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WHAT'S NEW IN ELECTRONICS
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MANAGING INTELLIGENT ELECTRONIC DEVICES VIA AUTOMATED SYSTEMS

Matthew Oong, Business Development Manager – Energy Automation Solutions

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As part of their recent funding for smart grid initiatives, utilities in the USA have been deploying large numbers of intelligent electronic devices (IEDs) to implement advanced automation systems. However, they are discovering issues related to security and the high cost of maintaining these devices.

Originally considered as essentially capital intensive, projects in the electrical sector have seen increasing operational costs as utilities are faced with devices that require complex commissioning, potential regular firmware updates and issues related to security management. In Australia and New Zealand, we can leverage the US experience and take advantage of their learnings.

Power distribution systems have traditionally been relatively static in the context of local and/or remote binary operations with binary feedback of equipment. Recent years have seen an increase in the amount of intelligent activities utilities are expected to carry out, including advanced, coordinated, real-time functions such as fault location isolation and service restoration (FLISR), real-time power network status reporting, VAR management and voltage optimisation and control.

This technological evolution can provide a wide variety of business benefits — but it also brings a number of operational challenges. Advanced automation systems are built out of large numbers of programmable intelligent electronic devices, which can come from a broad variety of vendors. All of these devices are expected to operate in conjunction with one another, while also exchanging data in a secure and reliable manner.

This is a significant change in paradigm; traditional power distribution systems were designed to be long-lasting, incorporate simple technology and use simple protocols, with little or no security. Once operational, they were not expected to change until they required repair or replacement. Automation systems were utilised to ensure functionality, but not much more. However, many modern automation systems are adopting or inheriting functions that have traditionally been part of IT systems:

- Greater system dynamism, with a shorter device life expectancy.
- More regular device upgrades, due to obsolescence or discontinuation.
- New generations introduce new technology and protocols.
- More complex devices, requiring regular firmware updates to address security vulnerabilities, programming errors and new functionality.

Change has therefore become a fundamental characteristic of modern automation systems, and it must be considered as part of a business's wider IT and security strategy.

The ongoing evolution

Traditionally, communications, interoperability and security have generally been secondary considerations for automation systems as engineers selected 'best of breed' devices, according to their functional capabilities.

From a practical standpoint, commissioning a device requires numerous manual operations, often using a proprietary software tool connected to a serial maintenance port. Up until now, this was not an issue since the automation system was often deployed as part of a larger project, with very few changes expected or planned once the device was installed. It was time-consuming in the initial outlay, but required little attention afterwards and most ongoing maintenance was carried out via manual means.

But with the expansion of automated system functions, they are no longer static and require greater attention, including maintenance and device updates or replacements. As utilities extend their communication networks to integrate ever-increasing numbers of devices across new applications, it will no longer be cost-effective to manage the system manually and some form of automatic configuration is inevitable. While vendors of networking devices and proponents of the Internet of Things (IoT) have been promoting a vision of plug-and-play devices and zero-touch deployment, the whole process of commissioning electrical controls such as protection relays, voltage regulators, recloser controls and capacitor bank controls, from a variety of vendors, is much more complex and will remain so for the foreseeable future.
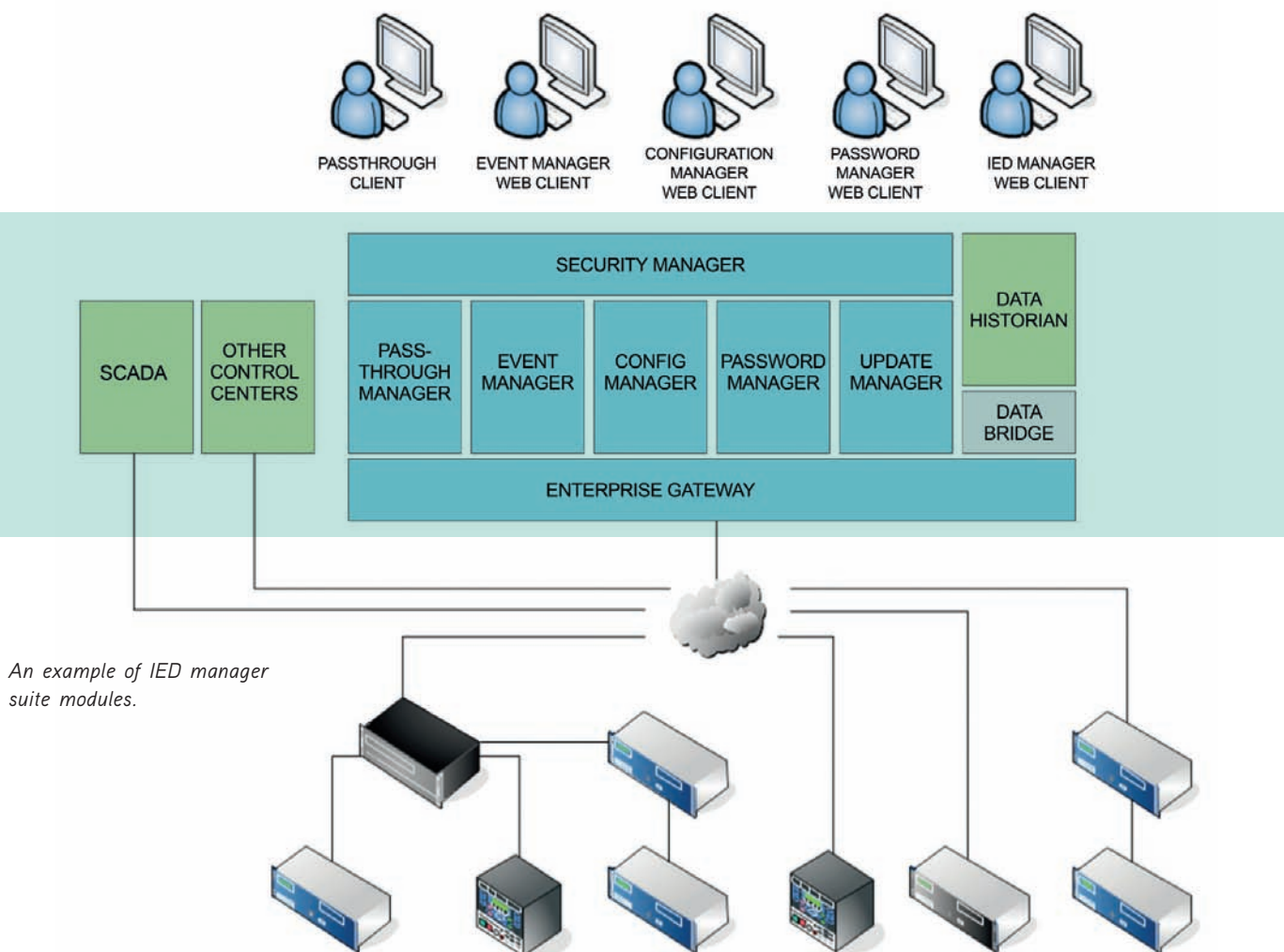
An example of IED manager suite modules.

Moving into new territory

As this is relatively new territory for power and IT specialists alike, Australia and New Zealand are still to develop a set of compliance standards surrounding the use of these technologies. Though Standards Australia and/or Standards New Zealand are likely to formulate them in the future as the technology becomes more widespread, at present it is recognised that the US-based North American Electric Reliability Corporation (NERC) CIP provides the most comprehensive standards in physical and cybersecurity.

Along with cybersecurity, there are currently efforts to extend standards such as DNP3 and IEC 61850 to include device properties and configuration settings, but these have not yet been widely adopted by the industry. As such, the task of managing devices used in automation systems requires specialised knowledge and experience that can only be expected from vendors in the electrical sector.

Electrical substations powering smart grids are host to a large number of IEDs, from a variety of vendors. These are used for protection, metering, monitoring and communications. Utilities that operate transmission substations were the first to implement automated device management systems; this

was originally to reduce operational costs, but also to help meet compliance requirements.

One of the first applications to be automated was the retrieval of power system event and fault data from digital fault recorders (DFR), in order to meet NERC PRC reliability requirements. Many utilities thus chose to connect their substations and deploy automated event retrieval software to eliminate the high cost of having skilled technical personnel drive to the substation simply to manually retrieve event data.

Deploying TCP/IP networks to the substations and installing advanced data concentrators had the additional benefit of providing the capability to manage devices remotely, further reducing operational costs. However, providing remote access to devices also opened a potential security issue which was rapidly addressed by NERC CIP.

Why automation needs to begin now

Complying with the NERC CIP standards involves much more than complying with technical requirements. Utilities have to provide evidence that their operational processes comply with the requirements. Managing lists of devices, firmware versions, users, access

permissions and passwords update history are all operations that can be much better handled by a device management software, rather than manually (eg, via spreadsheets). For many utilities, the business case for automating device management has thus been the ability to reduce operational costs through secure remote access, in addition to implementing tools to automate NERC CIP compliance.

Utilities that operate transmission substations must comply with the NERC CIP standards and also put in place policies and procedures to ensure the security of the devices used to implement critical functions in the bulk electric system (BES). While most large utilities have deployed some type of asset management software at the enterprise level, these systems are typically static and the information must be entered manually.

IT network management software, also typically used by large utilities, has generally been unsuccessful in handling IEDs because of the lack of standard protocols to interrogate substation devices and programmatically extract information such as firmware versions, serial numbers and device settings.

Specialist device management software designed for the electrical sector instead ›››

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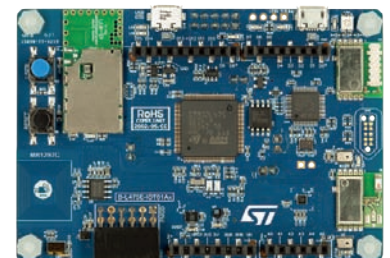
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implements device drivers for all common devices used in the electrical sector, and supports the functions required for managing the device's life cycle for NERC CIP compliance.

Reaping the benefits

Utilities that have deployed device management software to provide secure remote access and automate many of the most labour-intensive aspects of NERC CIP are now reporting additional unexpected benefits. Because substation devices can be accessed securely, departmental silos are breaking up, leveraging the communications infrastructure to provide access to multiple departments that require substation data for a variety of applications such as power quality or device condition monitoring. The time and effort required during the investigation of outages and power restoration is reduced through improved access to devices and the capability to remotely change settings during emergencies and weather events. Device management systems are thus providing proven benefits for the operators of transmission substations. While not yet being used on a large scale, some businesses with Australia and New Zealand are already taking advantage of the opportunities these systems present.

The high cost of compliance to NERC CIP standards provides a clear-cut business case for implementing automated management of substation devices — but what is the business case for devices used as part of distribution automation systems?

While the transmission substation can be characterised by the large variety of different devices installed in a single location, distribu-tion automation is characterised by the large number of identical devices deployed throughout a large geographical area. The operational challenges will thus be very different.

Experience gained while working with utilities that are deploying large fleets of distribution automation devices has provided us with a better understanding of the areas where operational costs are the most significant. Distribution automation devices are geographically dispersed, ensuring that remote management becomes a cost-effective alternative to an expensive truck roll. As an example, bulk settings and firmware updates can be performed remotely.

As utilities deploy their distribution automation systems, they gain a better understanding of the operation of their electrical network and will often need to change device operational settings from the original values. While some setpoints are mapped to DNP3 data points, not every setting is available through SCADA or DMS, and some changes need to be performed using the device configuration tool. Providing remote maintenance access to the device will obviously be less costly than driving to the site.

With thousands of devices to update, these operations rapidly become tedious, error-prone and very time-consuming. Firmware updates are the new reality in power system automation. As devices become more complex and perform more functions, they expose more programming errors and security vulnerabilities. While updating device settings is generally a short and straightforward operation, firmware updates require the transfer of larger data files and take much longer to perform with the communication speed provided by most distribution automation communication networks. Having qualified technical personnel sit in front of a maintenance tool watching a progress bar slowly creep forward is simply not a cost-effective operation.

As a ballpark figure, imagine an operation that requires at least 30 minutes performed, on a thousand devices, at an hourly cost in the range of $100 per hour to appreciate the potential cost savings of having the operation performed automatically, with no operator intervention. Firmware and setting updates are applications where the reality of distribution automation is very different than the realities of substation automation. Because of the criticality of substation devices, utilities generally prefer to be on-site to perform operations such as firmware updates. Device management software can accordingly be adjusted to meet the requirements of distribution devices that are typically less critical and where it is simply not cost-effective to perform updates manually.

Automating the process of keeping track of device configuration settings also makes sense from the perspective of operational best practices, even if it is not a compliance requirement.

Finally, most utilities will not consider managing device passwords as a very high priority for distribution devices. However, this will change in the future as it is expected that cybersecurity requirements will certainly extend to the distribution network.

Businesses looking at investing in this area of 'smart grid' with substation automation should be planning and anticipating now. The power distribution utilities will expand in their deployment and the functions and increase in complexity over the coming years. Investing in the proper management systems now can help prepare for future changes, and also reduce costs in the process.

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> **DISTRIBUTION AUTOMATION DEVICES ARE GEOGRAPHICALLY DISPERSED, ENSURING THAT REMOTE MANAGEMENT BECOMES A COST-EFFECTIVE ALTERNATIVE TO AN EXPENSIVE TRUCK ROLL.**

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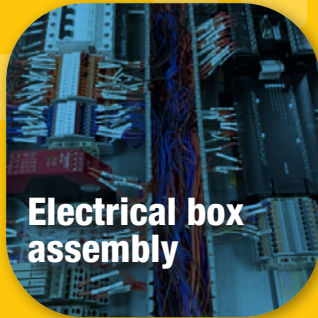
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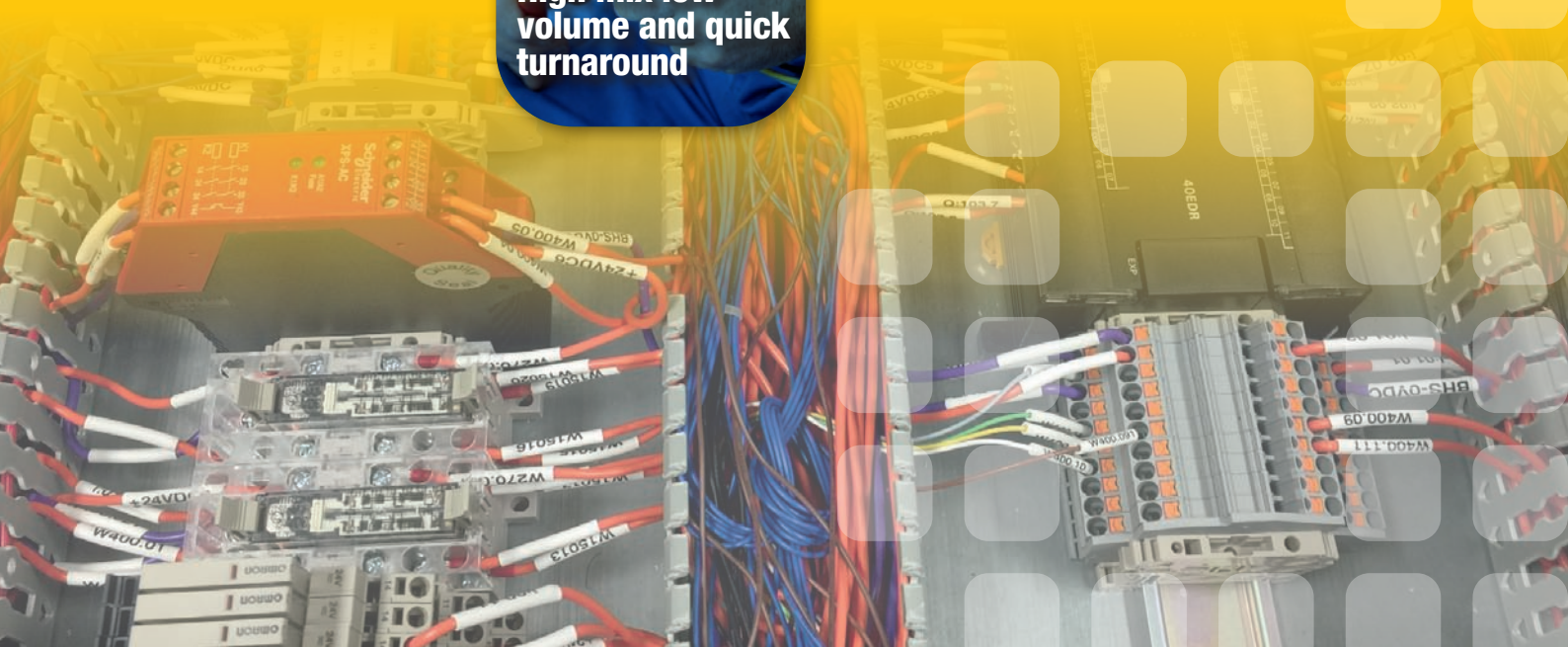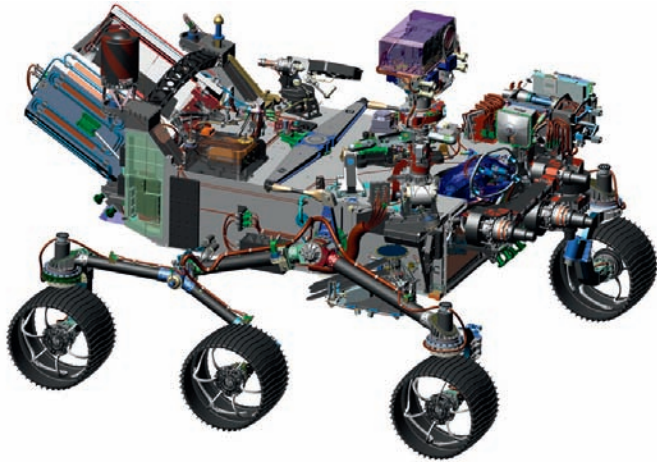Label and Wire Marker
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SHORT CIRCUITS

A computer-designed drawing of NASA's Mars 2020 rover.
Image credit: NASA/JPL-Caltech

DC MOTORS ON THEIR WAY TO MARS

maxon motor has supplied DC motor and gearhead combinations for the Mars 2020 rover, which is currently being built by NASA's Jet Propulsion Laboratory as part of a planned mission to the Red Planet in 2020.

