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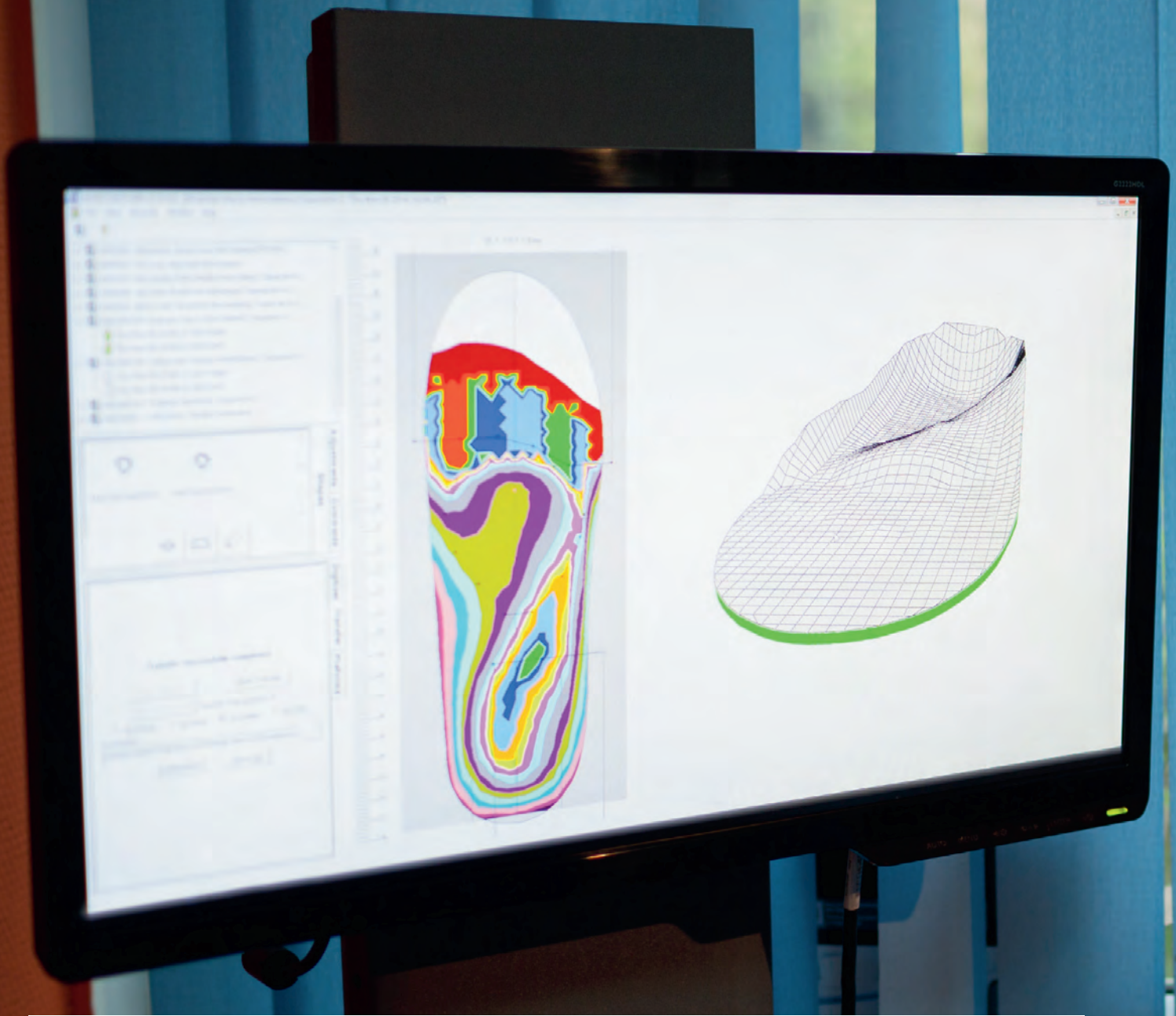
Engineering design involves many steps: conceptualisation, analysis, evaluation and verification of the form and function of products and systems. It also requires a vast awareness of new technology. New technologies pave the way to new possibilities and new innovations, and inspire new thinking that leads to new design solutions.

