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on the cover

Altron Arrow, strives to improve the time-to-market for all its growing customers' projects by introducing many development kits designed for each specific vertical in the electronics industry, to properly evaluate each technology and its applicability. In order to support the most innovative year yet in 2018, especially with the increasing demand in the IoT sector, turn to page 10 to see its top 10 list of recommended development boards and kits.

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www.dataweek.co.za
In memoriam: Zalman Orlianski

The South African electronics industry reacted with shock and deep sadness to the passing of Zalman Orlianski, founder of Zetech, last month.

In a testament to the esteem in which he was held, by both the industry and his community, his funeral on 18 September at Johannesburg’s West Park Jewish Cemetery was attended by a host of people from all walks of life, including Supreme Court judges, friends and rabbis. Particularly poignant is the fact that many of his company’s customers, and even competitors, also attended to pay their final respects to one of the longest serving members of the industry.

Zalman was born in Lithuania shortly after the Second World War, from where he graduated with an engineering qualification at a time when the computer sciences were still in their infancy. After marrying his first wife he moved to Israel in 1973 and had his first child, a son, where he worked at Motorola, an experience that he would later describe as having been very highly valuable in terms of his professional development.

He was also a folk dancer by hobby – a passion that he carried with him from his homeland to Israel, and later to South Africa. After visiting South Africa with his wife Inna, who he married in 1985, and went to share the rest of his life. In 1986 he finished studying for his MBA, and later securing a contract with Universal Instruments. Over the course of the next 32 years, the company went on to represent many leading companies from all over the world in SMT technology and robotics machines, and serviced countless customers across the South African electronics manufacturing landscape.

Although he is sorely missed by many, his business legacy will be continued by his wife Inna, who will take the reins of Zetech as per his wishes. In her the company lies in highly capable hands, as she is herself a computer programmer who has worked at Anglo American, as well as in the electronics industry working on CAD/CAM systems through her own personal knowledge and skillset.

She is also an MBA graduate and has for the past six years been coaching business owners on how to run their businesses, in addition to coaching MBA students at the Wits Business School. Her successful executive coaching business will now take a backseat to the day-to-day running of Zetech, which she is already well familiar with, having stepped in to help run things from time to time over the years, as circumstances required.

In a personal message, Inna said: “Zalman was a man of integrity, a brilliant engineer, a loyal husband and a dedicated father. He will always be remembered by me and by others for his laughter and his sense of humour. I am grateful for the insights I learned from him and feel empowered to continue his legacy as one of the few female business owners in this male-dominated industry. I would like to thank all those, including our customers and principals, from whom well wishes and flowers have poured in since his untimely death.”
South Africa

• The minister of telecommunications and postal services, Dr Siyabonga Cwele, and ICASA have agreed to settle the court matter involving the invitation to Apply (ITA) which was issued on 15 July 2016 for the allocation of high-demand spectrum. In terms of the settlement agreement, ICASA will withdraw the ITA and the minister will also withdraw the legal challenge. The settlement is in line with President Cyril Ramaphosa’s call to “initiate the process for the allocation of high-demand radio spectrum to enable licensing.”

• The Department of Science and Technology (DST) has invited unemployed science, engineering and technology (SET) graduates and postgraduates to apply for internships for 2019/20 through the DST-NRF (National Research Foundation) Internship Programme. Positions are available in various fields across all nine provinces, and applications are open to SA citizens who hold an Advanced Diploma or Bachelor’s degree at NQF level 7, Honours or BTech degrees at NQF level 8 and M Tech or Master’s degrees at NQF level 9. The NRF online submission system can be accessed at https://nrfsubmission.nrf.ac.za.

Overseas

companies

• Renesas Electronics agreed a deal to acquire IDT for $49,00 per share in an all-cash transaction representing an equity value of approximately $6,7 billion. The acquisition combines two recognised leaders in embedded processors and analog mixed-signal semiconductors, each with unique strengths in delivering products to improve performance and efficiency in high-computing electronic systems.

• Qualcomm has added more fuel to the fire in its feud against Apple by filing a lawsuit alleging that Apple engaged in “a multi-year campaign designed to steal Qualcomm’s confidential information and trade secrets,” and passing on the proprietary information to Intel, which is a rival to Qualcomm in the modem chipset market. The suit is scheduled to go to trial in April 2019.

industry

• The Semiconductor Industry Association (SIA) announced worldwide sales of semiconductors reached $40,16 billion for the month of August 2018, an increase of 14,9% compared to the August 2017 total. Global sales in August 2018 were 1,7% higher than the July 2018 total of $39,49 billion. Regionally, sales increased compared to August 2017 in China (27,3%), the Americas (15,0%), Europe (9,5%), Japan (8,4%) and Asia Pacific/All Other (4,7%). Sales were up compared to the prior month in China (2,1%), the Americas (3,6%) and Asia Pacific/All Other (1,3%), and decreased slightly in Japan (-0,1%) and Europe (-1,4%).

• The market for microcontrollers (MCU) is expected to continue hitting record-high annual revenues through 2022 after worldwide sales dropped 6% in 2016 because of a slowdown in MCU unit shipments. After drawing down MCU inventories in 2016, systems manufacturers stepped up purchases in 2017 with unit shipments surging 22% and strong growth continuing in 2018. IC insights raised its projection for MCU shipments to 18% in 2018 with the unit volume reaching nearly 30,6 billion. MCU revenues are now forecast to rise 11% in 2018 to an all-time high of $18,6 billion, followed by 9% growth in 2019 to about $20,4 billion.

technology

• Sonitus Technologies has been awarded millions of Dollars in funding by the US Department of Defense (DOD) for a novel personal communication system that Air Force personnel have nicknamed the ‘molar mic. The two-way, personal communication system, ATAC, fits a miniaturised traditional headset into a device that clips to a user’s back teeth. Sonitus uses a patented audio interface and near-field magnetic induction (NFMI) technology, and its system has been tested in multiple scenarios, with and without personal protective equipment, all with extreme noise and without loss of communication.

• Researchers at the University of California, Santa Barbara, have demonstrated that a Wi-Fi signal can be used to count the number of people in a given space, leading to diverse applications from energy efficiency to search-and-rescue, and no doubt with the potential of selling data to advertisers too. To accomplish this, they put two Wi-Fi cards at opposite ends of a target area roughly 70 square metres. Using only the received power measurements of the link between the two cards, their approach can estimate the number of people walking in that area. So far, they have successfully tested with up to nine people in both indoor and outdoor settings.

EVENTS

SMTA International
14-18 October 2018
Illinois, USA
Conference and exhibition covering SMT manufacturing equipment and technologies, featuring high-quality technical information and networking opportunities. Register at www.smta.org/smtai/

electronicAsia
13-16 October 2018
Hong Kong, China
Co-located with the Hong Kong Electronics Fair, this is a premier sourcing event for components, assemblies, electronics production, display and solar photovoltaic technologies. Register at www.electronicasia.hktdc.com

EDI CON USA
17-18 October 2018
California, USA
Brings together RF, microwave, EMC/EMI and high-speed digital design engineers and system integrators for networking, product demonstrations, training and learning opportunities. Register at www.ediconusa.com

GEMCON
7-9 November 2018
Stellenbosch
The 4th edition of the IEEE Global Electromagnetic Compatibility Conference, featuring special sessions on radio frequency interference, time domain metrology, and EMC in large installations. Register at www.gemcon2018.emcss.org

RAPDASA Conference
7-9 November 2018
Johannesburg
The Rapid Product Development Association of South Africa explores the role of additive manufacturing (3D printing) as a key driver for the fourth industrial revolution. Features a workshop, conference and exhibition. Register at www.rapdasa.org or email tebogor@resolutioncircle.co.za

electronica
13-16 November 2018
Munich, Germany
The world’s biggest electronics trade fair is expanding this year to occupy 17 halls, and will be co-located with SEMICON Europa featuring semiconductor manufacturing technology. Register at www.electronica.de
The future of energy-harvesting IoT applications

By Kristen Waldock, Arrow Electronics.

Energy harvesting offers significant advantages to the development and improvement of the Internet of Things (IoT). It is a critical component for creating an enhanced class of autonomous and mobile applications that can operate for much longer periods of time without the need for battery charges.

It also drives cost savings by significantly delaying battery replacement, which often costs more than the battery itself.

And energy harvesting is a key element in bringing intelligence to the edge and the IoT to a world of new places and applications. Analog Devices can help entrepreneurs with energy harvesting solutions through the Arrow Certification Program (visit https://www.arrow.com/en/indiegogo).

Enabling power at the node

To begin, let’s explore the setup of an energy harvesting system. First, an energy harvesting transducer converts ambient energy to harvested power. Then, a power management unit, or PMU, converts that harvested power into usable power. The energy storage is the third pillar in the energy harvesting power generation design. Storage is used as an energy buffer to collect energy for the power requirements of the sensor node including sensing, data processing and radio transmission.

In order to most effectively design a self-powered system, it is best to start with an estimate of how much power can be harvested from the available energy. In the case of photovoltaic systems, this is the light energy available. If using a thermoelectric harvester, a measurement of the temperature gradient that can be developed is needed, whereas in the vibration harvesting case, both the acceleration level and vibration frequency are needed to develop an effective self-powered system. A harvester type is selected based on the available ambient energy.

Next, the energy balance equation comes into play. The sensor node is designed with the energy budget in mind. Ultra low-power system design techniques are used to trim the power requirements of the sensor node. The sizing of the harvester and storage and the design of the sensor node tend to be an iterative process.

There are still some barriers to overcome when employing this new form of technology. Intermittent and low-level power sources can affect when and how much energy can be harvested. At the same time, the demand for more features at the node and the transmission of high volumes of data create a substantial drain on the available power.

Analog Devices offers ultra low-power solutions that remove these barriers, to help engineers design and create a new class of high-performance, low-power energy harvesting applications. The company has a suite of PMUs that offer highly efficient power conversion and highly optimised storage usage – all while consuming very little current when dormant.

The ADP5091 ultralow boost regulator (PMU) effectively harnesses and converts ‘indoor’ ambient light. Delivering efficient conversion (as low as 10 µW) with sub-µW losses, it also leverages open-circuit voltage sensing for optimised extraction.

Another such PMU is the LTC3109 ultralow voltage step-up converter and power manager. The LTC3109 is designed for applications with intermittent and low-level power sources, where the low input voltage requirement is critical, such as thermoelectric generators, thermopiles or small solar cells.

The LTC3311 is engineered to enable multimode harvesting from two sources, which allows for additional energy to be harvested in a particular environment. In addition, DC sources such as solar cells or thermoelectric generators can be paired with a high-voltage piezoelectric harvester to help maximise harvested energy.

Beyond harvesting: enabling intelligence at the node

Currently, the industry is experiencing a paradigm shift in edge sensor devices: low-power edge computing devices are advancing faster than cloud devices with the capability to bring intelligence as well as connectivity to the edge. As a result, data collected from multiple inputs can be fused into a single processor. For example, an outdoor air quality monitoring system could have multiple gas sensors and particulate matter sensors deployed in a common sensor node.

The advantages to leveraging intelligent edge nodes are significant. First, with intelligent filtering and decision making at the edge, less power is used because there’s little need for power-intensive data transmission to the cloud. There’s also reduced latency. When information is processed at the node, it can produce meaningful information sooner than sending large amounts of data to the cloud where more time is required to sort, analyse and deliver results.

Smart city applications

By reducing the need for battery maintenance and replacement, energy harvesting can help bring intelligent sensing to remote or hard-to-access locations within municipal infrastructures. For example, guardrails can be equipped with ADXL372 sensors that can detect an impact. That information can be processed locally and then communicated to an aggregator to alert first responders. This can bring needed help sooner and perhaps save more lives.

Additionally, with energy harvesting technology, multiple sensors and processors can be deployed over miles of road without requiring frequent and costly battery maintenance.

Utility metering is another area where intelligent nodes can play an advantageous role. Using a mesh network equipped with ultra low-power radio equipped meters, a single truck can gather data from the whole network of meters simply by passing by one. This can greatly reduce the man-hours needed for gathering billing information.

Smart factory applications

Ultra low-power sensing can also deliver benefits for industrial condition monitoring. Combining the ADXL357 ultra low-noise accelerometer with the ADuCM3029 for edge node processing, processes vibration data via an onboard FFT to aid in preventive maintenance and detect warning signs. This information can help plant and factory personnel take early corrective action to avert failures and costly downtime.

While cloud computing gets much of the focus in IoT, an increasing number of entrepreneurs and product developers are recognising the power and value of gathering and processing information at the edge. It is important to remember, however, that ubiquitous sensing in data-rich environments is only possible when the cost to maintain these sensing solutions is low compared to the value of the resulting data. Central to that is energy harvesting and management.

Analog Devices’ ultra low-power microcontroller and sensing portfolio enables efficient processing at the node, which in turn allows for more sensing systems to be self-powered. By employing self-powered sensor nodes in these environments, it is possible to achieve a low total cost of ownership solution, making sensing possible in areas previously considered impractical and ultimately solving challenges that couldn’t be solved before.

For more information contact Conrad Coetzee, Altron Arrow, +27 11 923 9600, ccoetzee@arrow.altech.co.za.
The 4th edition of the IEEE Global Electromagnetic Compatibility Conference (GEMCCON), is coming to Stellenbosch in the Cape Winelands of South Africa.

The conference will cover many topics in EMC, including special sessions on:

- Radio frequency interference.
- Time domain metrology.
- EMC in large installations.

Invited speakers

**Keith Armstrong**, Cherry Clough Consultants, United Kingdom - Techniques and Measures to Manage Functional Safety and Other Risks with Regard to Electromagnetic Disturbances.

**Sarel van der Merwe**, ITC Services, SA - A Brief History of EMC in South Africa.

**Frank Leferink**, University of Twente, Netherlands - Risk Based vs Rule Based EMC in Large Installations.

**Ferran Silva**, Universitat Politècnica de Catalunya, Spain - Time Domain Measurement Methods in EMC.

**Paul van der Merwe**, MESA Solutions, SA - EMI Measurements on Renewable Energy Plants.
The fields of aviation and aesthetic medicine could hardly be further apart, but one pioneering doctor hasn’t let that stop him. Dr Reza, one of South Africa’s most successful cosmetic surgeons, has designed and patented an aeroplane that is the first of its kind in the world.

Dubbed the Pegasus Vertical Business Jet (VBJ1), the aircraft aims to combine the best features of a helicopter and a business jet. In fact it would be the first ever civilian business jet with vertical takeoff capability ever made, targeting clientele such as government operations, companies, VIPs, medical evacuation, anti-poaching, offshore and resource development, as well as A-list business executives, politicians and celebrities.

“The idea started as a spark of inspiration at some point, and over time I researched each aspect of it to make sure I wasn’t wasting my time,” Reza explains. “This involved working with engineers to do feasibility studies, as well as market research and financial modelling. As we kept finding positive answers we continued going forward in the process step by step.”

According to Reza, what makes the VBJ1 special is its combination of the efficiency and convenience of a helicopter, with the speed, safety and range of a business jet. “In fact it boasts more range than a similar sized business jet,” he says. “It is able to take off vertically like a helicopter from any helipad (subject to similar conditions such as safe surrounding area), and then transition into jet mode and fly at 800 km/h for 6.5 hours. If taking off from the US this is enough range to cover the whole continent.”