From the outside, the Mars 2020 rover looks similar to its precursor, *Curiosity*, which is still operating on Mars. The latest rover will however have several new instruments on board to deliver new data. One key objective will be to search Mars for biosignatures; another will be to test whether it's possible to generate oxygen from the atmosphere for possible future human visits.

One of the rover's most significant new innovations is the ability to take rock samples in several locations and prepare them for return to Earth. The plan is to collect dozens of soil samples, seal them and leave them on Mars for future pick-up.

Nine brushless (flat) pancake DC motors and gearhead combinations from maxon's standard range will be used in the rover's sample handling aim, which moves the containers from station to station within the sampling system. Additional DC motors will sit inside the rover and assist with obtaining the samples and sealing the containers.

The brushless DC motors and gearheads have been heavily customised to survive the powerful entry, descent and landing sequence as well as the harsh daily conditions on Mars, with sandstorms and temperatures ranging from -130 to +70˚C.

PRECISE CONTROL OF PRINTED ELECTRONICS

Researchers at Linköping University's Laboratory of Organic Electronics (LOE) have demonstrated success creating printed electronic transistor circuits and displays in which the colour of individual pixels can be changed. Writing in the journal *Science Advances*, the researchers revealed their favourite material to work with: the conducting polymer PEDOT:PSS, which conducts both electrons and ions.

Displays and transistors manufactured from PEDOT:PSS have many advantages: they are simple and cheap to manufacture, and the material itself is non-hazardous. It has, however, been difficult to create devices that switch rapidly at a specific voltage, known as the 'threshold voltage'. This means that it has been difficult to control the current state of the transistors or the colour state of the displays in a precise manner.

"The lack of any threshold in the redox-switching characteristics of PEDOT:PSS hampers bistability and rectification — characteristics that would allow for passive matrix addressing in display or memory functionality," said Simone Fabiano, a senior lecturer at LOE and principal author of the new study.

A few years ago, LOE researchers wondered if they could solve this problem by combining electrochemistry with ferroelectricity. Ferroelectric materials consist of dipoles, with one end having a positive charge and the other having a negative charge. These ferroelectric dipoles rotate when they are exposed to an electric field beyond a specific threshold.
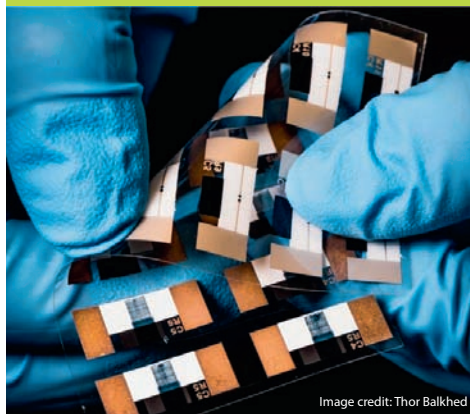

Image credit: Thor Balkhed

When laboratory head Professor Magnus Berggren was awarded a research grant from the Knut and Alice Wallenberg Foundation in December 2012, this was one of the high-risk projects he chose to invest in. Now, after many years of experiments, Fabiano and his colleagues at LOE have managed to apply a thin layer of a ferroelectric material onto one electrode in organic electrochemical devices and circuits.

"The thickness of the layer determines the voltage at which the circuit switches or the display changes colour," said Fabiano. "Transistors are no longer required in the displays: we can control them pixel by pixel simply through a thin ferroelectric layer on the electrode."

The researchers have thus demonstrated that 'ferroelectrochemistry' — the combination of ferroelectricity and electrochemistry — can be used in displays in the field of printed electronics and in organic transistors. The scientists envisage, however, many other areas of application.

"Ferroelectrochemical components can easily be integrated into memory matrices and into bioelectronic applications, just to give a couple of examples," said Fabiano.

Image credit: KIT

These solar glasses with lens-fitted, semitransparent organic solar cells supply two sensors and electronics in the temples with electric power.

SOLAR-POWERED SUNGLASSES TELL YOU THE TEMPERATURE AND MORE

German researchers have added organic solar cells to sunglasses, creating the first in what could be a new generation of consumer-oriented mobile applications with integrated solar technology.

Based on hydrocarbons, organic solar cells are flexible, transparent and lightweight. With the ability to adapt their colour, transparency, shape and size to the desired application, they are suitable for use in a variety of situations where conventional silicon solar cells would not be practical.

With this in mind, Dr Alexander Colsmann and his team at KIT's Light Technology Institute (LTI) designed 'smart' sunglasses featuring coloured, semitransparent solar cells that are self-powered to measure and display solar illumination intensity and ambient temperature. Their research has been published in the journal *Energy Technology*.

The solar cell lenses, well fitted to a commercial frame, have a thickness of approximately 1.6 mm and weigh about 6 g — just like the lenses of traditional sunglasses. A microprocessor and the two small displays, integrated into the temples of the solar glasses, show the illumination intensity and the ambient temperature as bar graphs.

The solar glasses also work in indoor environments under illumination down to 500 lux, which is the usual illumination of an office or a living area. Under these conditions, each of the lenses still generates 200 mW of electric power — enough to operate devices such as a hearing aid or a step counter.

Another possible application, according to Dr Colsmann, is the integration of solar cells into buildings. Since the glass facades of high-rise buildings must often be shaded, organic solar modules could be used for transforming the absorbed light into electric power. A further application could be to coat large surfaces with organic solar cells using reel-to-reel technology.

FLYING HIGH: LONG-LASTING DRONE DEVELOPED

Law student Tom Maclaurin has invented an unmanned aerial vehicle (UAV) that is capable of flying for five times longer than many drones currently on the market, as well as conducting aerial surveillance at a fraction of the cost of current manned aircraft.

Currently studying at The University of Western Australia (UWA), Maclaurin explained that he set out to address the considerable cost and time currently spent operating manned aerial surveillance platforms for activities such as beach and shark surveillance as well as crop monitoring in agriculture.

"What I have created is not only far cheaper, but can be operated remotely and is easy to use," he said.

Maclaurin's fixed-wing UAV, named Swift, is two metres in length and weighs six kilograms. It is capable of flying for more than six hours before its battery runs out, said Maclaurin, "and can be used to monitor anything on the ground by picking up data from sensors, taking images or recording video".

"It is lightweight and can glide safely to a stop should it lose power, instead of current drones which drop out of the sky when their battery runs out," he added.

Maclaurin said his device could have many useful applications, from beach patrols to monitoring crop levels, dam levels and

cattle locations, and could be used by councils and government authorities to monitor particular areas of land.

"There is a big demand for this kind of device across many industries," he said, claiming that Swift is cheaper, easier to operate and more accessible than current manned aircraft.

Maclaurin was recently awarded Student Start-up on the Year at UWA's Innovation Quarter (IQ) Awards for his invention. He is currently looking for investors to help him further develop his technology as well industry collaborators from local government, the agriculture industry and surf lifesaving.
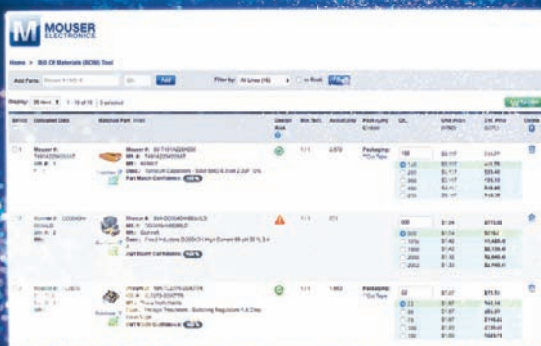
SMART INDUSTRY

FOUR PRINCIPLES POWERING THIS INDUSTRIAL REVOLUTION

'Smart Industry' isn't a random label one can just throw around, but the current industrial revolution brought on by a sophisticated and precise set of technologies that are changing man's relation to manufacturing.

Vipin Bothra held a session on the building blocks of the smart industry during the ST Developers Conference, which took place on 6 September in Santa Clara, California, to guide engineers to a better comprehension of what's actually happening behind the looking glass.

Living the Smart Industry revolution today

Industry 4.0, which we will use interchangeably with Smart Industry, was coined in early 2010 as the German government tried to make factories smarter by bringing connected technologies and manufacturing together. Hence, the Working Group on Industry 4.0, which offers recommendations to German leaders on how to bring on this new industrial age, has formalised the framework of this new step in the evolution of manufacturing.

The name Industry 4.0 shows it's the Fourth Industrial Revolution. The first one took place between 1760 and 1840 with the advent of mechanisation, as well as the use of chemical manufacturing, water power and steam. Then came batch production between 1870 and 1914, which was the Second Industrial Revolution. During that time, assembly lines and the use of electricity completely changed how plants operated. Finally, the third revolution took place during the 20th century, when computing systems and automation replaced manpower.

In their paper 'Design Principles for Industrie 4.0 Scenarios', German scholars Hermann, Pentek and Otto define the four pillars of the smart industry: technical assistance, information transparency, interconnection and decentralised decisions. According to Bothra, market development director at ST, his company is the only one in the world to offer leading solutions for all four of these principles. That means it can bring comprehensive innovations that work together in the most optimised and efficient way possible to realise the potential of this new revolution.

Here's a quick overview of these four foundational concepts:

Technical assistance means workers are no longer just operators but use machines to make critical decisions. For instance, mobile devices carry information that shape judgment calls and new systems make all tasks safer. Information visualisation is a significant component of this principle, and ST offers multiple development tools to help engineers build the apps they need to make technical assistance a reality.

Information transparency is the ability to bring all the elements of a smart plant together to substantially increase efficiency, thanks to the use of new models. It's basically where the virtual and the physical world meet. The consequence of this increase in efficiency is an augmentation in productivity and a decrease in energy costs. On top of enabling information transparency, ST makes it possible to compound those energy savings through low-power solutions, such as better motor-control systems or SiC components, among others.

Interconnection is what most people mean when they talk about IIoT (Industrial Internet of Things) or Smart Industry. However, as we've seen, Industry 4.0 is so much more than that. This principle signi-

fies that all the sensors, devices, machines and people are able to interact with one another by using secure and ubiquitous communication protocols that facilitate the exchange of information. ST has a crucial role in this domain because it offers fantastic software libraries to take advantage of powerful transceivers, and it is a major partner in most of the consortiums that define those protocols' specifications.

Decentralised decisions are the eye-catching aspects of this revolution because this principle moves the intelligence of the plant out of a centralised system to peripheral nodes. Thanks to low-power microcontrollers (MCU) offering new levels of horsepower, like the STM32 and STM8, more devices can make critical decisions, monitor activities and function autonomously. This increases efficiency and ensures the consequences of a failure are not as problematic since the rest of the plant is less affected, if at all.

Peeking at Industry 5.0

As Bothra explains, the most misunderstood and difficult principle to implement is interconnection. Because there are so many standards and constraints, most companies still prefer interconnection through wires, which can be challenging to deploy on a massive scale. Moving to wireless protocols is very complex because each plant must perform a lot of tests and trials to ensure there is no interference, as well as guaranteeing that all systems are reliable and secure.

He also explained that the decentralised decision pillar is probably gaining the most traction at the moment. ST's MCUs have become popular in the Smart Industry world as people come to grasp the new abilities and efficiencies that those components offer. In fact, Bothra anticipates that the next industrial revolution (Industry 5.0) will be the machine-learning capabilities that are coming to those systems.

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CABLE

DuraTest is a cable for daily measurement applications. The product is designed to withstand movement without degradation of its performance. It is suitable for error-free testing and end control of high-throughput production, where failure is not an option.

The cable is available with N and SMA connectors. It has an insert loss of 0.56 dB/m @ 2 GHz and 2.56 dB/m @ 26.5 GHz plus phase stability vs flexure of $\pm 7.4°$ @ 26.5 GHz.

Delta Gamma Consultant
www.delta-gamma.com

WELDING HELMET

The Speedglas Welding Helmet 9002NC has a streamlined profile, with high-performing Speedglas TrueView optics and a head harness made for increased comfort.

The Speedglas TrueView optics allow welders to view the weld pool and their general surroundings with a view that appears lighter, brighter and more realistic.

With a high optical rating (1/1/1), this large (55 x 107 mm) auto-darkening welding lens features shades 3/8-12 with arc detection down to 1 A. The Speedglas 9002NC is compliant with the relevant Australian and New Zealand standards and is suitable for MMAW, MIG/MAG, TIG and low amperage TIG.

The Speedglas 9002NC features exhaust vents that assist in removing exhaled air, keeping the welder more comfortable and the welding lens fog-free. At just 485 g and featuring an upgraded head harness with multiple adjustments for a customised fit, the Speedglas 9002NC is comfortable for all-day wear.

AWS Pty Ltd
www.awsi.com.au

ENERGY HARVESTING KIT

The Wurth Electronics Energy Harvesting Solution To Go Kit provides easy access to energy harvesting technologies, helping developers to apply them in future batteryless products.

The energy harvesting kit is a complete solution that allows developers to add energy harvesting, energy management and storage to their application. The kit features an energy harvesting board and an Energy Micro Giant Gecko Starter Kit.

The energy harvesting board is a multisource energy harvester with four Linear Technology voltage converters optimised for different energy sources: solar, electromagnetic, piezoelectric and thermal. The energy harvesting board offers two integrated energy sources to start the evaluation immediately: a solar cell (32 x 50 mm) and a thermogenerator (40 x 40 mm). Further external energy sources can also be added to the board.

The Giant Gecko Starter Kit features the EFM32 Giant Gecko MCU, an energy-friendly microcontroller with a comprehensive feature set: ARM Cortex M3, 48 MHz, 1024 KB Flash, 128 KB RAM, USB, LCD control, low energy sense and more. The kit can be connected by a 20-pin expansion header to the energy harvesting board. High-efficiency passive components from Wurth Electronics are integrated on the energy harvesting board as well as the starter kit.

X-on Electronic Services
www.x-on.com.au

HIGH-PERFORMANCE CONNECTORS

Harwin's M300 series is a 3 mm pitch, high-performance connector system suited to aerospace, defence, industrial and other harsh environments. The contact design ensures signal integrity under extremes of bump, vibration and shock, while the connectors operate under extremes of temperature from -65 to +175°C.

M300 provides a dual- and single-row cable-to-board and board-to-board solution for applications requiring up to 10 A of power in a small space.

The series features an extended rear potting wall for additional strain relief, three polarising points on each component to prevent mismating and optional jackscrews for security of connection. The housings are clearly marked with an identifier for fast visual inspection and are manufactured from halogen and red phosphorus-free, glass-filled thermoplastic. All M300 connector assemblies are RoHS compliant.

Crimp insertion/removal tool and crimp positioner are also available for the series.

Clarke & Severn Electronics
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HCF: SMD SOLID-STATE FUSE FOR THE MOST DEMANDING APPLICATIONS

SCHURTER's new High Current Fuse, HCF, is an extremely robust SMD fuse, designed using solid-state/thin-film technology. The HCF is especially suited for use in particularly harsh applications, where the reliable interrupt of high currents is critical.