So where do engineers go to find and learn about these new products that feature the latest technology? Fully focused on design, Mouser Electronics is a global, authorised distributor of semiconductors and electronics components from over 500 top manufacturers. In fact, Mouser has made it their mission to stock more new products than any other distributor. The company's Newest Products site on Mouser.com allows engineers to quickly search new products by category, manufacturer and week. The site also provides product life cycle information, clearly identifying 'not recommended for new design' and 'end-of-life' components. Furthermore, Mouser has also created Applications and Technologies sites to aid the creation of new designs. Each site highlights solutions based on specific applications and technologies, plus it offers block diagram navigation to easily view recommended products for specific system functions.

In addition, Mouser is an AS9100C registered distributor - the top industry standard for quality and control - assuring customers receive only traceable, genuine components. Knowing that every component stocked and shipped is obtained directly from the original manufacturer also adds another level of assurance.

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# WHY MEDICAL DEVICE MANUFACTURERS

MUST BECOME TOMORROW'S SOFTWARE INNOVATORS

*Jean-Baptiste Lanfrey and Bradley Horton\**



Today's medical devices are far more than their hardware components. And even small mistakes can have big implications.

**T**he software built into medical devices is arguably one of the most important sources of any manufacturer's competitive differentiation because it governs the increasingly complex functions and processes behind increasingly commoditised hardware. Mistakes such as errors in code can necessitate warning letters from the FDA or even lead to widespread product recalls with substantial costs to both a manufacturer's brand reputation and the bottom line. Even error-free software must conform to the compliance and regulatory regimes in every distribution market - a process that can send even the most technically rigorous developers back to the drawing board.

Medical device manufacturers must embrace the tools of software development to overcome these hurdles and make real innovations possible. The FDA references one such problem-solving approach - model-based design - as an effective software engineering method, including for medical device applications. Some Australian device manufacturers have already adopted model-based design within their core processes, but many more tend to stay with their traditional development approaches and face the risk of being left behind by their competitors.

### **Rapid prototyping: a software developer's scalpel**

Model-based design involves using modelling and simulation software to test and compare how different algorithms will work. Rather than having to build physical prototypes to gauge the effects of their algorithms, clinical personnel can do so within modelling platforms like Matlab and Simulink, developed by The MathWorks. With model-based design, developers can create mathematical models of their process dynamics and then simulate how their algorithms perform while interacting with these modelled systems. Within this

same model-based design environment, the software implementation of these algorithms can then be tested in real time, allowing embedded software engineers to further test and verify their code and strip out any errors far earlier and faster than ever before.

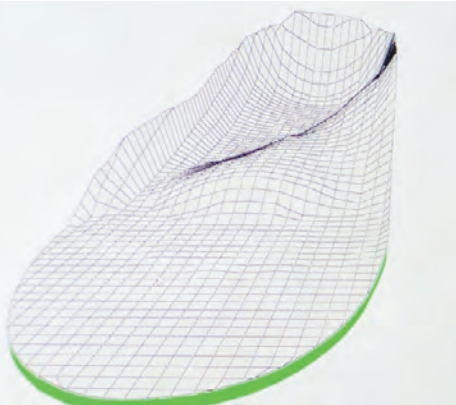
The time and cost efficiencies of such an approach are obvious, but model-based design's real value to device manufacturers stems from the ability to engage in rapid prototyping. Because tests no longer require expensive physical prototypes (a single one of which can cost in the tens of thousands of dollars), developers can test out every design option that's tabled instead of being able to trial only one or two. And they can do so within minutes, allowing them to cut through all the options and find the most effective solution in the least amount of time.

Rapid prototyping is not new to Australian medical device manufacturers. Cochlear's engineers have for years relied on Matlab and Simulink to quickly design, test and reiterate different algorithmic options for their iconic implants, using the modelling software to test up to six times more options than with traditional prototyping methods. This means that more innovations can be converted into real-world applications and be deployed to market more sustainably and more quickly than ever before, allowing Cochlear to maintain its competitive edge in an increasingly contested market.