For now the engineering side of the project is being handled on a consulting basis, but it is planned to bring engineers in-house to work full time as from this November. Needless to say it involves a multi-disciplinary engineering effort between experts in their respective fields, but Reza is confident that South Africa has the engineers to take on the challenge. “We definitely have the engineering talent in SA to pull this off. We might need some outside advice on control systems and automation, but otherwise we have everybody here,” he enthuses.

At this stage some simulations have been performed, and Reza explains that the reason a project like this is affordable is because nowadays most of the development can be done on a computer using computational fluid dynamics (CFD) which acts like a virtual wind tunnel. In this way Pegasus Universal Aerospace can be confident that by the time it builds a full-scale model, it will be good enough for flight testing and even to sell on as an initial sales model.

Funding is currently being secured for the VBJ1, and if it were secured immediately the company would expect to be able to have a prototype built and doing flight testing within three years, and delivering to customers within five years.

“Because we have a CIPC approved prospectus and we’re a public company we are allowed to advertise to anyone in the public space, so we’re looking at the financing side as a kind of crowd funding effort which is another novel side of the company. Anyone can get involved for a R2000 share by following the links on our website, and they can also follow our progress on Instagram @pegasus ua,” Reza says.

Unfortunately, DTI funding is not a likely avenue, as Reza explains that this would only be available later in a project. “What they want is technology readiness level 3 to 4 and above, which is prototype stage. In the aviation sector this doesn’t really help us, because by the time you have a prototype you can already start taking customer deposits because they can see the plane fly,” he explains.

Although he doesn’t rule out the possibility of selling Pegasus’ patents to a large overseas aircraft manufacturer, Reza says the company would ideally like to take the project on itself and keep it as an SA-made project. “As far as possible we would like to do all manufacturing in SA. Because we have a bilateral agreement with the US (which is 50% of the business jet market) we should be able to manufacture here and export to the whole world,” he concludes.

For more information contact Pegasus Universal Aerospace, +27 11 483 0881, info@pegasusua.com, www.pegasusua.com
Additive Manufacturing as a key driver of the 4th industrial revolution

RAPDASA (Rapid Product Development Association of South Africa) is a non-profit organisation that strives to be the official platform for rapid product development in South Africa. We connect leading innovators, entrepreneurs, industry partners and academics through various community engaging events.

RAPDASA 2018 provides an excellent opportunity for local industry to participate in the event and introduce the South African manufacturing sector to the latest developments in 3D printing.

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EMC conference programme announced

The local organising committee for the 2018 IEEE 4th Global Electromagnetic Compatibility Conference (GEMCon) – to be held in Stellenbosch from 7 to 9 November – has released the official programme for the show, accessible at https://drive.google.com/uc?id=1o2PEdJy3dKexZ4LX-N1v48_vmFrF99GK.

EMC short courses will be held in the week leading up to GEMCon, from 31 October to 6 November 2018 – more information is available at EMC_Short_Course. The conference will cover many topics in EMC, including special sessions on radio frequency interference, time domain metrology, and EMC in large installations. A panel session will also be held to discuss EMC standards and education.

Invited speakers include the following:
- Keith Armstrong, Cherry Clough Consultants, Stafford, United Kingdom – Techniques and Measures to Manage Functional Safety and Other Risks with Regard to Electromagnetic Disturbances. Keith will present a tutorial session later in the conference on this topic as well.
- Sarel van der Merwe, Interference Testing and Consultancy Services, Pretoria, South Africa – A Brief History of EMC in South Africa.
- Frank Leferink, University of Twente, Enschede, the Netherlands – Risk Based vs Rule Based Electromagnetic Compatibility in Large Installations.
- Paul van der Merwe, MESA Solutions, Stellenbosch, South Africa – Electromagnetic Interference Measurements on Renewable Energy Plants.
- Two workshops will be held during the conference as well; by Wurth Elektronik – Electrical Fast Transient Bursts and Surges; and EDA Technologies – Getting It Right the First Time. The committee also urged attendees to make use of the discounted group registration rates and IEEE membership rates being offered. Groups of four or more paid registrations from one company/organisation will receive a 5% discount on fees while groups of eight or more will receive a 10% discount. Discounts are also available for IEEE and EMC Society members. More details are available at www.gemcon2018.emcss.org.

For information about day tours or pre- and post-conference tours, readers can contact anelja@activecapture.co.za or visit the Stellenbosch Tourism website http://www.stellenbosch.travel/ for ideas on popular tourist activities in Stellenbosch.

For more information contact info@gemcon.emcss.org, www.gemcon2018.emcss.org.

CSIR camera to be launched into space

A CSIR-developed ‘K-line’ camera will be the first in the world to be launched into space on a nanosatellite.

The camera, which was featured at the Africa Aerospace and Defence 2018 exhibition, will serve as an optical payload on South Africa’s ZA-CUBE-2 to be launched into orbit in the coming months.

The K-line camera was designed by the CSIR to detect forest fires from space by detecting traces of potassium radiated from burning vegetation. The eventual goal is to establish a constellation of low-cost satellites that will produce data with a high spatial and temporal resolution for a large variety of applications.

The optical payload features a medium-resolution, near-infrared, potassium-sensing imager. Data from the camera will be fed into the CSIR-developed Advanced Fire Information System that provides near real-time warnings and updates on fires to clients around the globe. The envisaged nanosatellite constellation will improve the revisit time as the size of the constellation increases and with improved spatial resolution, as a result of refinements in commercial camera detector technology.

The K-line concept makes use of commercial, off-the-shelf components, such as camera modules, lenses and filters, which are space-qualified through processes and procedures developed at the CSIR.

For more information contact David Mandaha, CSIR, +27 12 841 3654, dmandaha@csir.co.za.

Norwegian PCB broker opens SA office

Elmatica, a printed circuit board (PCB) broker based in Norway, has established an office in South Africa to support growing demand in the country. The company says it has been an active partner in dozens of new South African projects over the last year, and experienced a 245% sales increase in 2017 compared with the previous year.

According to Elmatica’s CEO, Didrik Bech, the move also comes in response to feedback from SA customers that they would appreciate a firmer presence in relation to technical support. “This has strengthened our decision towards immediately establishing a temporary department here,” he says. “We have experienced that our concept of total transparency as to what we do, combined with knowledge sharing in regard to elements such as design, optimisation and compliance, is something our South African partners appreciate.”

When asked by its customers to analyse challenges on PCBs from other suppliers, Bech says Elmatica was surprised to find examples of non-existent certificates of compliance, no information about the factory of origin or adjustment of the factory between deliveries, and unclear marking, which results in poor traceability. “For Elmatica, full transparency is important, however Elmatica has experienced that this is not something everyone expects.

Some of our customers in South Africa are not used to suppliers providing this,” says Bech. Mikael Jansson, one of the company’s Swedish country managers, has relocated from Stockholm to South Africa to head up operations here, and the company further plans to establish a permanent and dedicated team in the country at some point in the future.

For more information contact Guro Krossen, Elmatica, +47 4819 3838, guro.krossen@elmatica.com.

Mikael Jansson.
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Top 10 development boards of 2018

At Altron Arrow, we strive to improve the time-to-market for all our growing customers’ projects by introducing many development kits designed for each specific vertical in the electronics industry, to properly evaluate each technology and its applicability.

In order to support the most innovative year yet in 2018, especially with the increasing demand in the IoT sector, here (in no particular order) are our top ten recommended development boards and kits:

**Microchip ATSAMA5D27-SOM1-EK1**
The ATSAMA5D27-SOM1-EK1 is a fast prototyping and evaluation kit for the SAMASD27 system-on-module (SoM) that integrates the basic components for an MPU-based system. The kit comprises a baseboard with a soldered ATSAMA5D27-SOM1 module, which features a 500 MHz core with 128 MB DRAM and 8 MB Flash memory. It also boasts a power management IC and 10/100 Mbps Ethernet interface for network communication.

The board packs a wide range of peripherals, including 128 GPIO pins for general use, as well as a user interface and expansion options, including two mikroBUS click interface headers to support MikroElektronika click boards and one PMOD interface. Microchip offers the Linux distribution and software packages which allow you to easily get started with your development.

**Samsung ARTIK 710 development kit**
Samsung has had its claim to fame in many industries and applications all over the world, and the ARTIK platform is one of its latest proving grounds. With the sole purpose of ‘bringing hardware modules and cloud services together’, Samsung has created an ecosystem of tools and partners to assist developers in achieving fast time-to-market for their Internet of Things designs.

The ARTIK 710 Developer Kit is one of several different module kits presented in the ARTIK Family, where the ARTIK 710 SoM specifically boasts an 8-core, 64-bit, ARM Cortex A-53 processor with built in Wi-Fi, Bluetooth and ZigBee for nearly any large, high-end gateway that also requires local processing and analytics or multimedia applications.

This development kit also has an ARM MALI GPU for multimedia, 1 GB RAM and 4 GB of eMMC memory, and an Ubuntu Linux package with multimedia connectivity. Best of all, it has enterprise-class security with hardware secure element on board. If you are designing factory automation, smart home, or multimedia applications, the ARTIK 710 development kit is certainly worth considering.

**Sierra Wireless MangOH Red**
Sierra Wireless boasts of having the smallest cellular development platform for IoT to date. The MangOH Red is a low-power development kit aimed at IoT applications that can run for 10 years on a battery in order to send your sensor data to the cloud.

Embedding the WP module from Sierra Wireless, which has scalability from 3G to 4G and LTE-M / NB-IoT, it also features an application core that runs Linux for a developer to add their own code onto the system. Along with the kit, Sierra Wireless also includes its Smart SIM (up to 100 MB free data, depending on region) but can also be used with any commercially available SIM, as well as its AirVantage IoT platform to create, deploy and manage solutions in the cloud.
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www.microchip.com/effortless
Specifically looking at the size constraints in certain applications, the MangOH Red offers a cost-effective development platform ideal for rapidly building proof-of-concepts.

**Cherry Blossom**

It has become a lot easier to get hold of prototyping boards in South Africa than in previous years, but while Raspberry Pis are easy to get hold of, sadly there are still import taxes and shipping costs to be taken into consideration. These factors push the price up considerably.

Altron Arrow has created new options for makers by producing the locally made Cherry Blossom, based on the AM335x reference design from Texas Instruments which is based on the Beaglebone Black. This home-grown alternative is available for a much more affordable price.

“The locally designed, produced and supported Cherry Blossom eliminates most supply and support issues that currently exist on Beaglebone Black today,” says Altron Arrow. “It also enables the developer to quickly and effectively use the processing power of a high-end processor without the hardware complexity normally associated with this type of design.”

**ST SensorTile Development Kit**

Built with the intention to prove low-power IoT application capability, the SensorTile Development Kit by STMicroelectronics offers loads of added capabilities. For the true developer, this kit supports the expansion of the SensorTile’s capabilities as an STM32-based module.

ST provides the software and firmware libraries as well as tools for evaluation of the sensors’ performance, including a dedicated mobile app for real-time sensor feedback. The cradle expansion board in the kit features audio DAC, USB port, STM32 Nucleo, Arduino UNO R3 and SWD connection capabilities. And for the prototyping application builder, this kit allows you to see real live MEMS and motion data on a mobile device less than 5 minutes after opening the box.

**Analog Devices ADALM-PLUTO**

Analog Devices has released several Active Learning Modules (ALMs) to help developers and educators alike, but the ADALM-PLUTO is arguably the most compelling. Also referred to as PlutoSDR, or Pluto Software Defined Radio, this development kit allows users to bridge the gap between RF theory and RF practice, and use industry grade hardware to learn and develop their own SDR platforms.

This active learning module can generate or acquire analog signals ranging from 325 MHz to 3800 MHz. Regardless of RF application, the ADALM-PLUTO is a very valuable asset.

**Raspberry Pi 3 Model B**

The Raspberry Pi 3 Model B accounts for more than half of the entire inventory that the Raspberry Pi Foundation has ever sold, and is one of the pillars of the DIY and developer worlds. It has become an intrinsic tool whether you are a seasoned developer pro or a novice tinkerer, and is a great way to create your own custom piece of electronics magic.

Incredible accessories such as the AIY Voice Kit and the PiCade have helped the Raspberry Pi 3 find its way into the hearts of consumers and tinkerers, but the Pi remains a fantastic development tool for a variety of applications. Raspberry Pi released a new iteration called the RP3B+, but it is still only in limited release, likely under allocation, and may prove hard to get until later this year, again making the Raspberry Pi 3 Model B one of the top development boards of 2018.

**Digi CC6UL SBC**

The Digi ConnectCore 6UL SBC delivers the ultimate connected off-the-shelf NXP i.MX6UL single board computer with complete capabilities and unparalleled design flexibility. Its unique pre-certified wireless...
connectivity options offer 802.11a/b/g/n/ac Wi-Fi and Bluetooth 4.2, including Bluetooth Low Energy. Out-of-box cellular integration options using the pre-certified Digi XBee cellular modem or third-party PCI Express mini card modem allow you to integrate cellular connectivity without the usual cost and complexity.

Digi’s complete Linux support includes the built-in Digi TrustFence device security framework with support for secure boot, encrypted file systems, protected ports and more.

**NXP i.MX8 Development Kit**

The i.MX family of application processors from NXP is one of the most successful 32-bit and 64-bit processor series to date, regardless of application. Across the stack of different application processors, the newest sub-series is the i.MX8, which is the most powerful of the five series currently available and is geared for multimedia applications.

To help developers access the power of the i.MX8M specifically, NXP created the i.MX8M EVK to enable quick familiarity with the product and i.MX8 processor before investing heavily in a chip-down design. The i.MX8M processor family is based on the ARM Cortex-A53 and Cortex-M4 for industry-leading audio, voice and video processing.

Whether you’re developing the next high-end home multimedia, an industrial automation application, or anything in between, the i.MX8M EVK is one of the best places to start.

**Arduino Uno**

The Arduino Uno is commonly associated with makers and electronics education, but it’s also become a near standard for relevant industry hardware development. If a component is compatible with a microcontroller, it has likely found a place on an Arduino-compatible development shield. If you are developing a simple sensing application, the next IoT solution, a data acquisition device, or even a robot, an Arduino Uno could well be the best place to start.

Rather than build a single solution for a handful of problems, Arduino has built an ecosystem around the Uno that nearly any product can be compatible with. Yes, it may not be the ultimate solution for an embedded chip-down design, but as a place to get started, the Arduino Uno is fantastic.

It seems as though the industry has finally caught on to the Arduino revolution and the sheer quantity and diversity of Arduino Uno shields still coming onto the market today gives everyone access to thousands of development-ready discrete components right out of the gate and cements the Arduino Uno on our list for that reason.

For more information contact Renaldo Fibiger, Altron Arrow, +27 11 923 9600, rfibiger@arrow.altech.co.za.
How to make sure your designs are properly grounded

By Lee Ritchey, Speeding Edge.

In the fields of electrical and electronic engineering the word ground is used to describe parts of systems or PCBs (printed circuit boards). The reason for using this word is to denote some part of a system or structure that is ‘neutral’ or zero potential.

To the newcomer to the field it can be confusing trying to understand how so many things can be called by the same name.

Recently, there has been a lively discussion on one of the open technical discussion venues about the various kinds of grounds and methods for connecting them together. The kinds of grounds mentioned in the discussion include:

- Digital logic ground.
- Analog ground.
- Chassis ground.
- Safety ground.
- Earth ground.