SCHURTER's experience, acquired from the development of solid-state fuses for the space industry, and the cooperation with ESA, has led to the development of the HCF. The new HCF has a similar structure as the two ESA-certified types SCHURTER MGA-S and HCSF. Fuses used in Space applications meet the most rigorous performance requirements, with only the most advanced, most reliable technologies available. However, the intensive screening of each individual fuse, which is essential requirement for space applications, is not necessary with the HCF for non-Space applications. This leads to a substantial reduction in the cost per fuse.

Solid state/thin film

In contrast to conventional fuses with a melting wire, the HCF has a metallic thin film layer. With this manufacturing technique, a metal layer is applied in conjunction with a so-called sputter. The two form on a glass substrate in an exact micrometer thickness. The resulting fuse element is enclosed with a ceramic housing that guarantees the necessary stability and interrupt capacity. No harmful substances escape in solid or gaseous form during cutoff of the fuse. This technology also makes the SCHURTER HCF completely impermeable to potting compound, which can be used to achieve a hermetic seal e.g. for use in intrinsically safe applications according to ATEX and IECEx requirements.

High breaking capacity

The SCHURTER HCF has a high breaking capacity of up to 1000 A at 125 VAC resp. 125 VDC with fast response. It covers a rated current range from 5 A to 15 A.

Application areas

Due to its robust design, the HCF fuse is particularly suited for applications which offer high reliability under particularly difficult conditions (thermal and mechanical shock, cycle endurance, etc.). Examples of possible applications: ATEX- and offshore oil and gas applications, equipment operated in sub-arctic regions, aviation electronics, and certain medical technology,

where robust and space saving fuse performance is required. The temperature from -50°C to 125°C, as well as a vibration resistance — tested up to 1600g — make the HCF ideal for the most demanding high-performance applications under the most adverse conditions.

Technical Data:

- Approval for IEC 60127-7 / UL 248-14 / CSA C22.2 no. 248.14
- High breaking capacity up to 1000 A
- Rated Current: 5 A / 7.5 A / 10 A / 15 A
- Rated Voltage: 125 VDC / VAC
- Quick-Acting characteristics (F)
- Smallest Fuse for 15 A @ 125 VDC
- Sealed
- According to Standard: ATEX EN 60079-0 (-11)
- According to Standard: MIL-PRF-23419

Applications:

- Applications where high reliability is needed
- Fail-Safe applications
- Aviation
- Offshore
- Commercial satellite projects

About SCHURTER

SCHURTER is an internationally leading innovator and manufacturer of electric and electronic components. The company focuses on safe power supply and easy-to-use equipment. Its extensive product portfolio comprises standard solutions in the fields of circuit protection, plugs and connectors, EMC products, switches, input systems and electronic manufacturing services. SCHURTER's global network of representative offices ensures reliable delivery and professional customer service. Where standard products are unsuitable, the company develops client-specific solutions.

SCHURTER (S) PTE LTD
www.schurter.com

⑤.SCHURTER
ELECTRONIC COMPONENTS

THREADED LOCKING CONNECTORS

Switchcraft has introduced the TS Dura-Twist Series of threaded locking connectors. IP68 rated when mated, they are available with up to nine contacts and in cable-to-cable inline and rear- or front-mounting panel mount options.

The threaded locking mechanism provides a secure and easy connection, enabling the connectors to withstand the temperature and pressure of autoclave sterilisation. They can fit the same panel cutout as EN2 panel mounts and are suitable for medical devices, audio connections, outdoor data acquisition devices and other harsh environment applications.

Clarke & Severn Electronics
www.clarke.com.au

VECTOR NETWORK ANALYSER

The R&S ZNLE vector network analyser from Rohde & Schwarz brings high RF performance and fast measurements to the economy class. The easy-to-use instrument is said to be the lightest, most compact VNA in its class, making S-parameter measurements easy.

Rohde & Schwarz has launched the R&S ZNLE vector network analyser to address the requirements of customers looking to perform RF measurements to characterise components such as antennas, attenuators, filters and PCBs. The standalone instrument weighs only 6 kg and has a footprint of just 408 x 235 mm, saving up to two-thirds of space on the workbench compared with competitor VNAs, according to the company.

The two-port vector network analyser not only saves space but also provides quick measurements due to its easy-to-use S-parameter wizard. The R&S ZNLE performs bidirectional measurements of the S11, S21, S12 and S22 S-parameters. An optional GPIB interface is available for remote control of the analyser. The instrument comes in two models with frequency ranges from 1 MHz to 3 GHz (R&S ZNLE3) and to 6 GHz (R&S ZNLE6).

The R&S ZNLE offers good RF performance with a wide dynamic range of typically 120 dB and measurement bandwidths from 1 Hz to 500 kHz. Measurement time is just 9.6 ms for 201 points at 100 kHz measurement bandwidth, for a 200 MHz span, with two-port TOSM/SOLT calibration. For stable, repeatable measurements, the R&S ZNLE produces low trace noise of typically 0.001 dB. Another feature is the large 10.1″ WXGA touch screen, providing good visibility of all traces.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com.au

PROFESSIONAL LED PANEL INDICATOR

Marl's 528 Series is a 13 mm mounting professional LED panel indicator featuring a high-intensity LED element. The product's internal circuitry includes a reverse protection diode. Termination is achieved by standard solder/crimp tags (150 and 1000 mm flying lead terminations are available).

The device is fitted with a low-profile, coloured diffused lens assembly to provide wide-angle viewing. It is internally potted, making it suitable for high-vibration applications. The precision-turned housing is manufactured from high-quality stainless steel.

The unit is supplied complete with full mounting hardware. A range of voltage options are available, as are a range of LED colours. Benefits include high optical performance, vandal resistance and sealing specifications in excess of IP67.

The product is suitable for use in industrial equipment, medical clean equipment, food preparation equipment, steel foundries and coal mines, defence platforms and navel equipment, heavy plant and equipment, and fairground and leisure equipment.

Aerospace & Defence Products
www.aerospacedefenceproducts.com.au
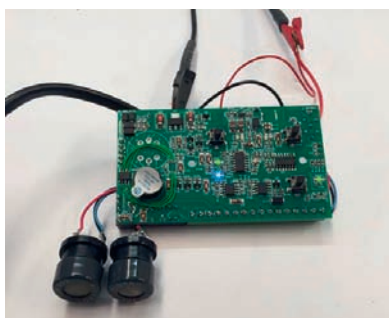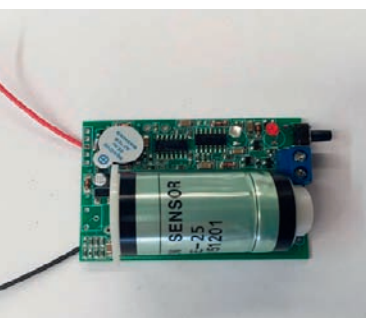
LPG ELECTRONICS MANUFACTURING

Peel Electronics (trading name Gas Sensors Australia) is an Australian designer of specialised electronics for the LPG automotive industry. Utilising a high-quality surface-mount machine to manufacture its products, the company designs and engineers its products locally.

The company can provide technical assistance in the development, engineering and design phase; assist with prototyping for development of the engineer's schematics; provide technical assistance in gas sensor technology and specific sensors required according to target gas; and assist in the design phase for PCBs from the engineer's schematic.

The company also offers consultancy and training in areas of the project with regards to PCB circuit design (Gerber files etc), PCB layout, component suitability ratings and circuit ratings.

Peel Electronics
www.peelinstruments.com.au

PCB PRINTER

Nano Dimension has developed the DragonFly 2020 3D PCB printer for printing professional multilayer circuit boards.

The printer produces professional multilayer printed circuit boards (PCBs) and 3D circuitry, making it a rapid prototyping tool for electronics professionals. It brings together a precise inkjet deposition printer, high-performance silver nanoparticle conductive and dielectric inks and dedicated software in order to bring the benefits of 3D printing to electronics professionals.

The printing platform is dedicated to the production of professional multilayer PCB prototypes and other circuitry in-house, within hours. This means there is no need to wait days or weeks for a custom PCB prototype that has to be fabricated off-site. The innovative hardware, dedicated nano-inks and novel software offer virtually limitless design flexibility to a wide range of research and development, prototyping and custom manufacturing projects.

The 3D printer offers the flexibility to print an entire board or just part of a circuit. Users can develop the RF and digital sections of the board in parallel, test and iterate on the fly. The printer thus encourages innovation, lessening development risks and enabling faster time to market.

The product deposits two materials, one conductive and one dielectric, in order to build a complete multilayer PCB from the bottom up. Each pass of the printhead deposits dielectric and conductive material at the exact location specified by the design file. Starting from the underside conductive traces, the materials are built up to finish with the topside conductors.

This process means that vias are built up, drop by drop, either as blind, open or complete vias. Plated and non-plated through-holes are created by repeatedly leaving a space at a particular XY coordinate, thereby building surrounding materials up around a void. The dielectric ends up as a solid piece within which the conductive traces are positioned at the precise XYZ coordinates specified.

Emona Instruments Pty Ltd
www.emona.com.au

FANLESS DIGITAL SIGNAGE PLAYER

iBase Technology's SI-623-N 4 is a fanless digital signage player with three HDMI outputs. It is based on the 7th/6th Generation Intel Core processor and supports up to 4K (3840 x 2160) resolution in each display channel.

The signage player comes with a pair of wall-mount brackets and can comfortably fit behind multidisplays or video walls deployed in places across markets such as hospitality, retail and public transport. It is powered by the integrated Intel HD Graphics 530 via 1x HDMI 2.0 and 2x HDMI 1.4 display interfaces.

The product is equipped with numerous storage and I/O connectivity options, including 2x DDR4 SO-DIMM sockets with up to 32 GB capacity, 1x RJ-45 for Gigabit LAN, 1x RJ45 for RS-232, 2x USB 3.0, 2x USB 2.0, 1x M.2 B-Key, 1x M.2 M-Key, 1x 2.5″ SATA HDD/SSD for storage, 1x SIM and 1x Mini PCI-E slot. The standard SI-623-N model is supplied with 8 GB system memory, 128 GB SSD and an 84 W power adapter.

Backplane Systems Technology Pty Ltd
www.backplane.com.au

MODULAR INDUSTRIAL PANEL PCS

With the arrival of Industry 4.0, and the resulting shift in market demands, conventional all-in-one automation panels lack the flexibility to meet industry requirements. To address this need, Advantech created its TPC series of modular panel PC solutions based on three performance-segmented models: a control panel (TPC-5000), industrial thin-client (TPC-2000) and web terminal (TPC-1000).

The modular design of the series allows the computing modules to be interchangeably combined with Advantech's display modules (available in five sizes) to provide up to 15 flexible platform solutions for specific field applications. The platforms can be rapidly customised and configured according to usage requirements. Users can choose from a thin-client or standard box PC equipped with an Intel Atom or Core i processor, analog resistive single-touch or projected capacitive multitouch displays, and over 30 I/O expansion modules in order to assemble a solution based on their exact specifications.

The flexibility, serviceability and modularity of the series offer numerous performance advantages, including complete HMI control and monitoring, customisation according to application requirements, rapid integration and deployment, reduced system downtime and maintenance costs, and support for future expansion. With features such as wide temperature support, an IP66-rated true-flat front panel with built-in Wi-Fi/NFC antenna, an anti-scratch surface and an optional NFC reader, Advantech's display panels are suitable for both industrial and commercial applications.

Advantech Australia Pty Ltd
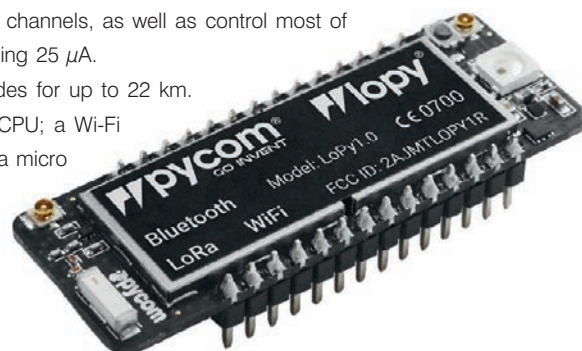www.advantech.net.au

DEVELOPMENT BOARD

The LoPy is a compact, triple-network, MicroPython-enabled development board (LoRa, Wi-Fi, Bluetooth), making it a suitable enterprise-grade IoT platform for connected things. With the latest Espressif ESP32 chipset, the product offers a combination of power, friendliness and flexibility, enabling the user to create and connect things everywhere they go.

The device can act as both a LoRa nano-gateway and a multibearer (LoRa, Wi-Fi and BLE) development platform suitable for all LoRa networks around the globe. It is programmable with MicroPython and the Pymakr plug-in IDE for fast IoT application development, easy programming in-field and extra resilience with network failover. It offers a blend of speed to deployment and access to LPWAN networks rolling out across Europe, USA, Africa and India.

The product includes a dual processor and Wi-Fi radio system on chip. The network processor handles the Wi-Fi connectivity and the IPv6 stack, while the main processor is entirely free to run the user application. An extra ULP-coprocessor can monitor up to 24 GPIOs and the eight 12-bit ADC channels, as well as control most of the internal peripherals during deep-sleep mode, while only consuming 25 μA.

As a nano-gateway, the product has a capacity of up to 100 nodes for up to 22 km. Its node range is up to 40 km. Other features include: a powerful CPU; a Wi-Fi range of 1 km; ultralow power usage; 2x UART, 2x SPI, I²C, I²S and a micro SD card; DMA on all peripherals; and more.

Elecom Electronics Supply
www.elecomes.com

MAKING THE IMPOSSIBLE POSSIBLE AND THE COMMON EASY

LET THE PAST SHOW YOU THE WAY TO THE FUTURE

Jeffrey Phillips, Principal Software Product Manager

The rapid pace of technological advancement should be celebrated and embraced. It fuels amazing new technologies and scientific achievements that make us more connected and safer. It also pushes the limits of what we previously thought possible.

The impact of these achievements is no longer isolated to a narrow market vertical. It permeates every industry and exposes the established market incumbents to an unusual combination of disruption and growth potential.

But the pressure and the challenge to drive business impact are daunting in this climate. How do you stimulate growth while making large investments in future technologies without dramatically changing your business model? Companies are watching their operational costs balloon as they dip their toes into numerous areas of investment that require significant and often disparate expertise. Meanwhile, small start-ups with incredible focus and no prior obligations can leverage new technologies in ways that established competitors struggle to answer.

So how do you protect yourself from disruption? How do you innovate without radically increasing the cost of doing business? It all boils down to one simple question: do you feel secure in the tools you're using?

That's the magic question, whether it's your personal finances, career or the engineering systems of the future. For instance, the Industrial Internet of Things ushers in a new era of both networked potential and significant risk. To best understand which software prepares you to most securely engineer future systems, you should turn to the recent past.

In 2005, the previous three technological decades were defined by one simple observation made by the co-founder of Intel, Gordon Moore. Moore's law was the prediction, based on the recent past, that the number of transistors per square inch on an integrated circuit would continue to double every 18 months. Seemingly linear growth was just the start of exponential growth.

Before we knew it, CEOs from every semiconductor manufacturer talked about the number of parallel processing cores over the next few years. Intel CEO Paul Otellini promised 80 core chips in the following five years. The demand for more processing power with lower latency marched on. Alternative processing fabric emerged. First, the FPGA stormed into popularity with its software-defined timing and massively complex low-level programming languages. Next, heterogeneous processing was born when the traditional processor and the FPGA were combined onto a single chip.

Along with this explosion of processor architectures came a flood of new programming environments, programming languages and open-source fads biding their time until the inevitable decline into oblivion. And, of course, the whole burden of figuring out how to efficiently program the processors fell on you.

But now, we look to the future. The explosion of processing capabilities is leading us forward into a world of hyperconnectivity. And this world becomes more connected as engineering systems become more distributed. Trends like 5G and the Industrial Internet of Things
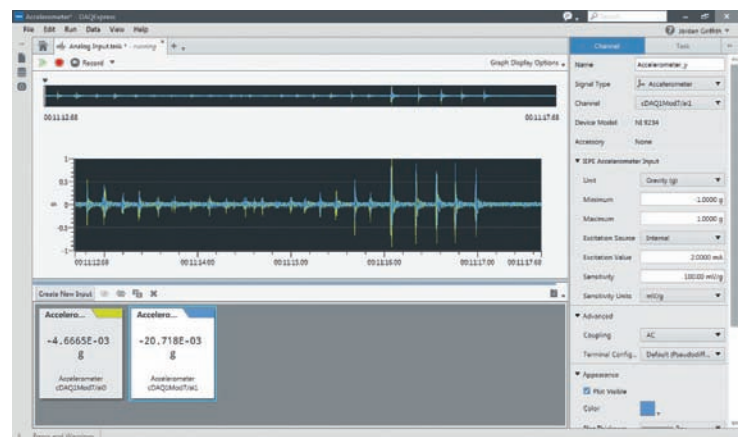
The interoperability between products in NI's software portfolio simplifies the sharing of IP and transfer of code for more complex development.

promise to connect infrastructure, transportation and the consumer network to enrich the lives of people the world over. It's inarguable that software will be the defining aspect of any engineering system, if it's not already. And it won't be long before hardware becomes completely commoditised and the only distinguishing component of a system will be the IP that defines the logic.