### **No need for manual coding**

One of the fundamental benefits that Cochlear experienced from a model-based design approach was that it allowed the clinical professionals with the algorithmic expertise to also stay engaged during the prototyping process - an advantage made possible via the visual nature of the Simulink model-based design environment. Rather than being hindered by the need to manually code in a lower-level language,





THE LATEST PHARMACOKINETIC SIMULATIONS RELY ON ANALYTICS TECHNOLOGY TO SIMULATE THE RESULTS OF DIFFERENT MEDICINE DOSAGES OR THEIR EFFECTS OVER VARYING TIMEFRAMES ON A SPECIFIC PATIENT. BUT, IF ANY INSIGHTS FROM DATA ARE TO BENEFIT PATIENTS IN THE REAL WORLD, THEY MUST BE TRANSLATED BY ALGORITHMIC OR HUMAN ANALYSIS INTO APPLICATIONS AND PHYSICAL DEVICES.

clinical staff were able to quickly create and test algorithms using a graphical programming interface. The model-based design environment then automatically converted these algorithms into the machine-language code that ran on the prototype devices, ensuring that errors were not introduced between the design and prototyping implementation stages.

Some platforms like Matlab also offer pre-designed application centric toolboxes and algorithms to further accelerate the development process. Instead of having to 'reinvent the wheel' - and potentially introduce code errors that may go unnoticed until it's too late - manufacturers can focus on new innovations and ideas that use pre-existing functions as a foundation to accomplish clinical goals.

When developing its AirSonea app for asthma sufferers (recently released in Australia), engineers at iSonea used Matlab to automatically generate the C code that would eventually be used in apps for iOS, Android and the cloud. Not only did model-based design speed up the design process, but it also dramatically reduced

the complexity of debugging and optimisation: the team knew that any performance issues were a result of design rather than errors in code conversion.

### Collaborative innovation

Designing a successful medical device is, however, more than simply a matter of technical efficacy. Model-based design's most powerful application could be as a common platform for the myriad silos involved in the development process.

This is particularly relevant as medical devices become reliant on patient data and predictive analytics, both of which require close collaboration between clinicians and data scientists. The 'softer sciences' of biology and chemistry are increasingly demanding platforms that can learn and make predictive diagnoses based on previous cases. The latest pharmacokinetic simulations rely on analytics technology to simulate the results of different medicine dosages or their effects over varying timeframes on a specific patient. But, if any insights from data are to benefit patients in the real world, they must be translated by

algorithmic or human analysis into applications and physical devices.

Model-based design environments bring together these insights and applications, providing full visibility to teams at every stage of development. Clinicians can access analytics results and feed them into algorithmic models in real time. Data experts can not only use them to design analytics algorithms, but also to review how their insights are being applied and to assess if the algorithms' results are sound. By providing what is essentially an open 'sandbox' for modelling and design, these frameworks provide a central platform between the different disciplines involved in medical device workflows.

This increased collaborative potential, coupled with the ability to test ideas faster and more rigorously than ever before, promises to turn medical device manufacturers into an industry of software innovators. The resulting devices will benefit communities in Australia and around the world.

MathWorks Australia  
[www.mathworks.com.au](http://www.mathworks.com.au)



*\*Lanfrey is a senior application engineer with The MathWorks. He holds a master's degree in electrical engineering from the French engineering school ENSIEG with a specialisation in control engineering. Prior to joining The MathWorks, he worked for five and a half years in the automotive industry: at PSA (France) his role in the Engine & Powertrain Control was to design, test and improve control laws; at Air International (Australia) his main focus was the development of embedded software, especially the algorithms controlling the heating, ventilation and air-conditioning system. Then he worked at Parrot (France) for one and a half years where he was responsible for the design of the embedded software that controls a quadrotor helicopter.*

