villiers said the world is changing fast, especially in terms of the gathering, sharing and exploitation of data and the new School is SU's stake in the unfolding future. He added that new school is a tangible expression of SU's new vision and strategic framework in terms of which the institution strives to be relevant to the people of South Africa, continent and the rest of the world, and making meaningful contributions of the highest quality that will take humanity forward.

Echoing De Villiers' sentiments, Dr Wim Delva, acting director of the School for Data Science and Computational Thinking, said the entity will connect people in government, business and non-profit organisations as they seek to use big data to address the challenges South Africa faces as a country. In addition to offering online programmes that are future-proof, the School will provide a roadmap to prospective students of what they can study in the field of data science, added Delva.

Contact Martin Viljoen, Stellenbosch University, viljoenm@sun.ac.za

Electric car tipping point will delight and destroy

It is nonsense to forecast pure electric cars costing the same as traditional ones, then life continuing much as usual. The up-front price of pure electric PE cars will be dropping below that of internal combustion engine ICE ones around 2025. The fundamentals are now clear. Short range electric cars will continue to sell badly because of range and financial anxiety: their resale value after three years can be down 80%. Three-hundred and twenty kilometres is the tipping point where resale value can be only 40% down on purchase price.

Raghu Das, CEO of IDTechEx advises, "Many barriers are falling. Vast numbers of public chargers will no longer be essential as electric ranges increase. Indeed, the new solar cars can be operated entirely from daylight and a regular domestic plug. The frugal, short-distance traveller will use daylight alone. The wealthy will buy cars with up to 800 – 1000 km range, such as the Lightyear One or the next Tesla Roadster, charging as infrequently as a regular car – no problem at all. Such ranges will be commonplace by 2030. Indeed, the Lightyear One is intended to be cost-reduced to more mainstream prices where the shorter range Sono Motors Sion solar car is today with a $145-million orderbook to prove the point. Plenty of people will sacrifice acceleration to escape the misery of roadside charging, particularly in cities where most of us now live."

In motor industry terms, the 2025 tipping point is very close, and the industry may not have fully grasped the seismic effect it will have on sales of yesterday's powertrains, including full hybrid electric vehicles (HEV) and plug-in HEVs. These do not have the cost reduction potential and they will increasingly incur hassle from gasoline station numbers declining, restrictions on ICE vehicles and decline in resale price. Forty-eight volt mild hybrids may be an exception, because they will get pure-electric modes at a fraction of the cost of HEV. Significantly, Continental has just announced such a 48 V powertrain. In contrast, although pure electric cars cost much more today and their insurance is much higher due to being a function of price and scarcity of trained repairers, that will be gone by 2025 with the ten times higher reliability and no inflated price benefiting insurance, which may even go lower than conventional.

So what is the pent-up PEV demand being released? It took only ten years for major cities to flip from horses to cars. New cars could well be 100% pure electric in 2035, tougher emissions laws underwriting that.

However, Das cautions, "As car manufacturers diverted by lesser opportunities go under and the pure-electric winners prosper there is only one cloud on the horizon – lithium-ion batteries. Although they may have dropped to only 20% of car cost by 2025, supply is an issue. IDTechEx estimates that a demand of around 2000 GWh just for Li-ion batteries in cars will exist in 2028 if car manufacturers can make enough pure electric cars at their projected costs. That exceeds the committed capacity of such batteries for all uses, let alone cars at about half of the overall Li-ion demand. Gigafactory commitments increase all the time but it is far from certain that they will rise sufficiently to meet demand and there are unlikely to be other batteries or supercapacitors available within the coming decade that can meet more than a minority of the emerging needs."

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Thoughts on the electric car industry

TrendForce@trendforce

The penetration rates of HEVs will reach 5% in 2019, while that of pure electric vehicles will only stand at 2%. Hybrid cars will start to become more and more affordable. The HEV market will split and develop along these two main lines… #HEV #electriccar

Corporate SA not in love with 4IR

The technologies that make up the so-called Fourth Industrial Revolution (4IR) have yet to be adopted with any enthusiasm by South African enterprises. This is a core finding of a new research study entitled "Fourth Industrial Revolution in South Africa 2019: Enterprise uptake and expectations for emerging technologies," conducted by World Wide Worx in partnership with Syspro.

The research delved into current and planned uptake of emerging business technologies like artificial intelligence (AI), robotics, virtual and augmented reality, the Internet of Things (IoT), and blockchain. "The most surprising finding was the lack of enthusiasm for artificial intelligence, despite the marketing hype that suggests every large business is embracing it," says Arthur Goldstuck, MD of World Wide Worx and principal analyst on the 4IR research project. "Only 13% of corporate South Africa is currently using AI and, of the rest, 21% plan to adopt it in the next twelve to 24 months."

A significant obstacle to adoption, the research reveals, is the cost of skills for implementing AI. Of those not using it, 43% cited cost as the key reason. Ironically, as awareness of AI grows in South Africa, enthusiasm seems to diminish. "Traditionally, intended uptake of new technologies shot up once education, awareness and knowledge increased," says Goldstuck. "Now, however, we are seeing the flip side of the coin. A year ago, 63% of those not using AI said they planned to use it in the future, and not a single company cited cost as a reason not to do so. A year and much hype later, the market seems to have woken up to the realities of obstacles like skills and cost, and the proportion of those planning to use it has plunged."

By contrast, robotics – in both hardware and software – has moved to the forefront of corporate strategy. Robotic process automation (RPA), which automates business processes through software "bots", has become readily and cheaply available from numerous service providers, resulting in a robotics boom. "We were astonished when we sifted through the data," says Goldstuck. "A year ago, only 6% of South African enterprises were using robotics. Then came the RPA explosion. Now the figure stands at 37%."

The industry sectors that have adopted robotics most enthusiastically also reveal the contrast in use cases between hardware-and software-based automation. The sector with the highest uptake, Legal services – at a high 67% – is able to reap massive benefits from automating standard, routine and dull processes like searches for legal precedents. On the other hand, the next most active sector in robotics, Mining, is focused on hardware automation of both dangerous and routine processes, like drilling and sorting.

The uptake of emerging technologies varies dramatically across technology categories and industry sectors. Virtual and augmented reality is used by a little more than a third of enterprises, but intended usage among the rest falls to below 10%. Blockchain, the technology for distributed ledgers that validate every step in a transaction process, is currently used by fewer than 10% of respondents.

The one stand-out sector, in which South Africa leads the world, is the IoT. The study revealed near-unanimous usage, with 92% of enterprises having adopted IoT. However, this is largely a factor of the ubiquity of vehicle tracking and fleet management technology, which began as telematics, and has evolved into a sub-category of IoT.

Contact Arthur Goldstuck, World Wide Worx, Tel 011 782-7003, arthur@worldwideworx.com

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Plug-and-play must be the new norm of electronics

Addressing the annual business breakfast of the Association for the Representatives of the Electronics Industry (AREI), guest speaker Stafford Masie said any future developments of electronics for the African market must embrace the plug-and-play concept. "Can you imagine having to develop a user start-up manual in many languages? For a start, we in South Africa alone have eleven official languages. It would be a very time-consuming and costly exercise."

Stafford Masie is a South African technology entrepreneur who was behind the Payment Pebble, introduced by Absa, a radical new design of a mobile point-of-sale (M-POS) system. It was developed in South Africa with a team of technologists. Instead of merchants having to use a third-party smartphone, the new device integrates a full smartphone into its design.

Masie believes that the electronics industry in South Africa has much to contribute to the country's economy. "We have smart engineers who develop cool products. We should stop underestimating our ability. With smart manufacturing, the industry will have the opportunity to become a major player in the African market and indeed enter the global market."

The main focus of his presentation was about artificial intelligence and its role to the fourth Industrial Revolution (4IR). "We will be doing things differently in the future. It will impact on the way people work. It will relieve people from doing boring repetitive jobs, but at the same time call for people to learn new skills. We already see this happening." He said that the call for teaching coding at an early age is not the ultimate. "We need to change the way our tertiary education system is shaped. Humanities and science should become an integral part of each other's discipline".

"The new business outlook is about recognition, community and legacy. It cannot be about taking all but also about giving!"

START-UP SPOTLIGHT

Smallest personal computer developed by South African innovators

Two young South African innovators have set their sights on disrupting modern day computing. They claim to have built the world's first personal computer (PC) with virtual input and output peripheral.

In a move set to enhance the mobility and usability of computing devices in areas where connectivity is an issue and electricity is in limited supply, these innovators have created a PC that does not require physical keyboard, mouse and monitor.

Luyanda Vappie from Eastern Cape and Motsholane Sebola from Limpopo came up with this idea two years ago. This was necessitated by the need to digitalise and improve accessibility of technological gadgets in rural areas. The device, called Prism, is a world first in that it is a personal computer that has a virtual keyboard and mouse as well as a virtual screen. Prism aims to enhance digital skills by improving the accessibility of digital literacy tools.

This PC is a small compact unit that produces around 2 Ghz of processing power. It has Bluetooth, wireless, LAN and a battery that lasts about two hours. The on-board memory is 64 GB and is extendable by SD Card to 200+GB.

Vappie and Sebola grew up with particular interests in software engineering, systems development and business analysis. They both studied information technology at university level. They always dreamed of

Luyanda Vappie and Motsholane Sebola.

becoming the best technology developers in the country, with a clear vision of making smart technologies accessible to ordinary South Africans.

"It has also always been our dream to improve our country, especially the rural communities. Technologies need to be usable and accessible in areas where electricity was limited," says Vappie.

Vappie added that the device would change the way people think about computers. "It is portable and can be used anywhere and at any time. Our aim is to deploy it to schools in areas with low connectivity as digital goods and ensure that the curriculum is available offline," he says.

"We have several deployment models that include tooling, up-skilling and employment of local resources to support devices deployed at schools. We are excited to contribute towards the realisation of the United Nations Sustainable Goal for Quality Education and have been invited to speak at a number of United Nations conferences on how technology can contribute to the Quality Education SDG," says Vappie.

Sebola says Prism represents the future of computing, saying that the Fourth Industrial Revolution presents the opportunity for young people to be innovative. "What we have essentially done is create virtualised components for input and output devices and in a compact unit that can be used anywhere. An all in one solution that incorporates virtual input peripherals and display in a single convenient package. It is highly interactive and usable in both urban and rural environments."

Their future plan is to successfully commercialise this product and build a manufacturing facility in South Africa that will create more engineering jobs for young people, especially those in the rural areas. The two now own a company called Root Tech, an African original equipment manufacturer (OEM) based in Johannesburg working in the consumer electronics market.

Contact Luyanda Vappie, Root Tech, Tel 082 837-2551, luyanda@root-tech.co.za

Consulting engineers welcome R100-billion seed fund for infrastructure

Consulting Engineers South Africa (CESA) welcomed President Cyril Ramaphosa's announcement during his State of the Nation address of the R100-billion seed fund for infrastructure development. Chris Campbell, CESA CEO said, the organisation is hopeful that between the Development Bank of SA (DBSA) and the new Department of Public Works and Infrastructure (DPW&I) they will ensure that value for money, fair, transparent and cost-effective decisions will be made to maximise the outcomes being pursued through this seed funding. Campbell said that these elements are essential to instil business confidence leading to foreign investor confidence for the further development of both social and economic infrastructure. Infrastructure, he said, is a critical area of investment that supports structural transformation, growth and job creation. As a body of consulting engineering companies in South Africa, comprising over 560-member firms, who employ more than 21 000 staff in the consulting engineering sector, CESA said it stands willing and able to partner with government through the implementation of the National Development Plan in order to meet Vision 2030.

Contact Bonolo Nkgodi, CESA, Tel 011 463-2022, bonolo@cesa.co.za

Virtual Panel Discussion: Learning opportunities for new graduates

Compiled by Aimee Clarke, EE Publishers

A common complaint in industry is that new graduates are not fully equipped to enter the workforce. What is learnt in textbooks is vastly different to what can be learnt on the job. Experience accounts for much, but is it realistic to expect universities to provide this? It should be kept in mind that tertiary institutions are limited by their resources, government funding, and university politics. Perhaps it is up to industry to create the kinds of graduates they want. This is what the industry had to say:

Do you agree that new graduates are not fully equipped to enter the workplace?

Emma Durkin, head of human capital, Altron Karabina: "I do agree with this statement. Graduates often have the necessary theoretical knowledge – some at post-graduate levels – but they do not have the soft skills and even basic technical skills that are required. Graduates often land in our business and do not have a professional grasp of business English. They type emails as if they are sending WhatsApp messages to friends – using shorthand and slang. I have worked with IT graduates who have no knowledge of how to use Word or Excel or even Outlook. Employers often expect that they will land in the business knowing the basics, but this is rarely true. What happens then is quite a hard landing for the employer and the new employee. They may feel embarrassed to ask the basics and spend the first few months unknowingly struggling, making their first experience in the workplace a stressful one. All new-starters should be assigned a people manager who navigate the new-starters through the organisation and coaches them on soft skills, workplace etiquette, etc. This close partnership with the new starters guarantees that skills gaps can be identified early."

Uthayan Elangovan

Uthayan Elangovan, CEO, Neel SMARTEC Consulting: "Yes, certainly from a corporate perspective. Traditional university education does not provide students with skills regarding the work environment. Students come into entry-level positions and require use of a skills advancement program to meet the job requirements. While college expends students' knowledge intellectually and offers them social development and exposure to new experiences, it does not equip them for a more specialised working environment."

Tebogo Moalusi, IR executive: Staffing and outsourcing cluster, Workforce Staffing: "I agree. It's one thing to have the knowledge, but there are limitations in terms of the practical know-how of the job. Increasingly, businesses are less likely to employ graduates due to the risk that they will require a level of investment from the company in order to meet the job requirements. This is coupled with the risk of them leaving the job for greener pastures after acquiring the skills from their original employer who chose to take the risk. It's a double-edged sword for the employer: graduates are cheaper to employ but require investment into their skills development, which might be lost before the value to the employer is realised."

Whose responsibility should it be to prepare these graduates; parents, institutions, employers, or the graduates themselves?

Uthayan Elangovan: "The responsibility lies with all, to some extent, but mostly between the institution and graduate; the former needs to offer opportunities, while the latter needs to be willing to grab them. There also needs to be dialogue between industry and institutions with regards to what skills are required for certain roles, so that curricula can be kept up to date."

Tebogo Maolusi

Emma Durkin: "A combined approach is the best approach. I do not believe that syllabuses at schools and tertiary institutions prepare students for the world of work. They should relook at their curricula, giving students a practical view into the working world. Work experience should be more commonplace and encouraged."

"While graduates should also be held responsible for upskilling themselves, the problem is that very often the graduates 'don't know what they don't know'. They need guidance from the institutions and their parents. In South Africa, it is not uncommon for graduates to come from previously disadvantaged homes where they are the first in their family to enter corporate environments. In these examples, parents are not able help prepare their children for the workplace."

Tebogo Moalusi: "It is a combined effort from all, although employers play a very dominant role in terms of who they want at the helm of

their business. Employers need not be afraid to employ graduates and invest in them. One acknowledges the risk of the graduate acquiring the skill and then leaving, or the risks of negligence or inability to do the job due to lack of experience. However, with proper training and guidance such challenges can be overcome. Furthermore, with proper career guidance and fostering, the graduate will not only be productive but will produce new talent in this ever-changing environment of technological advancement which the youth is known to master. Most businesses are consumed with their core business functions and perhaps fail to manage their graduates adequately. This creates neglect and can compromise the process of the graduate's transition into the working environment."

Given the global skills shortage, what can industry do to create more experiential learning opportunities?

Emma Durkin: "Encourage internships and learnerships and on the job learning. The Altron Technology Professional Programme (TPP) is a two-year programme focused on the development of scarce skills in Altron and the technology sector. The ultimate objective is job creation and building a talent pipeline within strategic growth areas, and building technical skills in specific competencies to strengthen strategic partnerships."

Tebogo Moalusi: "There is a growing trend of businesses avoiding employing inexperienced

Emma Durkin

candidates, but the opposite needs to happen. The recipe for success is providing the relevant training, guidance, induction and mentorship to the new candidate, and this will have a reciprocal effect whereby the candidate will have far more vested interest in the business."

Uthayan Elangovan: "The ideal method to apply experiential understanding in the workplace is to encourage it as part of the business culture. Employers should create customised programmes based on the demands of the organisation, and offer training with simulations that resemble real-world organisational issues that workers face in their specific functions."

Should experiential learning be mandated/ regulated, such as the community service year required by medical graduates?

Emma Durkin: "I am not an advocate of mandating or regulating anything as they often end up with a negative connotation. Employers 'have to' do it and with that comes an element of resentment and the passion for closing the skills gap becomes homework rather than coming from a place of passion to increase the skills base."

Uthayan Elangovan: "Yes, that is an option, but I don't think it will work as well as it does in the medical field. Rather, educational programmes should be created which develop capacity beyond the surface features of a job; there should be focus on the principles of the self-development, discipline and self-control. Students should be encouraged to explore new opportunities."

Tebogo Moalusi: "The concept is not be a bad one at all. Saying this, companies should be encouraged to host such graduates. It will play an important role in exposing graduates to the working environment and thus enabling them to gain relevant experience prior to being introduced to the working world. This will by provide them with the relevant and practical skills."

Send your comments to engineerit@ee.co.za

Industry & Technology: Celebrating technology by Africans, for Africa

From 30 – 8 September 2019 the Fak'ugesi African Digital Innovation Festival will return to Johannesburg to explore and celebrate technology and creativity by Africans for Africa. The 2019 festival has cast its central theme as "Own Your Force" which invites digital makers in Africa to stake their claim on their talent, industry and creative economy. Wits University's Tshimologong Innovation Precinct, in collaboration with partners in the Braamfontein area will be at the heart of festivities with a programme promising to yet again transform Johannesburg into a celebration of technology, creativity and innovation from across the African continent.

Now in its sixth successful year, Dr Tegan Bristow, Fak'ugesi African Digital Innovation Festival director says attendees can expect a fresh and energised line-up that explores screen-based digital creativity in gaming, virtual reality, mixed reality cinema and animation – with special focus on cross-sector collaboration in the region for Southern and East Africa, addressing blockchain, artificial intelligence, protection of intellectual and creative property and much more.

A highlight in this year's Fak'ugesi African Digital Innovation Festival programme is a conference developed in collaboration with the Goethe-Institut's Creative Entrepreneurship office, which will bring attention to the challenges of creative and digital entrepreneurship within the Fouth Industrial Revolution in Africa. Another highlight of the 2019 programme is the annual and much-loved Fak'ugesi Digital Africa Residency, which will bring together aspiring young digital artists from the SADC region. This year the project expands as young Swiss artists collaborate with their SADC counterparts. Working with Pro Helvetia and the ANT Fund for Development and Co-operation (SDC), the residency serves to highlight and develop incredible young digital talent in Southern Africa and boost their careers as important digital creatives.

"The Fak'ugesi African Digital Innovation Festival is the only one of its kind in Africa and the only digital arts focused festival in Sub Saharan Africa. It has risen to prominence as a platform through which many young digital makers have launched their careers and developed skills in digital media and technology innovation," adds Bristow.

Q&A: Ask an expert

Addressing SA's water challenges

Clayton Duckworth

In many parts of Africa and the world, hundreds of millions of people still lack access to clean and safe drinking water. Among the worst affected are those living in urban areas where population growth and rapid urbanisation are outstripping already inadequate infrastructure. When considering large investments in alternative water supplies, the costs need to be weighed against not only the cost of drought but also from diminished economic activity that a prolonged and severe drought can cause. We spoke to ABB's Clayton Duckworth to learn about how cloud-based IT coupled with smart flow-measurement devices make it possible to locate leaks and faults by analysing data from a water network and using statistical algorithms to detect anomalies. Contact him at clayton.duckworth@za.abb.com

What are the common water infrastructure challenges faced by South Africa?

Answer

Population growth and water scarcity, which is exacerbated during times of drought, have placed increased strain on water resource and water supply infrastructure. Up to 35% of our clean drinking water is lost due to leaks in aging infrastructure. There are operational issues around project funding and the financial management of infrastructure projects which filters down to projects not being executed properly, leading to poor quality pipelines and infrastructure management. Another key challenge is the need our local market has for improved technical skills to maintain, grow and especially plan our infrastructure. When it comes to planning infrastructure, this is a very niche skill.