Most test and measurement vendors have been slow to respond to the inevitable rise of software and are just now hitting the market with software environments that help the engineering community. But even those can only get you so far. As the industry continues to evolve, the tools engineers use to design these connected systems must meet four key challenges: productivity through abstraction, software interoperability, comprehensive data analytics and the efficient management of distributed systems.

Productivity through abstraction

Abstraction is one of those words that is so overused it's in danger of losing its meaning. Simply put, it is making the complex common. In the world of designing engineering systems, complexity often comes from programming. The custom logic that adds the smart to smart systems typically requires a level of coding that's often so complex, it's what separates the pros from the amateurs. The complex must become common, though.

To solve this challenge, engineers need a 'programming optional' workflow that enables them to discover and configure measurement hardware, acquire real-world data and then perform data analytics to turn that raw data into real insight. NI is introducing a new

configuration-based workflow in the form of LabVIEW NXG. It is complemented by the graphical dataflow programming paradigm native to LabVIEW and known for accelerating developer productivity in complex system design for nearly 30 years. With this configuration-based interaction style, you can progress from sensor connections all the way to the resulting action without the need for programming and still construct the code modules behind the scenes. That last step is a critical feature that streamlines the transition from one-off insights into repeatable and automated measurements.

Software interoperability

With the growing complexity of today's solutions, the need to combine multiple software languages, environments and approaches is quickly becoming ubiquitous. However, the cost of integrating these software components is considerable and continues to increase. Languages for specialised hardware platforms must be integrated with other languages as these compute platforms are being combined into single devices. The solution to this is typically the design team assuming the burden of integration. However, this is essentially just treating the symptoms and not addressing the root cause. The software vendors must fix the root cause.

By design, NI's software-centric platform places this software interoperability at the forefront of the development process. Though LabVIEW has been at the centre of this software-centric approach, many complementary software products from other companies are individually laser-focused on specific tasks, such as test sequencing, hardware-in-the-loop prototyping, server-based data analytics, circuit simulation for teaching engineers and online asset monitoring. These products are purposefully limited to the common workflows of the engineers and technicians performing those tasks. This characteristic is shared with other software in the industry tailored to the same purpose. However, for NI software, LabVIEW provides extensibility capabilities through an engineering-focused programming language that defies the limitations of tailored software. For example, consider DAQExpress.

DAQExpress is new companion software for USB and low-cost plug-in NI data acquisition hardware that drastically simplifies the discovery and configuration of hardware and provides access to live data in two clicks. All the configuration 'tasks' within this product are fully transferrable to LabVIEW NXG, which simplifies the transition from hardware configuration to measurement automation.
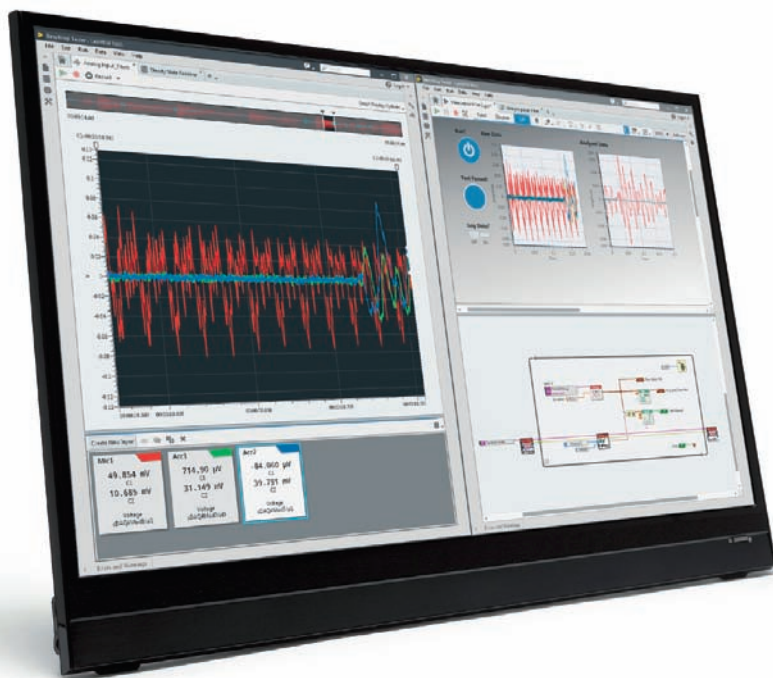

New workflows in LabVIEW NXG mean users can acquire, analyse and export measurement data without programming.

In addition to interoperating within the NI platform, products like LabVIEW 2017 feature enhanced interoperability with IP and standard communications protocols. For embedded systems that need to interoperate with industrial automation devices, LabVIEW 2017 includes native support for IEC 61131-3, OPC-UA and the secure DDS messaging standard. It also offers new interactive machine learning algorithms and native integration with Amazon Web Services.

Beyond the individual innovation within each of these products, the collection represents the fruition of NI's commitment to its ongoing investment in software. This combination of software products and their inherent interoperability separates NI's platform from the rest. Other vendors are just now figuring out that software is the key, but NI's investment in software has steadily increased over the last 30 years.

Comprehensive data analytics

Perhaps the most prolific benefit of the mass connectedness between the world's systems is the ability to instantaneously access data and analyse every data point you collect. This process is critical
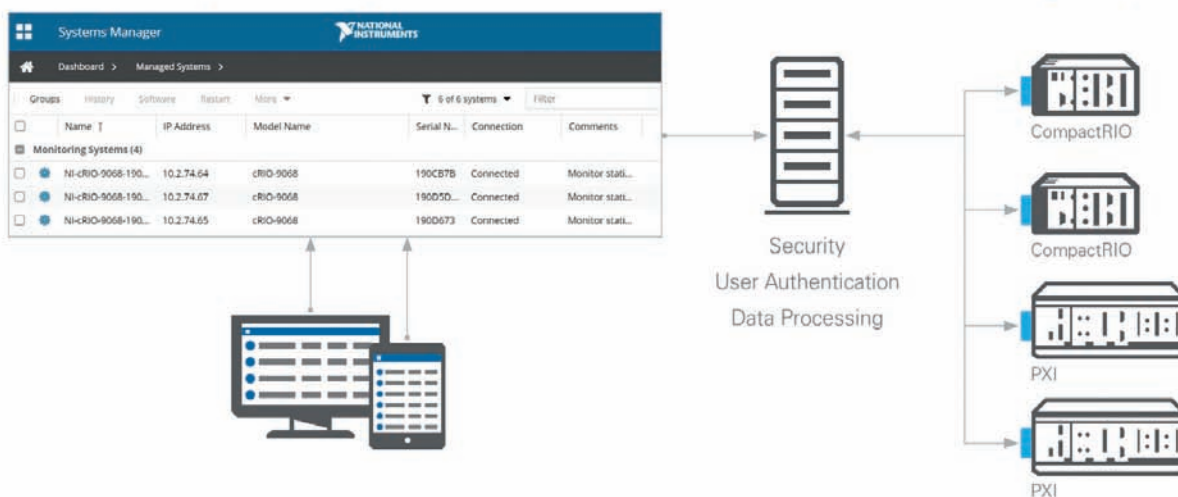
SystemLink introduces a web-based interface to manage distributed hardware systems.

to automating decision-making and eliminating preventable delays in the necessary corrective action when data anomalies happen.

To create the future network that can support this need, billions of dollars are being poured into research as algorithm experts from around the globe race to meet the demands of 1 ms latency coupled with 10 Gbps throughput. This direction introduces new demands on software. The first is to ensure that the processing elements can be easily deployed across a wide variety of processing architectures and then redeployed on a different processor with minimal (hopefully zero) rework. The second is to be open enough to now interface with data from an infinite number of nodes and via an infinite number of data formats.

NI has invested in server products that allow you to intelligently and easily standardise, analyse and report on large amounts of data across your entire test organisation. A key component is providing algorithms to preprocess files and automatically standardise items such as metadata, units and file types in addition to performing basic analysis and data quality checks. Based on that data's contents, the software can then intelligently choose which script gets run. This type of interface is critical to eliminating the complexity of real-time data analytics so you can focus on what matters: the data.

Distributed systems management

The mass deployment and connectedness of these systems have renewed the need to efficiently manage all the distributed hardware from a centralised — and often remote — location. Today, this typi-cally requires replicating single-point deployments across hundreds, and even thousands, of systems. Centralising the management then leads to the ability to see a real-time dashboard of the hardware from the remote depot instead of physically accessing the system.

SystemLink is innovative software from NI that helps you cen-tralise the coordination of a system's device configuration, software deployment and data management. This reduces the administrative burden and logistical costs associated with systems management functions. The software also improves test and embedded system uptime by promoting awareness of operational state and health cri-teria. It simplifies managing distributed systems and provides APIs from LabVIEW and other software languages such as C++.
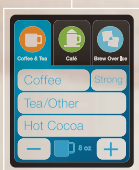
Ask yourself again

Beyond the individual innovation within each of these product releases, the collection represents the culmination of the ongoing investment in software that NI has committed to year after year. From discovering the Higgs boson particle to decreasing test times by 100x for Qualcomm to being Nokia's and Samsung's solution of choice for their 5G research, NI's software-centric platform is the building block that engineers use to solve the most complex chal-lenges in the world.

Ask yourself again: how secure do you feel in the tools you're using?

National Instruments Aust Pty Ltd
www.ni.com

MODULAR CURRENT MULTIPLIERS

Vicor has announced the introduction of Power-on-Package modular current multipliers (MCMs) for high-performance, high-current, CPU/GPU/ASIC (XPU) processors. By freeing up XPU socket pins and eliminating losses associated with delivery of current from the motherboard to the XPU, the product enables higher current delivery for maximum XPU performance.

Vicor's MCMs fit within the XPU package to expand on the efficiency, density and bandwidth advantages of the company's Factorized Power Architecture. MCMs mounted on the XPU substrate under the XPU package lid, or outside of it, are driven at a fraction of the XPU current from an external modular current driver (MCD). The MCD, located on the motherboard, drives MCMs and regulates the XPU voltage with high bandwidth and low noise.

With MCMs mounted directly to the XPU substrate, the XPU current delivered by the MCMs does not traverse the XPU socket. Because the MCD drives MCMs at a low current, power from the MCD can be efficiently routed to MCMs, reducing interconnect losses by 10 times — even though 90% of the XPU pins typically required for power delivery are reclaimed for expanded I/O functionality. Additional benefits include a simplified motherboard design and a reduction in the minimum bypass capacitance required to keep the XPU within its voltage limits.

The small (32 x 8 x 2.75 mm) package and low noise characteristics of the MCM make it suitable for co-packaging with noise-sensitive, high-performance ASICs, GPUs and CPUs. The operating temperature range is -40 to +125°C.

Vicor Corporation
www.vicorpower.com

PHASE CHANGE MATERIALS FOR THERMAL MANAGEMENT

TPM350 and TPM550 phase change materials offer high thermal conductivity, low phase change temperatures and low thermal resistance at the interface. Phase change materials are suitable for the thermal management of electronic assemblies, offering efficient thermal transfer, high performance with thermal shock cycles and good thermal protection where temperature spikes can occur.

Once heated above their phase change temperature, the phase change materials become highly thixotropic liquids that perform at least as well as thermal grease, according to the company. The consistency and performance of the materials also avoids possible application and migration problems that can be associated with thermal greases.

TPM350 has a thermal conductivity of 3.5 W/mK and becomes workable at approximately 50°C. At this temperature it changes state to become a lower viscosity material, minimising contact thermal resistance and improving thermal conductivity. Once it cools, it reverts back to its original state. The material's advanced formulation ensures minimal contact thermal resistance.

TPM550 has a higher thermal conductivity of 5.5 W/mK and an activation temperature of 45°C. In common with TPM350, TPM550 produces no mess due to its thixotropic characteristics which prevent flow outside of defined interfaces. Both TPM350 and TPM550 can be reworked and their low specific gravity means that more applications can be served per kilogram of the materials.

The phase change materials are silicone free, have an operating temperature range of -40 to +125°C and are RoHS-2 compliant. They are both screen printable and, while they contain small amounts of solvent to improve wettability on application, this rapidly evaporates following application to leave the solid phase change material on the substrate.

Electrolube
www.electrolube.com.au

PCB MOUNTING TACT SWITCHES

The PHAP5 Series is the latest addition to APEM's PCB mounted tact switch range, with four different sizes to choose from.

The series includes single-pole, normally open, PCB through-hole or SMT tact switches with positive feedback and various options available.

The switches are rated at 50 mA 12 VDC with a mechanical lifespan of up to 200,000 cycles at full load. Using high-quality, RoHS compliant materials, they offer durability and precision.

Control Devices Australia
www.controldevices.net

BLUETOOTH LOW ENERGY WIRELESS MODULES

The Cypress EZ-BLE Programmable Radio-on-Chip (PRoC) XR modules are 48 MHz, 32-bit solutions with 256 KB of flash, 32 KB of SRAM and a 12-bit SAR analog-to-digital converter (ADC).

The Bluetooth Low Energy wireless modules offer an extended range of up to 400 m bidirectional communication (or up to 450 m in beacon-only mode) for a broad range of applications, including Internet of Things (IoT) and home and factory automation. They feature two integrated crystals, up to 19 general-purpose inputs and outputs (GPIOs) and a programmable architecture that supports a number of peripheral functions (such as ADC, timers, counters and PWM) and serial communication protocols (including I²C, UART and SPI).

The modules include a royalty-free Bluetooth Low Energy stack compatible with Bluetooth 4.2 and are available in two certified versions (CYBLE-212006-01 and CYBLE-202007-01) and an uncertified version (CYBLE-202013-11). The CYBLE-212006-01 includes an integrated trace antenna, while the CYBLE-202007-01 supports an external antenna via a u-FL connector. The uncertified CYBLE-202013-11 supports an external antenna through an RF solder pad output and omits the RF shield.

Mouser Electronics
www.mouser.com

INTELLIGENT INDUSTRIAL 19″ PANEL PC

IEI Integration has released its intelligent 19″ industrial metal bezel panel PC, the PPC-F19B-BT. Powered by the Intel Celeron J1900 Quad-Core SoC, the panel PC can support up to 8 GB of DDR3L SO-DIMM.

The unit has a 19″ LCD screen and a robust, ultraslim aluminium front bezel for seamless panel-mount installation, equipped with 5-wire resistive touch screen. The full-function panel PC features multi I/O including 2x Gigibit LAN ports, 2x USB 3.0, 2x USB 2.0, 2x RS-232, 1x RS-232/422/485 and an audio connector.

The product meets the IP65 rating, providing resistance to dust and liquid ingress. The panel PC also offers full-size and half-size PCIe Mini slots for expansion opportunities.

The multifunction panel PC can be used in various applications including industrial, commercial, entertainment systems and hospitality. The operating voltage is 9–30 VDC.

**ICP Electronics Australia Pty Ltd**
www.icp-australia.com.au

SCALABLE PXI MICROWAVE SIGNAL GENERATOR

Keysight Technologies has announced its scalable PXIe microwave signal generator, with frequency coverage up to 44 GHz and modulation bandwidth up to 1 GHz, for generating complex waveforms used in emerging 5G and aerospace and defence DVT applications. DDS technology with the synthesiser VCO provides good phase noise performance. When combined with the baseband performance, the M9383A PXIe signal generator delivers 1% EVM, a critical measure of 5G modulated signal performance, for 800 MHz wide pre-5G waveforms.

Engineers can create Keysight-validated Verizon pre-5G standard (5GTF) compliant waveforms and 5G candidate waveforms, such as 8 x 100 MHz OFDM component carriers (CC), for the PXIe signal generator using the company's Signal Studio or SystemVue software. The software also allows engineers to create custom waveforms for emerging wireless, 5G new radio (5G NR) and aerospace and defence applications.

The M9383A PXIe vector signal generator is integrated in Keysight's 5G testbed reference solution, adopted by several 5G development teams working across the sub-6 GHz, 28 GHz and 39 GHz bands.