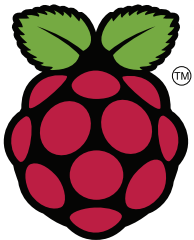
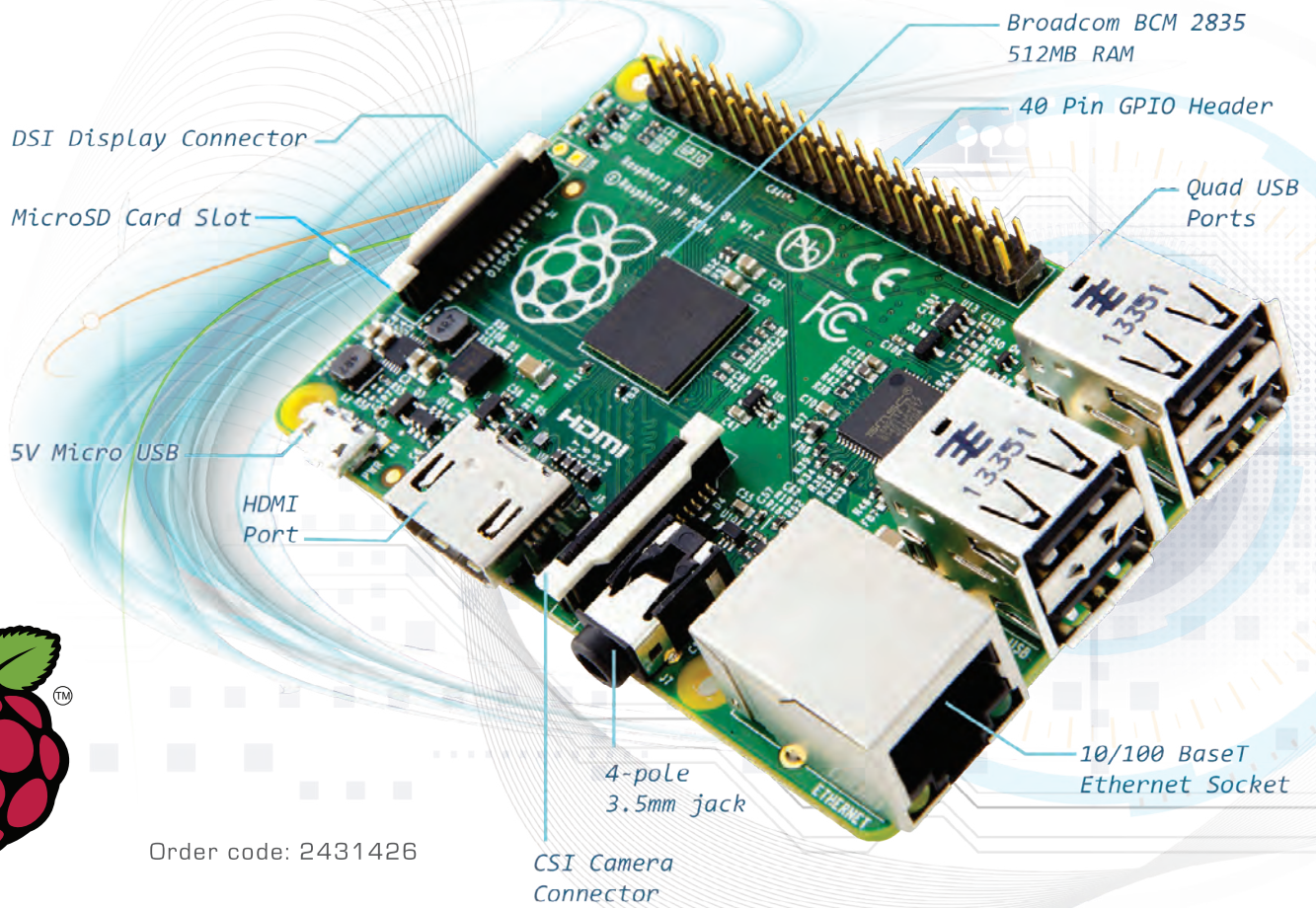


*\*Horton joined The MathWorks Australia in April 2006 and currently holds the position of Engineering Team Manager. He has spent the last 15 years helping clients adopt and implement MathWorks products over a broad range of application areas. As a principal engineer, Horton has supported and consulted for clients on projects ranging from process control engineering, power systems simulation, military operation research and business intelligence analytics. Before joining The MathWorks, he spent five years as a systems engineer with the Defence Science & Technology Organisation (DSTO) working as an operations research analyst. Brad also worked for the former Australian MathWorks distributor as both an application and consulting engineer. Brad holds a B.Eng. in mechanical engineering and a B.Sc. in applied mathematics.*



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**STAND B11**





It's that time of the year again - when the best minds in the electronics design engineering and manufacturing industry descend on Sydney for the annual electronics design and assembly expo, ElectroneX.