Methods proposed for connecting these various ‘grounds’ cover a broad range of options including:

- Connecting them at only one point
- Cutting the ground plane under a mixed-signal component
- Connecting them with capacitors
- Segmenting the ground plane in a PCB such that there is only a narrow connection at one place between the analog and digital sides of the design
- Separating the analog and digital grounds

These seemingly conflicting methods for dealing with ground can be a bit confusing. Some clarification about what ground is would be a good place to start. Once this has been established, dealing with the above points will become clearer.

The first question that one might ask is: How can all of the items above be ground? The answer to the question is very straightforward. None of them are. Ground is the one place in an electronic system that is a reference point from which voltages will be measured.

What are these other things that are being called ground? Below is a short explanation of them.

**Digital logic ground** is the ‘reference’ terminal of a digital logic power supply. For most digital logic systems it is the negative terminal of the logic power supply. It is usually designated with the symbol in Figure 1.

**Analog ground** is the reference terminal of the supply that powers an analog circuit. It is where one side of an analog signal source is tied. The other side of the signal source is tied to the analog input or output. Analog ground is usually designated with the symbol in Figure 2.

**Chassis ground** is the name given to the connection of the safety wire from the AC mains to the case of a product. It gets this name because the case of a product is often called the chassis. This wire is usually the green wire in an extension cord, in the three-wire mains connecting to a product or the third pin on an AC connector (the round one).

If one traces this green wire through a building it will finally connect to a copper stake driven into the earth. The purpose of this connection is to protect the operator of the product in the event that one of the mains wires accidentally makes a connection to the case or chassis of the product. So, it is a safety-only function.

Sometimes, EMI gurus erroneously refer to this ‘chassis ground’ as a place that has some function in the containment of EMI. This statement never has or never will be based on fact because it has no role in this part of an electronic design. Chassis ground is usually represented by the symbol in Figure 3.

**Safety ground** is another name used to describe chassis ground.

**Earth ground** is another name used for the safety ground.

This leads to the question of how to connect all of these ‘ground’ circuits together or whether they should be tied together in the first place and, if so, why. This question usually arises for one of two reasons: either the discussion centres on how to protect sensitive analog signals from outside noise sources or how to contain EMI.

### Handling analog signals

Taking the analog signal problem first, the engineering objective is to protect the analog signal from sources of outside noise that could degrade signal performance. Figure 4 (page 16) is an example of a typical mixed analog and digital integrated circuit showing the two sides of the circuit and both an analog ground pin and a digital ground pin on the IC. It is representative of most of the problems that are of concern when designing mixed-signal electronics.

Highlighted in red is what is called the analog decision making loop. This is the circuit that must be protected from outside noise sources in order for the circuit to perform properly. First, the reason there is an analog ‘ground’ pin and a digital ‘ground’ pin on the IC needs to be understood in order to arrive at a proper PCB design.

The digital side of this mixed-signal IC has transient currents flowing through its ground lead that are associated with the internal digital processing of the analog signal as well as for driving the output transmission lines. If this were an 8-bit analog-to-digital converter (ADC) in a logic system with 2.5 V logic levels, the current transients flowing in this path could be as large as 200 mA. This ΔI or rapidly changing current flowing through the ground lead inductance can develop voltage transients as large as 100 mV between ground on the PCB and ground on the die. This is an acceptable transient as far as the logic circuit is concerned.

If the circuit under discussion is a 12-bit...
ADC, the analog side of the circuit is tasked with resolving voltage differences of 0.5 mV out of a total signal swing of 2 V. If there is only one ground path out of the IC, the 100 mV digital switching transient would be superimposed on the analog signal, rendering the circuit useless. This is the reason that the analog side of the IC has a separate ground path out of the package.

Figure 4 is typical of circuits that have application notes or other guidelines that specify having an analog ground plane and a digital ground plane or splitting the ground plane under the component. Doing either of these things detracts from the actual engineering problem, which is protecting the analog signal loop from external noise. (Note: The direction of the current flow arrow in Figure 4 is the flow of the electrons which make up the current flow.)

If a designer chooses to split the ground plane under the component an unwanted side effect is created. This side effect is that signals that must cross from one side of the cut to the other do not have a path for their return current which can lead to signal integrity or EMI problems.

How does noise enter the analog signal loop? There are two ways this can happen. The first is by coupling into either side of the loop by capacitive coupling or magnetic coupling from an adjacent signal travelling too close. We usually call this crosstalk. Crosstalk can be generated by the electric component of the electromagnetic (EM) field (called capacitive crosstalk) or the magnetic component of the EM field (called inductive crosstalk). Which form exists depends on the configuration of the two conductors that are next to each other.

The second case of noise is by allowing the ‘ground’ side of the analog path to be shared by another signal. This usually happens when the connection between the analog source and the analog ‘ground’ pin of the device is made to the ground plane some distance away from the part.

In most cases, both of these problems are addressed by using a shielded cable that has its two connections made at the terminals of the IC, one connection being the shield that connects to the ‘analog ground’ terminal of the device and the centre conductor that connects to the input side of the analog device.

Examples of this type of circuit are the connections between amplifier stages in a radio; and connections between amplifier stages in a stereo system.

Handling EMI
Sometimes I find it useful to quote a fellow EMI engineer, Bruce Archambeaut, when the subject of ground comes up in relation to EMI: “Ground is a place where one sows seeds in hope of reaping a bumper crop of tomatoes come summertime.”

The reason that both Bruce and I make this statement is that using the word ‘ground’ in discussions about EMI has no value. In fact, it distracts us from the task at hand, which is containing RF energy that might escape our products and create an EMI failure.

Said another way, none of the things listed as grounds at the beginning of this article have any bearing on EMI containment. The items that are important to EMI containment are shields on cables and Faraday cages surrounding the products, but that is the subject of another article.

What is a Faraday cage?

Throughout this article I have used the term Faraday cage when discussing EMI issues. It might be helpful to explain what a Faraday cage is and what it does.

A Faraday cage is a metallic enclosure it which an electronic product such as a computer is housed. Its purpose is to contain energy that has escaped from the product in the form of electromagnetic waves and could create an EMI problem if allowed to find its way to a nearby product. An example of a Faraday cage is the enclosure that houses a router or switch.

The Faraday cage is often made up of the side panels of a card cage, the backplane and the faceplates of the plug-in modules. This is probably why some call it ‘chassis ground’ – it just so happens that part of the Faraday cage is made up of some or all of the material that also forms the chassis of the product.

When signals and power cables penetrate the Faraday cage the possibility of EMI escaping on those cables is created. In order to prevent this, shields are placed around cables that contain frequencies that are in the EMI frequency band. So, shields are extensions of the Faraday cage as long as they are attached with a very low-impedance connection.

For wires that cannot be shielded, such as power cables and mouse connections, some form of RF filtering must be placed on those wires as they exit the Faraday cage to prevent them from causing an EMI problem. An example of this is the ferrite toroids that are placed on power cords as they exit a box.

Figure 5 is the symbol I have created to indicate where a connection is to be made to the Faraday cage.

Summarising
There is a very large body of misinformation in print in the form of application notes and guidelines with respect to what ground is and how to use it. Some of the applications notes I refer to indicate that the ground plane should be segmented into an analog side and a digital side, and the two sides connected at only one point. Others suggest that there be two discretely different planes, one analog and the other digital. How these two planes are to be connected varies with each application note.

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Prototyping board for IoT projects

RS Components has announced availability of the latest version of the Arduino Yún Linux-based board, delivering advanced network connections for IoT (Internet of Things) projects. The board targets use by design engineers, hobbyists and in particular those in educational establishments, as the platform, including hardware, software and documentation, is open source and freely available to all.

The Arduino Yún rev. 2 enables easy connection to Wi-Fi or to a wired network via the Yún Web Panel, plus a dedicated sketch called YunFirstConfig. The web panel enables easy management of preferences and the uploading of the sketch. The board also uses the Bridge Library, which greatly extends its capabilities based on the power of its Linux processor.

A key feature of the board is its dual-processor offering, which includes an AVR Arduino ATmega25U4 microcontroller running at 16 MHz, and the MIPS 24K-based Atheros 9331 processor, running at 400 MHz. Interfacing to 64 MB DDR2 RAM and 16 MB of flash memory, this second processor runs both Linux and the OpenWRT wireless software stack, which enables connection to Wi-Fi and 10/100 Mbps Ethernet networks. In addition, the board makes it possible to call programs or custom scripts on the Linux system via the Yún Web Panel, plus a dedicated sketch called YunFirstConfig. The web panel enables easy management of preferences and the uploading of the sketch.

For more information contact RS Components, +27 11 691 9300, sales.za@rs-components.com.

Continued from page 16

My experience with these notes is that they are treating a problem that has not been proven to exist. The worst thing about such notes is that they do not address the actual problem that needs to be solved. That problem is protecting the decision-making loop from outside noise sources.

One criterion that should be applied to any of these rules is, is whether there is proof that a real problem exists, that the proposed solution solves the problem, and that the proposed solution does not create a new problem such as an EMI problem.

If these three questions do not have valid answers, chances are the solution is simply made up and may well create a problem, such as an EMI problem, that might otherwise not exist. Many EMI problems I have solved have had their origins in split ground planes. The most common place I saw this was small disk drives in the late 1990s and early 2000s.

Electronic systems have networks we call ground that must be understood to have both AC and DC voltage gradients in them as a result of currents that flow, so they cannot be considered equipotential with magic 'ground'.

A PCB does not need an analog ground plane and a digital ground plane as that does not guarantee proper operation of the analog section of the product. Instead, it should have only one ground plane that should be continuous throughout the PCB, followed by careful design of the decision making loop.

Splitting a ground plane destroys its integrity as an ultra-low-impedance connection between all of the components in a circuit and should never be done. I have asked more than 9000 students in my signal integrity classes if they have examples where splitting a ground plane improved performance. To date, none have been able to produce one, nor have any of my engineering colleagues.

In those rare cases where the ground plane must be split for high-voltage isolation purposes, signals that must cross the split will need to do so in such a manner that the need for a continuous return path is not required. Two ways this is done is with transformer coupling, which does not work for signals that have a DC component, or by using optical isolators.

The thing called 'chassis ground' is a safety-only feature and has no role in the electronic function of the circuits or their EMI performance. It is not necessary to connect logic ground to the chassis ground and, in some instances, it is not allowed. An example of this is a system that contains an RS-232 interface that does not allow connection of logic or signal ground to the case which is connected to the earth ground.

Perhaps one of the toughest challenges a design engineer faces is sorting through all of the misinformation in print and online that is inaccurate or, often, simply made up by someone who has not done the necessary research to ensure the advice given is technically valid.

Hopefully, this article can serve as a good starting point for demystifying the things that are erroneously referred to as 'ground' in the PCB design industry.

For more information contact EDA Technologies, +27 12 665 0375, sales@edatech.co.za.

Bluetooth 5.0 evaluation kit

The Cypress CYW920735Q60EVB-01 evaluation kit enables the evaluation and development of Bluetooth applications using the CYW20735B1, a dual-mode (basic rate and Bluetooth Low Energy) Bluetooth 5.0 wireless MCU device.

The CYW20735 includes an internal power amplifier that provides 10 dBm output power to greatly extend range. It includes several on-chip peripherals including hardware key scanner, PWMs, ADC and the likes. It also includes an analog microphone interface that provides a low-cost solution for voice-enabled remotes as well as Internet of Things (IoT) gadgets and toys.

The CYW20735B1 device and evaluation kit are both supported in WICED Studio 6.2 (or later). The kit features Arduino compatible headers for hardware expansion; a 9-axis motion sensor (3D digital linear acceleration sensor, 3D digital angular rate sensor and 3D digital magnetic sensor) and a thermostat; user switches and LEDs; and USB connector for power, programming and USB-UART bridge. It comes with a USB 2.0 Type-A to Micro-8 cable and a quick start guide.

For more information contact Dirk Venter, Altron Arrow, +27 11 923 9600, dventer@arrow.altech.co.za.
Communication controller for smart homes

Qorvo introduced a new system in package (SiP) that enables dynamic, simultaneous support for Zigbee 3.0, Green Power, Thread and Bluetooth Low Energy (BLE).

It integrates Qorvo power amplifier technology providing 20 dBm output, which is especially important for US smart home applications.

The QPG6095M is a fully integrated SiP for ultra-low power wireless communications. It is BLE 5.0 and Zigbee 3.0 platform and product certified, and offers Green Power energy efficiency. By extending range and battery life, it delivers optimised connectivity throughout the home, eliminating the need for complex mesh architectures and unnecessary battery consumption in intermediate devices.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za.

In-circuit debugger/programmer

The MPLAB Snap in-circuit debugger/programmer provides affordable, fast and easy debugging and programming of most of Microchip Technology’s PIC, AVR and SAM Flash microcontrollers (MCUs) and dsPIC digital signal controllers (DSCs), using the powerful graphical user interface of MPLAB X integrated development environment (IDE), version 5.05 and later.

The device connects to a computer via high-speed USB 2.0 interface and can be connected to the target via an 8-pin single in-line (SIL) connector. The connector uses two device I/O pins and the reset line to implement in-circuit debugging and in-circuit serial programming (ICSP) capability. MPLAB Snap has all the speed and features entry-level users need to quickly debug their prototype.

The MPLAB Snap programs quickly, and features a powerful 32-bit 300 MHz SAM E70 Arm Cortex-M7 based MCU for quicker debug iterations. Along with its support for a wide target voltage, the debugger/programmer supports advanced interfaces such as 4-wire JTAG and serial wire debug with streaming data gateway. It is also backward compatible for demo boards, headers and target systems using 2-wire JTAG and ICSP.

For more information contact Dirk Venter, Altron Arrow, +27 11 923 9600, dventer@arrow.altech.co.za.
Saki self-programming software accelerates 3D inspection and M2M communication

By Satoshi Otake and Yasuo Watabe, Saki Corporation.

Imagine if a 3D automated optical inspection (AOI) or solder paste inspection (SPI) system could be self-programming, require only a few clicks, and take less than 10 minutes to program.

A system that could program inspection data with the same standards and criteria, such as naming, orientation, parameters and IPC standard criteria for AOI and SPI systems, without the need for programmers.

Where you can use just one program to deploy all your inspection systems – SPI, pre-reflow and post-reflow – with just one click. And imagine that businesses primarily based on new product introduction, with customers requesting high-mix/low-volume production with short delivery time, could generate an inspection program without first preparing a golden printed circuit board.

Software is vital

Although there are lots of requirements for inspection and measurement systems, it’s the software that gives you the edge. The software determines the process controls, data capture, measurement capabilities, operation, feedback, reports, and the basic usability of the platform. Software drives the communication in machine-to-machine (M2M) communication and is an enabler for the smart factory and Industry 4.0. Programming is one of the main, and actually one of the most important, functions of software. The ease or difficulty, accuracy, reliability, speed to program, flexibility, and training required can make or break the decision to purchase a particular system.

“Programming has long been a challenge for inspection companies,” said Yoshihiro Akiyama, chief engineer and co-founder of Saki Corporation. “Saki had a vision for self-programming software. At the time, it seemed like a faraway goal, but here we are, introducing Saki Self-Programming software. It only requires a few computer clicks and less than 10 minutes. The time, labour and cost savings to companies have proven significant.”

Saki Self-Programming is a seamless system that doesn’t require DFM (design for manufacturability) software. It combines technology that captures complete height and XY data and images while simultaneously scanning multiple fields of view (FOV). The ability to select from over 300 000 components from the golden library offers unlimited possibilities.