What caused these challenges and could they have been avoided?

Answer

The causes are vast and include a ballooning population constantly utilising infrastructure that is being insufficiently maintained. There is the challenge of poor asset management and governance which has often led to the mismanagement of funding. There is most importantly, a lack of technical skills whose knock-off effect has led to infrastructure projects being more complex. In terms of whether or not these could have been avoided, everything starts and ends with financing. Government has made a pledge that in 2019, water projects will be prioritised, but it all comes down to managing that funding correctly and ensuring that the right hands, with the right expertise are implementing the projects. Companies with the end-to-end solutions that ABB provides can be leveraged as we have the capabilities in place to assist and impart the knowledge required.

Are there any places with similar challenges? How were they overcome?

Answer

Most developing countries across African face the similar challenges. We have a good case study in India, where they are using advanced technology to meter the water through their pipelines and to monitor leaks and all information received through the meter is fed back to a control centre where the data is analysed. The objective is to achieve a significant reduction in water wastage and lower rates of non-revenue water (NRW). A high-performance leakage management solution was required in the immediate term, but it also had to be future-proof and have the technical capability to meet the expanding needs of city's water consumption – which it did.

What knock-on effects/threats does a threatened water supply pose?

Answer

There are forecasts of a 17% gap between supply and demand of water within the next ten years. This is calculated based on our current rates of population growth and how our infrastructure is performing at the moment as well as our plans to grow it. These rates could change, as they are very dynamic. In essence, though, this will have an influence on South Africa's economic and social sustainability.

What can be done to solve challenges regarding SA's water supply?

Answer

We need a change in management systems coupled with increased funding and effective financial management to ensure that water infrastructure projects are delivered. We also need to focus on developing technical skills within the sector and leverage technology to efficiently manage, operate, monitor and maintain South Africa's infrastructure. Most importantly, the country at large needs to be educated on the importance of water and how to use it wisely for future sustainability.

How does drought and heavy rain affect SA's water infrastructure?

Answer

Weather conditions put pressure on our dams and ground water resources, which in turn lead to added pressure on infrastructure such as dam walls and drainage systems. We need more efficient and effective management systems to measure, monitor, maintain and restrict water during these periods. From our point of view, we can mitigate the impact by managing this through measurement, monitoring and maintenance.

We invite our readers to submit comments and/or questions, whether on this topic or any other area covered by EngineerIT, i.e. measurement & instrumentation, electronics, ICT, and automation & control. Please send your questions to ***aimee.clarke@ee.co.za*** *and we will do our best to have these answered by an industry expert.*

High demand spectrum policy – WOAN stays, 5G on hold

by Hans van de Groenendaal, EE Publishers

Government remains married to the Wireless Open Access Network (WOAN) despite the opposition it received from all quarters when the concept was first published in the National Integrated ICT Policy White paper in 2016. The WOAN concept has, to date, not been successfully implemented anywhere in the world and countries like Australia and Russia abandoned the idea, yet South Africa pushed forward.

South Africa's spectrum drought will continue for now, as Independent Communications Authority of South Africa (ICASA) is likely to follow the standard public consultation processes. But at least there is light at the end of the tunnel. Attempts to legalise the WOAN with the amendments to the Electronic Communication Act failed as the draft ECA Amendment Bill was modified once and withdrawn earlier this year.

The minister said in the policy announcement (Government Gazette 42597 of 26 July 2019) that she may direct ICASA to accept and consider applications for individual network service licences that provide wholesale electronic communication network services (the WOAN).

Research carried out by the CSIR found, after studying viability and sustainability on the basis of 20% market share, that the WOAN would require the following spectrum:

- 2 x 25 MHz of 800 MHz band (Band 20).
- 2 x 20 MHz of 2600 MHz FDD (Frequency Diversity Duplex) band (Band 7).
- 25 MHz of 2600 MHz TDD (Time Division Duplex) band (Band 38).

The remainder of the high demand spectrum will become available to individual licensees but conditions apply.

Who will own the WOAN?

ICASA is directed to issue an invitation, accept and consider applications for an individual electronic communications network service license for a WOAN. Minister Ndabeni-Abrahams says in her policy statement that the WOAN is an important policy instrument to lower barriers to entry for smaller players (there over 400 electronic communications network service licensees), improve ownership of the ICT sector by historically disadvantaged individuals, and to promote service-based competition. This may be so, but will it bring down the cost of broadband? Many are sceptical!

Minister of Telecommunications and Postal Services and Communications, Ms Stella Ndabeni-Abrahams.

And who will likely apply? At a workshop held last year and chaired by the director general of DTPS, Robert Nkuna, Telkom and Cell C supported the WOAN concept in principle and indicated that they would consider taking it on. However, much water has flowed under the bridge and they may well have changed their minds.

ICASA is also directed to consider special conditions for the WOAN such as a reduced spectrum fee covering only administrative costs and reduced or waived radio spectrum licence fees for a period of ten years. A minimum of 30% of national capacity must be procured from the WOAN collectively as soon as the WOAN is operational for a period of five years by radio frequency spectrum licensees that are assigned high demand spectrum.

Some good news

High demand spectrum remaining after allocation to the WOAN may be assigned to other electronic communications network service licenses, a process that must commence simultaneously. However, there many conditions attached such as the collective 30% uptake of the WOAN.

ICASA seeks consultants to establish a fair price for spectrum

Shortly after the policy announcement, ICASA issued an invitation to apply for a tender to help the authority value high-demand spectrum bands ahead of a planned assignment of the valuable radio frequencies.

ICASA wishes to appoint consultants to provide consultancy services to assist with determination of the fair economic value of the IMT700, IMT800, IMT2300, IMT2600 and IMT3500 radio frequency spectrum. The spectrum in question are all suitable for providing mobile broadband services, however, IMT700 and IMT800 bands are not available as large-scale digital migration of TV services has not commenced. The bands are still being used for television broadcasting.

ICASA had a non-compulsory briefing for parties interested in bidding for the consultancy tender on 6 August. The deadline to submit bids was 20 August.

5G on hold till after WRC19

ICASA is directed to investigate and report to the minister on the spectrum requirement for 5G in bands lower than 6 GHz and the millimetre wave bands currently under study at WRC19. The report should be submitted to the minister within six months of the conference, which takes place in Egypt at the end of October this year.

The investigation should cover the affected bands, the required ecosystem to support 5G, and the licensing implications.

Send your comments to engineerit@ee.co.za

Prioritise MRO strategy to manage costs for your company

by Brian Andrew, RS Components

It does not matter if times are good or bad – waste is never welcome at any proactive business.

Business is primarily driven by profit and efficiency, and waste is an attack on both. But many businesses, particularly among manufacturers, overlook a major cost hidden among their operations: that of maintenance, repair and operations (MRO) procurement.

MRO or indirect procurement concerns those many small parts needed to keep equipment running. It's fundamentally a supply chain/procurement discipline, but not often considered as a cost centre. Individual MRO items – small parts in big machines such as light bulbs, safety switches, connectors, push buttons, power supplies, etc. – tend to be inexpensive and not attract much attention. Yet as a pool, MRO procurement can represent a significant purchase base for companies.

The days of MRO being overlooked are numbered. According to a survey conducted by RS Components and UK-based CIPS (the Chartered Institute of Procurement and Supply), the focus is on to reduce MRO spend. Over half of the survey respondents cited pressure on operation budgets or reducing inventory costs, followed by asset performance (42%) and continuous improvement (38%) as motivations.

This message is less apparent in the South African market, but given the current tough economic conditions, it's well worth discussing. What can local businesses do to curb their MRO spend?

Taming MRO

Many businesses underestimate the amount they spend on MRO products over the course of a year. They also rarely understand the significant hidden costs associated with MRO procurement. In reality, the overall process of procuring a part can be double that of the actual part. Our research shows that an organisation spends £2 on the MRO procurement process for every £1 spent on

Brian Andrew

the MRO product itself. Bigger footprints such as multiple locations amplify this effect. South African patterns are unlikely to buck the trend.

What causes such a poor ratio? It may be because too much time is being spent on finding the cheapest product, or using the wrong strategies, for example category management and contracts negotiated on price alone to manage unplanned indirect spend. This may negate any actual savings made as extra processes and delays accrue costs.

Another reason is that MRO purchases often happen under the radar and tend to ignore official procurement channels. It may seem faster for an engineer on the floor to quickly acquire a spare part and get operations running again, using a convenient supplier. But amplify this over many instances and the purchases can compound into astounding inefficiencies.

Every company can meet this challenge with a good MRO strategy. It requires a new way of thinking and saving: a successful MRO strategy relies on all stakeholders involved in indirect procurement to collaborate. It must focus on improving the whole process of buying parts, involving stakeholders such as engineering, operations and finance functions, with buy-in at the c-suite level.

The strategy itself should aim for several objectives, which may include:

- Reducing "maverick" spend, where the user selects vendors outside the agreed supplier framework.
- Consolidating suppliers so procurers can make quick decisions without having to consider the bigger MRO picture.
- Procurement teams must communicate with users to understand what they need – this ensures suppliers with appropriate catalogues are chosen.
- Deploying an integrated eProcurement system to streamline ordering processes, which in turn will help users change their own procurement habits.
- Reducing items held in storage by only keeping critical spares and the items that will be used on a regular basis and then using suppliers that deliver on demand. This frees up working capital and space in your premises.

Without MRO, production can grind to a halt. A small part can stop everything for practical, health and safety, compliance or many other reasons. But sometimes the can-do attitude to keep lines going can result in inefficient MRO procurement choices.

Don't disturb that spirit on the work floor that keeps your business moving. Instead, establish an MRO strategy that compliments proactive workforce attitudes while establishing a framework which pursues efficiency and significant cost savings. Partner with a supplier who can develop these solutions with you and support you on the journey of taming your MRO procurement.

Send your comments to engineerit@ee.co.za

gadgets 4 geeks

1 New laptops with fingerprint capabilities

Dynabook has launched two new laptops coming to South Africa, the Portégé X30-F and the Tecra X40-F. The devices are the first to be Dynabook branded following the rebrand of Toshiba's computer business in April of this year. The new benefit from Modern Standby, the latest eighth Generation Intel Core processor (Whiskey Lake), and newly added Intel Optane Memory, and boast new upgrades including a hardware precision touchpad (PTP) with wake on fingerprint capabilities. In addition, a newly designed fan improves airflow and cooling by lowering fan noise.

For more visit www.dynabook.com

2 Start your car with your phone

As part of the Huawei's new EMUI 9.1 operating system update, Huawei P30 Pro users are able to sync their phones to their cars, enabling them to open the car, start the engine, as well as lock the car doors – without having to use their car key. All users need to do is save their user credentials and Car Connectivity Consortium onto a dedicated chip, which is completely protected from duplication and third-party access. Even if their phone battery runs out, it can still be used as a car key at least 15 times in 24 hours.

For more visit www.huawei.com/za/

3 Turn any venue into a party

Feel the deep and punchy bass sound with the popular Extra Bass series of speakers from Sony. The XB32 and XB22 have dual passive radiators, which work together with stereo full range speakers to enhance vocal clarity and give bass a boost, despite the compact size. Turn any venue into a party with the improved multi-colour line lighting on the XB32. Make it personal and customise these party functions via the Fiestable app.

For more visit www.sony.com/za

4 Meticulously re-engineered gaming mouse

Meticulously re-engineered from the ground up, the Logitech G502 Lightspeed keeps the shape and feature set of the original, while adding Lightspeed and Powerplay wireless technologies and a seven gram weight reduction. To make that possible, Logitech G engineering and design teams re-examined every element of the G502 and incorporated breakthrough innovations from the Logitech G PRO Wireless Gaming Mouse, including thin-wall design and endoskeleton chassis.

For more visit www.logitech.com/en-za

Send details of your gadgets to aimee.clarke@ee.co.za

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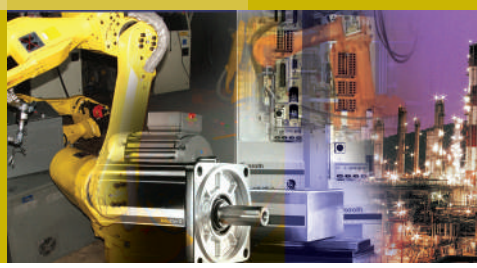
Innovative cooling for control shelters

by Martin Hess, Intertec, and Kasie Moodley, Protea Automation Solutions



Air conditioner-based cooling is widely used in hot countries for outdoor shelters housing control and instrumentation equipment.

Passive cooling techniques provide an interesting alternative, and the market for these has grown substantially during recent years. A further innovation in this area – "hybrid" cooling – is now extending the advantages of this approach and the variety of applications and climates that can be handled.

Reliability and cost

After price, performance and safety issues have been addressed, the two most significant concerns of operators commissioning control and instrumentation systems for remote sites and processing plants are usually reliability and long-term costs of ownership (LTCO). LTCO for field equipment almost invariably far outweighs the initial costs (purchase price is usually well under 10% of the total). And maintenance issues, especially those that may lead to downtime, have the potential to cause enormous financial loss.

Thermal problems are the direct cause of most malfunctions and shutdowns of electronic and electrical equipment. The reliability and correct functioning of electronics systems depends on keeping components within operational temperature parameters. As a rule of thumb, mean time to failure (MTTF) is cut in half with a 10°C rise in temperature. In desert and hot climates, the cooling of process control and instrumentation equipment is vital in order to avoid such problems.

Active vs passive cooling

A common approach when designing field-based control and instrumentation equipment is to employ conventional metal shelters for environmental protection – typically fabricated using sheet steel – or sometimes aluminium or stainless steel. These might house PLCs, RTUs, analysers, communications and other electronics equipment. If equipment is situated in a temperate climate, then all that might be necessary is simple fan convection to remove hot air. But if the shelter is located outdoors in a hot environment, then cooling can be much more challenging. In common practice, cooling is often achieved by means of a conventional consumer-style air conditioning unit – perhaps with a second unit to provide redundancy against failure. This approach is low cost, but has significant disadvantages. These include high running costs, and a need for routine maintenance. And, there are potentially problems with cooling performance or even equipment failure caused by local climate conditions such as dust and sand storms, or the ingress of corrosive media present in the local atmosphere.

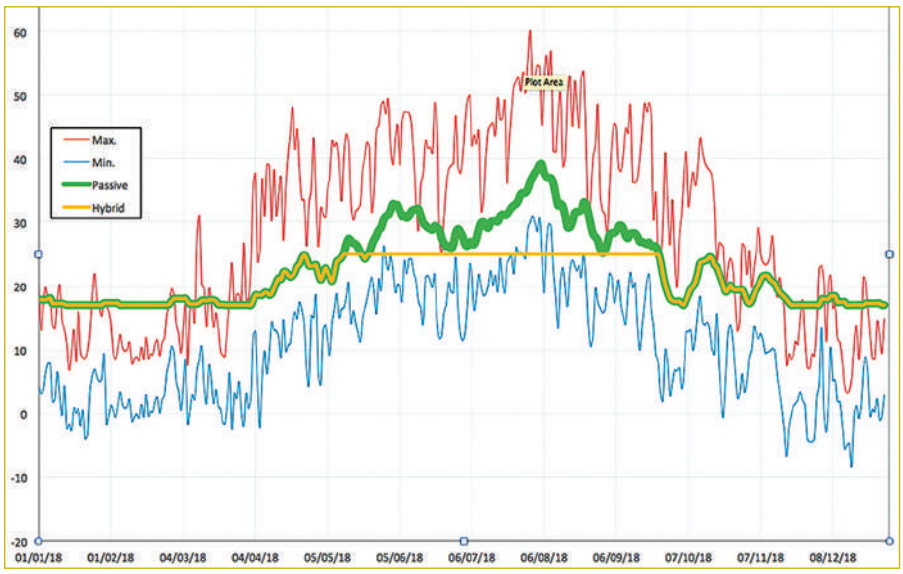


Fig. 1: Active and passive cooling elements working together over a year. Red and blue traces show daily min/max temperatures. Yellow shows normal hybrid operation with passive cooling boosted by active cooling in hot months. Green shows emergency mode, with passive cooling only.

Passively-cooled shelters work by exploiting the temperature swing over the climate's daily cycle. Fluid is employed as a medium to store the coolness of the night and moderate internal temperatures during the day. Natural convection moves the fluid (usually water) around the system with its heat exchangers, eliminating any need for electric power and making the system inherently explosion proof. As there are no moving parts, the possibility of failure is extremely small. If small levels of electric power are available at the site – even if the power supply is erratic – then the efficiency of such passively-cooled systems can be increased significantly by adding a powered chiller unit to decrease the temperature of the cooling water.

If the cooling system is configured as a "hybrid" solution like this (i.e. combining both passive and active cooling), then each element of the overall cooling system may be scaled down so that the active cooler only needs to help out during peak summer temperatures (Fig. 1). Then, if there is any failure of the active cooler, or an electricity supply outage, the passive system with its

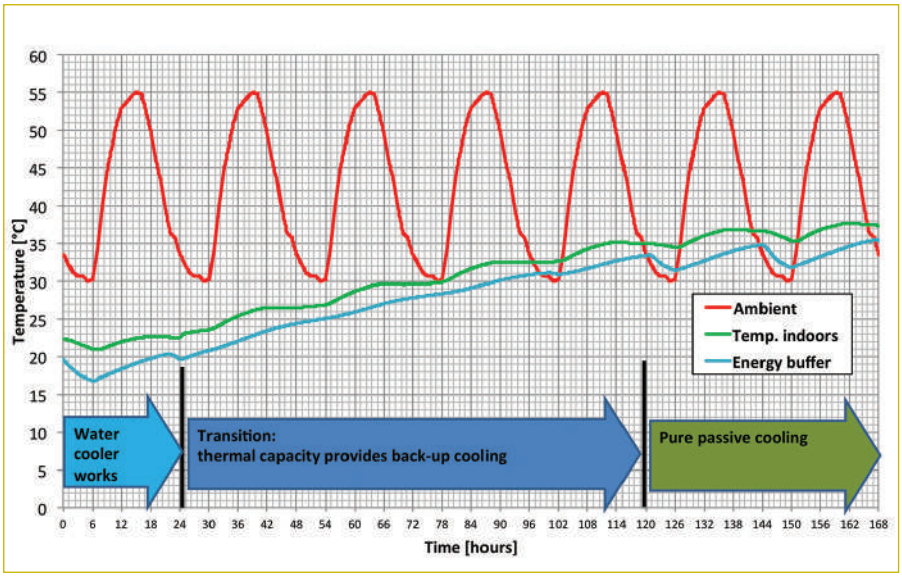


Fig. 2: Passive cooling can handle electricity outages or failure of powered cooling elements, as this one-week graph illustrates. This shelter's passive cooler was sized to maintain internal air temperature below 40°C, even if ambient temperatures reach 55°C – a worst case for its Mid-East location.

energy buffer is able to maintain low shelter temperatures for days, giving maintenance personnel plenty of time to respond (Fig. 2). Water cooling also provides an easy means of using conduction cooling. The heatsinks of controllers, PLCs, etc., can be installed directly onto conductive mounting plates, in contact with the liquid-based cooling media. This conductive heat transfer provides a much more efficient cooling mechanism – typically around five times better – than conventional air convection, allowing cooling to be selectively targeted at key components such as processors.

This approach has obvious advantages for remote sites. However it is also advantageous for plants such as refineries and chemical plants, as it can significantly simplify the installation of sensitive equipment much closer to the process, in difficult-to-access and hazardous areas where the cost of maintenance operations is extremely high.

Insulation is a catalyst

A vital component of outdoor shelters offering passive or hybrid cooling is efficient insulation. If the shelter is destined for an environment with hot and extreme conditions, starting the configuration process with one of the common types of metal shelter can cause difficulties. With metal construction, it is almost impossible to avoid metal parts in some design elements such as the door frame, door leaf, window etc, because the stability of this type of housing is based on bent sheet metal, and insulation materials are typically soft. Any metal connection between outer and inner shell provides a "thermal short-cut", decreasing cooling efficiency. Insulated shelters can appear to offer good U values (rate of transfer of heat through a structure). However, in practice, thermal short cuts caused by the construction technique, and the necessary process connection holes (for tubes, cables, etc) can seriously impact performance. For insulated enclosures, these often account for around 90% of total heat losses.