Engineers can add channels to either vector or analog configurations. Users can also upgrade frequency, bandwidth and other performance characteristics as signal standards evolve. Modulation bandwidths of up to 2 GHz are supported through external IQ inputs.
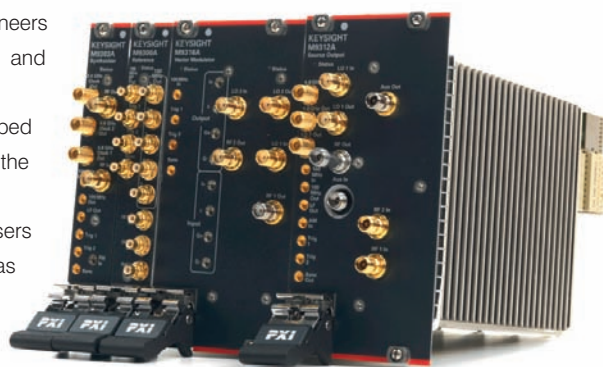
Keysight Technologies Australia Pty Ltd
www.keysight.com

DIGITAL STORAGE OSCILLOSCOPE

The Keysight DSOX3024 digital storage oscilloscope offers 200 MHz of bandwidth with four channels and an update rate of 1 million waveforms/s. The device has a sampling rate of 2 GS/s (4 GS/s half-channel interleaved mode) and 2 Mpts memory depth. It is available for rent from TechRentals.

Higher waveform updates improve the probability of capturing random and infrequent events and with deeper memory, capturing long and non-repeating signals while maintaining a high sample rate can be achieved. Keysight's MegaZoom technology automatically selects deeper memory when needed in order to maintain fast sample rates while also updating quickly.
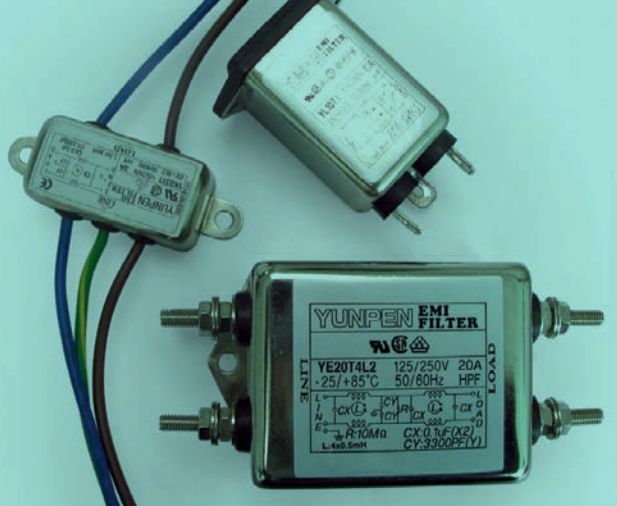
The product allows users to see more of their signals more of the time with a large screen — an 8.5″ WVGA display with 800x480 resolution. MegaZoom technology also allows the user to quickly navigate and zoom in on any areas of interest.

Other features include built-in WaveGen 20 MHz waveform generator, 16 digital channels and the capability to store and remove waveforms via USB.

TechRentals
www.techrentals.com.au

MIDGET FLANGE LED BULBS

Marl's 206 Series LED bulbs are designed to replace the filament bulb in professional and industrial switch tops. Benefits include high optical performance and low heat generation.

The T1¾ sized, 5 mm (MF Sx6s) midget flange incandescent replacement indicator features a high-intensity LED element. Integral circuitry has been designed to facilitate a range of voltage options. Termination is centre contact anode (centre contact cathode is available).

The device is manufactured with a flat-topped LED to provide wide-angle viewing for switch top and annunciator illumination. A range of LED colour options is available, so no colour filter is required. Warm white version is also available and may be used behind coloured lens as a true replacement for a filament lamp.

Applications include defence platforms, aerospace indication, industrial equipment control panels, audio switch illumination, simulator switch illumination, power stations control panels, theme parks and leisure equipment panels, and transportation panels.

Aerospace & Defence Products
www.aerospacedefenceproducts.com.au

MAINS FILTERS

Hi-Q Components stocks a large range of electronic components, including IEC inlet filters, mains line filters and PCB line filters.

The IEC inlet filter series integrates an IEC inlet and filter, and is available up to 10 A. The devices offer good noise suppression performance in a compact size.

The company's mains line filter is a general-purpose single-phase filter. Available up to 10 A, the product is said to be popular due to its compact size.

The PCB line filter series, specially designed for easy PC board mounting, is available up to 10 A. The series is suitable for use in household equipment, medical equipment, test equipment and automation equipment.

Hi-Q Electronics Ltd
www.hiq.co.nz

CATHODE MANUFACTURING

ELECTROPLATING CATHODES
CREATES POWERFUL BATTERIES

Researchers at the University of Illinois, Xerion Advanced Battery Corp. and Nanjing University have taken the same process that makes gold-plated jewellery or chrome car accents, known as electroplating, and applied it to lithium-ion battery cathodes.

Traditional lithium-ion battery cathodes use lithium-containing powders formed at high temperatures. The powder is mixed with glue-like binders and other additives into a slurry, which is spread on a thin sheet of aluminium foil and dried. The slurry layer needs to be thin; therefore, the batteries are limited in how much energy they can store. The glue also limits performance.

"The glue is not active — it doesn't contribute anything to the battery, and it gets in the way of electricity flowing in the battery," said study co-author Hailong Ning, director of research and development at Xerion Advanced Battery Corp. "You have all this inactive material taking up space inside the battery, while the whole world is trying to get more energy and power from the battery."

The researchers decided to bypass the powder and glue process altogether by directly electroplating the lithium materials onto the aluminium foil, with the results published in the journal *Science Advances*. Their work was described by study co-leader Paul V Braun, a professor at the University of Illinois, as "an entirely new approach to manufacturing battery cathodes, which resulted in batteries with previously unobtainable forms and functionalities".

Since the electroplated cathode doesn't have any glue taking up space, it packs in 30% more energy than a conventional cathode, according to the study. It can charge and discharge faster as well, since the current

Electroplating can be applied to textured, three-dimensional or flexible substrates, opening the door to new battery designs. The right side of this coin was plated with lithium cobalt oxide. Image courtesy of Hailong Ning and Jerome Davis III, Xerion Advanced Battery Corp.

can pass directly through it and not have to navigate around the inactive glue or through the slurry's porous structure. It also has the advantage of being more stable.

Additionally, the electroplating process creates pure cathode materials, even from impure starting ingredients. This means that manufacturers can use materials lower in cost and quality and the end product will still be high in performance, eliminating the need to start with expensive materials already brought up to battery grade, Braun said.

"This method opens the door to flexible and three-dimensional battery cathodes, since electroplating involves dipping the substrate in a liquid bath to coat it," said co-author Huigang Zhang, a former senior scientist at Xerion who is now a professor at Nanjing University.

The researchers demonstrated the technique on carbon foam, a lightweight, inexpensive material, making cathodes that were much thicker than conventional slurries. They also demonstrated it on foils and surfaces with different textures, shapes and flexibility.

"These designs are impossible to achieve by conventional processes," Braun said. "But what's really important is that it's a high-performance material and that it's nearly solid. By using a solid electrode rather than a porous one, you can store more energy in a given volume. At the end of the day, people want batteries to store a lot of energy." Researchers at the University of Illinois, Xerion Advanced Battery Corp. and Nanjing University have taken the same process that makes gold-plated jewellery or chrome car accents, known as electroplating, and applied it to lithium-ion battery cathodes.

RUGGED DETACHABLE LAPTOP

The Panasonic Toughbook CF-33 is a fully rugged 2-in-1 detachable laptop. The laptop has a detachable keyboard and large display tablet featuring a 3:2 aspect ratio. It can be used in multiple modes to meet a variety of business needs.

With the 12″ screen and hybrid design, the product provides flexibility and efficiency. The twin hot-swappable batteries provide the user with the ability to extend the battery life up to 20 h, which is particularly useful for those mobile workers with limited access to power.

The product has a 10-finger, capacitive dual-touch QHD screen (2160 x 1440 pixels). It provides an option for tablet users working outside with its 1200 cd/m^2 brightness. It also includes an IP55 digitiser pen for workers who need high levels of writing, drawing or signature accuracy in tough weather conditions.

It is available with Windows 10 Pro when configured with a 7th generation Intel Core processor. It comes with Intel i5-7300U, 8 GB RAM (16 GB project option) and 256 GB SSD (project option 128 GB and 512 GB).

It has an IP65 rating and drop resistance up to 120 cm. It weighs just 2.76 kg in laptop mode, with the detachable tablet weighing 1.53 kg.

It is equipped with a 2 MP webcam with stereo microphones and an 8 MP documentation rear camera.

It offers a 4G LTE option for connection to the office and workforce management systems, and the option for the latest u-blox NEO-M8N GPS for precise navigation.

The device's slim, purpose-built vehicle dock has antenna passthrough for strong communications signal while in-vehicle, and full port replication to provide users with full functionality when docked. The device can also be locked in storage mode to keep it secure or in convertible mode to allow for secure messaging and access to the GPS functionality.

Panasonic Australia Pty Limited
www.panasonic.com.au

STAINLESS STEEL KEYPADS

APEM has launched the PQ series, thus highlighting the features of what was previously known as the 8 series. In addition to its attractive design and performance, the keypad can easily be customised.

The keypad is available in 4-, 12- or 16-key configurations, with two key sizes, to meet specific customer requirements. LED backlighting can optionally be intensified for better visibility (up to four LEDs by key). LED voltage and backlighting colour can also be customised. Moreover, the inalterable laser-etched marking is suitable for intensive use.

Technical features include: flush keys; rear mounting; 12.5 or 15 mm square keys; IP65 panel sealing; and custom markings on request. With its robust construction and modern design, the series is suitable for access control, vending machines and marine applications.

Control Devices Australia
www.controldevices.net

ENCLOSURES WITH IP69K PROTECTION

ROLEC's aluCASE diecast aluminium enclosures are now available with an optional IP69K rating to protect electronics from high-pressure jet washing and steam cleaning.

The smart, modern aluCASE is ROLEC's 'go anywhere' industrial electronic enclosure. It can be mounted on walls, machines and bulkheads.

The enclosures can be installed 'lid closed' to safeguard the electronics and seal, making them suitable for challenging environments. All the screws are hidden beneath clip-on trims, protecting them from the elements and enhancing the aesthetics.

The lid is recessed to accommodate a membrane keypad, front plate or product label. Most models are available with polypropylene (PP) lid-retaining straps. Two versions feature transparent lids.

Threaded screw bosses are provided in the base and lid for PCBs, mounting plates and DIN rails. Cable glands and other accessories are also available.

The enclosure is available in 29 sizes, from 75 x 50 x 33 to 430 x 300 x 120 mm, and with ingress protection ratings of IP66, IP67 and IP69K. The standard colour is window grey.

Options include: anodised aluminium trims instead of the standard polyoxymethylene (POM); integrated exterior lid hinges with no visible fixings; and key lock access for added security. The enclosures can be supplied installation-ready.

Customisation services include CNC machining, custom colours, printing, engraving/laser engraving, EMC shielding, membrane keypads, assembly of cable glands and terminals and more, providing fully finished housings ready for fitting the equipment.

ROLEC OKW Australia New Zealand P/L
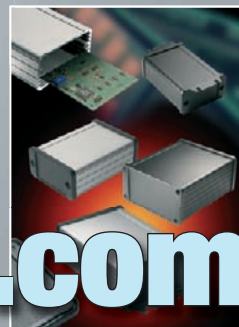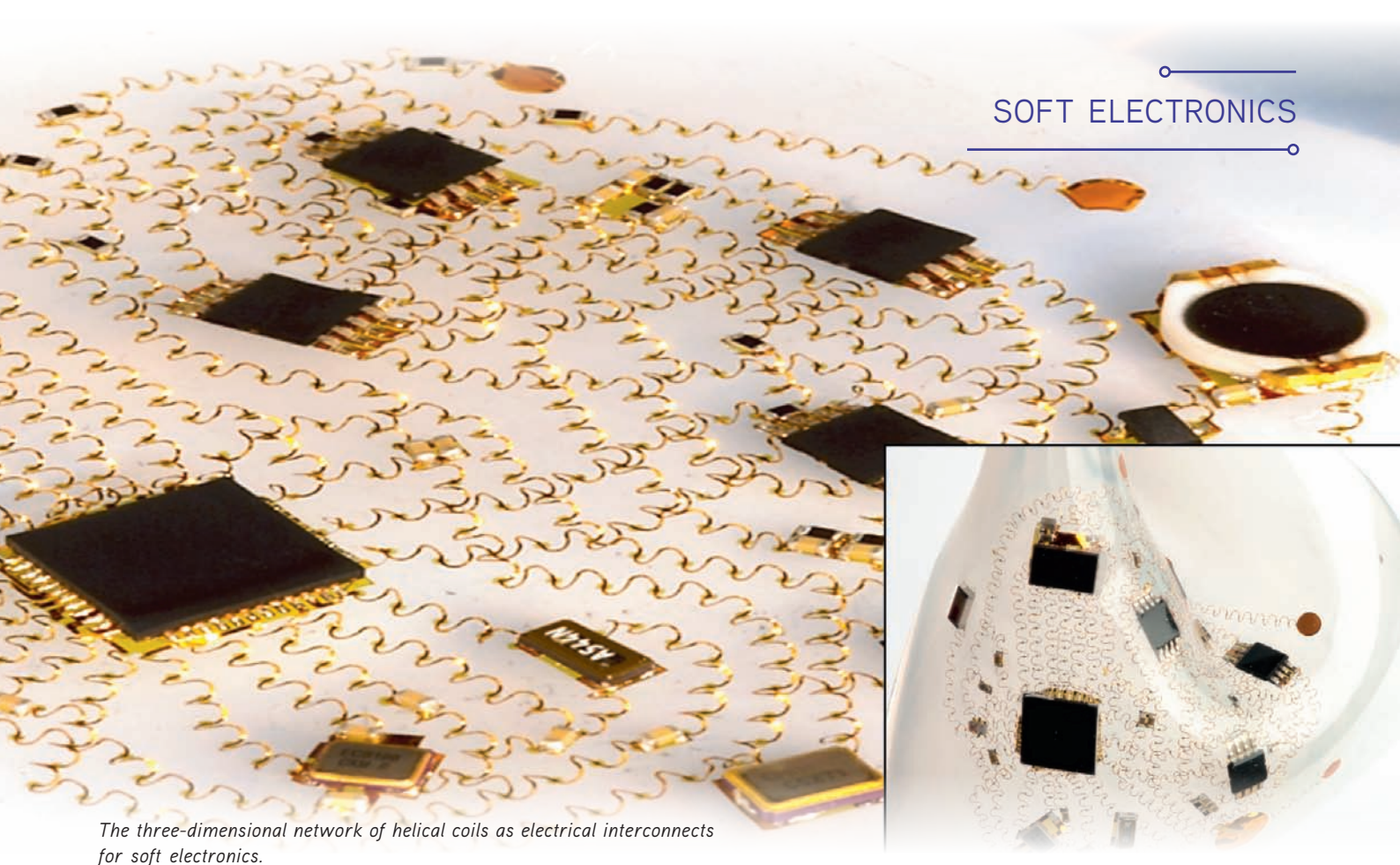www.rolec-enclosures.com.au

The three-dimensional network of helical coils as electrical interconnects for soft electronics.

ELECTRONIC SKIN:
THE FUTURE OF BIOSENSORS

There has recently been a growing interest in soft electronics which are designed to intimately interface with the soft tissues of the human body, such as skin. Now, an international research team has created a soft sensor microsystem with a 3D design, bypassing the limitations of traditional 2D designs and making it suitable for applications such as continuous health monitoring and disease treatment.

The microsystem contains a variety of sensors connected by a network of tiny wire coils, all placed in a soft silicone pad about 4 cm in diameter. The elastic silicone base is stretched while the tiny wire arcs, made of gold, chromium and phosphate, are laid onto it. The arcs are firmly connected to the base only at one end of each arc. When the base is allowed to contract, the arcs pop up, forming 3D coils that connect the system's sensors, circuits and radios to each other.
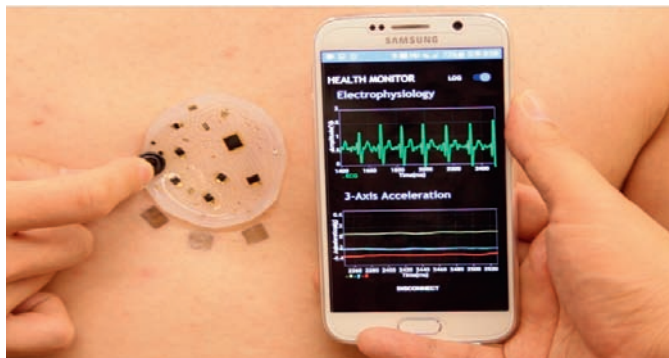
The research team collects, analyses and diagnoses biosignals wirelessly transmitted to a mobile application from the soft electronic skin.