Saki Self-Programming (SSP) software, installed on its 3D AOI and 3D SPI systems, makes programming fast, easy, and doesn’t require any special programming skill or training. All that’s needed is the Gerber and Centroid CAD data. The software does the rest.

Features of the software include an optical character verification collection setting that shows thumbnails of the components, and an inspection preset setting which quickly and easily skips between different processes. The user gets IPC quality standard setting (Class 1,2,3) with one click.

“Saki Self-Programming is critical for M2M communication,” explained Sakie (Jodie) Akiyama, president and co-founder of Saki Corporation. “It’s part of Saki’s smart initiative. To really make smart and M2M work, we need smart machines, a smart factory and a smart company. The inspection and measurement hardware and technology are, of course, a given for Saki. Now, Saki Self-Programming is the first in the industry and not only automates programming, but also the calibration of the machine, diagnostics, maintenance, inspection, data collection and extensive reporting functions.

“Until now, the accuracy of the inspection process depended not just on the inspection system itself, but on the skill level, characteristics, abilities, and standardisation and procedures followed by the programmer. Saki Self-Programming eliminates the variables of the operator and procedures.”

Key features of Saki Self-Programming

A sampling of the software’s features to improve process quality and control, ensure a defect-free product, and enhance Industry 4.0/M2M communication are:

• A solder inspection algorithm with unique character verification collection setting that shows thumbnails of the components, and an inspection preset setting which quickly and easily skips between different processes. The user gets IPC quality standard setting (Class 1,2,3) with one click.

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Another step toward Industry 4.0

Absolute precision is required to provide the accurate data needed for M2M connections to be effective. Inspection equipment plays a role in the feedback from SPI to printer, feed forward from SPI to pick-and-place, and feedback from AOI to pick-and-place.

The idea of the smart factory is to maximise efficiencies and improve processes through automation and self-optimisation. An integral component is the ability to collect accurate data and use it for process improvement. Industry 4.0 promotes vendor-independent machine-to-machine communication. Saki Self-Programming software was built around the idea of machine independence in all aspects of its operation.

As part of the smart/M2M initiative, we have established relationships with many of the leading companies in the electronics assembly industry, especially pick-and-place and screen printer equipment manufacturers,” said Jodie Akiyama. “These collaborations are essential for moving M2M forward, as they significantly contribute to the production of high-quality products and result in a more highly efficient process.

“Saki was the first company to receive Panasonic APC-MF8 certification for all its 3D AOI and SPI systems. Other important industry partnerships include Fuji Machine Manufacturing’s Smart Factory with Nexim initiative that standardises the communication protocol between Saki’s SPI and AOI machines and Fuji’s component placement machines to create a manufacturing line that extends beyond the boundaries of corporations. The ASYS PULSE Community networks Saki automated inspection and measurement systems with electronic production equipment from other PULSE member companies.

“Saki takes a proactive approach to standardisation of the communication protocol and standards development. As yet, no one single standard has been adopted. For our systems to talk to all available systems internationally, Saki adheres to the standards set forth by the SMT equipment communication protocol standardisation subcommittee (JARA) as well as the Hermes Standard, which focuses on Industry 4.0.”

Smart factory and Industry 4.0 are now being incorporated throughout the manufacturing sector. Inspection equipment functions as the sentry, to ensure that devices are being assembled precisely and accurately, that the equipment is working optimally, and that the data is reliable. It helps ensure that the standards of excellence are maintained. M2M processes can only be as good as the equipment, systems and the software running them.

The assembly industry has been moving forward at a rapid pace to produce the latest high technology products quickly, efficiently, and most important, reliably. Saki Self-Programming software accelerates this effort.

For more information contact Electronic Industry Supplies, +27 11 824 1427, info@iafrica.com.
LIGH-T-YEARS AHEAD...
EMS trends in 2018 and beyond

By Christine Brindle, Omnigo.

Over the past few years the pace of change has been picking up and many manufacturers have been turning to technology solutions more and more. With that said, many trends were identified for the electronics manufacturing industry in 2018 and beyond – from the IoT (Internet of Things), data driven intelligence and supply chain optimisation, to Industry 4.0 and automation.

The first nine months of the year have passed and it has become more apparent that Industry 4.0 and automation have been the leading trends so far.

Industry 4.0 or smart manufacturing is where advanced manufacturing and information technology meet, and data is exchanged. Industry 4.0 includes cyber-physical systems, IoT, cloud computing and cognitive computing. It is all about connectivity and proactive integration. It is said that it can improve production processes, improve safety, better monitor, increase efficiency, collect data and provide an infrastructure secure enough to be used in security-sensitive industries.

Many firms are embracing this approach and are developing their own IoT platforms and hardware. Trial runs are being performed in manufacturing firms and adjustments made as the process continues. Other firms develop platforms specific to client requirements and monitor them on a continued basis. Industry 4.0 has paved the way for new advancements in manufacturing technology and has moved automation and digitisation into a new era. Production processes have been revolutionised.

Improved X-ray machines allow electronics manufacturing service (EMS) providers to ensure defects are detected beforehand, technical support can be provided to clients and quality, working products are released to the end user. New surface mount technology (SMT) equipment places components faster and more accurately. Selective soldering machines have also simplified the soldering process by closing the gap between hand and wave soldering, and newly, newer version reflow machines ensure that profiles are accurate and more consistent.

For electronics manufacturers automation is important, especially when it comes to quality and quantity. Not only does it improve efficiency in manufacturing facilities but it leads to an increase in productivity, reduces lead times and also leads to better quality products being provided to the end user. Automation allows for better control and consistency throughout the production process, and also allows for greater safety when it comes to employees - especially where they are exposed to hazardous and other dangerous elements.

It is however important to keep your operational goals in mind when considering automation and even Industry 4.0. Optimisation of automation performance and the Industry 4.0 elements will need to be a top priority as this will influence productivity and efficiency. One will have to focus on monitoring the automation processes, diagnosing problems and resolving them to ensure optimal use of these platforms.

In the end these trends will need to help you achieve your company’s goals in terms of reducing costs, increasing productivity, improving safety and expanding capabilities. Research will be key in determining the success of these trends when applied to your company, and also ensure that the correct automation processes and Industry 4.0 platforms are implemented.

The electronics manufacturing industry is evolving at a rapid pace with more companies leaning towards the full outsourcing of their products to full turnkey manufacturing services. More strategic partnerships are being formed, user interfaces are getting smarter and the demand for high-quality products is increasing daily. Industry 4.0 and automation might just be what is needed for EMSs to remain competitive.

We are quite intrigued to see what the remainder of 2018 will have in store for the electronics manufacturing industry and also what new trends and technological improvements will be unveiled, not only in terms of automation or Industry 4.0, but also new and unexplored fields.

For more information contact Christine Brindle, Omnigo, +27 12 803 8218, christinem@omnigo.co.za.

Enhanced vision processing for module parts

Fuji has developed a new function suitable for manufacturing module parts. Along with the spread of mobile devices and wearable devices, the demand for module parts used in these products has been increasing. As module parts are smaller, lighter and more advanced, parts composing those module parts follow the same trend as well.

There is a growing need to support these new parts and efficiently produce them at production sites. On the other hand, there are some problems to be solved. For example, when placing parts such as system in package (SiP) or wafer level chip size package (WLCSP) parts, the bump positions could not be detected correctly when vision processing.

To deal with this problem, Fuji has successfully developed a technology by improving the vision processing camera. It is now possible to acquire an image of bumps alone without reflecting the circuits of SiP and WLCSP. Furthermore, by combining units and functions that are effective for manufacturing module parts, including placement modules (M3IIIS), heads (H24A), a dipping unit, a nozzle with a slit, and vacuum backup, the company can offer solutions for high-quality placement of module parts to enhance productivity.

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- The WT soldering stations can be stacked on the WTHA 1 hot air station, or on each other, saving precious workbench space

High performance soldering pencil with easy tip change
- Similar to a cartridge system, with the WTP 90 you can easily switch out the heating element while the iron is hot, or simply change only the tip.

Advantages at a glance

High performance
- WT soldering stations
  - Up to 150 Watts power
  - User friendly, stackable units
  - Best in class – attractive price/performance ratio
  - Maximum versatility: backwards compatible with existing soldering tools
  - Comprehensive range of accessories
  - Featuring the high performance WTP 90 soldering pencil. Innovative and cost-effective with a tip that performs like a cartridge tip

ESD safe
- Can be trusted for professional use

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Beat the exchange rate blues with local manufacturing

By Chris Viveiros, Otto Wireless Solutions.

A key part of any purchaser’s job is to ensure that their place of employment remains competitive at all times, which leads to negotiation with suppliers in order to drive down purchase prices. It is not uncommon for companies to be attracted to the relatively low cost of imported, complete cable assemblies because, on the face of it, this always presents itself as an area where cost savings can be achieved. Add to this the relatively high cost of RF cable assemblies and, if managed correctly, it would seem that massive cost savings can be achieved. But does this perception hold true during times of a weakening Rand, or indeed at all?

The answer to this conundrum is more complicated than merely a quick, cursory glance at a Dollar price multiplied by an exchange rate. Firstly, one thing which catches out many less experienced companies is the import duty of 15% applicable to imported RF cable assemblies. So all of the input costs to the completed assembly, being the raw materials (RF connectors, heatshrink and cable), plus the labour content are all effectively increased by this duty. Secondly there is the added freight. Unless one has the luxury of catering for a 12 week component lead-time, air freight is usually selected, and this adds significant cost to cable assemblies, easily a further 20-30% onto the cost price.

All of the above costs are of course 100% linked to the exchange rate, meaning that during a period of a weakening Rand, as we experienced over August/September this year, the landed cost of any imported products begins to spiral upwards very quickly.

As a comparison, the input costs for locally manufactured assemblies carry some stark differences. Firstly, the duty on the imported connectors is 5%, not 15% as is the case for a complete, imported assembly. The physical RF cable itself still carries a 15% duty, and the goods themselves still have to be transported to South Africa, but this is normally done in bulk, via sea freight, which yields a far lower landed cost price for the materials versus air freight.

The labour content for the completed assembly is a local Rand input cost, unaffected by the exchange rate.

The complexity of the input costs can be summarised as follows: particularly when the Rand is weak, local pricing and relatively fast turnaround time are both hugely attractive to customers. This is why we continue to support the local market with locally manufactured cables. Not only do we feel strongly about preserving and growing local jobs, but when managed correctly, local manufacture can be a highly attractive source of supply for local companies.

Our operators are trained to IPC/WHMA-A-620, which is an international standard, ensuring that the quality of the work remains of a high standard regardless of the choice of connector (SMA, BNC, N-TPE, MCX, MMCCX, SMA and U-FL being the common choices).

We make use of semi-automated coaxial strippers, which ensures that consistency is maintained across multiple batches of assemblies, irrespective of whether a client has elected to use RG58, RG174, RG316, LMR195, LMR200, LMR400 or even 1,13 mm coaxial cable. In addition, as an ISO9001:2015 company, all our test and manufacturing equipment is calibrated regularly, ensuring that when customers require test certificates, these are provided with confidence in the accuracy of the information being presented.

For more information contact Otto Wireless Solutions, +27 11 791 1033, chris@otto.co.za.

Permalex blade system for Yamaha SMT printers

Transition Automation announced the availability of a newly designed Permalex assembly blade system for Yamaha SMT printers. The new design features a two-part assembly that enables users to purchase either the blade element or the blade and holder element separately. The company has also expanded the range of available sizes for this equipment platform in mm sizes 600, 560, 530, 440, 400, 350, 300 and 250.

The part number codes for this new design are as follows:

- PLX-YAM-DBL-D1-XX, (XX denotes the length required); Permalex assembly blade bonded to aluminium attachment bar.
- PLX-YAM-DBL-D2-XX; Holder assembly with paste retainers and thumb screws.

Transition Automation is maintaining stock levels of this mission critical item so that manufacturers can receive shipments within three days after receipt of order.

For more information contact Testeron, +27 11 704 3020, info@testeron.co.za.

Chris Viveiros, sales and marketing director, Otto Wireless Solutions.

The complexity of the input costs can be summarised as follows: particularly when the Rand is weak, local pricing and relatively fast turnaround time are both hugely attractive to
A guide to manual cleaning of PCB assemblies

By Bob Willis.

Manual cleaning of soldering residues can be inconsistent across the industry. After rework or second-stage assembly, manual cleaning is difficult to guarantee that all residues have been removed and no contamination exists that may impact function or reliability.

Most problems occur when a customer decides that the no-clean process he has been accepting is not as clean as he would like and stipulates cleaning. Often this change in the process is not well thought through. This results in failure or cosmetically disappointing board assemblies.

To achieve and demonstrate the best possible result, engineers and production staff need to work as a team to define a process where cleaning material and flux residues are compatible (Figure 1 shows a possible consequence of not doing so). Finally, to achieve consistency, training members of staff, engineers, contract assemblers and possibly customers to complete the operation is very important.

Design engineers should consider the circuit design, defining critical areas for special attention to maintain their electrical performance.

Ideally, disposable gloves should be worn when working with soldering and cleaning materials in a rework area. Handle the board by its edges wherever possible, even when using gloves. If cotton gloves are used to reduce perspiration, they should be changed regularly. Remember that ESD-control wrist straps are worn on the skin, not over gloves, so fit the strap before the gloves.

During rework or manual assembly, applying flux or paste to pads or terminations on components (particularly area array packages) is best practice as it will leave minimum residues to remove from the PCB. Flooding the board surface, using a brush or dispensing bottle to apply liquid flux or gel should be avoided during rework – it is just more mess to clean.

After rework, modification or second-stage assembly, cleaning may need to be considered or specifically required. Ideally a no-clean flux, gel or solder paste which has been tested on site should be used to avoid the need to clean selected areas. This would be agreed in advance with a customer – often customers don't like dirty PCBs.

If manual cleaning is conducted, every effort should be made to use materials or application methods that result in the minimum residues from both flux and cleaning process in a defined process sequence. The cleaning material used must be compatible with the boards, components and most importantly, the residues to be removed.

The remaining residues from the soldering materials must be totally soluble in the cleaning material, and this requires pre-production trials and some form of reliability assessment like SIR (surface insulation resistance) or ion chromatography. ROSE testing is not adequate for confirming reliability. ROSE testing is a process control test often used as part of an evaluation process; it is not used to assess reliability of a product.

Suppliers of the cleaning chemistry will normally outline the best methods of cleaning residues from PCBs, or help you develop a procedure like the one outlined in our online webinar presentation.

Manual cleaning methods should apply the minimum solution to clean the board, components and under the components where possible. Any brushes should not shed any bristles, and can be natural fibre or alternative to avoid static generation or mechanical abrasion to the solder joints or solder mask.

There is a benefit with some synthetic white bristles as they also show up excess residues due to poor housekeeping. Any brushes used should be changed regularly. A combination solvent and a self-priming brush to control the amount of solution used, as well as providing the mechanical agitation, can be beneficial. The methods do rely on the skills of the staff in using the tools and they are the best people to help define the process.

A board assembly should ideally be lifted and angled (Figure 3, page 28) so that the cleaning material can run off the board onto an absorbent sheet. The direction of cleaning should be selected to minimise the cleaning solution running on to other parts of the board. It is also possible to use a dry/wet wipe around the component termination to be cleaned to capture any run-off from residues.

Placing a dry or wet wipe over the component area while brushing the terminations through the wipe can also

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work well (see Figure 4). The flux and cleaner is absorbed by the wipe and controls the run-off during cleaning and blow-off. The wipes selected will need to be more robust to avoid breakup during cleaning, but still be absorbent.