The event, being held 10-11 September at Australian Technology Park in Eveleigh, comprises a major trade show with more than 90 companies represented that will showcase and demonstrate the latest new product releases for industry, scientific and commercial applications. The show will help design, electronic and electrical engineers, and OEM, scientific, IT and communications professionals find the latest technology driving future product and system developments.

The SMCBA - Electronics Design & Manufacture Conference is being held in conjunction with the exhibition. This year's conference will feature several highly acclaimed international presenters and deliver a wealth of information on electronics design and manufacture as well as new streams on embedded systems and new product development.

The expo alternates annually between Sydney and Melbourne and the last event in Sydney in 2012 attracted over 1200 engineers and decision-makers from the electronics sector.

**New products and show features**

ElectroneX covers the entire spectrum of products and services for the electronics industry with many exhibitors releasing or showcasing new products, and a number of suppliers are also offering show specials for visitors.

**Test and measurement:**

The event features an extensive range of equipment for test, measurement, research and development, maintenance, service and repair with several companies releasing new products and show specials for any orders taken at the show.

Agilent Technologies, ADM Instruments, Emona, Scientific Devices, National Instruments and Rohde & Schwarz are some of the companies at the expo. Bench test and compare all the latest solutions for electronic, electrical, scientific, medical, communications and industrial test, monitoring and measurement.

**Design and development tools:**

Test and compare development software, boards, modules and tools for application across all product and system design disciplines. Discover applications for aviation, audio and broadcasting, communications and networks, niche manufacturing, defence, medical, mining, security, scientific, transport and utilities and more.

**Contract manufacturing:**

Companies seeking contract manufacturing services can speak to a number of Australia-based companies at ElectroneX. With the move to high-tech niche manufacturing in Australia, contract manufacturing is playing an increasingly significant role as companies outsource the development and design of prototypes and end products for specific applications.

**Product categories:**

ElectroneX features components, equipment and supplies for: assembly, board cleaning, cables and connectors, CAD and manufacturing software, cases and product casings, contract manufacturing, design modules, development software and tools, displays, LEDs, education, training and certification, electronics repair, electronic component supply, embedded computers and systems, enclosures, EMI/EMC control and certification, GPS controls and modules, industrial computers and platforms, industrial panels, identification and labelling, M2M connectivity tools, measurement equipment and instrumentation, membranes and overlays, motors and drives, PCB design and fabrication, power converters, batteries and supplies, prototyping verification equipment and software, rework tools, microwave RF and wireless solutions, service and maintenance equipment, semiconductor and microchip technology, soldering supplies, solar supplies, switches, test equipment, touchscreens and controls, wire and harness.

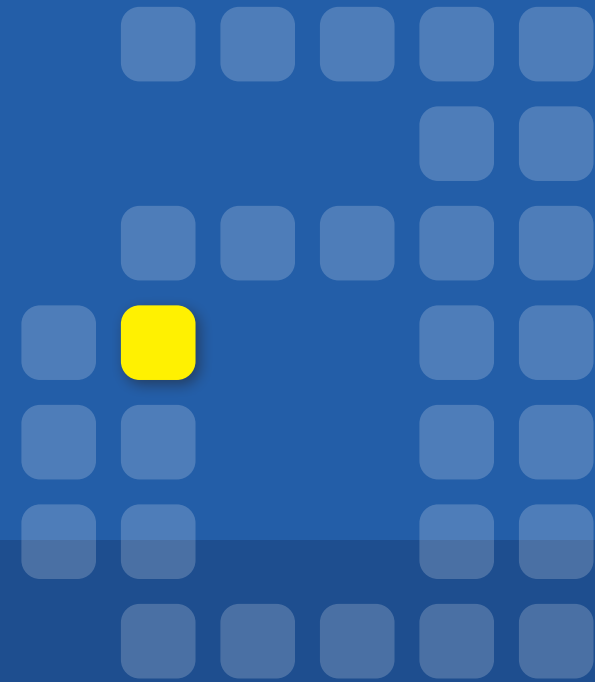
**SMCBA conference**

This year's SMCBA - Electronics Design & Manufacture Conference 2014 conference will feature several international presenters and deliver information on electronics design and manufacture and embedded systems technology.