The entire system is encased in a soft silicone material to protect its components, and is powered wirelessly rather than being charged by a battery. The platform enables wireless collection, analysis and storage of biosignal data performing as a separate computer.

The team used the system to build and test a biomonitor that can be easily attached to the skin. It contained about 50 components connected by 250 individual microcoils and wirelessly transmitted data on movement and respiration, as well as electrical activity in the heart, muscles, eyes and brain, to a smartphone application.

While conventional flat sensors are not suitable for the human skin, the coils are much more flexible than wires laid flat into a sensor; flexibility is critical for application on soft tissue. The coils and components are configured in an unusual spider web pattern that ensures "uniform and extreme levels of stretchability and bendability in any direction", according to the researchers, as well as minimising the system's size. The researchers also considered key electrical and mechanical issues to optimise the system's physical layout, such as sensor placement or wire length, to minimise signal interference and noise.

The microsystem is described in detail in the journal *Nature Communications*. The researchers noted it could be used in other areas of emerging interest in addition to bio-integrated electronics, such as soft robotics or autonomous navigation.

Duet Voice Capture Board

Raspberry Pi 3 Computer

8GB SD Card with OS & F/W

Compact Speaker Box

International Power Supply

Ribbon Cable

VOICE CAPTURE DEVELOPMENT KIT

Cirrus Logic's Voice Capture Development Kit for Amazon AVS is a complete solution for developing a hands-free AVS product enabled with Alexa, Amazon's intelligent voice control service.

The kit features Cirrus Logic's SoundClear voice capture solution, smart codec, MEMS microphones and control console that leverages the AVS APIs to help developers, design engineers and OEMs easily build commercial-grade, voice-activated products. It delivers high-quality voice command performance that, when combined with the provided Cirrus Logic tools and software, enables OEMs to bring high-fidelity speakers with Alexa voice interaction to market faster.

The development kit is suitable for applications such as portable smart speakers, networked smart speakers, digital assistants and smart home voice control, among others.

Digi-Key Electronics
www.digikey.com
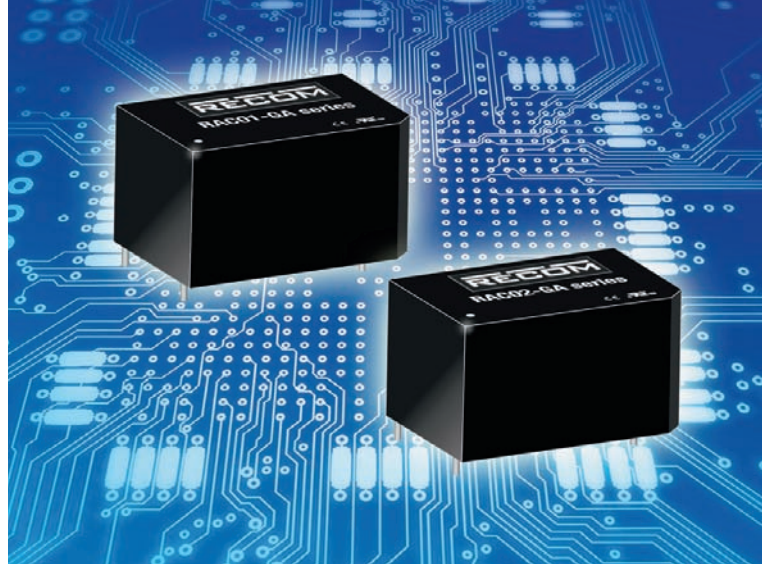
1 AND 2 W AC/DC CONVERTERS

Intelligently networked smart homes and smart offices require mesh control systems with many low-power nodes, actuators and sensors that are 'always on'. To meet these emerging demands, RECOM complements its low-power RAC series with converters with EN60335 household certification.

The RAC01-G (1 W) and RAC02-G (2 W) series were specially designed to continuously and efficiently power smart building infrastructures. They accept a broad nominal input voltage range from 100 to 240 VAC for worldwide use. Standard 5 or 12 VDC outputs are suitable to power relays, gateways and building automation nodes.

A typical no-load power consumption of only 180 mW makes the converters particularly energy-saving solutions. They operate over a wide temperature range from -25 to +80°C, are overcurrent and short-circuit protected, and fit into a tiny 33.7 x 22.2 x 19 mm package.

All modules are certified to EN60950 and EN62368. EN55022 Class A (RAC-GA) and Class B (RAC-GB) certifications are reached without additional components. The RACxx-GA series is also certified to the EN60335 household norm.

RECOM Power GmbH
www.recom-power.com

ACRYLIC CONFORMAL COATING

Electrolube, the specialist electrochemicals manufacturer, has introduced a halogen-free, acrylic conformal coating: HFAC.

The product has been developed as a suitable solution for manufacturers who require a coating that has been formulated without the use of aromatic solvents or chlorinated and brominated flame retardants that can created hazardous and highly corrosive species during a fire. For specific customer applications, HFAC will entirely eliminate the negative issues associated with halogenated materials and issues with aromatic solvents, presenting a good coating alternative.

The coating is flexible and transparent with improved flame retardancy, good clarity and UV resistance, making it suitable for use in LED applications. The UL94 V0 approved HFAC is a versatile coating which can be sprayed, dipped or brushed. With Electrolube's ULS Ultrasolve, the coating can be easily removed for rework.

HFAC joins Electrolube's aromatic-free conformal coatings range, which has been carefully developed without the use of hazardous aromatic solvents, such as xylene and toluene, making these particular coatings less harmful to the operator. In response to demand for a halogen-free coating product, HFAC was created as an alternative version of Electrolube's AFA aromatic-free acrylic coating. Its properties are much the same as the AFA coating range, including freedom from aromatic solvents; a wide operating temperature range; a UV trace to aid inspection; and fast touch-dry time at room temperature.

Electrolube
www.electrolube.com.au

ENGINEERING SYSTEM DESIGN SOFTWARE

NI has announced LabVIEW NXG 1.0, the first release of the next generation of LabVIEW engineering system design software. LabVIEW NXG is said to bridge the gap between configuration-based software and custom programming languages with an approach to measurement automation that empowers domain experts to focus on the problem, not the tool.

LabVIEW NXG has been designed to embrace a streamlined workflow. Common applications can use a simple configuration-based approach, while more complex applications can use the full open-ended graphical programming capability of the LabVIEW language, G.

The 1.0 release of LabVIEW NXG helps engineers performing benchtop measurements increase their productivity with non-programming workflows to acquire and iteratively analyse measurement data, according to NI. These workflows are said to simplify automation by building the necessary code behind the scenes. For instance, engineers can drag and drop a section of code equivalent to 50 lines of text-based code.

The product introduces a re-engineered editor that offers a user experience similar to complementary software in the market, according to the company. The refreshed editor extends the openness of LabVIEW to integrate with a broader set of languages. The modernised editor is said to improve programming productivity by streamlining the editor micro-interactions, user interface objects based on vector graphics and zooming capabilities.

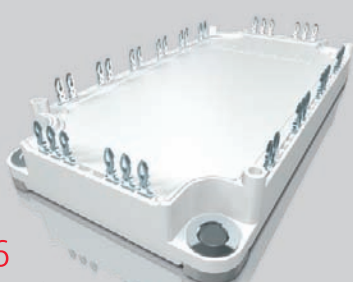**National Instruments Aust Pty Ltd**
www.ni.com

BLUETOOTH LOW ENERGY (BLE) SYSTEM-ON-CHIP

The latest Bluetooth Low Energy (BLE) system-on-chip from STMicroelectronics is expected to accelerate the spread of connected smart objects throughout homes, shopping areas, industry, toys and gaming, personal healthcare and infrastructure, according to the company.

Bluetooth Low Energy wireless technology enables consumers to interact with any BLE-enabled object from their own devices. Similarly, service providers can conveniently connect assets to the cloud for service delivery and data collection.

The BlueNRG-2 chip includes a power-efficient programmable processor and low-power features including an ultrafrugal standby mode. The high RF signal strength saves system power, while the on-chip memory for BLE software and application code simplifies system design by saving external memory components.

The product is Bluetooth 5.0 certified, which ensures interoperability with the latest generation of smartphones, and supports enhanced features such as security, privacy and extended packet length for faster data transfer. An optionally available software development kit (SDK) features the BlueNRG Navigator graphical user interface (GUI), which makes it easy for designers and innovators to create connected devices.

STMicroelectronics Pty Ltd
www.st.com
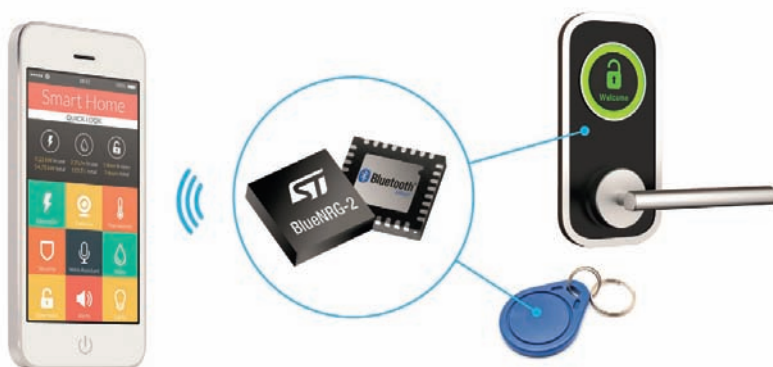
ULTRAWIDE INPUT VOLTAGE DC/DC CONVERTER

Along with the upgrading of traditional manufacturing processes and increased requirement for industrial automation, traditional industries like industrial control and communication industries have an increased demand for medium-power DC/DC power supplies.

Following this trend, MORNSUN's latest 100 W DC/DC converter, the URF48xxQB-100WR3 series, has ultrawide input voltage of 18–75 V and can be widely used in industrial control, communication, electrical generation and railway applications; for example, intermediate bus in industrial control systems, distributed power systems, wireless network equipment systems, medium- to high-power control systems and long-distance DC power supply systems.

With efficiencies up to 94%, the series seeks to offer efficiency improvements. In addition to a quality guarantee, service assurance and technical support, the series also provides users with improved choice, high reliability and good performance, according to the company.

The product features isolation voltage of 2250 VDC and has an operating temperature of -40 to +85°C. Inbuilt protections include input undervoltage, output short circuit, overcurrent, overvoltage and overtemperature protection. 1/4 brick international standard pin-out, connector and heat sink options are available. The product meets EN60950 standards.

DLPC Pty Ltd
www.dlpc.com.au

A SIGN OF THE TIMES

SMART GLOVE TRANSLATES SIGN LANGUAGE INTO TEXT

Engineers from the University of California, San Diego have developed a smart glove that translates the American Sign Language (ASL) alphabet into text and controls a virtual hand to mimic sign language gestures. Known as 'The Language of Glove', the device was built for less than $100 using stretchable and printable electronics that are inexpensive, commercially available and easy to assemble.

Current methods for tracking human body positions include cameras as well as optical systems involving infrared emitters and receivers. Both can yield good results but the former uses a lot of power, while emitters and receivers are expensive and immovable. Wearable sensor systems avoid these constraints and gloves in particular are intuitive human-machine interfaces. With this in mind, researchers led by Darren Lipomi set out to build a glove that decodes the ASL alphabet and then wirelessly transmits the text to electronic devices.

Lipomi and his team built the device using a leather athletic glove and adhered nine stretchable sensors to the back at the knuckles — two on each finger and one on the thumb. The sensors are made of thin strips of a silicon-based polymer coated with a conductive carbon paint. The sensors are secured onto the glove with copper tape. Stainless steel thread connects each of the sensors to a low-power, custom-made printed circuit board that's attached to the back of the wrist.

The sensors change their electrical resistance when stretched or bent, allowing them to code for different letters of the ASL alphabet based on the positions of all nine knuckles. A straight or relaxed knuckle is encoded as '0' and a bent knuckle is encoded as '1'. When signing a particular letter, the glove creates a nine-digit binary key that translates into that letter. For example, the code for the letter 'A' (thumb straight, all other fingers curled) is '011111111', while the code for 'B' (thumb bent, all other fingers straight) is '100000000'. Engineers equipped the glove with an accelerometer and pressure sensor to distinguish between letters like 'I' and 'J', whose gestures are different but which generate the same nine-digit code. The PCB on the glove converts the nine-digit key into a letter and then transmits the signals via Bluetooth to a smartphone or computer screen.

Writing in the journal *PLOS ONE*, the researchers revealed that the wearable electronic glove determined all 26 letters of the ASL alphabet accurately. Based on fatigue studies of the sensors, the system will translate ASL letters accurately after the knuckles are bent maximally 1000 times. The researchers also found that data from the glove could generate an accurate virtual display: when a real hand in the glove made the ASL gestures that spelt 'UCSD', a virtual hand mimicked them accurately.

"We've innovated a low-cost and straightforward design for smart wearable devices using off-the-shelf components," said Lipomi. "Our work could enable other researchers to develop similar technologies without requiring costly materials or complex fabrication methods."

Moving forward, the team is looking to develop the next version of the glove — one that's endowed with the sense of touch. The aim is to make a glove that could control a virtual or robotic hand and then send tactile sensations back to the user's own hand, opening up possibilities for a variety of applications — from virtual and augmented reality to telesurgery, technical training and defence.

"Our ultimate goal is to make this a smart glove that in the future will allow people to use their hands in virtual reality, which is much more intuitive than using a joystick and other existing controllers," said Timothy O'Connor, first author on the study. "This could be better for games and entertainment but more importantly for virtual training procedures in medicine, for example, where it would be advantageous to actually simulate the use of one's hands."
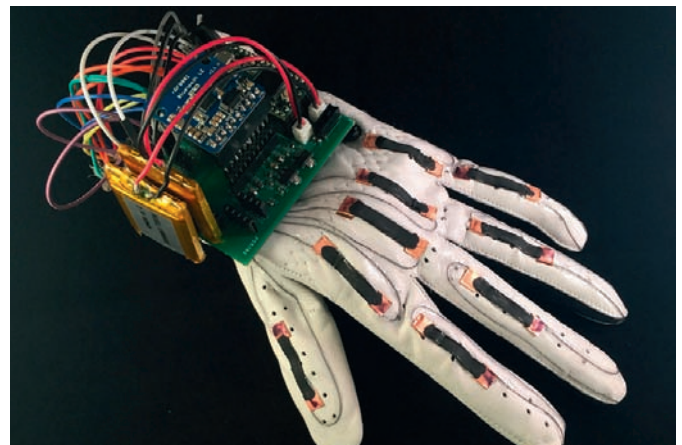

Image credit: Timothy O'Connor/UC San Diego Jacobs School of Engineering

COULOMB TRANSISTORS

TRANSISTORS CREATED FROM
METAL NANOPARTICLES

Researchers from the University of Hamburg have developed transistors based on metal nanoparticles, in a production method based on a completely different principle to current techniques. Their results have been published in the journal *Science Advances*.
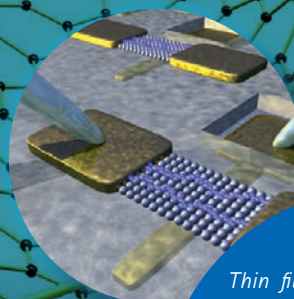
Thin films made of metal nanoparticles (in grey) are electrically contacted using gold electrodes. The current flowing through the films (in blue) is adjustable by the voltage of a local electrode that is below the film. For the characterisation, needle-shaped probes are applied to the components, which provide the corresponding voltages and measure the current.

Image credit: UHH/Klinke

Transistors are nowadays based on semiconductor-type materials, usually silicon. But as the demands for computer chips in laptops, tablets and smartphones continue to rise, new possibilities are being sought out to fabricate transistors in an inexpensive, energy-saving and flexible manner.

Led by Dr Christian Klinke, the University of Hamburg researchers produced transistors using metal nanoparticles which are so small that they no longer show their metallic character under current flow but do exhibit an energy gap caused by the Coulomb repulsion of the electrons among one another. Via a controlling voltage, this gap can be shifted energetically and the current can thus be switched on and off as desired.

In contrast to previous approaches, the nanoparticles are not deposited as individual structures — a process that renders the production very complex and the properties of the corresponding components unreliable. Instead, they are deposited as thin films with a height of only one layer of nanoparticles. Employing this method, the electrical characteristics of the devices become adjustable and almost identical.

The Coulomb transistors are said to have three main advantages that make them suitable for commercial applications. First,

the synthesis of metal nanoparticles by colloidal chemistry is very controllable and scalable. Second, it provides very small nanocrystals that can be stored in solvents and are easy to process. Third, the Langmuir-Blodgett deposition method provides high-quality monolayered films and can also be implemented on an industrial scale.