When cleaning and rinsing is complete and the flux residues appear to be removed, a non-shredding wet wipe can remove any cleaning drying/evaporation marks separately. Drying marks can be seen on the surface of the solder mask, which is another reason to specify the type of mask at the design stage - most engineers never do. Take care around component terminations to avoid damage as wipes can snag and leave fibres on the board, particularly on conventional through-hole leads.

It is best to repeat the operation with fresh cleaner as a final rinse, and wipe the surface using one of the methods outlined. Cleaning is best performed after the soldering or rework process. The residues tend to be more soluble this way than leaving them for a long period of time after soldering.

Finally, use a low-pressure air gun to remove any cleaner from under or around components and connectors, placing a dry/wet wipe on the opposite sides of the component to capture any fluid displaced by the air flow. Again, angle the board so any remaining contamination drains to the edge of the board and the wipe away from other components. If fluid is still present it may require a final wipe with a lint-free cloth.

It is good practice to allow the board assembly to stand vertically on a rack after cleaning, if possible with the reworked area at the bottom. The board assembly may be placed in a low temperature, air circulated oven. It would also be normal practice to bake board assemblies before any conformal coating process is applied, but this would be at a higher temperature as recommended by the coating supplier.

Never rush the cleaning, drying and conformal coating steps as some cleaners will react with coatings, preventing them from fully curing. The coating will fall off and in the worst case produce corrosion. Make sure that any wipes and old brushes are placed in the appropriate disposal container. In the case of brushes make sure they are cleaned after use to prevent them being clogged with residues or use disposable brushes.

Further information on cleaning is available in IPC-CH-65B, the Cleaning Handbook and IPC specifications like IPC 7711-7721. As with any assembly process, training staff in good practice, the materials and methods to be used and inspection for residues after manual cleaning is recommended. Any training should be included in any rework or hand soldering course and be recorded on staff records. Training should also be conducted for test engineers who often do touch-up.

Any manual cleaning must be developed as a process on the shop floor and not just adopted historically. The material compatibility, cleaning methods and acceptance criteria are defined by engineers with the support of production staff to assess the practical methods. Production staff are invaluable to test and try new methods and materials, or when flux or paste are changed.

Just like any other process, engineer it or you will just have failures and customer returns.

For more information visit www.bobwillis.co.uk
TELECOMMUNICATIONS, WIRELESS, MOBILE, RF & MICROWAVE FEATURE

Modular component placement machine

Panasonic’s NPM-W2S is designed to solve manufacturer’s need to tighten control of their work in process, minimise changeover, and expand feeder capacity while accommodating smaller lot sizes in a cost-effective manner.

It addresses these challenges as well as expanding the standard component range from 03015 mm microchips to massive 100 x 90 mm components and connectors nearly 150 mm long and up to 30 mm tall.

The machine delivers 100 N insertion force for greater odd-form capability and increases pin-through-hole device imaging capability via optional pin-in-paste illumination. Equipped with a multi-recognition camera, it enables component alignment, defect inspection, chip thickness and 3D co-planarity inspection in a single pass to promote high productivity and quality. Optical character recognition (OCR) and pre-pickup inspection features allow unique recognition of tray-fed parts from barcodes, lines and polarity marks to determine proper pickup angles, even if parts are fed incorrectly.

Single- and dual-lane mode functionality promotes the capability to process extremely long LED panels nearly 1200 mm in length. It can automatically convert modes to dual-lane ‘shared’ or ultra-productive ‘hybrid’ mode. The NPM-W2S offers features to enhance efficiency such as automated board support pin placement, self-aligning feeder cart changeover, intelligent feeder anywhere, and 2D-coded nozzle anywhere. It further enhances production quality with thermal expansion compensation, board warp mapping, a 20- or 40-position direct pick tray tower, and closed-loop component monitoring with material verification, control and trace.

Manufacturers can scale production lines from low- to high-volume depending on production needs, while conserving investments until production or technology requirements mandate. OEMs and EMS providers can reconfigure the machine heads in minutes. The NPM-W2S also incorporates existing CM series Panasonic feeders and nozzles to minimise capital investment and reduce inventory expense.

For more information contact Techmet, +27 11 824 1427, info@techmet.co.za.
Curie point soldering systems

For many years, due to patent restrictions, only one company in the world was able to manufacture and market high-quality hand soldering systems using Curie point technology.

However, several years ago the patents held by this company, OK International/Metcal, expired and a group of former employees, including a previous president and the managing director of manufacturing and development operations, started a new company called Thermaltronics, which now offers this technology at competitive prices.

Using their experience, the development team not only found ways to improve manufacturing efficiency but also add several new features and benefits to existing systems and tip cartridges which enhance quality, performance and reliability. As an example, the design of the TMT-9000 flagship product incorporates an enhanced grounding system for safety, an exterior mounted fuse for easy maintenance, and several improvements to the handpiece not found in competitor systems.

The Thermaltronics products are compatible/interchangeable with any of the original OK International/Metcal systems/cartridges.

Company profile: ExecuKit

ExecuKit is a relatively new fixture in the South African electronics manufacturing sector, having been founded in March 2017 with the vision of offering “a different approach to materials procurement, materials control and kitting with the goal to provide customers with a seamless chain of kit supply, saving them time and money,” in the words of owner, Renita Fleischer. “We have an open book pricing policy which will not be changed. Honesty is key.”

Fleischer works side by side with Angela Shasha, ExecuKit’s procurement manager, with the pair boasting 50 years of combined experience in the electronics industry. Shasha has a diploma in purchasing and supply chain management, as well as a diploma in aviation. Together they aim to always achieve the satisfaction of presenting 100% correct and complete kits to ExecuKit’s customers, on time.

“If I can quote Michelle Obama: ‘Success isn’t about how much money you make. It’s about the difference you make in people’s lives.’ This is my motto. I would also like to thank our suppliers, who were there from day one. Thank you for trusting ExecuKit and believing in ExecuKit. We will never forget the guys that stood by us from the first order. And finally, a special thank you to Gordon Curr, CEO of Saflec – a man who saw the opportunity and potential,” Fleischer concludes.

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Selective conformal coating and focused heat cure

Conformal coatings, of all types, serve a very useful purpose of circuit protection in harsh environments. They can modify the surface insulation resistance and provide a barrier to chemical or moisture attack, assist with mechanical shock resistance and help to keep dendritic growth down to acceptable levels. They will never stop dendrites, nor tin whiskers, from growing in the first place, but they will limit their activity and reduce the incidence of cross-talk or short circuits.

There are many applications where conformal coatings have become the norm because of this protective property, but it has to be said that conformal coating introduces further steps into the process chain and every step in that chain carries a risk of error – even though that error might be infinitesimally small. The basic SMT process of print solder paste/place components/reflow solder is a three-stage process and there are therefore three areas of error risk.

So, what is an error? The old perceived wisdom suggested that it is anything to do with a defect in the production process. Things like DPMO (defects per million opportunities) definitely apply but we should also consider things like efficiency levels. After all, we are supposed to be ‘lean, mean and hungry’ and we use concepts such as lean manufacturing regularly. This is where selective conformal coating starts to make an impact. It is an efficient process.

There is no hard-and-fast rule that states that any particular material is the only coating material for a particular task. All coatings perform to the protective requirements mentioned above. So, for example, a silicone material is a rubbery compound that has a fair degree of flexibility whilst adhering fast to the surface. It is therefore used extensively in industries where flexibility is required, such as flex circuits or flex-rigids.

The downside is that silicone is very difficult to clean and equipment needs regular cleaning and maintenance. There may not be any errors in the product but the efficiency of using silicone may affect the overall factory efficiency. Other materials may need specific processes and so the choice of material boils down to protective requirements plus ease of use.

Broadly, there are six material types that are commonly used: acrylics, polyurethanes, epoxies, silicones, parylenes and ARUR – which is a mix of acrylic and polyurethane. It is not the purpose of this article to discuss these materials in detail. They all have characteristics with respect to ease of use, rework, protection, industry usage and so on. Nor will this article be a guide to which is the best material for any application. The main purpose here is to discuss selective conformal coating which is suitable for all of these materials, with the exception of parylene which requires a vacuum deposition process, not a spray process.

If the product and the end-use demand it, any industry can adopt conformal coating but certain industries have historically used coating techniques for a long time. These are typically aerospace/avionics, automotive, military and medical. The medical industry is the least prone to change because of the regulatory procedures that must be undertaken, but the other industries, and any others, tend to choose a material for a particular purpose and then only change if necessary.

From a production point of view, we must consider the technologies available to provide the production efficiencies we require. There are factors such as: volumes or throughput, cleaning and maintenance, masks, flexibility of use, tooling, and repeatability that must be considered. We also need to consider costs, quality issues and special requirements such as the vacuum system demanded by parylene.

Continued on page 32
Focused heat cure

There are essentially four types of curing techniques, depending on the chosen material: heat cure, UV cure, moisture as a catalyst cure and vacuum deposition. Most materials use either heat or UV and there are a number of solutions available to provide the required throughput. Materials that require moisture as a cure catalyst will require extra cost to provide the moisture control.

Vacuum deposition systems (parylene) will be very expensive and are only available as a batch process which means that throughput depends on the coating amount and the batch sizes. Parylene is widely used by the military and aerospace industries because it coats very thin layers all over the product – even underneath components – and batch sizes tend to be small.

UV curing can either be a dwell process or a constant-movement in-line process. A dwell process means that the product dwells on a conveyor under a UV source for whatever time period the material needs. Throughput depends on the cure rate per product.

An in-line UV cure system has a controllable conveyor with a UV radiation system along its length so that boards are passed into it from a coating system on a regular basis. The length of this oven dictates the throughput. UV curing does not suit magazine batch curing since the UV must ‘see’ all of the conformal coat material on the board in order to cure it. Consequently UV systems need to process one board at a time.

Heat curing, as its name suggests, requires the application of heat to polymerise the material to cure the coating. In-line reflow ovens, situated after the coating system, can be set up for a cure profile and are often used for this application.

There is a unique alternative to conventional in-line heating and this is a magazine based system with a cyclic-run-conveyor. This technique is a TTnS patented invention for curing and can offer advantages over conventional in-line heat curing because the floor area is usually much smaller and, more importantly, the need to load a magazine with product before the magazine transfers into the batch oven means that the product undergoes ‘relaxation’ time before heating. During this relaxation time, solvents (either aqueous or alcohol based) will start to evaporate naturally before higher-temperature curing takes place.

This relaxation time is extremely important from a quality perspective because this time period yields a reduced propensity for voids or bubbles to occur in the material. A typical in-line reflow system probably will generally not have sufficient relaxation time for most of the solvent to evaporate, therefore the probability of voids or bubbles in the coating using an in-line reflow system will be much higher than using a magazine based system. Voids and bubbles are a significant quality issue because they could lead to poor adhesion, they could yield a site for dendritic growth to begin, and they also reduce the dielectric properties of the board.

Visit www.dataweek.co.za/papers/K5084.pdf for the full version of this article, which covers manual, semi-automatic, fully automatic and selective conformal coating application, as well as the issue of tin whiskers.

For more information contact Quamba Technologies, +27 83 417 4294, igmar@quamba.co.za
How one contract manufacturer benefited from storage towers

In just five years, California-based XLR8 Services went from being an unknown contract manufacturing startup to winning the top customer awards for quality, responsiveness and technology at this year’s IPC APEX Expo. So how has their kitting room evolved to support both high performance and exponentially rising product volumes?

For president, owner and co-founder, Jason Powell, the market niche for a new type of contract manufacturing service was clear, especially in southern California, where new tech companies and innovative engineers were growing impatient for quick, high-quality results. Consumer products or defence manufacturers, one board or thousands – it didn’t matter. Design cycles were shrinking fast. Testing never stopped. And everyone needed their boards in days, not weeks.

As an industry veteran with more than a decade’s experience at two of the world’s largest contract manufacturers, Powell foresaw a growing market need where others balked at the complexity. Together with an ex-colleague, he founded XLR8 Services with a determination to help customers turn ideas into designs, and designs into products, in record time.

Doing more with less space

Powell wasn’t immediately interested in SMD towers during the company’s early years. “With just one line and plenty of space, we felt we could manage using a lot of racks and boxes,” he explains. But as customer relationships evolved, expanding from just a dozen units to as many as 10 000 units per month for some customers, space became a critical constraint. Eventually the company had a decision to make: would it find a new, more compact kitting and storage solution or be forced to take on additional floor space in order to expand?

In early 2017, XLR8 had decided to install its first SMD tower, mainly to save space but also to support an additional Mycronic pick-and-place line. By this time, the company had grown to more than 30 employees with more than 100 accounts across all major market segments. A second SMD tower, and then a third, were added in quick succession.

“I’ll be the first to admit I was wrong to be sceptical in the beginning,” continues Powell, describing how quickly he was convinced by his first SMD tower. “As we grew, my mindset evolved…Today we have the same number of kitting staff, but revenue has more than doubled since the first tower was installed; he points out, explaining the efficiency of the new material handling system. “Now we’re about to add our third SMT line and have four towers in total.”

Cutting down on kitting time

In addition to being able to handle double the volume with the same number of kitting staff, the SMD tower setup has enabled XLR8 to achieve significant time savings. “For us a typical kit size is 80–100 line items,” says Powell. “Before the towers, it might have taken a person two or three minutes per line item to go and pull them from stock. With the towers it takes less than 15 seconds per item. A several-hour job becomes 20 minutes.”

It’s this level of efficiency that has changed the way Powell thinks about the value of his kitting and component storage. “For business owners, it’s easier to quantify the items that make you money – like your pick-and-place machines. The mental step that’s often ignored, but is equally important is: how do you save money, time, space and staff? It all affects the bottom line.”

An unexpected surprise

Another surprise came when Powell began to welcome customers into his new kitting room. “Customers just love it when they come in,” he says. “They see a very high-tech and secure material management system that accurately tracks their components in a controlled environment. I never expected it to be a sales tool, but every time I do a factory visit I make sure to show these machines. It’s a huge selling point for us.”

For a company like XLR8 – which averages four to six kits per day, regularly does same-day builds and ships nearly everything else within three days of receiving the order – the value of the SMD towers is clear. But what other
Trends in oscilloscope technologies

By Brett van den Bosch

The faster and more complex electronic circuits become, the greater the performance requirements are for the equipment with which to test and verify their performance. At the same time, the smartphone revolution has elevated users’ expectations in terms of ease of use and versatility. We asked Jason Strydom, account manager at Comtest, to elaborate on some of the ways in which oscilloscope technologies are advancing to keep pace with these demands.

What are some of the latest features in user interfaces?
The user interface is one of the biggest changes more recently, with a move towards larger touchscreens and USB-based devices. Larger touchscreens are now coming in high definition with true design for touch. This improves the sensitivity of the touchscreen and allows the user to more accurately control what they need to on it.

There is also a trend with light-up buttons on the device which change colour depending on which channel is selected. This ensures that the user knows which channel he is taking his measurement on or adjusting the settings for.

USB-based oscilloscopes, on the other hand, are bringing this functionality at a lower cost as they are able to interface to an already existing PC with a monitor for greater control compared to the previous instruments in the industry.

These options now make using these devices more ergonomic and allow the user to reference and control the instrument more easily so they can get their desired measurements faster, and save time during the design and development cycle.