The Best Practice in Electronics Assembly two-day workshop with Phil Zarrow will examine the adverse impact that non-optimal assembly practices and processes have on product quality and the financial success of electronic assembly businesses. It will also provide solutions for these issues and will examine them in relation to the manufacture of class 3 high-reliability products. The High Density Interconnect Technology two-day workshop has been developed by HDI expert Happy Holden to relate the successful design methodologies and processes used by a number of large aero/military, telecom OEMs, computer/notebook OEMs and consumer portable product OEMs to successfully implement HDI Technologies into their PCB programs. Many case studies will be used to demonstrate the effectiveness of this technology in achieving reduced costs while increasing PCB layout densities.

Dr Charles Bauer is presenting three one-day workshops. The first will examine modern design principles and practices (Design for X) which will focus on true yield management where X may represent cost, yield, assembly, test, logistics or any of a host of production metrics. The second workshop will present information on using 3D package on package technology in an SMT world and the final workshop will cover the application and implementation of commercial and development technologies to embed active and passive components in printed circuit boards and other interconnect substrates.

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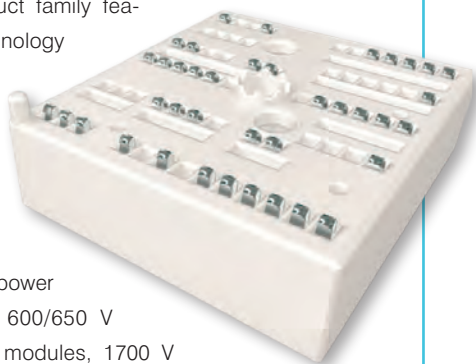
This special ElectroneX issue features insightful articles and new product editorials. Look for items with the show logo and the stand number to read about what is being exhibited at the show.



STAND C10

## POWER MODULES FOR INDUSTRIAL MOTOR DRIVES AND UPS SYSTEMS

The Semikron MiniSKiiP product family features user-friendly spring technology for power and control terminals and simple, solder-free, single-screw assembly of the circuit board, cooling unit and module. The product is primarily used in industrial motor drives, solar inverters and power supplies. In addition to the 600/650 V and 1200 V MiniSKiiP power modules, 1700 V modules with six-pack and converter-inverter-brake (CIB) circuit topology are available.



The 1700 V MiniSKiiP portfolio comprises six-pack and corresponding input bridge modules up to 100 A and CIB modules up to 50 A. The high current density helps to develop compact inverters to realise all the advantages of 600 V/690 VAC applications. All CIB modules have separate terminals for input bridge, brake chopper and open-emitter inverter for high PCB design flexibility and each single module can cover the whole three-phase application.

The migration from 400 V/480 VAC to 600 V/690 VAC voltage levels used in industrial applications offers several cost savings, based on the reduction of motor size, cable cross-section, max load current, total power losses, cable voltage drop during normal operating condition, motor start-up current and feeding transformer size.

**Semikron Pty Ltd**  
[www.semikron.com](http://www.semikron.com)

## 24 VDC, 20 A UPS

The PULS UB20.241 DIN rail UPS has been designed to be connected on the output side of a 24 VDC power supply and back up critical 24 VDC loads such as PLCs, RTUs and HMIs in the event of a power failure.

The product individually manages and monitors two 12 V batteries that are connected in series. When power is present, the UPS charges and monitors the batteries as well isolating the 24 VDC load connected to its output from the input supply. When it detects that power has been lost, it provides output power from the batteries while continuing to monitor each battery.

Other features include adjustable output voltage in buffer mode and negligible voltage dips or overshoots when transitioning from normal to buffer mode. The unit also has extensive diagnostic and monitoring functions.