This approach therefore enables the use of standard lithography methods for the design of the components and the integration into electrical circuits, which renders the devices inexpensive, flexible and industry-compatible. The resulting transistors show a switching behaviour of more than 90% and function up to room temperature, indicating that inexpensive transistors and computer chips with lower power consumption could be possible in the future.

"Of course there is still a lot of research to be done, but our work shows that there are alternatives to traditional transistor concepts that can be used in the future in various fields of application," said Dr Klinke. "The devices developed in our group can not only be used as transistors, but they are also very interesting as chemical sensors because the interstices between the nanoparticles, which act as so-called tunnel barriers, react highly sensitive to chemical deposits."

RF AND MICROWAVE SIGNAL GENERATOR

The R&S SMA100B RF and microwave signal generator provides pure output signals while maintaining a high output power level. It can handle the most demanding component, module and system T&M tasks in the RF semiconductor, wireless communications and aerospace and defence industries.

The SMA100B is suitable for all applications requiring clean analog signals. For LO substitution in radar applications, the device can generate microwave signals with low close-in SSB phase noise, enabling radar systems to detect even very slow objects. For testing analog-to-digital converters (ADC), the SMA100B produces signals with low wideband noise.
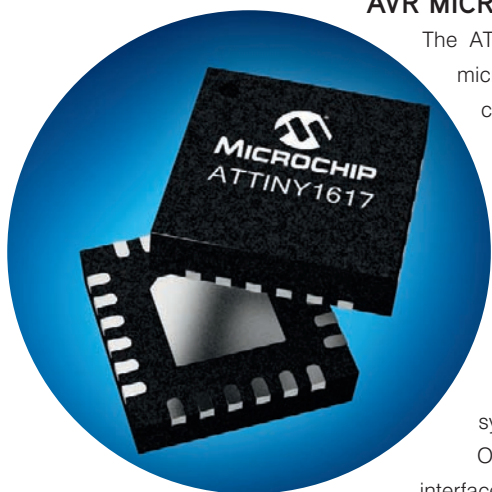
In automated production environments, the generator's ultrahigh output power eliminates the need for additional amplifiers while keeping harmonics low. The same signal generator can provide a pure clock signal for the ADC. A second, independent output can provide clock signals for ADC testing with lowest wideband phase noise.

With the SMA100B, it is no longer necessary to choose between signal purity and high output power. It is said to be the only signal generator that can supply signals with ultrahigh output power in combination with low harmonic signal components. The device covers all fields of application, from research and development to production, service and maintenance.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com.au

THROUGH-BOARD SMD PCB TERMINAL BLOCK

WAGO's 297 Series is a through-board SMD PCB terminal block for conductor cross-sections of 0.5 mm² (20 AWG).

Representing a departure from traditional designs, conductors are connected on the back of the LED modules — vertically to the PCB. The wiring on the back and a compact, housing-free design work to maximise space on the front side of the PCB for uniform light distribution and minimise onboard LED shadowing.

The design makes the series suitable for both linear and square LED modules, as well as spotlights. Integrated PUSH-WIRE connection technology provides tool-free, push-in termination of solid conductors and simple 'twist and pull' conductor removal. The series also features a suction area for automated pick-and-place assembly.

WAGO Pty Ltd
www.wago.com.au

AVR MICROCONTROLLERS

The ATtiny1617 microcontroller series is part of Microchip Technology's low-power 8-bit AVR microcontroller portfolio. The compact device runs at up to 20 MHz and provides a customised configuration and simplified process for capacitive touch systems, plus Core Independent Peripherals (CIPs) that help increase system throughput while lowering overall power consumption.

The AVR microcontroller features 16 KB of in-system self-programmable flash memory, 256 B of EEPROM and 2 KB of SRAM. It uses the 8-bit AVR processor with a hardware multiplier and provides an event system controller that allows peripherals to communicate without using the CPU. This enables designers to customise the configuration of the microcontroller to specific applications. Also included on-chip is an integrated QTouch Peripheral Touch Controller (PTC) that helps to simplify the development of capacitive touch systems, offering touch interfaces with proximity sensing and a driven shield.

Other integrated features include a 20 MHz internal oscillator; high-speed serial communication interfaces that include USART, SPI and I²C; configurable custom logic blocks; a 10-bit analog-to-digital converter (ADC) with internal voltage references; operating voltages ranging from 1.8 to 5.5 V; and picoPower technology for sleep currents as low as 100 nA. The microcontrollers are available in a 24-pin QFN package and are suitable for a variety of power applications, including LED lighting, motor control, H bridges and power converters.

Mouser Electronics
www.mouser.com

IoT CLOUD SERVICES

Advantech has launched its ARM mbed Cloud services integration at the WISE-PaaS Marketplace. mbed Cloud services provide secure identification, connection and device management services for IoT deployment.

With mbed Cloud, users can achieve flexible coverage across a vast range of ARM IoT client devices, efficiently manage them, establish trusted security, easily update software on devices in the field, and equip IT and DevOps teams for good productivity. The company integrated ARM Cortex-M based technology with silicon to develop sensor nodes with built-in ARM mbed OS for enabling mbed Cloud services with Advantech WISE-PaaS IoT Software Platform, ensuring easy integration with existing systems.

Users can subscribe to mbed Cloud services via WISE-PaaS Marketplace with a few simple clicks; furthermore, WISE-PaaS Marketplace provides IoT security, PaaS solutions and preconfigured packages, all of which help construct an IoT ecosystem that fulfils customer needs. Users can choose a standard suite or combine standard and purpose-built packages to enable IoT edge intelligence and customise an IoT solution according to their specific requirements and usage conditions.

By selecting certified IoT gateways — WISE-3610 (LoRa gateway) and WISE-3620 (Wi-Fi gateway) — customers can utilise the mbed OS with WISE-1510 (LoRa) and WISE-1520 (Wi-Fi) nodes designed to fit different RF transmission requirements and environments: LoRa for long-range sensor reporting and Wi-Fi for short-range communication with high throughput. IoT sensor nodes transmit data seamlessly to the mbed Cloud.
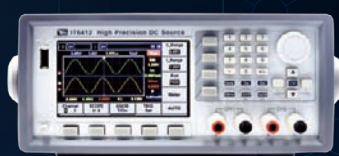
Advantech Australia Pty Ltd
www.advantech.net.au

PFC CONTROLLERS

As the degree of digitisation and networking aboard ships increases, so does the risk for data abuse and cybercrime. As a result, existing protection zone concepts (defence-in-depth models) are now increasingly running up against their limits. The demand now is for 'IT security by design' — IT security that is integrated from the very start into the configuration of layer-based security architecture in the controllers. WAGO offers this solution with its Linux-based PFC100/200 Controllers.

Regardless of the application in which the PFC controller is used, it records all relevant and sensitive measurement and control data, encrypts the data directly in the control system using SSL/TLS 1.2 encryption and transmits the data via VPN. The VPN tunnel required for this is set up via OpenVPN or IPsec directly from the controller. This means that no additional VPN tunnels have to be established by modems or routers, and the line between the controller and modem is directly encrypted.

Besides its layer-based security architecture, the PFC also comes with other security features such as password protection and user management, secure shell access, a firewall and a MAC white list. Onboard security is provided by WAGO's managed industrial Ethernet switches, which can be used anywhere from the bridge down to the machine room due to their robust temperature range of -40 to +70°C. Because it is Linux based, the PFC also has integrated services such as Syslog, FTPs, SFTP, SCP and an SD card reader.

WAGO Pty Ltd
www.wago.com.au

DC/DC CONVERTERS FOR NEXT-GEN SIC MOSFETS

High-frequency and high-voltage switching are the main challenges of driving SiC MOSFETs. Extreme voltage potentials between the control and power side can wear down isolation barriers and lead to failures. To meet these tough requirements, RECOM recently introduced a 2 W DC/DC converter series specially designed to power the latest generation of SiC MOSFETs.

Switching SiC MOSFETs requires turn-on and turn-off voltages atypical of other IGBT or MOSFET applications. The RxxP21503D series provides asymmetrical output voltages of +15 and -3 V, which are needed to efficiently switch second-generation SiC MOSFETs.

A typical DC/DC isolation voltage should normally be at least twice the working voltage, but the high ambient temperature and fast switching edges generated by these high-power transistors cause additional stress to the insulation barrier. Therefore, the RECOM series comes with 6.4 kVDC isolation to ensure that the isolation barrier stands up to even the harshest tests. The internal transformer uses a pot-core to physically separate the input and output windings, yet the converter still fits into an industry-standard SIP7 case.

The converters are available with input voltages of 12, 15 or 24 V and come equipped with ultralow parasitic capacitance (<10 pF). They are EN-60950-1 certified and fully compliant to RoHS2 and REACH.

A SiC MOSFET's high operating temperatures and high-frequency switching are tough on a power supply. RECOM therefore only uses high-quality name-brand components.

RECOM Power GmbH
www.recom-power.com

DESIGNER COMMAND/DISPLAY ENCLOSURES

ROLEC's ultramodern multiPANEL designer command and display enclosures can be specified for a huge range of applications involving displays, touch screens and flush integration of PCs.

The attractive and versatile IP65 enclosures can be installed hanging, upright or on a movable suspension arm. It is possible to glue panels or plates flush into the enclosure front or screw them in place from the inside (mounting them either flush or recessed).

Four rear options are available: flat panel with lock and external hinges; simple bolted flat panel; framed rear door with lock; and internal hinges in depths of either 15 or 60 mm. The product is available in depths of 70, 85 or 130 mm and in custom-specified lengths or widths up to a maximum of 800 x 800 mm.

The enclosure has been designed for mounting on the ergonomic profiPLUS (IP54) aluminium suspension arms. The arms can be mounted on walls, floors or ceilings due to a wide choice of die-cast aluminium joints and couplings. The standard colour is light grey with plastic covers in anthracite grey.

profiPLUS is available in two tube diameters (50 and 70 mm), both of which offer spacious routing for USB, HDMI, DVI and CP-Link 4 cables. All the junctions have integrated cable protectors. The elegant, modular, multivariable system can handle loads between 40 and 80 kg, depending on configuration. Simple one-screw adjustment speeds up installation times.

The product is manufactured from extruded aluminium with stainless steel trims. Customisation options include custom colours, CNC machining, printing, engraving, laser engraving, EMC shielding, membrane keypads and assembly.

ROLEC OKW Australia New Zealand P/L

www.rolec-enclosures.com.au

CAN TRANSCEIVER MODULES

With the rapid development of intelligent electronics, CAN bus can have trouble with load limitation. The Mornsun TD3(5)01MCANFD series promote data transmission rate to 5 Mbps with isolation of 2500 VDC. The two series come in the same package and both are pin-compatible, which makes them convenient for users to choose according to a system's communication protocol. They are suitable for automotive electronics, instrumentation, etc.

The modules meet ISO 11898-2 standard/ISO 11898-5 physical layer standard. They have a baud rate of up to 5 Mbps for the TD-MCANFD or 1 Mbps for the TD-MCAN. With an operating temperature of -40 to +105°C, the modules are suitable for 12 and 24 V systems. They come in a compact DIP8 package and feature bus timeout protection.

Other CAN bus transceiver modules include the TD301MCAN and TD501MCAN series, which integrate power isolation, signal isolation, CAN transceiver and bus protection in one module, and feature a space saving of 60%.

Mornsun products are distributed in ANZ by DLPC and in Victoria by Fairmont Marketing.

DLPC Pty Ltd
www.dlpc.com.au

DAQ COMPANION SOFTWARE

DAQExpress is NI's DAQ companion software. Its features will help reduce the time users spend setting up their system and analysing collected data.

On average, engineers and technicians spend about 86% of their time preparing their application. This includes setting up, configuring and testing hardware as well as writing software. Only about 14% of their time is spent processing, analysing and managing data. DAQExpress can help by reducing these users' preparation time, giving them more time for important decision-making.

The product's measurement panels provide an easy and interactive way for users to acquire and record measurement data. Users can record and capture data directly from the measurement panel, which can be viewed within the environment or exported. The software also provides several interactive analysis panels to apply common algorithms, with no programming required.

National Instruments Australia Pty Ltd
www.ni.com

5G PROTOCOL TEST TOOLSET

Keysight Technologies has announced a 5G protocol test solution designed to support chipset and device manufacturers developing the next generation of cellular devices. The company is currently working with mobile operators on early trials and 5G deployments.

The 5G Protocol R&D Toolset, the first in a series of network emulation solutions for 5G, covers the diverse global spectrum requirements specified in the pre-5G and 3GPP 5G NR standards. The toolset allows efficient testing of 5G features, including beamforming at mmWave frequencies as well as protocol testing with full access to layer 1 and layer 2 parameters. The built-in protocol state machine enables developers to easily create and execute test cases, debug errors and fully analyse results, thereby streamlining the 5G device workflow.

Keysight's 5G network emulation products offer valuable insights into the performance of prototypes, enabling developers to make informed decisions about their designs.

Keysight Technologies Australia Pty Ltd
www.keysight.com

The flexible biofuel cell could power LEDs and a Bluetooth radio.

STRETCHABLE FUEL CELLS
FOR SWEAT-POWERED WEARABLES

Engineers from the University of California San Diego have developed stretchable fuel cells that extract energy from sweat, which they can use to power electronics such as LEDs and Bluetooth Low Energy (BLE) radios. The biofuel cells generate 10 times more power per surface area than any existing wearable biofuel cells, according to the researchers, and could be used to power a range of wearable devices.

For some time, scientists have been struggling to make fuel cells that are both stretchable enough and powerful enough for the wearable devices they are supposed to power. The UC San Diego researchers achieved this by building a stretchable electronic foundation using lithography, plus screen printing to make 3D carbon nanotube-based cathode and anode arrays. Their biofuel cells were equipped with an enzyme that oxidises the lactic acid present in human sweat to generate current, thus turning the sweat into a source of power.

In order to make the cells flexible and stretchable, the researchers decided to use what they call a 'bridge and island' structure, the basis for which was manufactured via lithography and made of gold. Essentially, the cell is made up of rows of dots that are each connected by spring-shaped structures. Half of the dots make up the cell's anode; the other half, the cathode. The spring-like structures can stretch and bend, making the cell flexible without deforming the anode and cathode.

Next, the researchers needed a way to increase the biofuel cell's energy density — the amount of energy it can generate per surface area — which was key to increasing performance for the biofuel cells. As noted by Amay Bandodkar, a first author on the study and PhD student at the time of the research, "We needed to figure out the best combination of materials to use and in what ratio to use them."

To increase power density, the engineers screen printed a 3D carbon nanotube structure on top of the anodes and cathodes. The structure allowed the engineers to load each anodic dot with more of the enzyme that reacts to lactic acid and silver oxide at the cathode dots. In addition, the tubes allow easier electron transfer, which improves biofuel cell performance.

The finished biofuel cell was connected to a custom-made circuit board — a DC/DC converter that evens out the power generated by the fuel cells, which fluctuates with the amount of sweat produced by a user and turns it into constant power with a constant voltage. Four test subjects were equipped with the biofuel cell-board combination, before being asked to exercise on a stationary bike. The subjects were able to power a blue LED for about four minutes.

Publishing their results in the journal *Energy & Environmental Science*, the engineers conceded that further work is needed in two areas. First, the silver oxide used at the cathode is light-sensitive and degrades over time, so the researchers will need to find a more stable material in the long run. Also, the concentration of lactic acid in a person's sweat gets diluted over time, which is the reason why the subjects were able to light up the LED for only four minutes. The researchers are currently exploring a way to store the energy produced while the concentration of lactate is high enough and then release it gradually.

ESD-CLAMPING DIODES
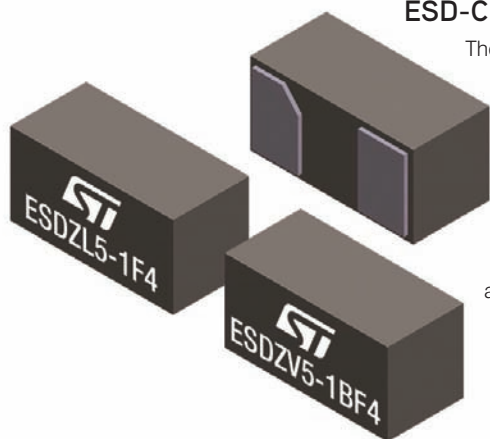
The latest miniature (size 0201) single-line ESD-protection diodes from STMicroelectronics quickly clamp transients to a voltage as low as 7 V, and handle 7 A peak pulse current, to provide good protection and design flexibility for space-constrained smart objects. The diodes are claimed to have the lowest clamping voltage available at this level of capacitance and stand-off voltage.