What must engineers consider with regards to data interfaces?
Interfaces are all about what you want to do with the data or instrument. USB connection has become a great way to get your data locally and fast; this is useful if you want to use RF software on a PC coupled to the oscilloscope.

Alternatively, if users require remote connection then an IP connection can be very useful for controlling the instrument over a network (e.g. someone in their office being able to control an instrument that is in the lab). Additionally, for a Windows-based device, a video output port could be considered to incorporate multitasking on the device.

GPIB, among other interfaces, can be used to incorporate the device into an automated test system. PXI is an open standard that only a few vendors support, and is typically used where users need to incorporate multiple different types of high-speed instruments (not just an oscilloscope) into a particular system.

How are bandwidth and channel counts keeping pace?
We are seeing bandwidth upgrades and higher channel counts on mid-range instruments, indicating the mid-range is shifting upwards. We now have options for up to 8 channels on a single device, something that hasn’t been common until recently.

We also have the ability to synchronise multiple instruments, should the user need more than 8 high-speed measurement channels. Additionally, there are options to upgrade the standard.

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2x2 MIMO measurement function for WLAN equipment

Anritsu has launched a new 2x2 MIMO measurement software MX886200A-010 option for the wireless connectivity test set MT8862A. This latest release extends the measurement functions of the MT8862A to offer support for evaluating 2x2 MIMO WLAN equipment.

Most devices requiring high data transmission rates, such as smartphones, tablets, PCs, etc., are now using MIMO technology to increase the data transmission speed. Since MIMO uses a multi-antenna environment, assuring communications quality is particularly difficult. Consequently, WLAN equipment makers are anticipating more support calls from end users related to communications quality issues, and so urgently need support for MIMO measurements under actual operating conditions.

The wireless connectivity test set MT8862A is a measuring instrument for IEEE802.11ac/n/g/b/a WLAN equipment. Using its built-in network mode, it offers a test solution that covers all measurements of radio-wave coverage range, output signal quality, modulation accuracy and 2x2 MIMO of IEEE802.11ac WLAN equipment under actual operation conditions.

Installing the MX886200A-010 option to the MT8862A provides support for receiver sensitivity and transmit power measurements of 2x2 MIMO WLAN equipment using two MT8862A units in combination, helping WLAN equipment end users to assure communications quality and troubleshoot the cause of communications errors.

For more information contact Coral-i Solutions, +27 11 315 5500, sales@coral-i.co.za
bandwidth on many devices, even after the device has been acquired by an end user.

What other features are engineers looking for?
There are a few standard criteria that users should always be on the lookout for, such as bandwidth at least 5 times faster than signal speed, sample rate at least 5 times faster than your signal, and enough input channels.

It is also important to consider having compatible probes of the right type (passive probes, active probes, current probes, near-field probes for RF, or even high-speed probes with a solder connection onto the board to be tested). Accessories (transit cases, software for in-depth analysis, adaptors, preamplifiers or even interposers), easy operation, connectivity, serial bus decoding, and in-country support are also important factors.

Additional features that users should be looking for are integration of time and frequency domain (RF) analysis on a single device, visual triggering, power measurements, built-in demonstration files so the user can see how to easily set up their acquisition, and the ability to mount network drives on non-Windows oscilloscopes.

For more information contact Jason Strydom, Comtest, +27 10 595 1821, jason.strydom@comtest.co.za

Multi-channel power analyser
Magnet’s range of Carlo Gavazzi products includes WM50 multi-channel power analysers, which efficiently measure main electrical variables, as well as voltage and current harmonic distortions, in a three- or single-phase system.

“This flexible device is able to view total and partial active and reactive energy consumption; up to three water, gas and heat totalisers and up to six different energy consumption tariffs,” says Stephen Rogerson, Magnet’s Johannesburg regional manager. “This system, which provides up to 16 alarms, can be integrated with accessory modules to expand its control and communication capacity. Main unit functions are increased with the addition of a maximum of two modules, which include a digital input/output module, an analog input module and a communication module.”

Three analog inputs and six digital inputs and digital outputs are managed via an optional accessory module. This system is able to transmit data to other systems and is also used to log measurements and events.

The WM50 device has been designed for quick configuration and easy installation. Detachable terminals connect to 12-channel current sensors with proprietary cables and clips are supplied with sensors to ensure efficient operation at all times. The wide backlit LED display clearly shows single and total load measurements, as well as configuration parameter values. Digital communication between current sensors and the device ensures excellent disturbance immunity.

Magnet’s range of Carlo Gavazzi automation products also includes energy management solutions, including energy meters, current transformers and energy-efficiency monitoring solutions.

For more information contact Samantha MacDonald, Magnet, +27 31 274 1998, samantham@magnetgroup.co.za
It’s always nice to buy something that belongs to you, even if just for the sake of knowing that you have it when you need it. With the cost of brand new high-end test equipment running into the hundreds of thousands of Rands or more, though, it can prove unaffordable for most companies. Renting equipment is usually the more attractive option in these cases, so we asked Coral-i Solutions’ sales director, Niki Lankesar, and training director, Donald Peddie, to help weigh the benefits of renting versus buying.

Which use-cases make renting most attractive?
Most of the time, the rental option is most desirable for project-based work. If a company is doing contract work they can build the rental cost into their budgeting and not have to worry about being lumped with a piece of equipment that they’ll hardly ever use. In some cases, a company might need to test something like an infrared camera only once a year, so it will likely prove cheaper to rent rather than have an instrument that lies in the stores and only gets used for two weeks out of the year.

In the telecoms industry, contractors are regularly expected to have an unreasonable number of teams on the promise of work that never materialises. This makes it easy to end up purchasing lots of equipment that end up just lying in your store, which can hurt a company badly. Having said that, we always suggest that, depending on the length of the contract, you may want to look at purchasing at least some of the equipment.

What instruments do you offer for rental?
We rent entry-level equipment but mostly high-end instruments, because a company will often be prepared to pay for a cheaper instrument and buy a brand new one to keep rather than rent. Some of the equipment we rent runs into the region of R1 million to buy outright – not even the biggest companies can justify buying equipment in that range because they typically only need it during the prototyping phase.

In terms of spectrum analysers we go up to 43 GHz bandwidth, and for Ethernet testers we go up to 100 Gbps. We’ve gradually progressed to concentrating on a comprehensive offering of handheld, battery operated equipment to make life easier for people who’re going into Africa to do work, for example. We don’t rent much into Africa directly but a lot of our SA clients do business across the continent.

These high-end instruments represent a big investment for Coral-i. We’ve been in the market long enough to know that even though they might only be rented out once or twice a year, we pride ourselves on being able to meet test equipment rental requirements 95% of the time. We have some equipment that doesn’t make money for us but we take the long view that being able to supply what people need, when they need it, stands us in good stead in the marketplace.

What sort of service and support can rental clients expect?
When buying, you have to worry about service and calibration, whereas we build that into the rental so you have peace of mind that you always have a calibrated instrument. Importantly, this mitigates those cases where test equipment is used by multiple engineers in a company, and when they move equipment between them they usually don’t have systems in place for checking whether the equipment is functioning correctly. So one engineer might use it for a month or two and the next one takes it to do a project in deepest Africa with an instrument that proves to be faulty.

Through our rental model, when you return the equipment it goes through a set of tests to make sure it complies with its manufacturer’s specifications. In this way we guarantee that when you collect a piece of equipment from us it will operate correctly and within spec.

We also provide technical training to customers if they have minimal experience, but most of the time they are from a technical background and only require a short (half-hour to hour long) session with one of our specialists to familiarise them with the features and operation of the particular equipment in question. If people buy high-end equipment from us, we also readily throw in training for free because we want the instrument to work for the customer.

Rather than simply offering a ‘set menu,’ we are able to structure individualised rental packages according to a client’s needs. It is important for us to be flexible in this regard since some of the instruments have options that come with them, so depending on requirements we actually activate or deactivate options on the instrument for specific use-cases.
With state-of-the-art GaN technology, the range covers frequencies from 0.7 GHz to 26.5 GHz in power ranges from 1 W to 50 W, with a 40 GHz model on the roadmap for the last quarter of 2018.

The amplifiers have high linearity over the band for wideband communications testing. They feature variable gain adjustment, high-resolution displays showing amplifier status, and all amplifiers go through burn-in and ageing testing for long-term reliability.

For more information contact Conical Technologies, +27 66 231 1900, daniel.haywood@conical.co.za

Test and measurement instrumentation amplifiers
The MPA range of high-quality test and measurement instrumentation amplifiers from Maury Microwave are not only used in load-pull systems but are also ideally suited for lab and test range testing setups.

For more information contact Coral-i Solutions, +27 11 315 5500, sales@coral-i.co.za

We also offer discount structures, for instance, if someone wants to rent something for a long period like a year, and tend to offer good discounts to good paying customers.

What trends are happening in the rental market?
The market is highly influenced by technology rollouts, so we find when there is a jump in technology or upgrades, like with 3G to LTE, there’s a massive requirement for the new equipment that goes with it. The next jump we anticipate is 5G, something we are looking forward to and gearing towards.

The telecoms industry is generally poorly managed in terms of projects and rollouts happening at the drop of a hat. This makes life particularly difficult for contractors as the telco will tell them there’s all this work in the pipeline but they’re not sure when it’s going to kickstart. Then suddenly they call on a Friday and expect you to do the rollout the following Monday. The chances of procuring a brand new piece of high-end equipment on the same day is virtually impossible. Also, if you have a fibre break and it’s an urgent situation, it’s not an option to wait a week or more to acquire a new piece of test equipment.

When the economy is under pressure rental becomes a more attractive option, so for example, a lot of people are nervous right now about capex because they don’t know what’s going to happen with the government. Our biggest market is definitely contractors, since all the network operators have gone towards outsourcing their network functions, so there are more smaller players without massive resources.

A crucial issue right now is fluctuations in the rate of exchange – this really impacts the price of goods, sometimes to the tune of hundreds of thousands of Rands for the high-end equipment. To budget for this is very difficult for companies, but our extensive rental pool makes us fairly immune to these fluctuations.

For more information contact Coral-i Solutions, +27 11 315 5500, sales@coral-i.co.za
High-resolution infrared cameras for R&D

Whether designing or testing printed circuit board prototypes, developing new products or new product materials, or analysing lamina flow patterns on an aerodynamic design, thermal imaging plays a key role.

Analysing characteristics such as temperature, heat dissipation, latent heat and other heat-related material properties can reveal countless potential problems at an early stage in the development process to help ensure quality and avoid failures downstream. The technology has the potential to provide valuable insight into a wide range of applications, from materials analysis to component design to controlled chemical reactions.

Infrared cameras (also called thermal imagers) are ideal tools for both scientific research, and early and late stage development troubleshooting and analysis, because they collect thermal data without physically contacting the target and without interfering with the process.

Understanding what is really occurring in any situation often depends on the proper understanding and control of variables that may affect the material or device under test. Using a non-contact infrared camera to document and measure the performance or changes in thermodynamic properties of the object under test often eliminates variations that might be introduced by a contact temperature device such as an RTD or other contact temperature probe.

Furthermore, far more simultaneous data points can be collected with an infrared camera than physical sensors could ever possibly collect. These simultaneous data points combine to form a detailed, false-colour picture of the heat patterns at any point in time. This is invaluable to engineers and scientists, who understand the fundamentals of thermodynamics and heat flow, and have specific knowledge of the material or design under test.

Get the detail and accuracy you need

R&D infrared inspection and analysis covers a wide range of applications, from identifying thermal anomalies in circuit board components, to tracking phase changes in injection mould manufacturing, to analysing non-destructive testing of multilayer composites or carbon fibre components. While the specifics of those applications vary tremendously, all benefit from infrared cameras with a high degree of accuracy, excellent spatial and measurement resolution, high thermal sensitivity and responsive performance.

Fluke offers infrared cameras that provide all of these capabilities with a versatile set of features that are indispensable for many types of R&D applications. High resolution, coupled with optional macro lenses, can provide for up-close imaging capabilities that produce highly detailed and informative images, with apparent temperature calculations for each pixel.

Individual images can provide a wealth of data on their own. Capturing multiple images, or streaming radiometric data, means that the mountain of data increases exponentially. All who take on the task of research and development will therefore appreciate useable, accurate and analysable data.

Users can easily access this data from the included SmartView software and then often export it and apply their own analysis and algorithms. The extremely high thermal sensitivity of these infrared cameras, combined with their spatial resolution, allows for radiant analysis not possible with most commercially-available products. This allows for a more thorough and accurate analysis of various material properties.

When it comes to analysing printed circuit boards specifically, these thermal cameras can aid in performing the following functions:

- Finding localised over-temperature issues. Design engineers have to combine heat intensive solid-state, high power transformers, high speed microprocessors, and analog-to-digital or digital-to-analog signal converters into a very small package.
- Establishing cycle times. By setting the infrared camera to record thermal measurements as a solder point cools, cycle times for automated systems can be determined. Key points can be annotated with voice and text for quick review.
- Analysing assembly impact. Quality review can be performed at various stages of the development and manufacturing processes to ensure that any issues are captured early to avoid costly component failures down the road.
- Validating thermal modelling. Using thermal modelling software provides a good estimate of what will occur when a board is populated, but it’s still only a simulation. Designers can easily validate those results by comparing their thermal CAD model to what they’re actually getting with the camera as they populate the board and power-up components. Then the finished, powered-up prototype can be scanned and the results compared to the model to see how close it is.
- Assessing collateral damage. Sometimes heat from the circuit board can affect the performance of other components in the system, such as making an LCD run too hot or interfering with mechanical operation. To avoid that one can assess how much heat dissipates from the entire package and how that heat may affect other parts of the system.

A designer can start by capturing an image of the powered-up unit with the cover on; that image shows the temperatures of all the components under power. Then the cover can be removed and a radiometric video recording performed of the temperature decay curve. A group of maximum temperature points can then be exported into spreadsheet software and used to backward-extrapolate the resulting curve to time zero, to see what the temperature of the component was before the cover was taken off.

For more information contact Comtest, +27 10 595 1821, sales@comtest.co.za

www.dataweek.co.za
Multi-fibre testing tool

Exfo has developed an automated solution that combines testing of polarity, continuity and connector cleanliness – the critical tests needed to validate multi-fibre push-on (MPO/MTP) links – into a single solution that delivers a combination of fit, cost and reporting capabilities.

Fibre fusion splicer

Sumitomo Electric Industries has released its new core-alignment fusion splicer, the T-57. The T-57 is built on the foundation of the previous model, the T-55, with several improvements including a short heating time of 15 seconds; larger battery capacity, for 300 cycles of splicing and heating; better portability with a smaller and lighter body (2.0 kilograms with the battery); and a smarter user interface with higher resolution and smoother touch screen.

User friendly touch panel operation is facilitated thanks to a brand-new UI featuring easy smartphone-like operation. The new splicer boasts excellent performance with fast splicing in six seconds, in addition to improved environmental durability, compactness and light weight.

The ConnectorMax MPO link test solution pairs a light source at one end of the cable with a fibre inspection probe for analysis at the other end – a first in the industry. Additionally, it is the only all-in-one solution that provides a clear pass/fail diagnosis of MPO 12 and MPO 24 links in a single report. For customers who already own an Exfo probe, this solution is highly economical.

Telcos are reconfiguring their central offices into data centres (CORDs) and deploying MPO cables with 12, but more and more, 24 fibres. When not properly tested, multi-fibre links can put the entire health of a network at risk. Traditional solutions often fall short on design or price, can't perform all three critical tests or don't offer analysis and reporting capabilities. Customers are left choosing between solutions that are either too much for what they really need (and too expensive) or sorely lacking in features and fit. What's more, they often have to buy different units to get the job done.