Achieving stable and efficient passive and hybrid cooling is significantly simplified by efficient insulation (along with sunshades to minimise solar gain), and GRP shelter construction materials provide the platform for this advance. The GRP sheet used to build such shelters has a very high thermal resistance compared to metal, with an efficiency that is some 1000 times better. GRP sheets are also typically fabricated easily in composite "sandwich" forms, enclosing efficient insulation materials. This allows shelters to be built with virtually perfect insulation – with no thermal short-cuts between interior and exterior.

With these properties, passive cooling systems work extremely efficiently in GRP shelters, and the number of hours required by the system for cooling water at night may be reduced substantially.

Combating corrosion

The layout of shelters can be another key contributor to long-term reliability, and novel design principles can be used to avoid the damaging effects of corrosion on sensitive electronics. Many remote oil and gas locations such as wellheads expose electronics equipment to corrosive elements in the local atmosphere such as hydrogen sulphide. If the site is a refinery located near the sea, then chlorine in the air poses another major corrosive threat. In an ideal world, sensitive control and instrumentation equipment housed inside a field shelter should never be exposed to such atmospheres. This is the target of a novel layout concept known as the perishelter.

Fig. 3: Perishelters utilise an "inside-out" construction principle.

With a perishelter, system components required for normal day-to-day operation are made accessible at the shelter or cabinet exterior. The concept can be considered as an "inside-out" building. In the example shown in Fig. 3, panel-mounting enclosures on the exterior provide access to electrical connection and I/O termination. This particular shelter design houses a PLC, so a touchscreen HMI also sits on an external wall, allowing operators to make local adjustments to the control programs locally via an inspection panel. Although the shelter has a door, this is locked and is there purely for access during plant shutdowns or other strictly controlled circumstances.

This approach allows shelters and cabinets to be assembled and tested in safe and controlled factory environments. Then after shipping to site, installation work such as connection of I/O may be carried out purely via the building exterior. In this way, the sensitive electronics inside can remain sealed and protected against corrosive atmospheres throughout installation, commissioning, and operations.

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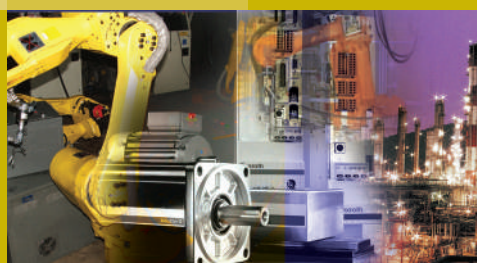
The paperless path to digitised maintenance

by Stephan Sagebiel, Phoenix Contact



Although digitisation is an undeniable trend, regular inspection rounds with a defined maintenance plan will continue to be an integral part of plant monitoring and maintenance. Clear and easily legible/scannable markings are essential for these inspections. The identification systems in many old plants are in dire need of modernisation. By modernising, companies can pave the way for digitally supported maintenance rounds.

"I'd never go on vacation without my tablet. Or at least my smartphone." These days, most of us can hardly imagine locating an address in a foreign city or even in our home town without a smart device. Technology that has long been the norm in our personal lives would also be desirable for many workers who maintain and operate systems in chemical plants. In such a scenario, a handheld device designed for industrial environments with explosion-risk zones would guide the worker through the large, compactly built facility to the exact device or machine that the employee needs to inspect.

Proper marking as the basis for proper maintenance

Actually, such solutions do exist. But in reality, these digital solutions still have a long way to go when it comes to supporting maintenance and inspection rounds. In fact, even the "road signs" are often missing, to use the analogy of the address search again. Or, the signs are totally illegible. Old plastic signs in brownfield plants may be weathered or even broken, metal signs are often filthy or corroded, and the numbers on them are barely decipherable. This might not be a problem if you know your plant like the back of your hand. Veteran employees can easily locate an "address" in the plant. But new employees or external maintenance contractors will have difficulty. This wastes time and, in the worst case scenario, can lead to mistakes. Operational safety suffers when a unit or pipeline cannot be clearly and quickly identified. There is a better route to efficient maintenance: clearly legible, standardised markings.

The most obvious solution is durable, easily decipherable signs, such as laser-engraved stainless steel markings. Plant operators can improve productivity and system availability by installing these markings on all components and equipment consistently throughout the plant. This alone ensures more consistent, error-free maintenance and repairs. For even greater efficiency, RFID tags can be used. These tags stay readable for a long time, even if a layer of dust forms on them.

Fig. 1: Comprehensive WiFi coverage supports paperless maintenance sequences. Maintenance software on an industrial-grade handheld guides the employee and also enables fast, error-free documentation on site.

Marking equipment immediately

Companies that are considering updating markings as part of modernisation measures in their plant should remember that "as-built" is rarely identical to "as planned". Very often, the modernised system deviates from the plans by as much as 30%. Weeks after the renovation, the system has to be re-documented and re-marked, which involves a lot of work. However, some companies eliminate this problem before it can even arise and label each new piece of equipment immediately after installation. Some use RFID tags, others use stainless steel tags. Locally-installed marking systems facilitate this task. Instead of having to print an ID label several hundred metres away in the control room, installers can create robust markings directly in the construction trailer, with no delay and less likelihood of errors.

Standardised markings

Like many companies, K+S, based in Wunstorf near Hanover, Germany, also wanted consistent, standardised markings. The company's in-house power plant had been expanded and modernised over decades. The plant identification system and documentation were not from a single source and were therefore not clear. Berghausen opted for a standardised, systematic marking system based on the Power Plant Identification System, or KKS. Once preparations were completed and as-built plans were digitised, Phoenix Contact created 4800 plant identification tags with the standardised labelling as well as QR codes to help employees locate the documentation for each piece of equipment. Another company focusing on high print quality is RWE AG, which uses bar codes in addition to the KKS key and a short description on its marking labels in the processing engineering environment. These can be used for damage reports during the maintenance process.

RFID transponders as the foundation for digital support

Companies like K+S or RWE that want to optimise the markings in their plants should consider the benefits of an RFID system as a forward-thinking solution. Phoenix Contact has already installed RFID tags at several companies as part of a full-service package. During that process, the company saw the bad state that many well-known companies are in. For many companies, there's simply no way around it: They have to spend money to improve the situation. Easily readable RFID HF or UHF transponders, integrated into the marking or installation material, are an investment that will not only increase safety, but also pave the way to more advanced maintenance methods. One such method is the use of maintenance software on tablets. Better than any paper tracking sheet, this software guides the maintenance engineer to all components scheduled for inspection. It also makes

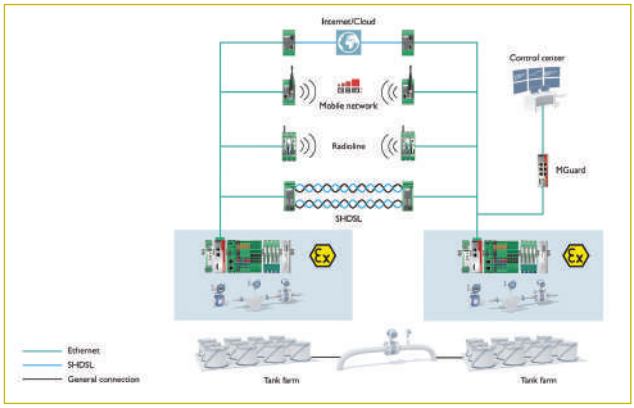


Fig. 2: The SHDSL modulation method enables existing cables to be used to transmit Ethernet or fieldbus signals. This allows for hybrid solutions in which the wireless network is used only for some signals.

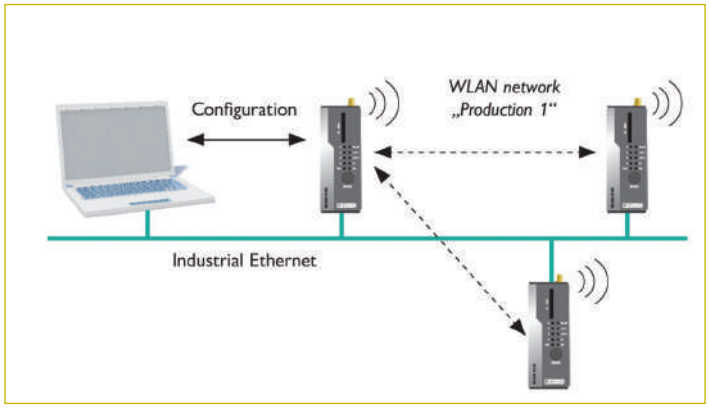


Fig. 3: Process control teams can quickly and easily set up a WiFi network in the production environment using cluster management technology. All access points can be configured collectively via a web interface.

Fig. 4: Companies that have fulfilled the prerequisites for digitised maintenance by implementing clear markings and a reliable wireless network can go on to test the first mixed-reality applications for maintenance processes.

documenting the inspection round easier. The employee can immediately confirm performed maintenance procedures online.

Actually, all companies with organised workflows have already established good processes for inspecting all equipment that is important for safety and availability. However, their practices vary greatly. If inspections are documented on paper, some items might be quickly checked off. For example, a safety shower that was supposed to be checked might not really get turned on. Mistakes can also be made when this information is entered in the maintenance system. In any case, this extra step costs time. A maintenance application on the tablet significantly simplifies tasks and improves results for the maintenance staff, thereby increasing plant availability.

The right wireless technology, plus security expertise

This scenario requires a wireless network that connects the tablets to the master MES at all times. As with markings and RFID, Phoenix Contact provides the essential hardware and services, unless a company already has these prerequisites in place. A WiFi network is suitable if industrial office equipment will be used to support maintenance processes. Numerous chemical companies, including large refineries, have already installed WiFi hotspots extensively.

However, Phoenix Contact also provides wireless infrastructures for smaller companies whose automation departments are also responsible for wireless communication in the production environment. This service includes everything from design to installation to the IT security strategy. The right wireless technology is chosen based on the needs of users and can be anything from WiFi, GSM, 3G, 4G and Bluetooth to WirelessHART or the proprietary Trusted Wireless solution (Fig. 1).

Hybrid solutions using copper and SHDSL

A combination of wired and wireless solutions is also feasible. One example is a large company that wanted to connect its fire alarm systems over long distances. Instead of the giant wireless network originally planned, we recommended using existing cables wherever possible, many of which were still unused in the old facility. The result was a hybrid solution using SHDSL technology. SHDSL operates at bit rates of up to 30 Mbps, sufficient for monitoring applications, and can be combined with fieldbus and Ethernet networks. In the case of fire alarm systems, this means that more than 60% of the signals are transmitted via the existing copper cables, and the rest wirelessly (Fig. 2).

Cluster management is simpler than office WiFi

Another option, which is particularly effective for smaller networks up to around 20 access points, makes WiFi suitable for industrial use. Office solutions of this size are mostly server-based, with complex security and user management. One alternative is cluster management, which greatly simplifies setup processes. With this method, only one access must be configured. This setting is then transferred to the other access points in the network. The necessary security-related parameter requirements are also met (Fig. 3).

This option does not require much time and effort. As a result, even the most conservative users are currently testing wireless technologies in pilot experiments, at least in a small section of the production facility. The potential benefits are obvious. When company decision-makers see these advantages, they often quickly get on board. The MES and maintenance systems are already present in brownfield plants anyway. Connecting the team in the field to the online network is the last step in the process.

Outlook: From RFID to mixed reality

The last step for now, that is. Early adopters are already beginning to explore the benefits of augmented reality (AR) applications. The tablet, which has identified a piece of equipment via NFC or an AR marker, then displays further information on the camera screen, such as a data sheet, the maintenance manual or a video of all the procedures involved. Measured values such as tank levels or the temperature of sensors without local displays can also be displayed. Phoenix Contact is also gathering experience by using AR to visualise temperatures within plastic injection molding machines at its own facilities. The status of pumps or motors can also be displayed on an explosion-proof tablet or smartphone or, in the future, directly on the operator's smart glasses. The operator can then use gestures to open a maintenance sheet or an exploded diagram and view it in 3D. Virtual and augmented or mixed reality have lost their gamer associations. Today, these scenarios are no longer just a fantasy. They are an everyday reality in our industrial engineering department and in-house tool shop. AR applications can effectively support operation and maintenance teams thanks to modern marking methods and a reliable industrial-grade wireless network (Fig. 4).

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New generation of communication modules for automation

Following the successful introduction of the Simatic RF185C, RF186C and RF188C communication modules, Siemens is launching two additional devices on the market: Simatic RF186CI and RF188CI. As well as the option to connect two or four radio frequency identification (RFID) readers, both modules have an additional port for digital I/Os. The basis for this is an integrated IO-Link Master. For the new modules, access to configuration, commissioning and diagnostics tools is no longer simply supported via the proven TIA (Totally Integrated Automation) Portal but now also via web-based management. Simatic RF185C, RF186C/CI and RF188C/CI support OPC UA as their interface to the Internet of Things (IoT) world, and communicate via the OPC UA Auto ID Companion specification V1.0 data model. This enables manufacturer-independent communication within the automation and a standardised connection to cloud applications such as MindSphere – the open, cloud-based IoT operating system – through an industrial IoT gateway. Siemens is therefore paving the way for high frequency (HF) RFID cloud connection. For maximum flexibility in terms of design, the communication modules support star, line, and ring topologies by means of two M12 plugs each for Ethernet and power supply and an integrated switch. This means that every type of application can be implemented quickly and cost-effectively.

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Mobile app for configuring radar level transmitters

Emerson has added the Radar Master app for the AMS Trex device communicator, making it easier for field technicians to safely and efficiently configure Rosemount radar level transmitters. Radar level devices are critical to help deliver accurate, reliable measurements on both liquid and solid materials. The new app allows users to easily bring the radar configuration tools of Radar Master software to the field. Radar level devices in the field are typically mounted in high, hard-to-reach locations that sometimes do not have onsite power. Technicians hoping to configure these devices typically carry cumbersome laptops and device power sources into the field to perform configuration. The AMS Trex device communicator solves these problems by enabling technicians to carry a handheld communicator that is capable of both configuring and powering radar devices via the Radar Master app. Dynamic graphics and an intuitive touchscreen interface in the Radar Master app help ensure that users can more quickly configure tank measurement devices with the correct settings.

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Electronic position indicator for spindle adjustments

Instrotech is pleased to announce the availability of the Siko AP20 position indicator, ideally equipped to detect the position of spindle adjustments in machines. It displays

the corresponding positional data to the operator, and passes it on to the machine control system. Simple system integration in combination with modern interfaces is all that is required. On the one hand, this ensures the shortest possible downtimes, on the other the interfaces provide loss-free data communication between the position indicator and the machine control system. The compact system is particularly suitable for flexible manufacturing with production machines such as packing machines, woodworking machines, printing machines and machines for further processing of printed products. Wherever manual adjustment is carried out on production machines, bus-compatible Siko position indicators are able to optimise the production process in such a way that costly refitting times during product changeovers are kept to a minimum. Once installed, position indicators provide 100% process reliability.

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Presidential endorsement of Smart Cities creates compelling vision

President Cyril Ramaphosa, in his State of the Nation address, said, "I dream of a South Africa where the first entirely new city built in the democratic era rises, with skyscrapers, schools, universities, hospitals and factories". This is an exciting vision and one that Schneider Electric South Africa shares. Taru Madangombe, VP of power systems in Southern Africa for Schneider Electric: "We are aware that smart, connected devices are being deployed in cities and industries globally to gather data and glean contextual insights used to achieve higher levels of efficiency and productivity. In alignment with 4IR, in which the Internet of Things (IoT) is reshaping societies, Schneider Electric has formed a strategy in a bid to refuel growth, boost organisational efficiency and better leverage opportunities in the Middle East and African regions." The company's IoT-enabled, plug-and-play, open, interoperable architecture and platform, called EcoStruxure, provides services required to help businesses and cities plan ahead and improve the way they are managed. It delivers innovation from connected products to edge control, and apps, analytics and services, on six domains of expertise – Power, IT, Building, Machine, Plant and Grid.

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Industrial automation in data centres

It won't matter how robust or technically advanced the IT systems and facility equipment are if a data centre's infrastructure management (DCIM) capabilities are inadequate for the task. The challenge for data centre operators is to dynamically manage a flexible network to achieve reliability, energy efficiency and maximum utilisation from all data centre assets. ABB Ability data centre automation can help. This system provides a scalable, modular solution that adapts to your data centre. Traditional BMS/PMS/BCM combinations are no longer needed, since ABB Ability data centre automation delivers this base-level functionality during the initial deployment. The modular approach allows you to achieve your data centre strategy based on your current data centre investments, instead of being dictated by a vendor's DCIM product strategy. Moreover, its open platform allows for reuse of infrastructure point-solutions to simplify migration. This solution delivers benefits that encompass the areas of infrastructure and operations that help manage your data centre cost, capacity and control.

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BACnet certificate renewed

Starting with version 4024 of TwinCAT 3, the new BACnet supplement is available. With a total of 657 possible combinations of basic device, CPU, operating system and display size (for Panel PCs), the right solution is available for any application. Each controller can process data volumes for a number of BACnet objects ranging from 400 to 5000. The globally standardised BACnet compliance check included testing and certification of BACnet Revision 14, the routing between BACnet/IP and MS/TP, along with twelve new object types. The advanced AS-B profile of the AMEV was also recognised in connection with the certification process. Issued in January 2019, the BACnet certificate will be valid for five years. BACnet Revision 14 also features significantly improved and expanded alarm properties. In addition, basic data types such as, for example, a date, a character string or floating-point values can now be mapped with twice the precision as before by help of the "primitive value" objects. The Remote Manager in TwinCAT 3 ensures downward compatibility with legacy objects in BACnet Revision 12.

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Sensors for gantry crane positioning project

The world of automation is rapidly evolving and at the forefront of distance sensors, detection and ranging are technologies developed by Sick Automation. The

company delivers precise information over any distance, and in all environments. This made Sick Automation South Africa the obvious choice for Rockwell Automation's gantry crane positioning project with South32. Here, Rockwell Automation required long-distance, no-contact sensors for gantry crane positioning as part of the larger project for South32. SICK's DL100 distance sensors offer fast, reliable and precise positioning over a range of long distances. In this project, the distancing sensor head was mounted on the gantry crane. The test bench was at Sick in Lanseria, Johannesburg and live-feed tests between sensor and PLC were conducted on-site. The company's function blocks are written and developed by its specialists and are available its website for download, making interface with customers' systems easy-to-use.

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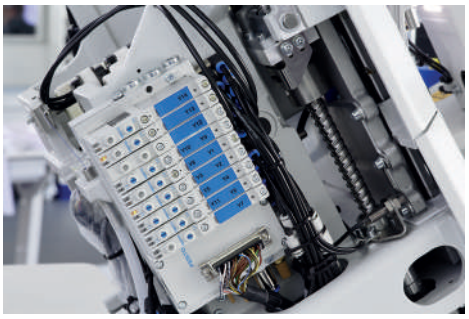
Producing eyelet buttonholes with solenoid valves

Buttonholes are not only functional but also have a visual aspect. However, in textile manufacturing there is generally very little time to produce them. The automatic eyelet buttonholer 581 from Dürkopp Adler delivers the necessary speed. Thanks to the compact Festo solenoid valves VUVG, it takes just under four seconds to create a buttonhole. Dürkopp Adler's automatic sewing machines are much more than just sewing machines. The high-tech automatic machines feature state-of-the-art control technology, multiple thread feeds and automatic cutting systems which cut through the fabric at lightning speed after the buttonhole shape is stitched. The shape and length of the buttonholes are set on the operating panel of the machine. Festo solenoid valves VUVG are an important component of these ultra-modern sewing machines. They enable the fabric to be handled and processed extremely quickly and precisely, with the fastest variant for making jeans having a cycle time of just under four seconds.



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Integrating IO-Link devices in Profinet

Turck's Simple IO-Link Device Integration, or SIDI for short, simplifies the handling of IO-Link devices in Profinet engineering systems. As the devices are already integrated in the GSDML file of the master, users can select the devices from the device library (for example in the TIA Portal) and integrate them in their projects via drop-down fields as if the devices are submodules on a modular I/O system. The user benefits from access to all device properties and parameters in plain text. Measuring ranges, switch points and pulse rates can be set directly from the engineering system – without any programming or additional software required. From now on, SIDI is integrated on all Turck IO-Link masters of the TBEN-L, TBEN-S and FEN20 series. The software contains all the IO-Link devices from Turck and Banner Engineering. Turck has also included IO-Link devices from third party manufacturers, such as valve blocks, in the SIDI catalog. Other devices of manufacturers can be added on request. SIDI also considerably simplifies maintenance.