The unidirectional ESDZL5-1F4 and bidirectional ESDZV5-1BF4 have a snap-back characteristic, with 5.8 V trigger voltage and low dynamic resistance, to provide high protection in a device measuring only 0.58 x 0.28 mm (typical). With as little as 6 pF capacitance, they ensure the integrity of high-speed signals. Capable of withstanding 15 and 18 kV contact discharge respectively, both devices exceed the IEC 61000-4-2 specifications.

With leakage current below 100 nA helping to maximise battery life, the ESD-clamping diodes are suitable for protecting equipment such as industrial sensors, IoT devices, active cables and connectors, smart home electronics, wearable devices like smart watches and healthcare or fitness bands, and portable products including smartphones, tablets, data loggers and point-of-sale terminals.

STMicroelectronics Pty Ltd
www.st.com
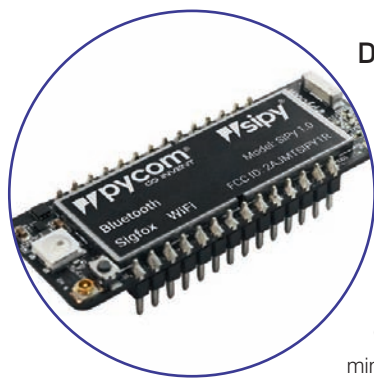
DEVELOPMENT PLATFORM

The SiPy is a multinetwork (Sigfox, Wi-Fi and BLE) development platform. It is programmable with MicroPython and the Pymakr IDE for fast IoT application development, easy programming in-field and extra resilience with network failover.

The product offers a blend of speed to deployment and access to LPWAN networks rolling out across Europe, USA, Africa and India. Users can also configure the module in FSK mode to send packets directly from SiPy to SiPy. The user can create the network configuration of their choice and then use another SiPy as a central nano-gateway to forward the data to the cloud via Wi-Fi.

The product includes a dual processor and Wi-Fi radio system on chip. The network processor handles the Wi-Fi connectivity and the IPv6 stack, while the main processor is entirely free to run the user application. An extra ULP-coprocessor can monitor up to 24 GPIOs and the eight 12-bit ADC channels, as well as control most of the internal peripherals during deep-sleep mode, while only consuming 25 μA.

Other features include: a powerful CPU; a Wi-Fi range of 1 km; ultralow power usage; 920–922 MHz Sigfox operation frequency (ANZ, Latin America and SE Asia); 2x UART, 2x SPI, I²C, I²S and a micro SD card; DMA on all peripherals; and more.

Elecom Electronics Supply
www.elecomes.com

FIXED RATIO DC-DC CONVERTER MODULE

The Vicor BCM6123TD1E2663Txx is a high-density, high-efficiency, fixed ratio DC-DC converter module in a ChiP package, which operates from a 384 VDC nominal input and delivers an isolated and safety extra low voltage (SELV) 24 V secondary output.

The product is offered in a through-hole form factor measuring 61 x 23 x 7.26 mm.

Targeting industrial, telecom and lighting applications, high-voltage bus converters give system designers a simple and cost-effective means to create common bus voltages of 12, 24 and 48 V directly from 384 VDC.

Based on the patented Sine-Amplitude Converter topology, high-voltage ChiPs are able to reach peak efficiencies of 98% and achieve power densities up to 2400 W/in³. These flexible modules can be easily paralleled into high power arrays and outputs can be put in series to achieve higher VOUT. In addition, the high-voltage BCMs are offered with either analog or digital signal interface and all have an operating temperature range of -40 to 100°C.

High-voltage BCMs allow designers to reduce the amount of bulk capacitance needed at the load by utilising the sine-amplitude converter's low AC impedance relative to the down-stream regulator, effectively 'reflecting' the capacitance across the module.

With the K=1/16 model, 500 μF of 24 V point-of-load capacitance can be effectively provided by 2 μF on the module's primary side.

Vicor Corporation
www.vicorpower.com

DYNAMIC MEASUREMENT DC SOURCE

The Keysight 66332A dynamic measurement DC source is suitable for testing wireless and battery-powered devices. It is available to rent from TechRentals.

By offering high transient performance, the DC source reduces transient voltage drop due to pulse loading characteristics of digital communications devices. It enables users to maximise test throughput by minimising test interruption due to false trigger of device low-voltage shutdown.

The product offers a built-in measurement system to measure battery current drains when the device operates in modes including talk, active, standby and on/off. Measurements obtained from these modes are vital to ensure that battery usage is optimised and devices are operating correctly.

The programmable DC source includes a battery emulation function and an easy-to-use graphical user interface. It has an output rating of 0 to 20 V and current from 0 to 5 A.

TechRentals
www.techrentals.com.au

3D PRINTERS

When standard ABS and PLA 3D printed parts are not strong enough or lack the refined finish of an end-user part, the Markforged range of 3D printers will print high-strength carbon fibre parts with the strength of metal for end-use products, prototypes, enclosures, brackets and mounts.

Carbon fibre 3D printing technologies are said to offer advantages over traditional manufacturing techniques like CNC machining and modular fixturing, by printing parts in carbon fibre that are equal to or better in strength than aluminium. Carbon fibre also offers an alternative to injection moulding of low-volume or even one-off jobs by providing a strong, smooth matte black finish with the look of an end-user part.

Markforged's carbon fibre reinforced and chopped micro carbon fibre materials are used in the Mark Two and Mark X range of 3D printers. The Mark Two offers a 320 x 132 x 154 mm build size and the Mark X offers an industrial-scale 330 x 250 x 200 mm build size. In addition to a large print volume, the Mark X introduces print capabilities that include in-process laser inspection as well as a fine (50 μm) surface finish, making it a powerful and precise 3D printer.

Emona Instruments Pty Ltd
www.emona.com.au

Conformal coating collaboration proves productive

Electrochemicals specialist Electrolube is partnering with key dispensing equipment manufacturers to ensure that its two-part (2K) conformal coatings enable customers to obtain optimum results.

Electrolube's systems are specifically designed to combine the protection and properties of a resin with the straightforward application of a conformal coating without the use of harmful solvents. But while its coatings continue to receive acclaim from the electronics industry, customers frequently enquire about the dispensing process.

Throughout the development of the 2K range, Electrolube has worked closely with coating machine manufacturers to ensure that formulations are optimised for application using commercially available dispensers. Included among these is PVA's two-component spray valve VPX-2KS, which has proved successful with Electrolube's 2K500 — a two-part polyurethane conformal coating system that provides a wide operating temperature, maintains clarity after prolonged exposure to UV light and features good thermal shock and abrasion resistance.

Electrolube's conformal coatings team, comprising Jade Bridges, Joel Shenton and Phil Kinner, recently joined PVA's Shane Plasse and Matt Lilla at PVA's Boston headquarters to further improve and refine the 2K application process.

At one point during the technical collaboration, an opportunity arose to test a new process for a customer who needed to apply a 2K coating of just 70 μm thickness. This is considerably thinner than the recommended 200 μm for 2K coatings and was dictated by the 100 μm clearance between the board and its housing.

Due to the low flow rate and metal valve construction, the combined PVA/Electrolube team decided that a simple valve block heater would provide a further level of control over the process. After several iterations, the heater was able to supply sufficient heat to enable a controlled application of this unusually thin film, meeting the customer's target specification precisely. As well as providing good control of material flow, this arrangement also resulted in improved edge definition and easier regulation of dispensing starts and stops.

"While our core business is the development of pioneering circuit protection materials and associated products, we are of course acutely aware that their ultimate success relies heavily on those all-important downstream processes — particularly dispensing," said Phil Kinner, global business/technical director, Coatings Division at Electrolube.

"I believe this recent collaborative exercise with PVA has been highly productive and successful, illustrating quite clearly our aim to provide a complete customer service that covers not just the formulation and supply of materials, which we frequently tailor to specific customer needs, but also the methods of applying them.

"We are currently in discussion with additional dispensing equipment manufacturers and will be reporting on dispensing trials over the coming months."
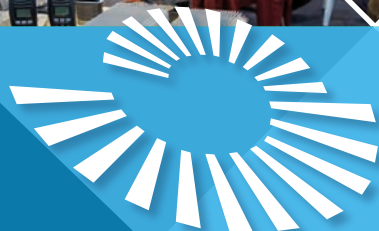
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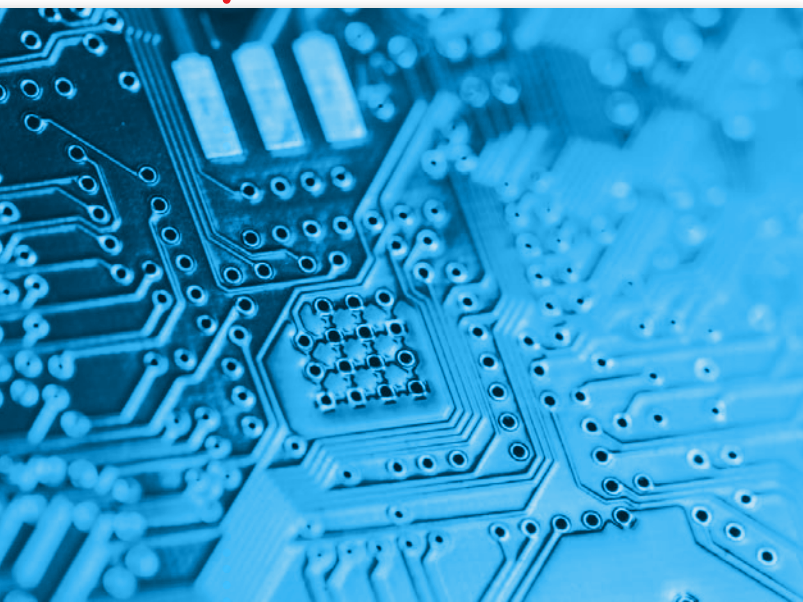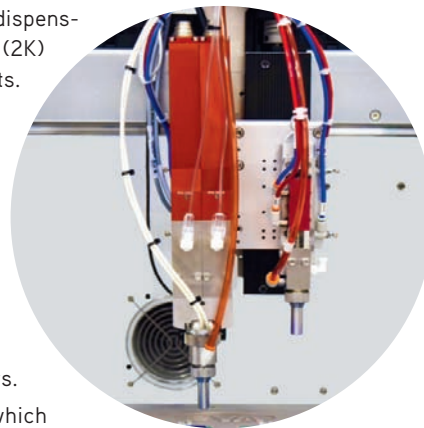
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NATURAL MOLECULE

COULD SPEED UP BATTERY RECHARGING

German researchers have found that the porphyrin molecule, on which chlorophyll, blood and vitamin B12 are based, can be used as an electrode material that speeds up the charging process of rechargeable batteries.

The most widely used battery technology in the world right now is based on lithium ions, as no other rechargeable storage device for electric energy has comparable properties. Thus, lithium-ion batteries are currently indispensable for devices such as laptops, smartphones and cameras, even though improved properties such as quick charging would be desirable.

Many materials that improve the properties of lithium-ion batteries do exist, but these are typically rare, expensive, toxic or harmful to the environment. Ideally, high-performance energy storage materials would be based on renewable resources.

Now, an interdisciplinary research group headed by Professor Maximilian Fichtner and Professor Mario Ruben, from the KIT Institute of Nanotechnology, presents a new energy storage material that enables the very fast and reversible inclusion of lithium ions. Their work has been published in the journal *Angewandte Chemie International Edition*.

"Porphyrins occur very often in nature and are the basic constituents of chlorophyll, of human and animal blood pigment (haemoglobin), and of vitamin B12," Professor Fichtner said. Technical variants of these materials are already in use, eg, for blue-coloured toner in laser printers or for car paint. By bonding functional groups to porphyrin, the scientists managed to leverage its specific properties in electrochemical electric storage systems for the first time.

Functional groups were added to the organic copper porphyrin molecule, which produces structural and electroconductive cross-linking of the material when the battery cell is charged for the first time. This significantly stabilises the structure of the electrode in lab tests and allows several thousands of charge-discharge cycles.
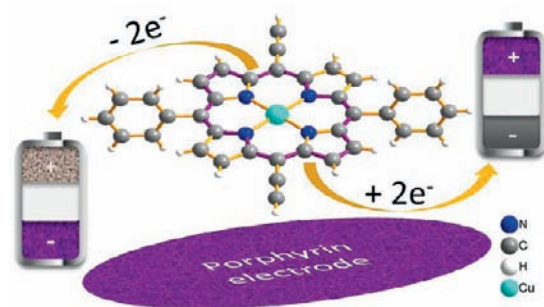
The porphyrin molecule, used in electrodes, speeds up the charging process of batteries in the lab.

Image credit: KIT/HIU

With this material, storage capacities of 130–170 milliamp hours per gram (mAh/g) were measured in the lab — at a medium voltage of 3 V — along with charging-discharging times of only 1 min. Current experiments suggest that the storage capacity can be increased by another 100 mAh/g and that the storage system can be operated not only with lithium, but also with the much more abundant sodium.

"The storage properties are exceptional, because the material has the storage capacity of a battery but works as fast as a supercapacitor," Professor Fichtner said.

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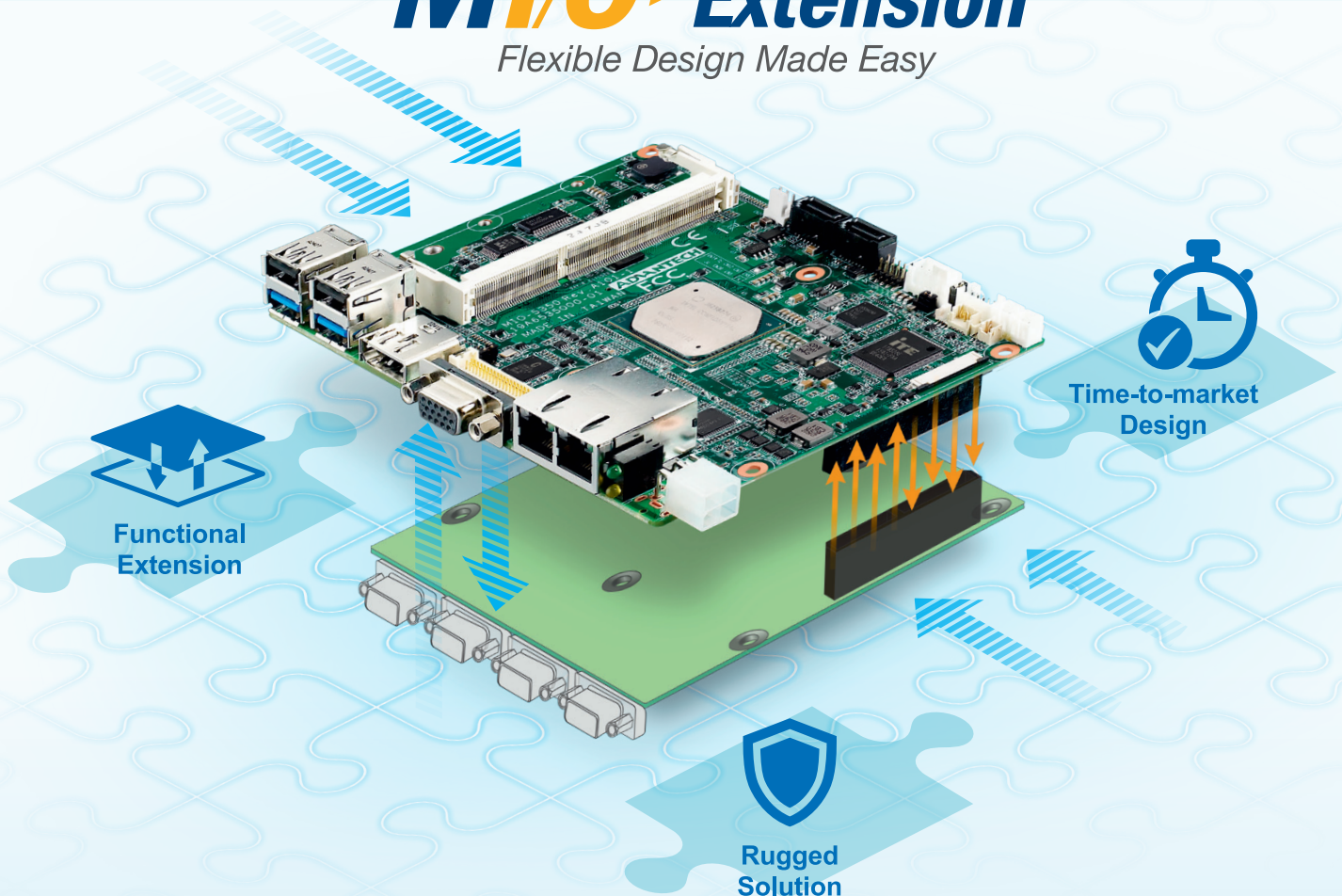
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