The ConnectorMax MPO link test solution provides a quick, reliable and less costly method to test multi-fibre cables before installation, so if outages occur technicians can be certain their pre-tested links are not the cause.

For more information contact Chris Nel, Lambda Test Equipment, +27 12 349 1341, chris@lambdatest.co.za

FTTx and PON-Optimised OTDR’s

FlexScan OTDR

Allowing technicians to access multiple test platforms within one small unit, Pocket-sized, Performance-packed, Easy to Use and Affordable FlexScan OTDRs enable both novice and expert technicians to quickly and reliably troubleshoot optical networks or fully characterize newly installed or repaired networks. Using FlexScan’s innovative SmartAuto mode, multiple OTDR scans quickly and accurately detect, locate, identify and measure network components and faults. After applying industry-standard or user-set pass/fail criteria, the characterized network is displayed using FlexScan’s intuitive, icon-based LinkMap view.
### Half-brick DC-DC converter

SynQor introduced the new NQ40, non-isolated half-brick DC-DC converter – a buck/boost regulator which employs synchronous rectification technology to achieve extremely high conversion efficiency. The wide input voltage NiQor Brick family of converters can be used in traditional distributed power architecture systems or provide a regulated output voltage from a battery source or other variable voltage source.

The NQ40 has an input voltage range from 9 to 40 V. The output voltage range that can be achieved varies from 0 to 40 V d.c. at a maximum current of up to 55 A. The variable output voltage makes this device ideal for battery charging applications where a 12 V power source like a motor vehicle alternator can be used to charge deep-cycle batteries to their maximum charge.

This versatile device can be used in cascade to increase the available current to suit any application. The NQ40 half-brick form factor is small and has a high efficiency of up to 96% at full rated load current. Very little heatsinking is required for this device, saving on space and cost in a design, and mean time before failure has been demonstrated as more than 10 million hours.

For more information contact
Conical Technologies, +27 66 231 1900,
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### UCT team to build solar powered house

Three University of Cape Town (UCT) lecturers are part of the only team representing sub-Saharan Africa in an international competition to design and build a fully functional, modular, net-zero-energy house in Stellenbosch. The competition, called Solar Decathlon, takes place in Morocco next year.

Solar Decathlon challenges teams to design and build a ‘green’ house of between 55 and 110 square metres, powered by only solar energy and equipped with technically advanced building and energy technologies. This should be done using local ingenuity, craftsmanship and materials.

UCT senior lecturers Mike Louw and Kevin Fellingham (School of Architecture, Planning & Geomatics), and Dr Dyllon Randall (Department of Civil Engineering), have been brought on board Team Mahali – based at Stellenbosch University’s Sustainability Institute – for their design skills and knowledge of innovative waste-water systems, respectively.

Louw commented: “Part of the design theme is inspired by the central place of the tree in African culture: a place of meeting, education and important community decision-making. The house has been designed for conditions in Morocco but also for other African contexts.”

Locally available and recycled materials have been used as far as possible.

The latter area of the structure is being led by former and current students in the Faculty of Engineering & the Built Environment – Gordon Rae, Muven Naidoo and Elouise Pretorius, with input from Randall.

Rae, Naidoo and Pretorius are implementing a wide range of sustainable water practice and technology into the house, ranging from composting toilets and grey-water systems to advanced water management and monitoring, as well as rainwater harvesting.

The house will be built in Stellenbosch, then dismantled and shipped to Morocco for reassembly on the test sites in Mohammed VI Green City in Benguerir. During the final phase of the competition, the house will be open to the public.

“We’re merging very high-tech digital design manufacturing with traditional crafting in the making of an identity for the house,” Louw explained. The design phase of the project is due mid-November, after which the team moves on to completing construction documentation.

Although Team Mahali has $50 000 (just over R700 000) in seed funding from the Moroccan government, they still need to raise R3 million and are looking for funders and donations of furniture and energy-efficient household appliances from retailers.

This project is investigating the potential for upskilling and job creation on the building side, using people outside academia. For example, local craftswomen will be employed to supply a large proportion of the building’s components. Two members of Team Mahali recently cycled 1000 km across Morocco to raise funds. They have also launched a crowd-funding campaign.

For more information contact
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### Compact DC-DC converters

Now available from RS Components is a range of 2 W and 3 W DC-DC converters in the compact SIP-8 package. Manufactured by Traco Power, the devices target a range of general electronics design applications, and are especially suited to deployment in factory automation equipment.

The converters – including the TEC 2, TEC 2(WI), TEC 3 and TEC 3(WI) series – have all been designed to deliver improvements in terms of cost, efficiency and performance compared to previously available 2 W and 3 W SIP-8 packaged devices. Offering increases in efficiency of more than 20%, the converters enable a significant reduction of thermal loss and thereby allow an expanded operating temperature range of –40°C to +90°C.

The converters offer fully regulated outputs from zero to 100% load, with no requirement for minimum load. The input voltage range options have also been extended and now include 4.5 to 13.2 V d.c. Models are also available with standard 2:1 input ranges, including 9 to 18, 18 to 36 and 36 to 75 V d.c. The TEC 2WI and 3WI series also offer devices with ultra-wide 4:1 input-voltage ranges.

Other key features include: functional I/O isolation designed to meet IEC/EN 60950-1 with a test voltage of 1600 V d.c. for 60 seconds; continuous short circuit protection; remote on/off; and a three-year product warranty.

For more information contact RS Components,
+27 11 691 9300, sales.za@rs-components.com
The WE-CMBNC is a VDE certified series of common mode chokes with a highly permeable nanocrystalline core material. Despite the small size, it delivers outstanding broadband attenuation performance, high rated currents and low DC resistance values. Low profile and high voltage ratings can also be realized by the common mode chokes of the WE-CMB family.

For further information, please visit:
www.we-online.com/we-cmb
Safety of lithium-ion batteries

By Isidor Buchmann, founder and CEO of Cadex Electronics.

At the original time of writing of this article, in August 2016, Tesla Motors expected to consume two billion Li-ion cells by 2017. Both the Tesla Model S and Model X electric vehicles (EV) get their electrical energy from the 18650 cell, a format that also powers laptops and medical devices. The 18650 cell measures 18 mm in diameter and is 65 mm long.

A cylindrical cell in a metallic case is durable and has a high specified energy (capacity), but cylinders are heavy and have a low packaging density in a cluster, compared to the prismatic architecture and the pouch pack. A battery pack for a Tesla vehicle deploys over 7000 cells, and to get the desired voltage and amperage, the cells are connected in series and parallel. Figures 1 illustrates the popular 18650 cell.

At 90 kWh, the Tesla Model S has the largest battery in an electric car in terms of Watt-hours; it also delivers the longest driving range between charges. In comparison, the Nissan Leaf comes with a 33 kWh pack, the Ford Focus EV has 23 kWh and the Chevy Volt 16 kWh for correspondingly shorter driving ranges. A 90 kWh battery holds enough energy to provide a typical US household with electrical needs for almost three days. But batteries must be charged, and this draws heavily on the grid. They are also expensive; the EV battery alone carries the price tag of an economy car.

Lithium-ion batteries come in many variations and Tesla chose the high-energy nickel cobalt aluminium chemistry (NCA) for the S-Model. Made by Panasonic, the cell is rated at 3100 mAh, a specific energy that is slightly higher than most contenders. Other advantages of the NCA are high specific power for exuberant acceleration and long life. The negatives are high cost and a lower safety margin than other Li-ion systems. Figure 2 outlines six of the most important characteristics of a battery in a spider web.

Batteries for the electric powertrain need high loading and a long life, and the NMC is another popular Li-ion system. NMC stands for nickel-manganese-cobalt and is also used in e-bikes, power tools and military and medical devices. The cathode may consist of one-third nickel, one-third manganese and one-third cobalt, but other combinations are also used to satisfy special requirements. These blends lower the raw material cost due to reduced cobalt content. Figure 3 demonstrates the characteristics of the NMC.

Another popular Li-ion system for electric powertrains is the lithium iron phosphate (LiFePO4). Its strength lies in long life and superior safety, but it has a lower capacity than cobalt-based Li-ion systems. A further trade-off is the lower nominal voltage of 3,3 V/cell rather than the customary 3,6 V/cell of other Li-ion systems. Figure 4 summarises the attributes of Li-phosphate.

A Swiss manufacturer of upscale e-bikes did a comparison on older and newer cells. They use the NMC 18650 cell from Panasonic and LG Chem. The early version rated at 2 Ah still delivered 80% after the onboard battery management systems (BMS) indicated 1000 cycles. Then came the 2,2 Ah NMC and the capacity dropped to 70% after 1000 cycles. The modern 3 Ah NMC used today drops to 60% after 1000 cycles. It should be noted that the end-capacity of the newer cells is still higher than the older ones; the 3 Ah cell retains 1,8 Ah after dropping 60% whereas the 2 Ah cell has only 1,6 Ah after a 20% capacity drop.

EV batteries must carry an eight-year warranty. To achieve this, a new battery may only charge to 80% and discharge to 30%. As the battery loses capacity with age, many BMS gradually increase the charging bandwidth to maintain equal driving range. Once operating at full bandwidth, the battery gets stressed more, reflecting in accelerated performance drop and reduced driving range.

Cold temperature causes the performance of all batteries to drop. Bitter cold also makes charging more difficult, especially with Li-ion, as charging is more delicate than discharging. The ability to use a battery at low temperature does not automatically permit charging under these same conditions. Careless charging at low temperatures can inflict permanent damage to the battery.

Li-ion should not be charged below 0°C. Some battery manufacturers permit charging down to -10°C by reducing the charge current to a tenth of the battery rating, or 0,1°C, a charge that would take 12–15 hours on an empty battery. Charging too fast at low temperatures could lead to dendrite growth, reflecting in higher self-discharge and compromised safety.

The battery stress is highest at 4,20 V/cell when the battery reaches full charge. Keeping a lower voltage also protects the battery during cold-temperature charging and some BMS limit the voltage and current accordingly. Many EV batteries include a heating blanket to protect the battery when charging at cold temperature. Energy to heat the blanket is readily available from the grid.

EV owners want ultra-fast charging and technology is available to do so. Although convenient, fast-charging is harmful to the battery. If at all possible, avoid charge times that are less than 90 minutes, or charge rates above 1°C. The onboard BMS keeps record of stressful battery events and historic data can work against a warranty claim. This was the response of a large European EV manufacturer when the question of ultra-fast charging came up at a recent EV battery convention in London.

Safety is a further concern, but this applies to all batteries. A 1-in-200 000 failure triggered the recall of almost six million lithium-ion batteries in 2006. Sony, the manufacturer of these cells, said that on rare occasions microscopic metal particles may come into contact with other parts of the battery cell, leading to a short circuit that can cause venting with flame.

Li-ion has improved and the failure rate has been reduced to 1 in 10 million. This is reassuring, but the formula of 1-in-10 million could cause 200 cells to fail in the batch of two billion that Tesla plans to consume. It is likely that the failure rate has gone down further but caution is in place when storing tons of batteries in one place. Fires with battery manufacturers and in warehouses storing batteries are common.

Relatively little is known when Li-ion batteries are exposed to harsh environmental conditions. Internal shorts and rapid disassembly are of concern, an event that no safety circuit can stop once in progress. The fault occurs inside the cell and the battery must burn out.

The Li-ion battery of the Boeing 787 Dreamliner may have failed due to an electric short; the modified battery enclosed in a metal housing will provide a safeguard should a short recur. All batteries are subject to failure and there is also a reported incident where the battery circuit breaker of a Boeing 777 had to be pulled because of an overheating NiCd battery. In the early 1970s, the National Transportation Safety Board reported several battery incidents per year involving the then new nickel-cadmium ship-board battery on aeroplanes. Improvements eventually made NiCd safe; this will also happen with Li-ion.

Transporting batteries by air remains a concern. There are regulations as to how much metallic (or equivalent) lithium can be included in an air shipment. Some content may go unregistered and the United Arab Emirates
General Civil Aviation Authority found with reasonable certainty that the fire aboard the UPS 747-400 freighter was caused by a lithium battery. The aircraft went down on September 2010 in the Dubai desert about an hour into its flight to Cologne, Germany.

New air cargo containers are being tested with materials that can withstand intense fires for up to four hours, enabling an emergency landing on most flights. The fire-resistant panels of these air cargo containers consist of fibre-reinforced plastic composite that suffocates fire by depriving it of oxygen.

A fire is easier to put out in the cabin than in the cargo bay and since January 2008, people can no longer pack spare lithium batteries in checked baggage. Airlines allow them as carry-on where extinguishers are available. A coffee pot served as an extinguishing device of a flaming laptop battery in one incident. Travellers are reminded of how many batteries can be carried on board in portable devices and as spares. This also includes primary lithium batteries and the maximum weights of lithium (or equivalent) are:

- 2 grams for lithium batteries. Few consumer products use these primary batteries today.
- 8 grams for a secondary lithium-ion. This amounts to a 100 Wh battery (a laptop has about 60 Wh).
- 25 grams for all Li-ion combined. This amounts to 300 Wh worth of Li-ion batteries.

Effective 2016, lithium-based batteries can no longer be carried as cargo in a passenger aircraft. In addition, Li-ion in cargo must have a state-of-charge of 30%. All packages must bear the Cargo Aircraft Only label in addition to other required marks and labels. This limitation does not affect lithium ion batteries packed with or contained in equipment.

While Li-ion is being scrutinised for safety, other chemistries also exhibit problems. Nickel- and lead-based batteries cause fires too, and some are being recalled. Reasons for failure are defective separators resulting from ageing, rough handling, excessive vibration and high-temperature.

Examining 113 recorded incidents of transporting batteries by air over a 19-year period reveals that most failures occurred due to inappropriate packaging or handling. Damaged battery packs and electrical shorts due to careless packaging were the main culprits. Most incidents happened at airports or in cargo hubs.

Problem batteries include primary lithium that contains lithium-metal, as well as lead, nickel and alkaline systems, and not just lithium-ion, as is perceived. Modern consumer products have very few failures involving Li-ion batteries today.

For more information contact Michael Rogers, Uniross Batteries, +27 11 466 1156, michael.rogers@uniross.co.za
**DC-DC converter with integrated H-bridge**

Diodes Incorporated’s new AP72200 is a high-current synchronous buck/boost DC-DC converter with integrated high-side and low-side H-bridge MOSFETs. It delivers up to 97% efficiency with 1% voltage regulation accuracy, low quiescent current and very low output ripple.

The AP72200 employs proprietary buck/boost current-mode control technology to achieve excellent voltage regulation and a continuous output current of up to 2 A. The design allows for seamless transition between buck and boost operation while the wide 2.3 V to 5.5 V input voltage range provides flexibility of supply and produces between 2.6 V and 5.14 V output voltage.

The high level of integration, along with low quiescent current and wide input voltage range, make the device well suited for a wide range of portable applications including smartphones, tablets and other battery-operated consumer devices.

Many of the features of the AP72200 are user-configurable through an industry standard \*I2C interface, which can operate in standard mode, fast mode, fast-mode plus and high-speed mode. This includes programmable output voltage ramp-up and ramp-down slew rates, output active discharge, over-voltage protection threshold and over-current threshold.