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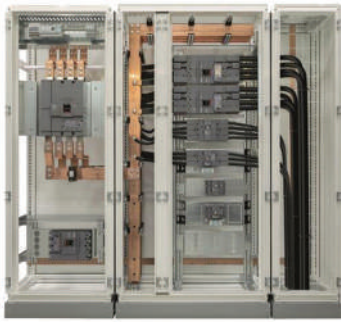
Cutting the complexity of panel design



A low-voltage electrical distribution system design to reduce the complexity of panel design is available from local supplier ElectroMechanica. Quadro+ modules from Hager combines modularity with low-voltage components to simplify the design of distribution solutions. The modules include assemblies, equipment and accessories required to build a complete enclosure, with IP30 or IP55 protection levels up to 4000 A. This solution is designed around a rigid frame offering adaptability, ease of assembly and quick build times, along with quality components. The system offers support of third-party products like Socomec change-over switches, Lovato motor control and metering, Delta variable speed drives and automation products. This simplifies the completion of projects on time. Customers partnering with EM can design and build the complete LV electrical distribution system they require.

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High-speed level measurement with IO-link

Morton Controls, in partnership with Anderson-Negele, introduce the innovative level sensor that is based on the modular device platform. The new platform strategy used with this sensor is based on a building-

block principle that offers high flexibility in the assembly of individual sensor components. Users will benefit from the advantages of a building-block system and profit from the reliability with which these sensors provide measurements even in strongly adhesive and foaming media. For example, the device will accurately display that a tank is empty even in the presence of substantial foam. Due to the short response time, highly accurate metering processes can be reliably realised with the NSL-F – even with alternating and pasty media. Anderson Negele's specific Flex-Hybrid technology allows for easy operation of the sensor with either digital IO-Link or analogue 4 – 20 mA technology, as well as in parallel with both interfaces.

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Experts gather in Germany to test FSoE devices

The EtherCAT Technology Group (ETG) recently held its first Safety over EtherCAT Plug Fest with great success. Numerous manufacturers of EtherCAT safety master and slave devices came to Verl, Germany, to test the interoperability of their Safety over EtherCAT (FSoE) devices and to exchange knowledge with the other participants and the experts on-site. EtherCAT Plug Fests have been a fixture in the ETG event calendar for many years. Although the exclusive focus on FSoE was new at this particular Plug Fest, it was well received: A total of 36 participants from 18 different companies came. The attendees tested their FSoE devices for interoperability, and in total they brought nine masters, 15 slaves as well as one stack and one tool. According to the experts on-site, the interoperability of all devices was consistently very good. EtherCAT devices without safety functionality were not permitted at the event; the EtherCAT protocol served only as a transport layer. The focus of the event was on FSoE masters as safe controllers for distributed and central solutions as well as on FSoE I/O devices. In addition, safe drives whose safe drive functions are implemented with the support of the ETG.6100 profile were tested. The profile serves to standardise the functionality and parameters for drive-integrated safety functions.

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IoT telemetry – A real-time solution for SA's water crisis

by Donavan Hendricks, Enaqua

The current crisis of sewage pollution and lack of maintenance of water and sanitation systems in the Vaal River has highlighted the need for intelligent, pre-emptive systems and measures to protect South Africa's precious water and other natural resources. The Internet of Things (IoT) could be the answer.

Forward-thinking industries like mines, agriculture and local municipalities are now able to use real-time, secure, cloud-based SCADA (supervisory control and data acquisition) technology to gain control over their operations anywhere that has cellphone, WiFi or Ethernet connectivity.

The situation in the Vaal was originally blamed on lack of funding needed to perform the required maintenance on the water purification systems. But after further inspection, the Parliament's Portfolio Committee on Water and Sanitation recommended that government use technological developments in the sector to find ways to reduce infrastructure development costs.

The use of telemetry (automated processes of remote measurement and data collection) has shown success in managing and pre-empting maintenance needs for water, sewage, agricultural and energy operations, but the development of cloud-based telemetry presents a further level of control, cost-savings and capability.

The catch? Well, it requires a mindset shift.

In today's competitive business environment, there is no margin for error or delays. To save costs, improve efficiency and avoid disasters, operations that manage water treatment plants need integrated fault detection, reporting, monitoring and management systems that will proactively give them the visibility they need to troubleshoot, resolve issues and regain control – within the shortest time possible.

The traditional definition of telemetry implies the use of special equipment to take specific measurements of something and then to transmit those measurements elsewhere using radio transmissions. There is a connotation here of remoteness, distance, and intangibility to the source of the telemetry.

Fig. 1: View of the Vaal River from the N3 highway looks safe, but in 2018 there were reports of the water being poisonous and causing fish to die.

Cloud-based telemetry is the antithesis of remoteness in the sense that it brings business-owners closer to their business from wherever they are. For example, data is key to successfully managing and optimising a purification plant and in modern telemetry, IoT allows chief operational officers to connect disparate information from multiple pieces of equipment into an integrated ecosystem, from almost anywhere in the world in real - time.

But can it work in South Africa? Based on a case study from a US pumping station, it seems it can.

Case study

A pilot project was carried out at American Water's (AW) Innovation Department as part of the company's strategy of constantly improving and increasing the efficiency of the water and waste disposal systems it operates.

For the pilot, two Environmental Disposal Corporation (EDC) facilities were connected to demonstrate RealiteQ System's capabilities and its compatibility with American Water's needs, to allow the subsequent connection of the various remaining water company facilities to this system. This resulted in the command and control of all the corporation's facilities being managed by a single system.

The EDC featured various facilities spread out over a fairly large geographical area. It ranged from sewage pumping facilities, through a waste treatment and purification facility, to a system for discharging the treated waste into the river.

The vast majority of these facilities were not equipped with telemetry devices and

were not connected to a comprehensive SCADA array. Therefore, no command and control existed for the various facilities and tracking their function and operation was complicated.

As a result, the customer defined a need for an advanced system that could connect all the sites to a single command and control array, quickly and at low cost.

The results

A cellular telemetry system and cloud-based integral SCADA saved the cost of installing software or applications, while allowing an unlimited number of approved users to connect to the system (subject to their authorisation level) from any device (computer, tablet, telephone).

The system installation was considerably faster than that of traditional SCADA projects. It involved connecting both sites, (including splitting measurements using analogue and discrete distributors) and wiring them to the relevant field instrumentation. The total time it took the systems engineer was six hours.

From the moment physical installation was completed, data began to gather in the cloud database, and the system's functioning could be viewed in real time. Beyond the display of the facility's real-time operational data and saving their history, effective dashboards were defined in the cloud management portal.

The operation and maintenance personnel observed a large amount of data and could, each according to their own authorisations, perform different actions in the system. The system operators found it easy to operate and installation costs together with the regular operating costs remained low.

Furthermore, ongoing maintenance is unnecessary as the system is continually being managed and it remains a part of the service.

Conclusion

In the South African context, various legacy factors, some political and others practical, are at play when it comes to the management of our water resources. The old adage: "Prevention is better than cure", seems to be most appropriate in this case, as local municipality and government scramble to deal with the aftermath of the spillage crisis.

Employing an affordable cloud-based telemetry system seems to be indispensable to the way South Africa manages the current challenges and to avoids similar incidents going forward. Since these systems are quick to install and do not require large capital expenditure on equipment and software, this could be a quick first step for South African organisations with extensive monitoring needs towards taking corrective measures and gaining control over operations.

Big corporates are also taking notice of the cost-saving effects of installing these systems.

The applications for businesses do not only apply to water management systems. The opportunities are endless in the areas of increasing the efficiency of cooling towers, industrial and agricultural desalination systems, remote supervision and control of irrigation systems, solar energy fed communication base management, production line efficiency and security in natural gas infrastructures.

The real question is not, "Will it work in South Africa?", but rather "Will South Africa listen?"

Contact Donavan Hendricks, Enaqua, info@enaqua.co.za

Practical guide: Thermography in preventive maintenance

Information from Testo

When it comes to maintaining buildings and technical systems, thermography has proved to be an indispensable aid. With the help of invisible infrared radiation, it is not only the function and condition of electrical and mechanical systems that can be monitored reliably. Weak spots and wear can also be detected at an early stage and non-destructively and thus remedied in good time. Furthermore, thermography provides excellent services for quality control and fill level measurement in production plants. In facility management, for example, it enables optimum control of heating systems as well as simple and safe testing of electrical systems.

No wonder then that the use of thermography is required in various standards and guidelines and that some insurance companies require their customers to regularly assess the insured equipment and facilities thermographically. Companies that refrain from regular thermographic inspections will therefore be subject to considerable financial and legal risks in the event of personal injury and property damage.

Thermography for more safety and efficiency in facility management

Plant operation and safety, operating costs, and energy consumption – facility managers not only have to keep an eye on a number of factors, but also have to improve the efficiency of systems and processes at the same time.

Inspecting electrical systems

Overheated connections in a control cabinet indicate potential or actual defects. A thermal imager can detect anomalies such as these without contact and during operation, before downtimes can even occur.

Discover the energy-saving potential

A thermal imager allows concealed weak spots, thermal bridges, mould or faulty installation to be detected in a building. Especially in existing buildings, a thermal imager can be used to uncover large potential energy-savings fast and easily.

Detecting damage on and in the building

If water damage occurs in a building, this is usually due to potential leaks in the floor or walls. This results in the extremely time-consuming and laborious task of trying to identify the location of the leak, as large areas of the floors or walls often have to be opened up. On the other hand, a thermal imager means the leaks can be specifically accessed and rectified cost-effectively.

Fig. 1: A thermal imager can detect anomalies such as overheated connections in a control cabinet.

Checking radiators

Contamination in a heating system has adverse effects on its efficiency, as large amounts of energy is wasted. To ensure that a heating system is working efficiently it's a good idea to analyse the function of the radiator with a thermal imager before pressure flushing to reveal uneven heating. After flushing, the thermal imager can be used to quickly check that the radiator is working properly and efficiently.

Thermography makes preventive maintenance easier

Unscheduled costly system downtimes can be prevented to a large extent by regularly checking electrical installations, control cabinets and mechanical components. Carrying out thermographic inspection a second time reduces a system's rate of failure by around 80% and provides an added safeguard against fire.

Defining the scope of inspection

Before beginning the inspection tour, the thermographer or plant manager needs to define a few aspects to include: How extensive does the inspection need to be? At what intervals are the tours to take place? And which thermal imager meets the requirements?

Defining priority criteria

Identifying the risk doesn't mean it is automatically eliminated. When and how a problem is remedied – immediately, as fast as possible, at the next opportunity – is decided by the thermographer or plant manager. On the one hand, rectifying all identified thermal anomalies immediately would be too inefficient and costly. On the other hand, a component's temperature limit also depends on its function. It's therefore advisable to classify the inspection results, for example, into three priority classes:

- *Class A (red):* A severe problem that requires immediate action.
- *Class B (orange):* A serious problem that needs to be remedied within a week.
- *Class C (yellow):* A problem that needs to

be remedied the next time the system is scheduled to be shut down.

The applicable standard regulations, type of system, and previous experiences are primarily referred to in determining these priority levels. The aim has to be the efficient operation of a system with as little interruption as possible while ensuring the greatest level of work, equipment and environmental safety.

Challenges faced in maintenance

It's not only countless measuring points that require inspection during technical maintenance. Depending on the size of the particular measurement object, up to three thermal images are required to evaluate it; this means that often hundreds of images are generated by the thermal imager in one inspection tour. This gives rise to the following challenges:

- How can the thermal images be assigned to the respective measurement object?
- How expensive and time-consuming are the evaluation and reporting processes?
- Can the temperature development of a component be identified over the course of time, and can the necessary measures be derived from this?

The solution: Automatic site recognition

Testo SiteRecognition can be used to create a measurement site archive in the Testo IRSoft analysis software, which serves as a database for all thermal images. For every measuring location stored in the archive, markers (small symbols similar to QR codes) can be created and attached on site. During the subsequent inspection, this marker is simply recorded using the camera's wizard; the measuring location, along with its corresponding information, is then automatically stored with the thermal image and sorted into the measuring location archive with the software. On the basis of the description of a measurement object or a date, the images can located quickly and easily in the archive.

Site recognition in three steps:

- *One-off creation of the measurement objects:* First, the measurement objects have to be saved once in the software and then assigned to the measuring locations. The database created during this process is transferred once via USB interface to the thermal imager, and stored there for the inspection tours. In this step, a marker is created for every object being measured, printed on self-adhesive labels, and attached to the object.
- *Inspection:* During the tour of inspection, the respective marker is scanned using the digital camera of the thermal imager. This activates the object being measured and measuring location and all thermal images saved afterwards will be assigned to these.
- *Archiving and analysis:* At the end of the inspection tour, the thermal imager is connected to a PC that has the software installed on it. With the aid of the import wizard, the thermal images are automatically assigned to the measuring locations and stored. After the automatic importing process, the respective thermal image can be opened and analysed. Critical temperature differences can thus be easily identified and appropriate measures initiated quickly.

Contact Testo, Tel 011 380-8060, info@testo.co.za

Roadshows to highlight latest developments

Test Dynamics is holding a series of roadshows in September and October to share the latest developments in LabView 2019. The half-day training/information sessions will discuss the technologies that support current trends in software development. The three separate sessions will allow delegates to see the latest developments in LabView NXG, the new generation LabView. Delegates will be able to find out if this is the right choice for their next project. The signal conditioning requirements for a typical DAQ system will also be examined and attendees can see how to make more effective measurements by selecting the right sensors and signal conditioning for a measurement project. The first information morning takes place at the Midrand Conference Centre on 17 September. KZN delegates can attend the morning session at the Durban Country Club on 2 October and the final session will take place at the Protea Hotel in Durbanville on 7 October. All sessions begin at 8h30 and end at 12h30. Space is limited so interested parties are encouraged to book a seat as soon as possible online here.

Contact Stephen Plumb, Test Dynamics, Tel 062 217-0063, stephen.plumb@testdynamics.co.za

New series thermal imagers

Comtest is offering Fluke's expert series thermal imagers – the TiX560 and TiX520. Users of infrared devices need maximum flexibility with an ergonomic design that allows for easy navigation over, under and around hard-to-reach objects. With an articulating lens that rotates a 180° with the FlexCam lens and a 5,7 inch touchscreen LCD, Fluke's TiX560 and TiX520 can easily capture the target that was once impossible to see. They also feature the largest LCD touchscreen and leading spatial resolution for a 320 x 240 infrared camera in its class, meaning 150% more viewing area, making it easier to annotate, edit and analyse images. Users can capture detailed images and begin analysing images while still in the field with on camera analytics. Incredible image detail is possible from a distance or close up and the SuperResolution mode, available on camera in the TiX560, turns the 320 x 240 images into 640 x 480.

Contact Comtest, Tel 010 595-1821, sales@comtest.co.za

Radar sensor for vehicle detection

The new Q130R radar sensor from Turck Banner is configured using free software allowing users to set sensor settings visually, including defining the sensing distance,

sensitivity and output configuration. Setting up and verifying sensor settings can be challenging because of the wide field of view and long range of radar sensors. However, the graphical user interface of the Q130R allows users to adjust settings intuitively and replicate them across multiple devices. The Q130R radar sensor uses frequency modulated continuous wave (FMCW) technology to detect moving and stationary targets including cranes, cars, trains, airplanes, trucks and cargo in extreme and unpredictable weather conditions. Sensing function is unaffected by wind, rain or fog, sunlight, humidity, shock and vibrations, and temperatures ranging from -40 to 65° C. The rugged IP67 housing is made for dependable, long term operation in harsh environments.

Contact Brandon Topham, Turck Banner, brandon.topham@turckbanner.co.za

Monitoring solutions to cut inspection time

FLIR has introduced monitoring solutions to cut inspection time of energised electrical equipment. The AX8 thermal sensor allows for continuous monitoring of critical electrical infrastructure, while the FLIR IRW Windows provide an easy and affordable option that reduces the cost and time associated with thermal inspection and adds a safety barrier to protect the thermographer from arc flash accidents. The FLIR AX8 is a temperature sensor with thermal imaging capabilities, combining thermal and visual cameras into a compact, affordable package. The sensor provides continuous temperature monitoring and automated alarming when pre-set temperature thresholds are exceeded. It helps guard against unplanned outages, service interruptions, and equipment failure. Inspection via IR windows requires involving fewer personnel and eliminates the need for cumbersome PPE. In short, IR windows offers considerable potential for exposing faults before they become costly failures, saving costs in the process without compromising personnel safety. Although primarily designed for use with the entire range of FLIR thermal imaging cameras, the FLIR IRW-Series of IR inspection windows can be used with any camera brand.

Contact Reynhard Heymans, Flir, Tel 011 300-5622, reynhard.heymans@flir.com

Strengthening expertise for advanced analysis

Endress+Hauser has expanded its centre of competence for advanced analysis in Lyon, France. The Group invested 2-million euros in a new production facility and office space to meet the growing demand in the area of advanced process analyses. From Lyon, around 20 employees support Endress+Hauser sales centres across Europe in the application and sales of advanced analysis technology, with a focus on the project business and after-sales services. Ten Endress+Hauser sales centres across Europe already have specialists on board to handle this complex field of activity. The new 630 square metre production facility will be used for customer-specific manufacturing and the assembly of complete analysis systems. Rounding out the facility are offices, rooms for factory acceptance tests and space reserved for future use. The adjacent 1500 square metre office building, which opened in 2017, is also home to the Endress+Hauser France regional sales office. Advanced analysis provides immediate information related to material properties and product quality. Endress+Hauser continuously develops its analysis portfolio to provide online monitoring of quality parameters, for example through spectroscopic techniques. This allows customers to reduce time to market and optimise their processes.

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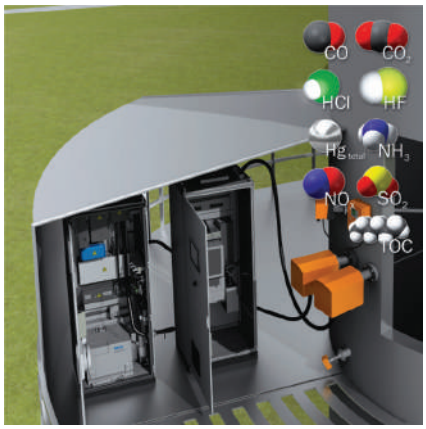
Emission monitoring for compliance with Carbon Tax Act



As of 1 June 2019, the Carbon Tax Act, 2018 is in operation. South Africa is the worst polluter on the continent and the Carbon Tax is a milestone in government's efforts to tackle climate change. The Carbon Tax will be phased in over a period of time to allow for smooth transition in adopting cleaner and more efficient technologies and behaviours. The first phase runs from 1 June 2019 to December 2022. Businesses who use this window to start evolving their business practices will be better equipped in the long run. With a proven track record in the power, EFW and biomass sectors as well as process automation applications, Sick has tried-and-tested technologies in continuous emission monitoring across the globe. The National Treasury says the carbon tax will not have a negative effect on trade but will help protect South African companies against punitive trade actions for failing to reduce greenhouse gas emissions.

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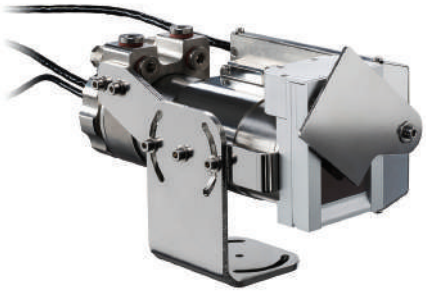
Compact IR camera with industrial accessories

Instrotech, the local representative of Optris, known internationally for infrared camera technologies, has announced an addition



to the Compact Line (the Xi 80 and Xi 400), now with new industrial accessories for use in rough conditions. The system has a modular design and as a result, the water cooled housing, the air purge unit and the shutter can be used both individually and combined. The stainless-steel shutter is generally used to protect the optics from contamination and foreign objects. This is particularly important when the infrared camera measures upwards and the measurement objects are above it, such as in the glass industry. With a response time of just 100 ms, the IR camera is optimally protected from falling broken glass. Furthermore, the shutter can be used in intermittent processes so that the optics are exposed to environmental conditions only during the measurement process. A stainless-steel, water-cooled housing and an air purge collar made of anodised aluminum are available so that the compact infrared camera can be used in rough conditions in the industry.