**Control Logic Pty Ltd**  
[www.control-logic.com.au](http://www.control-logic.com.au)

## PROXIMITY AND AMBIENT LIGHT SENSOR

The VCNL4020X01 from Vishay Semiconductors is a proximity and ambient light optical sensor with an operating temperature range to 105°C. The product combines an IR emitter, a photo-pin-diode for proximity, an ambient light detector, a signal processing IC and a 16-bit ADC in one 4.8 x 2.3 x 0.8 mm rectangular leadless package.

The unit saves power by turning off the display backlight until a user is detected, while using its integrated ambient light function for display/keypad adaptive brightness control and rear-view mirror dimming. The device eliminates the need for additional light barriers and optical alignment of the IR emitter and photo diode.

The product can function at any depth or air gap below the glass window and can be assembled on the main PCB near other components. The interrupt function enables the sensor to work independently until a predefined proximity or ambient light event occurs.

The product provides a programmable LED drive current from 10 to 200 mA in 10 mA steps, allowing distances up to 200 mm. The device offers good ambient light suppression by modulating the infrared signal. The emitter wavelength peaks at 890 nm and has no visible 'red tail'.

The ambient light photo-pin-diode offers a 16-bit dynamic range for ambient light detection from 0.25 lux to 16 klux. The sensor offers 100 Hz and 120 Hz flicker noise rejection. Featuring standby current consumption of 1.5 µA, the device offers a supply voltage range of 2.5 to 3.6 V and I2C bus voltage range from 1.7 to 5 V.