The AP72200 can also be configured to operate in PWM or PFM mode, as well as in ultrasonic mode, which reduces the switching frequency to avoid the generation of sub-harmonic frequencies in the region of 20 kHz that can cause interference in the audible frequency range. The buck/boost output can also be disabled using the \*I2C interface, allowing a master device to control the operation of the regulator across a standard \*I2C bus. The output voltage can be set to between 2.60 V and 5.14 V in 0.02 V increments by programming the device over \*I2C.

The integrated H-bridge MOSFETs feature extremely low \*R\_\*DS\(\text{ON}\) of 25 mΩ and a shutdown current of less than 1 µA. Quiescent current is as low as 20 µA when operating in non-switching mode and a typical of 29 µA in PFM mode. The switching frequency in continuous switching mode is typically 2.5 MHz, dropping to 27 kHz in ultrasonic mode.

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**Power monitoring IC with reinforced isolation**

Allegro MicroSystems has released a fully integrated, small form-factor power monitoring IC with reinforced voltage isolation. The ACS724 and ACS711 current sensor ICs are commonly used in Internet-connected power outlets and other IoT devices. The ACS71020 improves upon these popular ICs by including power sensing functions and by eliminating power and isolation components that would otherwise increase the cost and the size of customer systems.

The ACS71020 IC builds upon Allegro’s Hall-effect current sensor IC technology by adding line voltage sensing (to voltage levels > 500 VRMS) and a dedicated metrology engine that digitally calculates detected power levels. This enables a power monitor IC that can be powered from the same voltage supply as the system microprocessor, without needing digital isolators or multiple power supplies.

The new chip simplifies common power measurements by offering digital computation of parameters including active, reactive and apparent power. These power values can be read out through \*I2C or SPI interfaces. The IC also includes dedicated pins for voltage zero crossing (suitable for light-dimming applications) and fast over-current fault detection (for sensing short circuits). The ACS71020 eliminates the need for optocouplers, dual output isolated power supplies and a current-sense resistor in single-phase power monitoring applications.

The device is also housed in a single SOIC-16 wide body package that provides a reinforced isolation rating up to 517 VRMS. The IC is programmed at Allegro for optimised accuracy measurement to either ±15, ±30 or ±90 A.

For more information contact Conrad Coetzee, Altron Arrow, +27 11 923 9600, ccoetzee@arrow.altech.co.za

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**PCB-mounting power supplies**

Recom has expanded its range of low cost AC-DC power supplies for PCB mounted, compact, board-level industrial applications. The RAC01-GB series is now offered with 3.3 V and 24 V output modules, while the RAC02-GA and RAC02-GB series now come with 3,3 V, 15 V and 24 V options.

The modules all feature a universal AC input voltage range, regulated and short-circuit-proof isolated DC outputs, low standby power consumption and -25°C to +80°C operating temperature range. They have a built-in Class A / FCC Part 15 EMC filter, are certified to EN60950 and EN62368 safety standards (as well as EN60335 in the case of the RAC02-GA) and come with a three year warranty.

For more information contact Brabek, +27 21 706 3162, info@brabek.co.za
Antenna for RTK positioning

EAD is introducing a multi constellation magnetic antenna for RTK (real-time kinematics) GNSS (global navigation satellite system) applications. The MP-RTK antenna is based on the popular MP (magnetic puck) platform and supports GPS L1, L2, L5, GLONASS 1, GLONASS 2, Beidou 1 and Beidou 2 frequencies.

Fed by a single RG174 cable for all frequencies, the antenna has an integrated low-noise amplifier (LNA) with approximately 37 db gain, thereby offering high gain performance. With a strong magnet in the base of the antenna, it is ideal for vehicle or non-permanent mounting applications. Alternatively, if required the MP-RTK antenna element could be housed in the CPx permanent mount enclosure when a through-hole mounting solution is required.

For more information contact Gyula Wendler, Altron Arrow, +27 11 923 9709, gwendler@arrow.altech.co.za

Vertical launch high-frequency connectors

Pasternack has introduced a new line of solderless vertical launch connectors that are ideal for high-speed networking, high-speed computing and telecommunications applications. The series consists of 12 models that provide VSWR as low as 1.3:1 and maximum operating frequency of up to 50 GHz, depending on the model.

These removable launches boast a reusable clamp attachment and can be used for microstrip or stripline. They are offered in male and female versions, covering 2.4 mm, 2.92 mm and SMA interfaces, and all models provide solderless installation.

The vertical launches feature a stainless steel outer conductor, gold-plated beryllium copper centre contact and Polyetherimide (PEI) insulators. They are ideal for high-speed backplanes, signal integrity measurements, semiconductor verification boards, multi-channel tests and SERDES applications.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za

NB-IoT antennas

Taoglas has launched three NB-IoT antennas, including a compact ceramic NB-IoT antenna and an ultra-thin, flexible multiband antenna that supports all LTE bands.

The low-profile, highly efficient NCP5820 is a ceramic surface mount multiband antenna that supports bands 8 (880 – 960 MHz) and 20 (791 - 862 MHz), as well as band 5 (824 – 894 MHz) to allow IoT devices – such as asset trackers – to work across different regions and different carriers. Its low profile (2 mm) and small footprint (14.1 x 8.3 mm) make it the smallest NB-IoT antenna, according to Taoglas.

The NCP5820 is designed with the patent-pending Taoglas Boost technology, which delivers up to a 2 db improvement in antenna performance when integrated into small devices. Taoglas Boost is particularly suited to designs with shorter ground planes, allowing IoT and other device designers to bring to market a wider range of smaller devices that would otherwise not have been able to meet certain stringent carrier certification requirements.

The NCS5820 is a surface-mount onboard antenna that supports bands 5, 8 and 20. Its low profile (1.6 mm) and small footprint (11 x 20 mm) allow it to be integrated into even the smallest of IoT devices. As it is a larger antenna, it demonstrates higher efficiency, and Taoglas Boost is also available with this antenna, and any Taoglas onboard antenna.

The third antenna in the Extensis range is the patent-pending FXUB64 flexible ultra-wideband antenna, which has been designed for all working frequencies in the 600 to 3000 MHz spectrum, covering all cellular, 2.4 GHz Wi-Fi, ISM and AGPS, including LTE band 71. The ultra-thin polymer antenna is delivered with a flexible peel-and-stick body with excellent efficiencies on all bands.

For more information contact Andrew Hutton, RF Design, +27 21 555 8400, andrew@rfdesign.co.za

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www.dataweek.co.za
TDK introduced the new, extensive B3237* series of EPCOS MKD 3-phase capacitors for filter applications. The capacitors cover a voltage range from 250 \( V_{\text{RMS}} \) to 850 \( V_{\text{RMS}} \) in 10 stages, and are available with capacitances of between 3 x 10 \( \mu \text{F} \) and 3 x 400 \( \mu \text{F} \).

Depending on the type, the capacitors are designed for currents of up to 60 A. Internally, the capacitances are connected in three phases. In accordance with IEC 61071, the life expectancy is about 100 000 hours at the rated voltage, the maximum drop in capacitance being 3\% from the initial value.

The capacitors are accommodated in robust aluminium cans with M12 bolts on the bottom. Depending on the capacitance, they have a diameter of between 75 mm and 136 mm, and a height of between 163 mm and 350 mm. The capacitors are designed for an operating temperature of between -40\°C and +70\°C.

They are UL-listed and have an internal overpressure disconnector that isolates all three internal capacitors from the feed lines. Typical applications are output filters in power electronic devices such as converters and inverters for industrial and energy applications.

For more information contact Deon Schoombee, Electrocomp, +27 11 458 9000, deon@electrocomp.co.za

Würth Elektronik eiSos has expanded its portfolio of AEC-Q-qualified products with a high-current inductor. The patented ferrite core design of the new power choke has an air gap optimally centred to ensure a precisely defined saturation current. The WE-CHSA can be used in the extended temperature range of -55\°C up to +150\°C.

The patented product design with air gap enables extremely high saturation currents up to 54 A. The magnetically shielded package of the WE-CHSA assures a low stray field and the embedded solder pads offer optimal co-planarity while allowing good automatic optical inspection capability. The rated current of the power choke extends to 28 A.

The product is available in package sizes of 8 x 8 x 9 mm, 10 x 10 x 11 mm and 12 x 12 x 12 mm. For the rapid development phase, the complete series is available in a design kit. The WE-CHSA is particularly suitable for applications in the automotive industry, such as in powertrain control devices, in infotainment systems or in high-current applications for eMobility.

For more information contact Jason Page, Würth Elektronik eiSos, +27 71 259 9381, jason.page@we-online.com

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- Buzzers-Microphones-Speakers DB Products
- Liquid Crystal Displays-OLED Displays Powertip
- Electrolytic-Polymer-SMD Capacitors Koshin International

**LEVEL 2 BEE CONTRIBUTOR**
**PCB-mounted power relay**

TE Connectivity’s RZF series power relay offers through-hole technology (THT) printed circuit board (PCB) terminals plus top-mounted 4.8 x 0.5 mm quick connect tab terminals for load connections. Its low-profile design results in a mounted height about 19% less than that of some previous generation PCB relays with similar features and top-mounted tabs.

Contacts in a 1 form A (normally open) arrangement are rated 16 A at 250 V a.c., resistive. The 530 mW coil is offered in 5 V through 48 V d.c. versions. The relay complies with IEC 60335-1, 5th edition (GWT) and is UL recognised, VDE approved and CQC certified. It is suitable for applications such as microwave ovens, water heaters, cooking appliances, air conditioning and industrial/commercial equipment.

For more information contact Juan Ras, Altron Arrow, +27 11 923 9600, jras@arrow.altech.co.za

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**GDT lightning arrester**

Nextek announced the release of a new gas discharge tube (GDT)-type lightning arrester with N-type male to N-type female panel mount connector. The PTCNFSAF09E is fitted with a replaceable protective element, and the coaxial arrester operates from DC to 3.2 GHz.

The device has enhanced RF performance with a typical VSWR of only 1.35 and an insertion loss of only 0.25 dB in an extremely compact design. The PTCNFSAF09E has a multi-strike capability of 10 strikes at 20 kA or a single strike of up to 50 kA. The unit features high RF power, low PIM and a through current of 65 V d.c. at 10 A.

The PTCNFSAF09E has a rugged waterproof design and it offers bidirectional protection. It is used by several military manufacturers and communication networks to protect sensitive communications systems and air navigation systems.

For more information contact Conical Technologies, +27 66 231 1900, daniel.haywood@conical.co.za

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**High-power chip resistors**

The new Bourns Model CHP ultra high-power thick film resistor series offers triple the rated power compared to general-purpose resistors. It comes in four different footprints from small 0603 (1608 metric) up to 2512 (6431 metric).

The CHP series has a wide resistance range from 0.1 Ω and high rated power, making it ideal for current sensing. It also has a superior pulse load capability. These resistors are suitable for use within consumer electronics, industrial automation, power supply and LED lighting applications, and communication base stations.

The resistors are made using a thick film element printed onto a ceramic substrate. The 2512-size version offers 3 W of rated power at 70°C.

For more information contact Electrocomp, +27 11 458 9000, andrew@electrocomp.co.za
Hot Chips

**Bluetooth and Wi-Fi modules**

Silicon Labs offers a new Wireless Xpress solution to help developers get IoT applications connected and running in a day, with no software development necessary. The solution provides a configuration-based development experience with everything developers need, including certified Bluetooth 5 Low Energy (LE) and Wi-Fi modules, integrated protocol stacks and easy-to-use tools. With on-board wireless stacks controlled through a high-level API for setup and control, Wireless Xpress devices require only modest resources from a host processor, enabling developers to add wireless connectivity to any MCU. Bluetooth and Wi-Fi products based on Wireless Xpress can be remotely managed and updated over the air using native device management features.

*NuVision Electronics, +27 11 608 0144.*

**Digital signal controllers**

Microchip Technology announced a new family of dsPIC33CK 16-bit digital signal controllers (DSC) which provides system designers with DSP power combined with the design simplicity of a microcontroller. Designed to deliver faster deterministic performance in time-critical control applications, the dsPIC33CK have expanded context selected registers to reduce interrupt latency and new, faster instruction execution to accelerate DSP routines. With 100 MIPS performance, the core of the dsPIC33CK delivers almost double the performance of previous single-core dsPIC DSCs, making it ideally suited for motor control, digital power and other applications requiring sophisticated algorithms such as automotive sensors and industrial automation.

*Altron Arrow, +27 11 923 9600.*

**Reinforced isolated amplifier**

Texas Instruments introduced a new reinforced isolated amplifier designed for isolated voltage sensing in factory automation and control, grid infrastructure, rail transport and motor drive applications. TI's capacitive isolation technology enables the longest lifetimes and 50% higher working voltages than required by isolation industry standards, common-mode transient immunity (CMI) of up to 80 kV/μs and robust operation over an extended industrial temperature range of -55°C to +125°C. The high-precision ISO 224 enables highly accurate measurements of ±10 V signals, which are widely used in industrial applications. The chip also features a single, high-side supply with integrated voltage detection that simplifies the design and system-level diagnostics.

*Avnet South Africa, +27 11 319 8600.*

**Zigbee certified SoC**

Nordic Semiconductor’s nRF52840 multiprotocol system-on-chip (SoC) can now be used to build and ship commercial Zigbee designs. This means Nordic customers can now build and ship commercial Zigbee products using the SoC and nRF5 SDK for Thread and Zigbee. As with Nordic’s other mesh solutions, concurrent Zigbee and Bluetooth 5/Bluetooth Low Energy operation is also supported. During the Zigbee Compliance certification process using the latest nRF5 SDK for Thread and Zigbee and its integrated S140 v6.1 SoftDevice (or ‘stack’), the nRF52840 was concurrently connected to a Bluetooth 5 / Bluetooth Low Energy network the entire time.

*RF Design, +27 21 555 8400.*

**LNA with high dynamic range**

Mini-Circuits announced the release of the PHA-13HLN+ monolithic amplifier, an advanced wideband amplifier fabricated using E-PHEMT technology and offering extremely high dynamic range over a broad frequency range and with low noise figure. In addition, the device has good input and output return loss over a broad frequency range. It is enclosed in a SOT-89 package and has very good thermal performance. Covering a frequency range of 1 MHz to 1 GHz, the PHA-13HLN+ has low noise and a high IP3 of 43 dBm at 0.5 GHz. Its flat gain over wideband makes it ideal for sensitive, high-dynamic-range receiver applications in communication systems, cellular devices, CATV and base stations environments.

*Conical Technologies, +27 66 231 1900.*

**NFC tag chip**

NXP Semiconductors introduced its newest NTAG DNA tag chip that delivers privacy enabled, multi-layered security for NFC and IoT authentication applications. The NFC Forum-certified NTAG 424 DNA and NTAG 424 DNA TagTamper delivers cutting-edge security and privacy features, making it possible to confidently authenticate products and goods. These NFC chips provide cost-effective product protection and channel authentication for the fashion, food and beverages, pharmaceuticals, electrical appliances, and many other consumer and industrial goods markets – throughout the supply chain.

*EBV Electrolink, +27 21 402 1940.*
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<td><a href="http://www.uct.ac.za">www.uct.ac.za</a></td>
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<td>Würth Elektronik eSos</td>
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<td>Zetech</td>
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<td><a href="mailto:zorlianski@zetech.co.za">zorlianski@zetech.co.za</a></td>
<td><a href="http://www.wrb.co.za">www.wrb.co.za</a></td>
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