Contact Instrotech, Tel 010 595-1831, sales@instrotech.co.za

IR-thermal imaging camera with SD-slot

The PeakTech 5610 is a versatile thermal imaging camera with a resolution of 220 x 160 thermal pixels, making temperature differences easy for users to see. Take advantage of this new development, e.g. to find thermal bridges in thermography, leaks in equipment and tube systems, or track heating pipes in walls and floors. In electrical engineering, this thermal imaging camera offers the possibility to find contact problems and contact resistances easily, e.g. in sub distributions, and thus to prevent a fire hazard in time. This device also has five different thermal imaging color palettes, as well as five overlay modes for photo to thermal imaging, so that the user can easily locate the source of the problem in the real image or one of the overlays. Its features include: the latest IR thermal imaging camera technics; 2,4" LCD colour display and graphical menu navigation; a thermal image resolution of 220 x 160 pixels; photographs with integrated digital camera; pictures with emission factor and measurement values; five steps to thermal-photo overlay; and five colour palettes (spectra, iron, cool, white, and black).

Contact Vepac Electronics, Tel 011 454-8053, sales@vepac.co.za

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Flexible IoT gateway for intelligent tank level monitoring

Wayra Networks is an IT systems integrator and develops individual IoT solutions for industrial clients in the field of hardware and software automation. As part of a current project, Wayra was contracted to install a monitoring system for more than 15 oil tanks. Wayra uses an open, freely programmable Siemens IoT hardware platform as the solution for this and many other projects. This allows the client to easily call up stock levels using a robust, open system which is CE and UL certified, has an extended temperature range, and is easy to install. Besides this, the company benefits from a convenient industrial gateway. In this project, and many previously, Wayra was facing multiple challenges. The customer needed a flexible IoT hardware solution with field and cloud connectivity, extendable interfaces, and data management: and the solution had to be robust and cost-effective. Besides this, support was required for quick, modular software development based on Linux. By using an intelligent industrial gateway, Siemens Simatic IOT2040, Wayra was able to meet all these requirements with just one system.

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Portable process calibrator approved for hazardous areas

Wika's CPH7000 portable process calibrator has received ATEX approval. It is therefore also suitable for use in hazardous areas. The CPH7000 provides highly flexible on-site calibration for process transmitters and pressure gauges. A high-pressure version even tests measuring ranges up to 10 000 bar. The portable, multi-function instrument integrates an electronics module, a hand pump for generating test pressures of up to 25 bar, and a high-performance data logger. Due to its equipment, the device also fulfils test tasks for the measurement parameters of temperature, voltage and current.

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Competence centre for flow measurement technology expands

In the Kägen industrial quarter of Reinach, Switzerland, the construction machines are starting up: in mid-August, Endress+Hauser will begin work on

expanding its competence centre for flow measurement engineering. The company will invest more than 60-million Swiss francs in expanding the site by the end of 2021. Initial preparatory work is already underway. The actual construction work will begin with the deconstruction of the orange-coloured building at the corner of Kägenstrasse and Christoph Merian-Ring. In its place, Endress+Hauser is constructing a new office building with a training centre and visitor reception area. The parking lot next door will also be converted. Another production hall and a new training workshop will be built there. The buildings are scheduled for completion in the third quarter of 2021. As a preparatory measure, Endress+Hauser put a multi-story car park at the corner of Christoph Merian-Ring and Seewenstrasse into operation in 2018.

Contact Natlee Chetty, Endress+Hauser, 011 262-8000, natlee.chetty@za.endress.com

Two new series of oscilloscopes launched

Comtest is pleased to announce the addition of two new Tektronix oscilloscopes with the launch of the 3 Series MDO and the 4 Series MSO. Engineered for a wide range of demanding applications at an affordable price, the new mind-range oscilloscopes have been reimagined with the award-winning user experience and industrial design first introduced in the 5 and 6 Series MSOs. Built from the engineer up, the 3 Series MDO and the 4 Series MSO round out Tektronix' portfolio of oscilloscopes. The two new series feature the largest display sizes in their class, highly intuitive touchscreen user interfaces, class-leading performance and advanced analysis capabilities. Together, the 3 Series MDO, 4 Series MSO and the 5 and 6 Series MSO oscilloscopes represent a state-of-the-art portfolio that look and drive the same and provide a complete range of performance, functions, specifications and price points that make them market leaders in their respective segments. The 3 and 4 Series share a user interface design with touchscreens and front panels that keep key controls close at hand.

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Advanced battery management in energy storage systems

by Stefano Gallinaro, Analog Devices

Battery monitoring systems are fundamental enablers of different markets. Batteries play a key role in a range of applications, from going the extra mile in electric vehicles to storing renewable energy for the smart grid. The same and similar battery technologies are used in medical devices for increased safety of operation and for having the freedom to move instruments around in hospitals.

All these applications run on batteries that need accurate and efficient semiconductors to monitor, balance, protect, and communicate. This article explains how a state-of-the-art battery monitoring system, including cell balancing and isolated communication networks, can exploit the benefits of new lithium battery chemistries. Using innovative integrated circuits permits higher reliability and a 30% longer battery lifetime, especially for large-scale energy storage systems.

Batteries used in medical applications need to meet very high standards for reliability, efficiency, and safety in all applications where they are typically used: patients' portable systems such as chest compression systems, hospital emergency room equipment, powered medical carts and beds, portable ultrasound machines, remote monitoring, and the newcomer in the market, energy storage systems (ESS).

Energy storage systems are not directly linked to patients, nor are they operated by doctors. They are the next step forward for uninterruptible power supplies (UPS). UPSs have traditionally been used as backup power for the most critical applications (for example, emergency room devices, IT network critical infrastructure). Energy storage systems for hospitals are covering more and more functions, enabled by the new lithium-based batteries. They are becoming fully integrated with the hospital power grid, bringing advantages like:

- Complete backup power for entire facilities, rather than just a small, critical subset of facilities, as well as protection from blackouts, poor power/voltage quality from the grid, and reduced usage of emergency diesel generators. With megawatt hour (MWh) scale ESS, hospitals can operate even during prolonged blackouts, and they can participate in grid stabilisation.

Fig. 1: Energy storage battery cells.

- Economic benefits on the electricity bill. With ESS, hospitals can directly control the usage profiles of electricity and reduce high power peak demands, which results in lower bills from utilities.

Hospitals generally have sizable roof estate, which is good for installing photovoltaic (PV) systems to generate electricity. PV systems combined with ESS allow for the storage and self-use of generated electricity, while also providing economic benefits and a reduced carbon footprint.

Lithium-based chemistries are now state-of-the-art for the batteries used in various markets, from automotive to industrial to healthcare. Different types of lithium batteries have different benefits to better suit the power requirements for a variety of applications and product designs. As an example, $LiCoO_2$ (lithium cobalt oxide) has very high specific energy and this makes it suitable for portable products; $LiMn_2O_4$ (lithium manganese oxide), with its very low internal resistance, enables fast charging and high current discharging, which means that it's a good choice for peak shaving energy storage applications. $LiFePO_4$ (lithium iron phosphate) is more tolerant to full charge conditions and can sustain being kept at high voltage for a prolonged time. This results in it being the best candidate for big energy storage systems that need to work during a power outage. The drawback is a higher self-discharge rate, but this is not relevant in the above-mentioned storage implementations.

The differing needs of applications requires a variety of battery types. For example, automotive applications need high reliability and a good charging and discharging speed, while healthcare applications necessitate high peak current sustainability for efficiency and a long lifetime. However, the commonality among all these solutions is that the various lithium chemistries all have a very flat discharge curve at a nominal voltage range. While in standard batteries we see a voltage drop in the range of 500 mV

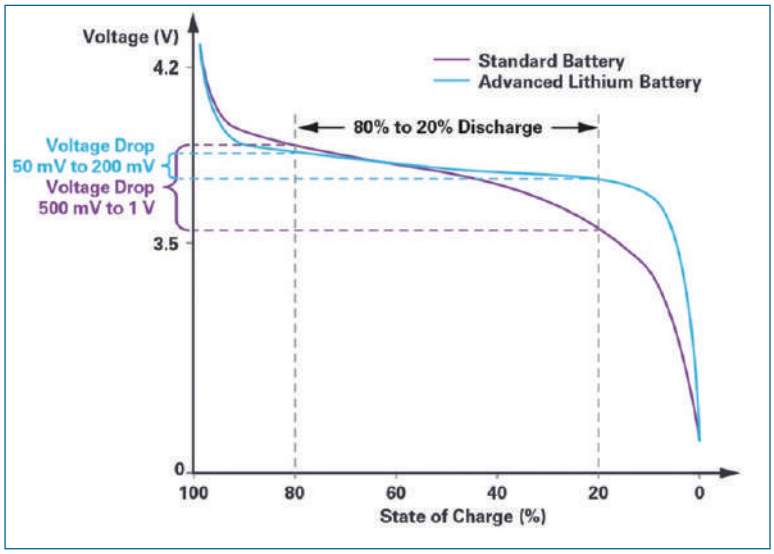

Fig. 2: Lithium battery discharge profile

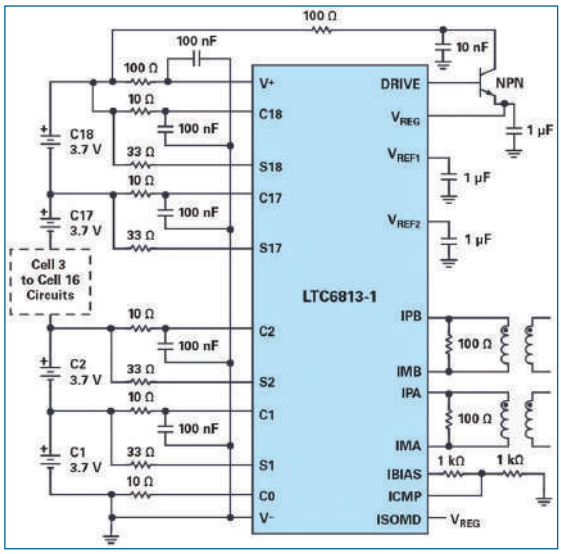

Fig.3: LTC6813 application schematic.

to 1 V, in advanced lithium batteries, such as lithium iron phosphate ($LiFePO_4$) or lithium cobalt oxide ($LiCoO_2$), the discharge curve shows a plateau with a voltage drop in the range of 50 mV to 200 mV.

The flatness of the voltage curve has tremendous benefits in the power management chain of ICs linked to the battery voltage rail: the DC-DC converters can be designed to operate at a maximum efficiency point in a small input voltage range. Converting from a known VIN to a very close VOUT, the power chain of the system can be designed to have an ideal duty cycle of the buck and boost converters to achieve >99% efficiency throughout all operating conditions. Moreover, the battery charger can perfectly target the charging voltage and the loads are dimensioned according to a stable operating voltage to increase the precision of the final applications, such as remote monitoring or patient in-body electronics. In case of old chemistries or non-flat discharge curves, the DC-DC conversion operated from the battery will work with lower efficiency, which results in a shorter battery duration (–20%), or, when linked to medical portable devices, the need to charge them more often because of the extra power dissipation.

The main drawback of a flat discharge curve is that the state of charge (SOC) and state of health (SOH) ratings of the battery are much harder to determine. SOC must be calculated with a very high precision to ensure that the battery is properly charged and discharged. Overcharging can bring safety issues and generate chemistry degradation and short circuits that lead to fire and gas hazards. Over-discharging can damage the battery and shorten the battery lifetime by more than 50%. SOH gives information about the status of the battery to help prevent replacing good batteries and to monitor the state of bad batteries before an issue appears. The main microcontroller analyses the SOC and SOH data in real time, adapts the charging algorithms, informs the user about the potential of the battery (for example, if the battery is ready for a high current deep discharge in case of power break), and makes sure that, in big energy storage systems, the balance between batteries in bad condition and batteries in good condition is optimal to increase the total battery lifetime.

By imaging a very old battery with a steep discharge curve, it is easier to calculate the state of charge of that battery by measuring the delta of the voltage drop in a small amount of time and knowing the absolute value of the battery voltage. For a new lithium-based battery, the accuracy required to make this measurement is orders of magnitude higher, since the voltage drop is much smaller in a given time frame.

For the SOH, old batteries discharge in a faster and more predictable way: their voltage discharge curve becomes even steeper and the target charging voltage cannot be reached. New lithium batteries will keep the same good behaviour longer, but eventually can degrade with a more exceptional behaviour and rapidly change their impedance and discharge curve just when they are close to end of life or being damaged. Extra care must be taken for temperature measurements, ideally at every single cell, to integrate the SOC and SOH algorithms with this information to make them more accurate.

Precise and reliable SOC and SOH calculations help extend battery lifetimes from ten years to 20 years in the best case and generally result in a 30% lifetime improvement, which reduces the total cost of ownership of the energy storage system by greater than 30% after including maintenance costs. This, together with the higher accuracy of the SOC information, avoids overcharging or overdischarging conditions that can quickly drain a battery; minimises the chance of short circuits, fire, and other risky situations; helps use all the energy in a battery; and enables charging batteries in the best, most efficient way possible.

The LTC6813 battery management solution (BMS) proposed in this article can be used in healthcare devices such as portable ultrasound machines and in large scale (megawatt/hours) energy storage systems (for hospitals, factories, grid stabilisation, electric vehicle charging infrastructure, and residential units), as well as in industrial robots and vehicles.

One new and unique solution for having the most efficient and reliable battery monitoring system involves the combination of an 18-cell monitor and balance IC with a microcontroller to SPI slave isolated interface. A multicell battery stack monitor measures up to 18 series connected battery cells with a total measurement error of less than 2,2 mV. The cell measurement range of 0 – 5 V makes it suitable for most battery chemistries. All 18 cells can be measured in 290 μs, and lower data acquisition rates can be selected for high noise reduction.

Multiple stack monitor devices can be connected in series, permitting simultaneous cell monitoring of long, high voltage battery strings. Each stack monitor has an isoSPI interface for high speed, RF immune, long distance communications.

Multiple devices are connected in a daisy chain with one host processor connection for all devices. This daisy chain can be operated bidirectionally, ensuring communication integrity, even in the event of a fault along the communication path. The IC can be powered directly from the battery stack or from an isolated supply. The IC includes passive balancing for each cell, with individual PWM duty cycle control for each cell. Other features include an onboard 5 V regulator, nine general-purpose I/O lines, and a sleep mode where current consumption is reduced to 6 μA.

Due to the short- and long-term accuracy demands of the BMS application, it uses a buried Zener conversion reference rather than a band gap reference. This provides a stable, low drift (20 ppm/√kHr), low temperature coefficient (3 ppm/°C), low hysteresis (20 ppm) primary voltage reference along with excellent long-term stability. This accuracy and stability are critical since it is the basis for all subsequent battery cell measurements and these errors have a cumulative impact on acquired data credibility, algorithm consistency, and system performance.

Although a high accuracy reference is a necessary feature to ensure superior performance, that alone is not enough. The analogue-to-digital converter architecture and its operation must meet specifications in an electrically noisy environment, which is the result of the pulse-width modulated (PWM) transients of the system's high current/voltage inverter. Accurate assessment of the state of charge and health of the batteries also requires correlated voltage, current, and temperature measurements.

To mitigate the system noise before it can affect the BMS performance, the stack monitor converter uses a ∑-Δ topology that is aided by six user selectable filter options to address noisy environments. The ∑-Δ approach reduces the effect of electromagnetic interference (EMI) and other transient noise, by its very nature of using many samples per conversion, with an averaging filtering function.

The need for cell balancing is an unavoidable consequence in any system that uses large battery packs arranged as groups of cells or modules, such as the big energy storage units used to supply hospital microgrids and subgrids. Although most lithium cells are well matched when first acquired, they lose capacity as they age. The ageing process can differ from cell to cell due to several factors, such as gradients in pack temperature. Exacerbating the whole process, a cell that can operate beyond its SOC limits will prematurely age and lose additional capacity. These differences in capacity, combined with small differences in self-discharge and load currents, lead to cell imbalance.

To remedy the cell imbalance issue, the stack monitor IC directly supports passive balancing (with a user-settable timer). Passive balancing is a low cost, simple method to normalise the SOC for all cells during the battery charge cycle. By removing charge from the lower capacity cells, passive balancing ensures these lower capacity cells are not overcharged. The IC can also be used to control active balancing, a more complicated balancing technique that transfers charge between cells through the charge or discharge cycle.

Whether done using active or passive approaches, cell balancing relies on high measurement accuracy. As measurement error increases, the operating guard band that the system establishes must also be increased, and therefore the effectiveness of the balancing performance will be limited. Further, as the SOC range is restricted, the sensitivity to these errors also increases. A total measurement error of less than 1,2 mV is well within system-level requirements for battery monitoring systems.

In energy storage systems, a communication loop is mandatory to connect all battery cells. This loop transmits data from the system's battery to a cloud-based energy management algorithm that tracks charging and discharging events to determine the best way to maximise battery use or to keep the highest capacity battery fully charged in case of a power outage.

The battery stack monitor device needs to communicate with the master unit where a microcontroller or processor calculates the SOC and SOH values and regulates the charging and discharging profiles. Various forms of interconnection are possible, where the isolated communication channel is preferred for high voltage applications, such as energy storage systems (400 – 1500 V) and portable devices with high capacity batteries (40 – 200 V).

The isoSPI feature built into the LTC6813 battery stack monitor, when combined with an LTC6820 isoSPI communications interface, enables safe and robust information transfer across a high voltage barrier. IsoSPI is particularly useful in energy storage systems that produce hundreds of volts via series-connected cells, which require full dielectric isolation to minimise hazards to personnel.

In these storage systems, where more than 18 cells are used, multiple BMS boards will need to be interfaced together. Here a robust interconnection of multiple identical PCBs, each containing one LTC6813 is configured for operation in a daisy chain. The microprocessor is located on a separate PCB. To achieve two-wire isolation between the microprocessor PCB and the first LTC6813 PCB, the LTC6820 support IC is used. When only one LTC6813-1 is needed, it can be used as a single (non-daisy-chained) device if the second isoSPI port (Port B) is properly biased and terminated.

The main design challenge for battery stack monitors with balancing and communication functions is to create a noise free PCB layout design, with critical trace routes far from the noise sources – such as switching power supplies – giving clear signals to the stack monitor.

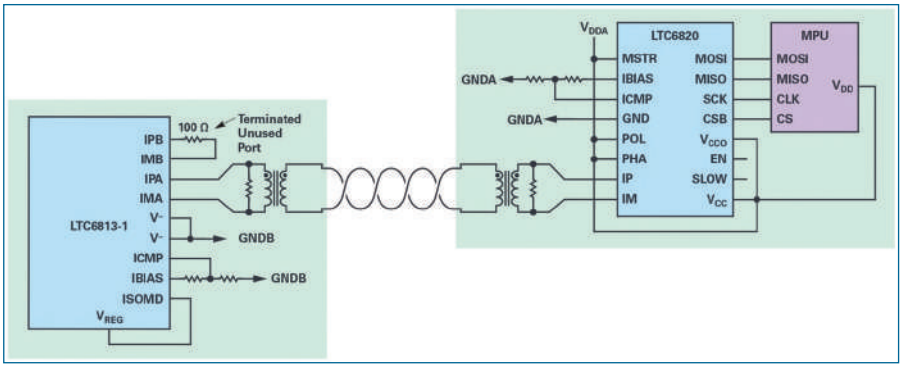

Fig. 4: LTC6813 isolated connection with an LTC6820.

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Digital power: Challenges and opportunities for power designs

by Gary Bocock, XP Power

Digital power has experienced rapid growth over the last five years, taking advantage of the many benefits that digital control can bring to a traditionally analogue domain. The increasing adoption of digital control has been supported by the many new products from microcontroller vendors which specifically target the digital power market.

In a traditional analogue power supply, control is implemented using a control integrated circuit (IC) consisting of operational amplifiers and comparators combined with a series of carefully selected external capacitors and resistors to form the compensation network. This compensation network is designed to give the power supply the desired regulation, transient load performance and stability in the frequency or s-domain. The compensation network is fixed and often compromised by the presence of the bandwidth limiting optocoupler in the feedback loop. This is shown in Fig. 1.

Digital power means a digital control loop which regulates and stabilises the power supply replacing the analogue control ICs which have traditionally been used in switch mode power supplies. In the digital power supply shown in Fig. 2, the analogue control IC and its associated analogue compensation network has been replaced by the microcontroller.

The microcontroller is used to close the feedback loop of the power supply. In a typical digitally-controlled power supply, an analogue-to-digital converter (ADC) module on-board the microcontroller samples the output voltage or current which is compared to a demand reference value with the result being an error term. The error term is used as the input to the discrete time controller. The discrete time controller is executed at exact, predefined, intervals each time there is a new ADC sample available. Just like the analogue compensators in the s-domain, the discrete time controller has a frequency response in the time or z-domain. The controller coefficients determine the frequency response and stability of the power supply and must be analytically calculated to stabilise the power supply.

Microcontrollers have been used in the power supply field for many years for the purposes of implementing basic functionality

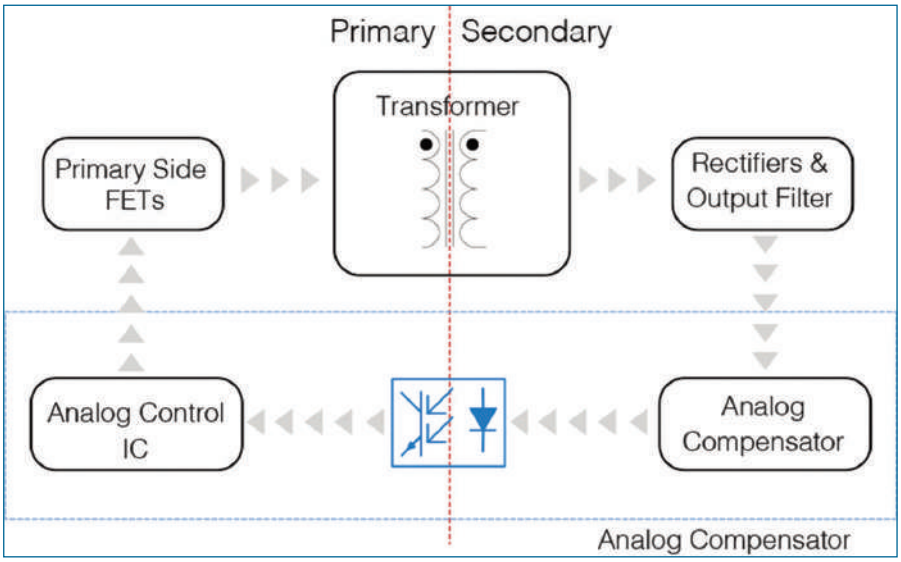

Fig. 1: An analogue controlled power supply

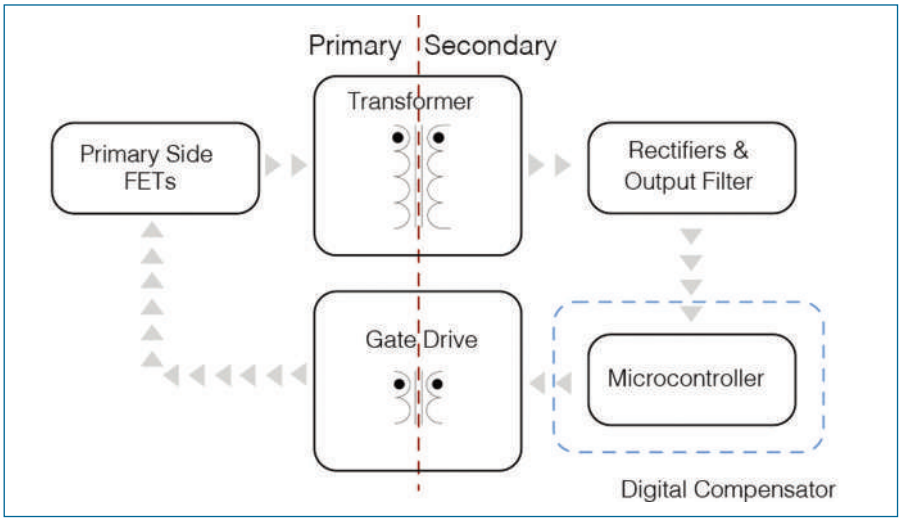

Fig. 2: A digital controlled power supply

such as serial interfaces and fan speed control, using relatively simple and low-cost microcontrollers. Full digital control has previously been most prevalent in the server and telecoms market with uptake in the industrial and medical markets lagging.

The predominant prohibiting factor to the switch to digital control has been the combination of the cost and complexity associated with digital power. The cost of a

Continued on page 40...

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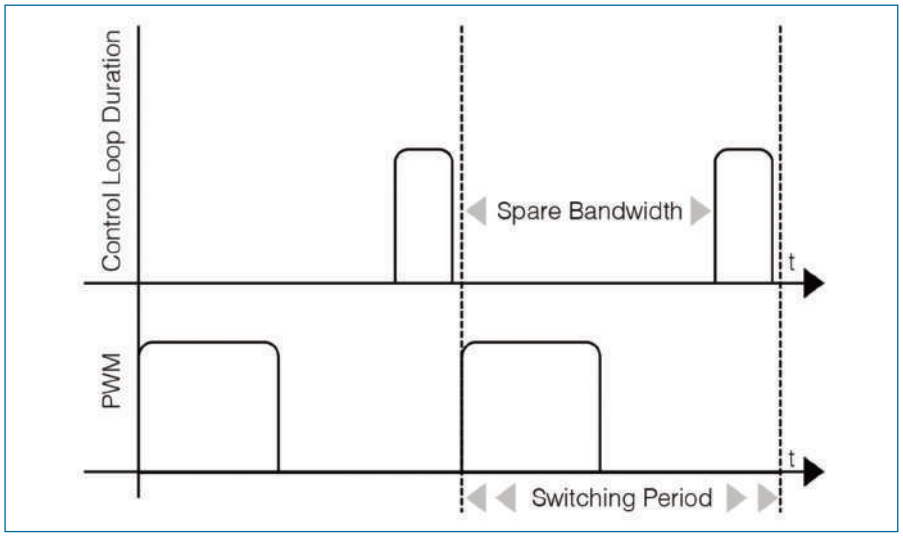

Fig. 3: Typical control loop duration vs PWM switching period

modern microcontroller with the digital signal processor (DSP) functionality needed to implement full digital control has decreased dramatically in recent years but the complexity remains an issue, stemming from the need for a mixed domain approach to designing the power supply.

The development of robust and efficient firmware for a power supply can take a significant amount of time depending on the complexity of the design. Of course, once the initial investment has been made, one of the benefits of digital power is the ability to reuse firmware across many different products, the change in firmware for products with different output voltages within one series may be a simple case of changing the controller coefficients.

The digital control loop has many advantages over its analogue counterpart. It is insensitive to the environment, temperature, ageing and tolerances of the control loop components. It allows the system to monitor the performance of the power supply in real time and adjust parameters to tune the performance as required. Furthermore, advanced discrete time control techniques allow us to achieve higher performance compared to analogue compensators, recovering from transients in a matter of a few switching periods.

The ever-increasing demand for high efficiency power converters is a key area where digital power offers solutions beyond the capability of typical analogue control schemes.

The latest microcontrollers for digital power applications contain DSP functionality that allows the digital control loop to execute within a fraction of a single pulse width modulation (PWM) switching period, every switching period. Fig. 3 shows the PWM switching period of a typical digital power supply. In this simple example, the output voltage is sampled once per switching cycle. An ADC conversion time of a few hundred nanoseconds is typical for a microcontroller designed for digital power applications. Following the ADC conversion, the interrupt service routine is called to execute the discrete time controller. This is a time critical routine.

As shown in Fig. 3, for this example, the time that the microcontroller unit (MCU) does not spend executing the controller is spare bandwidth. This spare bandwidth can be used to perform other tasks or functions specific to an application. Any low priority tasks are run in a slow loop and will be interrupted whenever the high priority tasks occur, such as the ADC interrupt to run the control loop code.

Given the flexibility that a microcontroller adds to the design, digital power lends itself well to custom or modified standard power applications where the standard product may not satisfy every aspect of the customer's requirements. There may be specific communication requirements such as controlling the power supply over USB, I2C or EtherCAT. The customer may require the output voltage or current limits to be adjusted or require real-time monitoring, power rail sequencing or accurate current share between output modules. Application specific requirements that may have traditionally required hardware changes can often be implemented in firmware.

For sure, the high-performance microcontroller used for digital power will be costlier than the analogue IC it replaces. However, the digital controller opens the opportunity to implement other functionality within the MCU rather than using discrete components. This can lead to a reduced component count and more compact solutions, especially for designs with complex signal requirements or multiple power rails which could be controlled using one microcontroller. The result may be an overall solution that is more cost effective. Of course, for some complex requirements, going digital may be the only realistic solution.

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Power supplies for space-constrained applications

XP Power now has new range of 180 W U-channel AC-DC power supplies (UCP180 series) intended for space-constrained medical (BF), industrial, and IT applications. The low-profile devices are just 29,5 mm high and occupy a small 107,6 mm x 62,8 mm footprint, allowing them to be used in high-density designs. They are suitable for Class I and Class II operation, and offer 2 x MOPP (means of patient protection) of isolation while delivering up to 94% efficiency. These power supplies have an integrated 12 V, 500 mA fan output, eliminating the need for any external driver circuitry. When used in conjunction with a fan delivering 10 cfm airflow, they can deliver 180 W of power to a load – a power density of 14,2 W/in^3. They are also suited for use in convection-cooled applications where they deliver 120 W (9,4 W/in^3). The U-channel construction provides a robust housing, and an optional cover is available for applications where the unit may be user-accessible. Suitable for medical (BF) applications, the PSUs are approved to EN 60601-1, IEC 60950-1-1 and IEC 62368-1. EMC performance meets EN 61000-4, suitable for applications including ITE and industrial.

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High-performance inverters

Omron's new RX2 high-performance frequency inverters meet the changing demands of system integrators, machine builders and manufacturers, helping them ensure productivity, quality and reliability, along with easy customisation. The RX2 inverters are designed for applications such as filling control, press working and tension control, for both permanent magnet (PM) motors and induction motors. The RX2 series maintains the same mounting dimensions as the previous RX model, offering an easy replacement to existing control panel and mounting locations. In addition, the existing CX-Drive software can be used. With this software, parameter settings and programs used for the previous model can easily be converted and transferred to the new RX2 inverters. Thanks to the built-in noise filter, which correspond to the European EMC Directive (IEC61800-3 2nd Environment Category C3 and UL Power Conversion Equipment/UL61800-5-1), users do not need additional external hardware, avoiding further costs. The new full-colour LCD interface makes setup and operation intuitive and easy. The parameter copy function allows users to quickly copy settings to other RX2 inverters. The RX2 inverter can also perform simple sequence control programmed using the CX-Drive support software.

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Effective monitoring of energy consumption

A cost-effective new system is allowing switched-on building owners and facility managers to monitor and manage energy

consumption using advanced new sensors and an easy-to-use cloud-based operating system. Distributed by local technology integrator, Euca Technologies, on behalf of one of the world's leading logging and monitoring system specialist companies, Onset Computer Corporation, the new EG4100 Series systems from Onset combine an energy meter, current transformers, and cloud-based dashboard for seamless, simple and cost-effective monitoring of energy parameters in real time to allow simple, highly accurate and cost-effective management of energy for buildings. The core of the EG4100 Series is a revenue-grade power meter that combines an energy meter, data logger, and web server into a single integrated unit. Offered in 15- and 30-input models, the EG4100 Series allows customers to replace dozens of traditional sub-meters with an all-in-one system that streamlines the power monitoring process.

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Pre-programmed MAC addresses in NOR flash

Microchip announces the introduction of the SST26VF Serial Quad I/O (SQI) 3V Flash family, the industry's first NOR Flash devices to offer integrated MAC address options. Pre-programmed with EUI-48 and EUI-64 addresses, the devices do not have a minimum order requirement, providing cost-effective, plug-and-play storage solutions for connected applications that use Ethernet, Bluetooth, WiFi, IEEE 802.15.4 and FireWire. The SST26VF family of flexible MAC address chips help designers to save time and costs while accelerating time to market for low- to mid-sized volume production. MAC address options are available at Flash densities of 16 Mb, 32 Mb and 64 Mb. The rapid growth of the Internet of Things (IoT) means that embedded system designers must currently source, programme and serialise Media Access Control (MAC) addresses from the IEEE-Registration Authority (RA) for all connected products. Only sold from the IEEE-RA in blocks ranging from 4000 to 16 million, small-to medium-size businesses pay higher costs for low-volume services. The SST26VF help to eliminate the need for companies to self-procure and manage these unique identifiers from the IEEE-RA.

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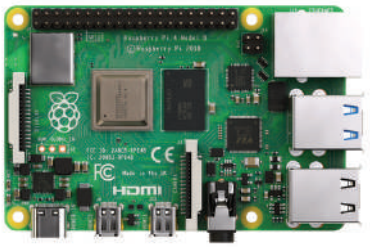
Raspberry Pi 4 available for pre-order



The Raspberry Pi 4 has been launched globally but South African fanatics will have to pre-order and wait a little longer to get their hands on these revolutionary microcomputers. RS Components South Africa is excited to announce that the latest offerings from the Raspberry Pi Foundation recently received Independent Communications Authority of South Africa's (ICASA) stamp of approval and are now available to pre-order. The first of the fourth generation Raspberry Pi that will be available is the Pi 4 Model B. This new OS is based on the upcoming Debian 10 Buster release and delivers a modern user interface and updated Chromium 74 web browser. Other improvements include the adoption of the Mesa V3D graphics driver, which offers OpenGL-accelerated web browsing and the ability to run 3D applications in a window. The Raspberry Pi Foundation has also released new accessories for the Pi 4 Model B, including a new case, a USB Type-C power supply, a microUSB to USB Type-C adapter, and micro HDMI cables. Notable upgrades include Gigabit Ethernet, support for up to 4 GB of LPDDR4 RAM, dual-band WiFi, as well as 4K60 hardware HEVC decode support.

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Programmable power in smart home appliances

Qorvo, a leading provider of innovative RF solutions, has introduced a new intelligent power control solution that significantly reduces energy consumption, bulk, weight and noise in smart home appliances, AC-powered fans and compressors. This new, mixed-signal system-in-package (SiP) product can reduce bill of materials by as much as 35%, even as it enhances performance, reliability and energy efficiency in brushless DC (BLDC) motor and permanent magnet synchronous motor (PMSM) control applications. The Qorvo PAC5556 Power Application Controller (PAC) delivers extreme power density in a slim, compact 52-PIN 10×10 QFN package. It features a 150 MHz Arm Cortex-M4F digital high-performance processor with 128 kB FLASH and integrates a 600 V N-channel DC/DC buck controller and signal conditioning components. This greatly reduces the bill of materials in high-voltage systems that do not require isolation.

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Vehicle detection system intervenes to improve safety

As a leader in proximity detection systems, Booyco Electronics is well known for its

proximity detection system (PDS) that keep pedestrians safer in the underground mining environment. Its next advance has been to develop a vehicle detection system (VDS) that triggers interventions to prevent vehicle-to-vehicle accidents in line with EMERST guidelines. Booyco Electronics' new VDS is an innovative evolution of the company's vehicle-to-vehicle detection system, and now incorporates the necessary high level of accuracy to introduce interventions in the operation of the vehicles. The VDS is applicable in both surface and underground environments. The system can measure the distance between the vehicles in a range from 10 – 100 m. With a measuring accuracy of 1 m, not only can it determine the position of a vehicle but also the direction in which it is travelling. This means that the operator will be informed if another vehicle is close by, as well as the number of vehicles there are in the proximity. Based on a high frequency wave transmission, the new VDS technology has been developed to comply with the latest safety regulations for moving vehicles on mines.

Contact Booyco Electronics, Tel 086 126-6926, info@booyco-electronics.co.za

80 V DC-DC buck LED driver IC

Infineon Technologies AG introduces the new LED driver IC ILD8150/E. It features an innovative hybrid dimming mode technology for achieving 0,5% of the target current. With its supply voltage range from 8 V DC up to 80 V DC, the driver IC provides a high safety voltage margin for applications operating close to safe extra-low voltage (SELV) limits. The driver IC is ideally suited for general and professional LED lighting applications with high dimming requirements. The ILD8150/E offers a deep dimming performance without flicker and prevents audible noise. A PWM input signal between 250 Hz and 20 kHz controls the LED current in analogue dimming output mode from 100 to 12,5% and from 12,5 to 0,5% in hybrid dimming mode, with a flicker-free modulation frequency of 3,4 kHz. The digital PWM dimming detection with high resolution and the low power shutdown perfectly match the ILD8150/E to microcontrollers. The device also has a dim-to-off function and a pull-down transistor to avoid LED glowing in dim-to-off mode.

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Digitisation needs new skills

Smart grid investments by municipal and public power utilities typically focus on electric distribution and customer systems. The expected benefits include lower costs, better customer service and more reliable and efficient electric system operations. The uptake in South Africa has not reached its potential and Taru Madangombe, VP of power systems in Southern Africa for Schneider Electric, comments: "This energy revolution is causing dynamic changes in the market. One of the major challenges is the unavailability of good technical competencies, as people need to adapt from traditional power systems, with labour intensive practices, to a new model based on digitisation. This Fourth Industrial Revolution (4IR), ushering in the industrial internet of things (IIoT), requires new skills and expertise based on digital expertise. In the implementation of a smart grid system, there is a gap between the available skills and understanding of the system. We are involved in the updating of digital training courses at universities and technical colleges across South Africa and in the Anglophone region (including East Africa). These skills need to address the region's requirements of new connectivity, new mobility, remoteness of regions and how you make systems more efficient, smarter and reliable."

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High frequency power dividers

Fairview Microwave, a leading provider of on-demand RF, microwave and millimetre-wave components, has recently launched a new line of high frequency power dividers available with same-day shipping and no minimum order quantity (MOQ). The line is ideal for 5G cellular communication, satellite communication, and automotive radar applications. The company's new line of high frequency power dividers is made-up of 19 new models that provide low insertion and return loss. The dividers in this line have maximum operating frequencies ranging from 26,5 GHz to 67 GHz and are available quickly, which is ideal for initial proof-of-concept testing and prototype builds. Additional features include SMA, 2,92 mm, 2,4 mm and 1,85 mm connectors, power handling capability up to 20 W(CW) as well as two-port and four-port model options. These RF splitters are well suited for telecom carriers, cell phone, contract and defence manufacturers, labs and research institutes.

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How data centre operators can manage growth

by Andreas Sila, Huber+Suhner

This article addresses how data centre operators can manage growing bandwidth and connectivity demands. The number of data centres opening around the world is increasing, with the Cloud Africa 2018 report finding that cloud use among medium-to-large organisations has more than doubled between 2013 and 2018, highlighting the truly global challenge facing operators on every continent.

This is a period of rapid technological advances – 5G, the Internet of Things (IoT) and Artificial Intelligence (AI) are just three examples of new technologies that are changing the way we all live. The connectivity and bandwidth demands that these new technologies will bring are reflected in the pressures that data centre operators are under to develop and build data centres that can adjust to and manage the increased demand.

As global cloud data centre traffic continues to grow, data centres need to be able to react to their ever-changing environments seamlessly. It is predicted that hyperscale cloud data centres will have to be upgraded every two years to keep up with the bandwidth and storage demands, which would be incredibly costly for data centre operators to overhaul the entire system every couple of years. Instead, operators need to be doing all they can to future-proof data centres.

The battle of the transceivers

The sheer size and scale of hyperscale cloud data centres means that operators must decide to use an optical network that is based on multimode or singlemode fibre.

Singlemode transceivers allow for an increase in bandwidth requirements, are future-proofed for 400 G and would be able to handle any increase of up to 800 G. Due to singlemode cabling requiring less fibres, the complexity of the horizontal backbone cabling can be reduced within the topology. Singlemode fibre is able to cover significantly longer distances than multimode cables, which is an undeniable benefit for hyperscale data centres with facilities exceeding 900 square metres.

In comparison, multimode fibre is favoured by enterprise data centre operators as the facilities are usually smaller in size so the long-distance capability is not so important. Multimode transceivers are lower in cost and usually available earlier than its single-mode version. Whilst there is no issue with the amount of reach multimode fibre can support until all data centres are on a large scale, the reach shortens with every generation that boosts speed to the next level. As an example, typical gigabit multimode SFP transceivers easily cover more than 500 m on widely available OM3 multimode fibre; 100 Gbps QSFP28 SR4 modules require OM4 or better to cover just 150 m.

Fig. 1: Fibre management systems are crucial in organising the cabling in a clear and concise way, reducing the risk of damage and downtime.

With data centres growing as quickly as they are, in Africa and beyond, singlemode transceiver deployments are going to increase massively. With the trend of higher bandwidths set to continue, the range of use of multimode fibres will continue to decrease.

Fibre management systems with a difference

Fibre management systems are crucial in organising the cabling in a clear and concise way, reducing the risk of damage and downtime. The large costs that inaccessible data brings means that downtime is not acceptable for a data centre operator. Hyperscale data centres contain a large number of servers, so every single fibre moved needs to be the correct one. Fibre cabling is complex, so operators need to deploy a flexible comprehensive fibre management system that can be managed with ultimate ease and maximum efficiency.

For the highest level of protection and maximum ease, operators should install fibre optic distribution systems with a high-density cross-connect technology and a clear demarcation point. To ensure a highly-secure environment and reduce the likelihood of human errors, selecting a dense side-access fibre management system is best. With a cleverly-designed main distribution area (MDA), there are fewer reasons for someone to interact with the active equipment in the data centre and cause an error.

Operators are not able to completely future-proof a data centre, as it is impossible to know how the environment will change in the next decade and beyond. But selecting a structured fibre management system with modules that can be installed, exchanged and removed in a simple and easy way, is crucial to adapt to changes in bandwidth and connectivity demands. This modular approach makes the cabling structure in a data centre incredibly flexible and an intelligent fibre management system can be installed in a diverse range of positions whether that be against a wall, end of row or back to back in a row – this means the system can be used in the main distribution area but also in the horizontal distribution area.

There are many options for operators to consider when selecting a fibre management system but as the pressure on data centres is only going to increase, operators need to take advantage of systems that are simple, high-density and high-quality that will help them do their jobs effectively.

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The surprising story of how Ford helped put a man on the moon

Information from Ford Motor Company

"Houston, Tranquility Base here. The Eagle has landed." Neil Armstrong's words reverberated throughout the NASA Mission Control Centre in Houston, and cheers and celebrations erupted both at Mission Control and around the world. The Apollo 11 lunar module had just landed on the moon.

Fifty years after that fateful moment, there isn't much about the moon landing that has escaped our collective knowledge. But one thing that might surprise people is that Ford Motor Company had a huge hand in the Apollo 11 mission. All of the equipment that enabled the mission – including the voice transmission back to Houston and out to the rest of the world – was possible because of Ford's role in building and maintaining the Mission Control Centre.

How did the company that put the world on wheels come to be a part of putting a man on the moon?

From carbon arc lamps to the Space Race

The story begins with Philco, founded in 1892 to produce carbon arc lamps before shifting into battery, radio and television production. In 1953, Philco engineers invented the surface barrier transistor, the first high-frequency transistor that enabled the development of high-speed computers. Philco's effort to miniaturise and perfect the transistor led to work with the US Military and NASA, but by 1960 financial difficulties forced the company to seek an outside buyer.

Looking to expand its product offerings beyond the automobile industry, Ford was intrigued by the access to new and innovative technologies engineered by Philco. It purchased the company in 1961 and Ford transferred its Aeronutronic Division to a new entity it called Philco-Ford.

In 1963, the company went head-to-head against tech giants like IBM, RCA, Lockheed, Hughes Aircraft and AT&T in a bid to implement the Mission Control Centre at the new Manned Space Centre in Houston. Although Philco-Ford was considered an underdog in the process, it was ultimately awarded the role as prime contractor.

"Had it not been for the merger with Ford, the company most likely would not have been considered for the job because of the magnitude of the engineering resources required," Walter LaBerge, manager of Philco-Ford Houston Operations, noted in an oral history recounting the project.

Building what had never been built before

The job responsibilities for Philco-Ford were immense, encompassing the design of hardware and software systems to solve problems that had never been experienced before, plus manufacturing, installation, start-up and testing of the control centre, including data and control links to NASA's remote tracking sites.

"In short, what NASA needed on the ground to assure a landing on the moon in the '60s was a major computer-assisted decision-making capability which no one had when

Fig. 1: Philco was a pioneer in battery, radio, and television production and was purchased by Ford in 1961.

Philco-Ford received the contract," reads a company document from the time.

The Mission Control Centre was completed in about two years – just in time to monitor the Gemini 3 mission in March of 1965 – and was fully functional a few months later when all mission control operations were moved from

Fig. 2: The Houston Mission Control Centre breathes a sigh of relief as the Apollo 11 missions meets success.

Cape Kennedy to Houston's Manned Space Centre.

In addition to designing and building out the control centre, Philco-Ford provided technical and engineering support personnel during construction and ongoing operations. The system designs were updated for each mission, some of which required as many as 2-million wiring changes. Other statistics from Mission Control are just as staggering now as when they were installed more than 50 years ago:

- More than 1500 different items of telemetry data – from an astronaut's health to the results of tests and flight data – flowed into the centre simultaneously.
- The Mission Control Centre housed the largest assembly of television switching equipment in the world.
- More than 96 000 km of wiring were laid and maintained to continue operations.
- Five IBM 360/75 mainframe computers sent data to more than 1300 indicator switches to be monitored by mission flight controllers.

The journey to the moon

While Philco-Ford was involved with all of the Apollo missions, two stand out for their complexity.

The Apollo 8 mission featured the first spacecraft to orbit the moon and return to earth. This mission presented serious challenges to the personnel and equipment at the Mission Control Centre because signals and data would be lost as the craft went behind the moon during the lunar orbit. There were some concerns about how the signal would be reacquired, but the equipment worked flawlessly and even allowed the astronauts to make several broadcasts from space – including a message of peace on Christmas Eve 1968.

In July 1969, Apollo 11 was the focus of the world. The work by Philco-Ford and the Mission Control staff was even more complex due to the unprecedented nature of the mission. As the world held its breath on 20 July, the descent to the moon's surface was broadcast around the globe.

The astronauts conducted a series of experiments and gathered lunar surface materials. They deployed the Early Apollo Scientific Experiments Package (EASEP), which would remain on the moon and monitor environmental conditions. The EASEP was a joint effort of NASA, Philco-Ford and IBM, so even after the successful return of the astronauts on 24 July 1969, the experimental package would remain and broadcast data for another year.

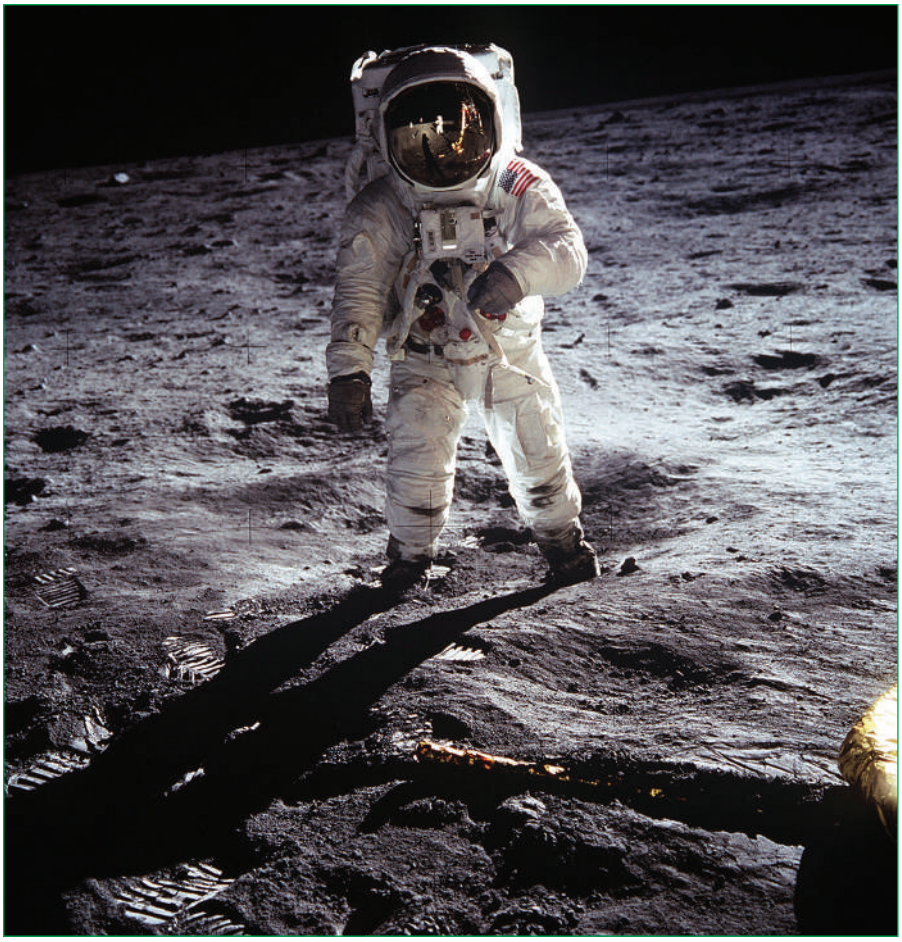

Fig. 3: Iconic photo of Edwin "Buzz" Aldrin Jr on the Apollo 11 mission.

Life after the "giant leap"

Philco-Ford's role with Mission Control continued as the Apollo missions gave way to Skylab, Apollo-Soyuz and eventually the Space Shuttle. Renamed Ford Aerospace and Communications Corporation in 1976, the company also began to provide additional services in satellite communication, including high-speed information systems with communication and environmental satellites. At one point in the early 1980s, Ford Aerospace had built more than half the communications satellites in orbit.

In 1990, Ford Motor Company exited the aerospace industry when Ford Aerospace was sold to Loral Corporation. Meanwhile, the Mission Control Centre became a symbol of the space race recognised around the world, with historian Layne Karafantis describing it as "the most famous iteration of a particularly mid-century technology: the global control centre".

"The MCC in Houston, filled with consoles and computers and displays of real-time data, became iconic," Karafantis continued. "MCC was a dynamic space whose design was created and implemented with almost every possible contingency considered. The Philco-Ford team's integration of display, communication, and data-processing technologies within the centre made a manned mission to the moon possible."

Just like the rest of the world, Henry Ford II watched star-struck when that mission proved successful, inspired by its magnitude – and by what it could also mean for our terrestrial future.

"Only a few generations ago, most men lived and died within a few hundred miles of their birthplaces," he said in a statement. "Now our horizons are virtually limitless. If man can walk on the moon, he can look to the planets and beyond the solar system as Columbus must have looked across a forbidding ocean. If we show the same determination and willingness to commit our resources, we can master the problems of our cities just as we have mastered the challenge of space."

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Compromising on software outsourcing may lead to disaster

by Hans van de Groenendaal, EE Publishers

It remains a mystery at the heart of Boeing's 737 Max crisis, how a company renowned for meticulous design, made seemingly basic software mistakes leading to two deadly crashes. Peter Robison at Bloomberg recently wrote "Longtime Boeing engineers say the effort was complicated by a push to outsource work to lower-paid contractors. The Max software, plagued by issues that could keep the planes grounded for a long time, was developed at a time Boeing was laying off experienced engineers and pressing suppliers to cut costs.

According to reports, the iconic American plane maker and its subcontractors have relied on temporary workers making as little as $9 an hour to develop and test software, often from countries lacking a deep background in aerospace – notably India.

In offices across from Seattle's Boeing Field, recent college graduates employed by the Indian software developer HCL Technologies occupied several rows of desks, said Mark Rabin, a former Boeing software engineer who worked in a flight-test group that supported the Max. The coders from HCL were typically designing to specifications set by Boeing. Still, "it was controversial because it was far less efficient than Boeing engineers just writing the code," Rabin said. Frequently, he recalled, "it took many rounds going back and forth because the code was not done correctly."

Based on resumes posted on social media, HCL engineers helped develop and test the Max's flight-display software, while employees from another Indian company, Cyient, handled software for flight-test equipment.

Boeing said the company did not rely on engineers from HCL and Cyient for the Manoeuvring Characteristics Augmentation System (MCAS), which has been linked to the Lion Air and Ethiopian Airlines disasters. The Chicago-based plane maker also said it didn't rely on either firm for another software issue disclosed after the crashes, a cockpit warning light that wasn't working for most buyers. A Boeing spokesman said, "Our primary focus is on always ensuring that our products and services are safe, of the highest quality and comply with all applicable regulations."

Multiple investigations are trying to unravel how and when critical decisions were made about the Max's software. During the crashes of Lion Air and Ethiopian Airlines, planes investigators suspect that the MCAS system pushed the planes into uncontrollable dives because of bad data from a single sensor. It has been an expensive lesson for Boeing, not just monetary but also at the cost of many people's lives.

Lessons for all

When you have to downsize, take a critical look at who you are offering packages to. Loosing institutional memory can turn out to be more costly than the savings.

The outsourcing of software development is not something that is limited to Boeing; it is a common practice in many industry sectors. Generally, there are two main reasons why companies contract out software development. It is either because they lack in-house expertise, or are finding a more cost-effective option. There are merits in both cases.

Companies that develop new products and services may have the engineering skills but lack specialised software expertise and will go to the market to find a company to create the software required for their product or service.

What to look for when outsourcing software development

Gartner's Luis Mangi says that identifying the appropriate criteria to determine which applications (or portions of applications) should be outsourced can be complicated. For organisations not experienced in application outsourcing, it is best to start small: choose projects that are not critical to the business (but have some visibility), or existing applications. Make sure they are relatively simple, do not impact mission-critical business processes, and have a history of few problems in production which are well-documented. This way you can build up a rapport with the company, learn about their expertise and way of working.

Outscoring of software development is a growing trend but selecting a partner for a software engineering outsourcing project requires considerable reflection on the factors that are most critical for long-term success. It is essential for both teams to have open communication and a strong grasp of the development processes. A development team must have a positive energy to become a productive part of the project. This energy can become infectious and drive team members to excel when it's in the right place. Team spirit, therefore, needs to be encouraged from the beginning of the project, so that it can carry members through the inevitable challenges that occur for all projects.

An outsourcer's geographic location is a critical consideration for any software development project. The distance separating the outsourcer and client can have a dramatic effect on the development process, even with essential technologies such as broadband internet access, videoconferencing and secure digital audio recordings. To outsource software development to a company halfway across the globe places unnecessary stress on both sides as the difference in time zone necessitates for one or both parties to work outside their normal business hours.

Another important aspect to consider is the company's track record and its experience in the type of software development required. Think twice if the outsourcing company has never developed software in your field of operation.

Outscoring software development to another country because they charge less often comes back to bite. South Africa has many competent and successful software developers; they should be your first choice before considering India, Brazil or any so called "cheap software" countries. As the old saying goes, you get what you pay for.

Above all, frequent testing and feedback is important. Just waiting for the final product to be delivered can just make your new project or service fall out of the sky.

Send your comments to engineerit@ee.co.za

Telecoms developments in Africa

Compiled by Aimèe Clarke, EE Publishers

Showcasing 5G potential in Nigeria

Nokia is hosting a series of Innovation Days in Lagos to showcase how 5G technology can transform the way people live and work as well as enhance the industrial productivity in Nigeria. As a global leader in 5G technology with its end-to-end portfolio, Nokia will present how this technology can benefit telecom operators, enterprises including the public sector and individuals. As an end-to-end network supplier, Nokia is uniquely positioned to address all its clients' network, services, and software needs while helping them transition from 3G to 4G and 5G in the future. Nokia is showcasing a world where anything can be 'connected', from retail to conservation, industries, entertainment and education. In the connected conservation use case, Nokia will use high definition 360° capable cameras with pattern recognition, artificial intelligence and software solutions to monitor the movement of intruders at fences and send alerts when anomalies are detected. This can be used to prevent poaching, which is a major challenge across the African continent.

Protecting the environment with data

In every corner of the world, researchers and organisations face unprecedented challenges – to develop solutions that address climate change and a catastrophic loss of biodiversity while sustainably feeding a growing population and protecting water supplies. To date, Micorsoft has awarded 34 grants to projects with impact in twelve countries across the Middle East and Africa. Microsoft's AI for Earth programme awards grants to support projects that change the way we monitor model and ultimately manage Earth's natural systems. Through partnership with the Leonardo DiCaprio Foundation and the National Geographic Society, Microsoft is awarding three new grants to fellow pioneers looking to help us build a more sustainable future. Microsoft is empowering people and organisations with AI and cloud tools to solve global environmental challenges. Through the AI for Earth programme, individuals and organisations are now using AI to collect, process and analyse data at a scale and speed previously unimaginable. By turning information into insight, they can prevent and even predict environmental threats.

Bringing fibre to Soweto

Frogfoot Networks, a licensed open access fibre network provider, is rolling out fibre infrastructure in Protea Glen, Soweto, in a phased approach, with up to 20 000 homes and business standing to benefit from access to affordable, reliable broadband connectivity. Earlier this year, President Cyril Ramaphosa appointed a Presidential Commission on the Fourth Industrial Revolution (4IR), which will assist the government in taking advantage of the opportunities presented by the digital industrial revolution. Affordable broadband connectivity is critical to making this a reality. Being an open access provider, customers stand to benefit from more choice and better service; with over 50 internet service providers (ISPs) operating on Frogfoot Networks, customers have numerous options when it comes to line speeds, whether they have a capped or uncapped account, data package sizes, and more. Expanding fibre connectivity further means that more people have access to education, skills development, and training materials online – be it internet research for students' school work or even to complete online courses and gain certification from recognised institutions.

Investment into Namibia's network infrastructure

Paratus Africa and Nampower have announced plans to launch The GridOnline — this collaboration is set to commercialise Namibia's national optic fibre network and provide access to its national Optical Ground Wire (OPGW). In 2018, Paratus Africa secured access into The GridOnline in strategic locations in order to extend both its national fibre coverage as well as implementing redundancy for its routes in and across Namibia. The company says it was crucial to ensure that the interconnection between the two organisations was functioning optimally before active traffic could be carried across the various routes. Paratus Africa completed access into the Van Eck (Windhoek) and Swakopmund sub-station months ago. It went through an extensive and vigorous test phase. Construction has commenced into the Zambezi (Caprivi) and Walvis Bay sub-stations. The construction phases are said to have cost millions to implement and form part of Paratus Africa's investment strategy into infrastructure across the African continent.

Broadcasting via satellite

Spacecom, an Isreali satellite communications operator, and the operator of AMOS-3 and AMOS-7 satellites has announced its partnership with IDS Africa, a Nigeria-based broadcaster. IDS Africa will broadcast services on the AMOS-17 satellite, Spacecom's newest satellite. The AMOS-17 is currently set for launch to its orbital position of 17°E. IDS Africa will use the new satellite to broadcast Channels TV news programming throughout Nigeria, as well as the Nigerian population and diaspora outside the Nigerian borders. The AMOS-17 satellite, according to Spacecom, is designed to meet Africa's fast-moving communication demands. The satellite's payload will be Africa's most technologically-advanced satellite. The AMOS-17 will aim to provide C-Band HTS capabilities, Ka-Band and Ku-Band to a number of different markets. The satellite will also aim to combine broad regional beams and high throughput spot beams in order to maximise throughput and spectral efficiency with the goal of connecting Europe, the Middle East and Africa.

Integrated social payment platform for Africa

Cassava Fintech International, a fintech company in Africa, has announced the launch of its integrated Social Payments platform. Sasai will be available to individuals and businesses and offered in partnership with mobile network operators (MNOs). It is said to combine instant messaging, social media and mobile payments into one App — available for download on Google Play and iOS app stores. Group CEO of CFI, Darlington Mandivenga says "the launch of Sasai is the first time in Africa a company has developed a platform that combines social messaging apps with the mobile money payments system. It is in response to the call by the Global System for Mobile Communications Association (GSMA) for mobile payment operators to embrace convergence with social payment platforms to create value addition for clients". The initial release of Sasai will include Pay, Chat and Explore features to allow users to familiarise with the bedrock features of the platform. There will be scheduled monthly releases which will include queued additional features and on-boarded partners.

Collaboration to deliver turnkey power solutions in SA

Turnkey power solutions provider, Diesel Electric Services (DES) has announced its distribution partnership with IT infrastructure technology provider, Vertiv, in a bid to enhance critical infrastructure in South Africa. Vertiv's expertise in power and thermal management, core and access sites, hyperscale and edge computing and centralised and distributed networks add value to the Diesel Electric Services current product offerings. This distribution partnership tackles head-on the ongoing power outages in South Africa as a result of diminished resources. "Our distribution partnership with Diesel Electric Services is a step forward in resolving the load shedding crises in South Africa. Our solutions are well-placed to support Diesel Electric Services in its pursuit to modernise South Africa's current power infrastructure." says Wojtek Piorko, regional director, South East Africa at Vertiv. "Through this distribution partnership, we'll be focusing on creating sustainable value for all our stakeholders and provide affordable power solutions" says Richard Baxter, sales manager at Diesel Electric Services. "By teaming up with Vertiv, we can help solve our customers' most pressing challenges with the industry's most formidable array of data centre critical infrastructure, services and management solutions."

Contact Diesel Electric Services, Tel 086 110-6633, sales@dieselelectricservices.co.za

Altron responds to judgment on Tshwane contract

The Gauteng High Court in Pretoria has set aside the City of Tshwane's (CoT's) Municipal Broadband Network Project contract which was awarded to Thobela Telecoms, a special purpose vehicle in which Altron Nexus, a subsidiary of JSE-listed Altron, was a minority shareholder. Altron Nexus was involved as primary network designer and architect, supplier of broadband equipment and related services. Altron chief executive Mteto Nyati said Altron was studying the judgement. Up to this point, the City of Tshwane has not paid a cent of taxpayers' money towards the project as Altron is in the build phase which is being funded by its funders. The matter relates to a dispute between Thobela Telecoms and CoT over the City's allegations that the tender award process was unlawful due to internal processes and procedures at the CoT not being correctly followed. The project was later put on hold by CoT, pending the outcome of the court case.

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Modular fibre optic panel for FTTH cabling

Latest from Webb Industries is the fibre termination box – a modular fibre optic patch panel system which facilitates customised

cabling in locations where large numbers of apartments or buildings have fibre optic outlets installed. Each apartment or building unit is connected to its own module. This allows extensions and modifications to be carried out to the up-and-running network without disturbing the links already in operation. There are diverse applications where customised construction and extension of the fibre optic network have a clear economic benefit over wide-area cabling for the user. Thanks to Telegärtner's fibre termination box (FTB), now available locally from Webb Industries, owners and tenants of apartments are no longer required to invest in fibre optic cabling until they are really sure they want fibre-to-the-home (FTTH). The FTB is not limited to FTTH applications. It can also benefit users and investors when cabling a company site, university campus, hotel complex or holiday resort that comprises many smaller buildings scattered over a large area.

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ContinuitySA named platinum reseller by Veeam

ContinuitySA, a leading provider of business continuity and resilience services, is now

a platinum reseller, the highest level in the Veeam ProPartner Programme. As a key partner within the program, ContinuitySA has a proven history of success in delivering Veeam solutions which deliver availability for the always–on enterprise. Platinum resellers like ContinuitySA are a vital part of the Veeam ecosystem, playing a key role in identifying solution opportunities that help their customers meet the demands of an always–on enterprise. Key benefits for Veeam platinum resellers include privileged access to the highest levels of Veeam's technical teams, greater flexibility in designing client solutions using Veeam software, and joint business planning. The award of platinum status as Veeam reseller is a major milestone in ContinuitySA's cloud journey.

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A technology home for tomorrow's connected enterprise

Vendor neutral data centres are set to change not only the internet, but how businesses and their strategic partners work together. This is according to the managing director of Teraco Data Environments, Africa's most connected data centre and home to NAPAfrica, the largest IXP on the continent. Vendor neutral data centres are essentially places of interconnection. By providing access to internet infrastructure and connectivity, data centres will play a key role in the overall growth and innovation across Africa. By establishing a point of presence within a vendor neutral interconnection data centre, clients can benefit from more than just sound technology. Reaching the edge of the internet is becoming a priority for many clients. This edge platform approach offers aggregation of networks, content, cloud and services all in a single facility.

Contact Lex van Wyk, Teraco, Tel 011 573-2800, lex@teraco.co.za

In the infrastructure and data centre business

In September, Modac will have been in the infrastructure and data centre business for 34 years. The company began in September 1985, doing RS233 cabling and multiplexers. In 1994, it began building computer rooms, and soon moved towards producing modern, more efficient and user-friendly data centres. Over the years, the company learned it needed to have a mix of unique, cost-effective, easy to maintain, local and imported products to bring a data centre within easy reach of any budget while adhering to local and international specifications. Modac's business model is a mix of product, design, installation, maintenance and distribution for its reseller market. The Axil brand was developed in the late 1980s and has changed drastically in the last eight years. The product line covers all data centre requirements from specialised air conditioning, raised floors, fire suppression, cabinet POD designs, UPS's, design tier 1 to fully redundant tier 4 data centres. Finance options include specifically designed rental plans incorporating maintenance, remote management, monitoring systems and relative sofware.

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Continuing to meet green goals

Canon South Africa continues its path towards carbon neutrality by implementing strong systems and processes to manage environmental impacts responsibly across operations and through the supply chain. The company has set the target to reduce the lifecycle carbon emission from its products by 3% every year. In the EMEA region specifically, the company's goal is to reduce carbon footprint by 15% (from 2010 levels) by 2020. This will be achieved through remote maintenance strategies, the smart dispatch of engineers, more efficient logistics, consolidating office space and transforming Information Communication Technology asset policies, and virtualising servers, amongst other measures. In June 2019, Canon EMEA, which includes Canon South Africa, received the Circular Economy Award for its multi-function devices (MFDs) remanufacturing programme (EQ80), wider MFD refurbishment programmes, and their laser toner cartridge recycling initiative. The approach to make Canon part of the Circular Economy mostly focus on how it manages manufacturing devices and handles them at the end of their lifecycle. The company has developed an asset recovery hierarchy that is applied universally through the remanufacturing, refurbishment and disposal of machines.

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Available from SA data centres

Microsoft South Africa has made Office 365 services available from its South African data centre regions to help provide best-in-class productivity and collaboration capabilities for customers and partners while meeting data residency, security and compliance needs. This will provide businesses with the cloud-powered intelligence needed to enable the modern workplace, as well as empower employees with the tools to drive real-time productivity and collaboration from anywhere. Underpinning these benefits of Office 365 are the robust policies, controls and systems built in to help keep data secure and comply with regulations. Office 365 provides in-country data residency for core customer data, for example, to help customers meet their data residency requirements. In-country data residency for core customer data adds additional assurances regarding data privacy and reliability for organisations and enterprises. Core customer data is stored only in their data centre geography — in this case, the cloud data centres within South Africa. This is particularly important and relevant in industries such as healthcare, financial services and government, where organisations need to keep data in-country to comply with local regulations.

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Software-defined wide-area network under development

MTN is developing a software-defined wide-area network (SD WAN), and is re-purposing thousands of sites across the country to harness narrow band internet of things (NB-IoT) as the rollout of turnkey solutions for enterprise customers gathers pace. An NB-IoT network is a low-power wide-area network (LPWAN) radio technology standard that provides strong coverage over large areas and enables wide-range connectivity of new IoT devices and services. Software-defined networking (SDN) technology, meanwhile, connects enterprise networks (including branch offices and data centres) over large geographic distances. MTN has invested over R40-billion in the past four years to build its South African network. This investment is providing a powerful platform from which new solutions can be rolled out, both now and into the future. When companies extend networks over greater distances and across multiple carriers' networks, they face operational complexities, including network challenges, delay in transmitting data and even service outages. The SD WAN network will counter these constraints, by allowing companies to extend their computer networks over large distances and to connect remote branch offices to data centres and each other. It will also deliver the applications and services required to perform business functions.

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Ultra-smart surveillance solution

Uniview's 12 MP fisheye fixed dome camera will transform your security system and the way you look at surveillance. This feature-rich camera is the ideal surveillance solution

for enterprise and project applications such as classrooms, warehouses and offices surveillance. The 12 MP fisheye fixed dome camera provides a 360° panoramic view with up to 25 frames per second so you'll never miss a moment. This camera also supports 2D/3D digital noise reduction (DNR), offering you a distortion-free image even in the noisiest environments. Not to mention an integrated infra-red light that will keep your image resolution clear and well-defined at night. Uniview's fisheye fixed dome camera also supports region of interest (ROI), allowing you to remove areas that don't require surveillance and at the same time-saving space on your hard drive along with decreasing your data usage. The camera is 4K ultra HD vandal-resistant and packed with an extremely powerful onboard SD storage system that can handle a micro SD card up to 256 GB as a recording option, giving you the opportunity to be aware and in control at all times.

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AeroSpace and Beyond

One step closer to the SKA: International collaboration pays off

As the international engineering consortium tasked with planning the assembly, integration and verification (AIV) of the Square Kilometre Array (SKA) Radio Telescope had formally completed its work, another crucial step towards the construction of the world's largest radio telescope started in Carnarvon with the installation and testing of the newly designed dish for the SKA.

The AIV Consortium, formed in 2013, was led by the South African Radio Astronomy Observatory (SARAO), and was responsible for delivering the AIV process for SKA's mid-frequency array (SKA-MID) in South Africa and the low-frequency array (SKA-LOW) in Australia.

The experience gained and lessons learnt by South African engineers, from designing the AIV process for MeerKAT, positioned SARAO as the natural lead for the AIV consortium. SARAO engineers, as well as engineers from Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Netherlands Institute for Radio Astronomy (ASTRON) constituted the SKA AIV consortium.

"The AIV programme is critical to ensure that telescope elements, that have been designed and built by a dispersed global community, are tested, assembled and verified in a rational and thorough way, thereby ensuring that the entire telescope system will work as designed, to budget and on schedule," says Professor Justin Jonas, chief technologist at SARAO.

"The AIV consortium was made up of individual engineers and scientists assigned from various institutions. SKA consortiums are self-funding and are disbanded once their work is completed with members returning to their own institutions. The AIV is followed by a bridging phase consortium which will be formed in a similar way with experts seconded for various organisations."

Fig. 1: Radio frequency interference being tested at the SKA-MID prototype dish erected at the SKA Karoo site [Credit: Justin Jonas].

Experience with other radio telescopes has demonstrated that the roll-out activities are often under-estimated, resulting in delays in deployment, due to re-engineering and retrofitting of components, which in turn increases the total cost of the system. Many issues that are discovered during "downstream" integration and verification are the result of "upstream" neglect. The sheer scale and complexity of the SKA therefore made it essential that AIV planning was done at an early stage, in parallel with the work of the element-design consortia.

SARAO's Richard Lord, AIV Consortium Lead said: "SKA-MID will consist of nearly 200 dishes in South Africa (including the 64 MeerKAT telescope) and 130 000 antennas in Western Australia, so we don't want to assemble and integrate and then discover something crucial is missing, or doesn't work as we expected it to. We've learned valuable lessons from MeerKAT about how challenging AIV can be if issues are identified too late during deployment."

The work completed by the AIV Consortium will be included in the overall System Critical Design Review (CDR) for the SKA, scheduled for later this year, which will ensure that all the different design elements of the SKA align with each other.

Multi-country approach to develop the SKA dish

In a major milestone for the SKA Project, the 54th Institute of China Electronics Technology Group Corporation (CETC54) has completed the structural assembly of the first SKA-MID dish, bringing together components from China, Germany, and Italy. While the first prototype dish is continuing being evaluated in China, a second dish, funded by the Max-Planck Institute, is nearing completion at the

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Vertical vs horizontal antenna polarisation benefits questioned

by Hans van de Groenendaal, EE Publishers

Recent spectacular two-way communication between South Africa's West Coast Radio amateurs and St Helena during good tropospheric propagation condition has raised the question whether horizontal polarisation (H-Pol) of the antenna would yield better results than a vertically polarised (V-Pol) antenna.

Operating on the simplex frequency of 145,500 MHz making a two-way contact over a distance of over 3000 km does not happen every day. The amateurs on both sides were using vertically polarised antennas which started the debate. The convention says that H-pole antennas during tropospheric ducting conditions are preferred and should provide a gain advantage over V-pol antennas. It is, of course, important that both sides should use the same polarisation, which was the case with the St Helena contacts. This started a North-South debate that over the past years has become quite intense.

At a joint SARL/AMSATSA VHF workshop recently held in Gauteng, this subject was the main item on the agenda with a paper presented by Dick Coates (ZS6BUN) entitled "Are you serious about the last dB?" Coates did an intensive literature review and, coupled with experiential data from various radio amateurs, discussed the merits of both polarisations which proved that there was a marginal advantage using H-Pol over V-Pol. But does it really matter in practice? Well, yes and no!

Fig. 1: 144 MHz contact between South Africa and St Helena.

Research into H-Pol and V-Pol started in the 1930s when the question was raised when one of the early TV stations in New York was planning to install their antenna on the Empire State building. The outcome was inconclusive so they decided on a compromise solution mounting the antenna at a 45-degree angle. It stopped the argument for some time but it did not prove anything.

By convention, the polarisation of an antenna is defined as the orientation of the electric field component of the wave it emits. For a yagi or a dipole this matches the orientation of the elements of the antenna. For many years, the "conventional orientation" for VHF and HF beams has been horizontal. Cross-polarisation losses, in other words a V-pole antenna at one end and a H-pole antenna at the other end, can be large, up to 30 dB is often quoted.

One of the misconceptions is that the polarisation of antennas is determined by the mode of transmission. For many years people believed that V-pol was best suited for FM modes. This idea came about because radio amateurs started using the FM mode when repeaters were established on the 145 and 435 MHz bands for mobile communication. It was simpler to fit a vertical antenna on a motor vehicle as it basically radiates omnidirectional while an H-pole antenna radiates directionally.

"Just recording audio or video of contacts with different antenna polarisations does not provide any reliable proof. One would need to set up two identical stations on either side with the ability to physically switch the antennas from V-pol to H-pol several times and take accurate signal strength readings with the AVC witched off. Simple readings on the s-meter built into the receiver will not work as S-meters are notoriously inaccurate", Coates said. "I have not come across any experiments as I have described."

From science we learn that an H-pole antenna is more efficient, even if it is relatively marginal, as ascribed to the electromagnetic characteristics (magnetic susceptibility μR, conductivity σ and relative permittivity εR) of the soil. However, under absolute perfect conditions there should be no difference between the two polarisations.

The question to consider is whether the signal at the other end is received in or out of phase. Transmitted radio waves can follow slightly different paths before reaching a receiver. The waves can arrive at slightly different times

Fig. 2: Dick Coates (ZS6BUN) explaining the difference between vertical and horizontal polarisation of antennas and their effect on propagation.

and will be slightly out of phase due to the different path lengths. Depending on the magnitude of the phase shift, the waves can interfere constructively and destructively. The path between the transmitted and received signals is described as the Fresnel zone named after physicist Augustin-Jean Fresnel.

If a signal is vertically polarised and it deflects off the ground the resulting signal will be inverted relative to the original signal. This means the high points of the sine wave are now low points, and vice versa. Hence the bounced signal will arrive out-of-phase, which will weaken the received signal.

If a signal is horizontally polarised and it deflects off the ground the resulting signal will be received in-phase resulting in a stronger signal.

Wikipedia has an interesting an analogy. Place a mirror on the floor in the middle of a room, hold a flashlight on the other side of the room. The flashlight represents a signal and your eyes are the receiver. The mirror represents the ground. Move the flashlight move up and down representing vertical polarisation. Note that in the mirror, the flashlight moves in the opposite direction, that is, it moves down and up rather than up and down. This is out-of-phase. Now have the flashlight move to the left and right representing horizontal polarisation. If you look in the mirror, the reflected image of the flashlight moves exactly in tandem with the actual flashlight. Left is left, right is right. This is in-phase.

For poor ground the modulus of the reflection coefficient for V-pol is lower than for H-pol. It is also dependent on the angle. For grazing reflections, the modulus premium of H-pol over V-pol is less. Antenna height also plays a part. The additional signal strength of H-pole over V-pole antennas has been calculated as between 3 – 4 dB, hardly noticeable for FM or SSB signals. The mathematical treatment of the ground wave reflection was developed some years ago by two European radio amateurs, Gaeten Horlin (ON4KHG) and Palle Preben-Hansen (OZ1RH). The 3 – 4 dB gain comes into play in weak signals modes such as in the WJT digital modes. Between the West Coast and St Helena, one would not notice the difference when tropospheric conditions are good. On the other hand, one would not use V-pole in attempting tropospheric propagation communication between the West Coast of South Africa and Brazil, here the 3 – 4 dB of the H-pole polarised antenna would come in handy. In theory a tropospheric contact on 144 MHz between the countries is possible but definitely using H-pole antennas.

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SKA site in South Africa. During this year, six of the new dishes will form the pre-SKA at the Karoo site

China's CETC54 has been leading the design and production of the prototype dish, in particular the production of its highly precise main reflector, sub-reflector, backup structure, and pedestal. The process developed by CETC54 ensures that the dish has a very precise surface-accuracy level as well as consistency for all panels.

In Mainz, Germany, MT Mechatronics (MTM) has been designing and manufacturing the precise hardware and electronics such as the drive units and electronics used to move the dish within an accuracy of up to a thousandth of a degree as well as reliability to produce over 130 such systems behaving equally well.

In Italy, near Naples, the Società Aerospaziale Mediterranea (SAM) has been working on the design and production of the feed indexer, an electro-mechanical component that will support the various receivers and move them into position to align them with the optics of the dish when required, depending on the observations.

The feed indexer is a very innovative part of the dish, the first of its kind. The indexer needs to move with high accuracy to position the receivers with sub-millimetric precision, and it also needs to be able to sustain heavy loads, with for example the Band 1 receiver alone weighing 165 kg.

Onsala Space Observatory at Chalmers University of Technology in Sweden, EMSS Antennas in Stellenbosch, South Africa, and Oxford University and the Science and Technology Facilities Council (STFC) in the United Kingdom have been working on the various receivers that will be fitted on this second dish, covering a broad frequency range from 350 MHz to 15,3 GHz.

Additional institutes involved include the Italian National Institute for Astrophysics (INAF), which is developing the software to monitor, coordinate and control the dish subsystems. A group of engineers at the National Research Council (NRC) Canada, are developing the hardware that digitises the signals recorded with each of the five receivers while the University of Bordeaux, France contributes their expertise to digitise high frequency signals. SKA South Africa has been leading the system engineering, which played a key role in coordinating the consortium.

People, People, People...

Seen at the...

AREI Business Breakfast

Seen at the...

MyBroadband Fibre Conference

Seen at...

SA GeoTech 2019

Upcoming events

1 – 4 September 2019
SATNAC 2019
Fairmont Zimbali Resort, Ballito, Durban
Contact Mooketsi Mocumi, Telkom, Tel 081 425 0044, mocumimsm@telkom.co.za

4 – 5 September 2019
AI Expo Africa 2019
Century City Conference Centre, Cape Town
Contact Tishala Communications, Lauren Leonard, Tishala Communications, lauren@tishalacommunications.com

16 – 18 September 2019
WAPALOZA Conference and Training Indaba
Leriba Lodge, Centurion, Gauteng
Contact Estelanie Kennedy, WAPA, secretariat@wapa.org.za,

7 – 9 October
FTTx Council Conference
Sandton Convention Centre, Johannesburg
Contact Reesha Iyer, FTTx Council, Tel 083 647 7020, reesha@fttxcouncil.com

12 – 14 November 2019
AfricaCom 2019
Cape Town International Convention Centre
Contact Becky Lyons, AfricaCom, becky.lyons@knect365.com

27 – 28 November 2019
African Advanced Manufacturing and Composites Show
Nelson Mandela Bay Stadium, Port Elizabeth
Contact Graziella Ventresca-Norton, Inkanyezi Events, Tel 086 110-1475, graziella@inkanyezi.co.za

New appointments

Dr Setumo Mohapi has been appointed managing executive, Internet Solutions.

Julie Sweet has been appointed CEO, Accenture.

Marc Fletcher has been appointed territory lead, Western Cape. Altron Karabina.

President Ntuli has been appointed MD, HPE South Africa.

Sammy Zoghlami has been appointed senior VP of sales for EMEA, Nutanix.

Brandon Bekker has been appointed senior VP, EMEA, Mimecast.

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