**Arrow Electronics Australia Pty Ltd**  
[www.arrowaustralia.com](http://www.arrowaustralia.com)

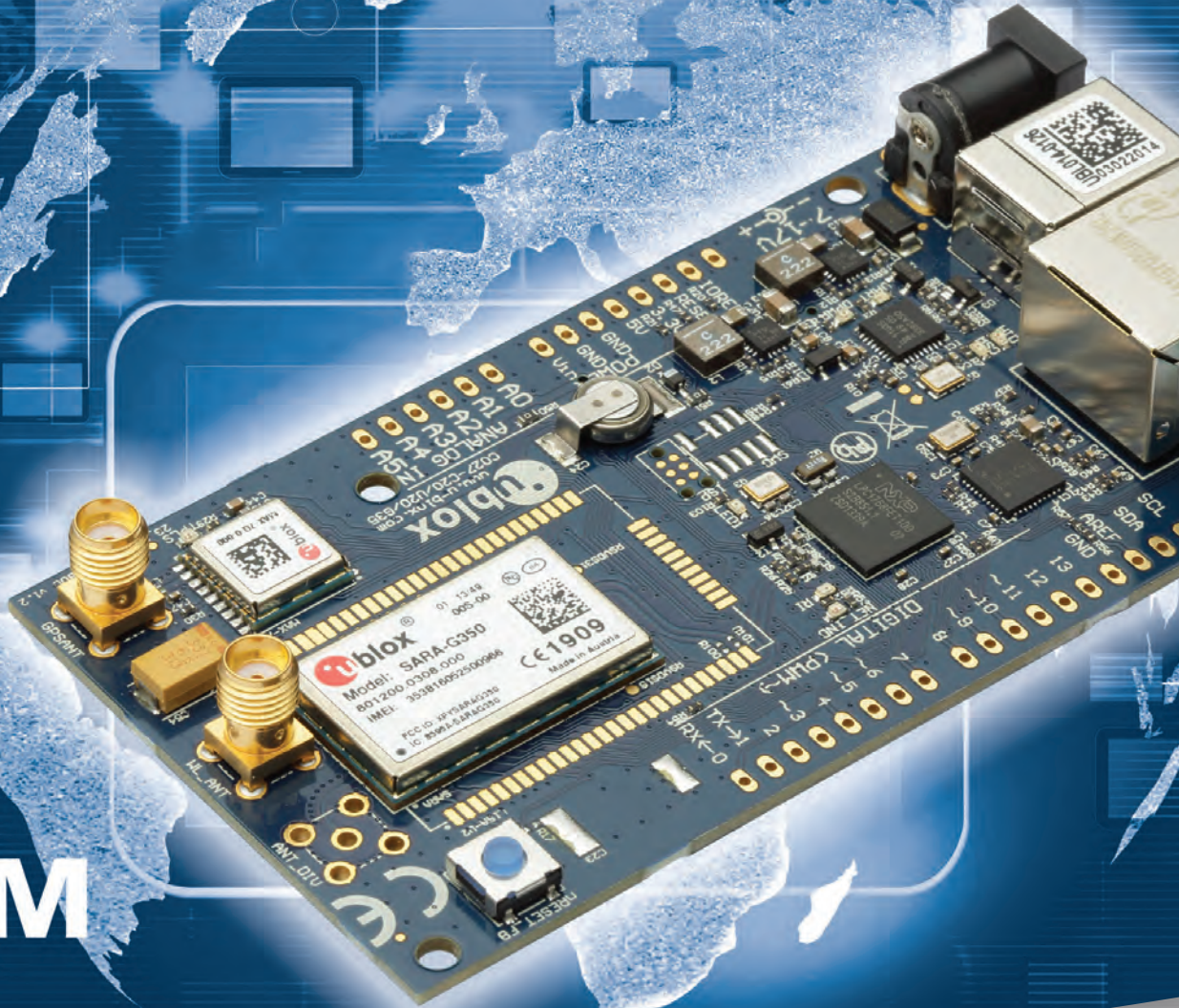




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## RUGGED TABLET PC

RuggON's Windows-based rugged tablet PC, the PM-311, is designed for field applications. The product meets the MIL-STD-810G rating for shock and vibration and can be dropped from 1.5 m onto plywood on a concrete surface. It is sealed against the ingress of liquid and dust damage (IP65) and has an operating temperature rating of -20 to +50°C.



The 7" LED backlit screen with integrated 5-wire resistive touch screen features a display brightness of 400 nits. The tablet is based on Intel's Atom N2600 1.6G Hz Dual Core CPU and includes 2 GB of DDR3 SODIM and 32 GB of upgradeable SATA Solid State Disk. The hot-swappable dual batteries offer up to 8 h of battery life.

A 5 MP webcam with an LED light is embedded in the rear bezel and a 2 MP camera with audio input is in the front panel. Seamless communication is available via the onboard GPS or optional 3.5G or 4G TLE modules. Multiple connectivity interfaces include 2x USB, 1x RS-232, 1x audio jack, 1x micro SD slot and 1x ethernet port supporting PXE function. For user flexibility, five programmable function buttons are located on the front panel.

**Backplane Systems Technology Pty Ltd**  
[www.backplane.com.au](http://www.backplane.com.au)

## LINEAR POSITION TRANSMITTERS

Macro Sensors HSIR Series LVDT linear position transmitters are suitable for serving as level sensors to measure liquid level changes from a few centimetres to several metres in gauging tank level volumes.

Sensitivity to the change in level depends on the length of the product. While the sensors are used to measure level changes from 50, 300 or 500 mm, shorter lengths offer greatest sensitivity. As there are no springs to fatigue or parts to wear out, the linear position sensors are nearly friction free to offer good resolution and long-term operation.

**Bestech Australia Pty Ltd**  
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## TENSIONING SYSTEM FOR SOLDER PASTE STENCILS

The DEK VectorGuard Framing System is an automatic tensioning system for solder paste stencils. It eliminates the need for complex alignment procedures and is independent of traditional pneumatic assistance processes.

The stencils feature an extruded aluminium guard, which is securely attached to the edge of the foil using interlocking plastic corners. Providing accurate and automatic tensioning, it takes only seconds to mount a foil into the VectorGuard frame. The system provides good-quality tensioning and is claimed to result in a reduction of stencil storage space by up to 75% compared to traditional mesh-mounted stencils.

**Mastercut Technologies**  
[www.mastercut.com.au](http://www.mastercut.com.au)

## SMARC COMPUTER-ON-MODULE

ADLINK Technology has introduced a SMARC form factor computer-on-module running on Intel x86 processors.

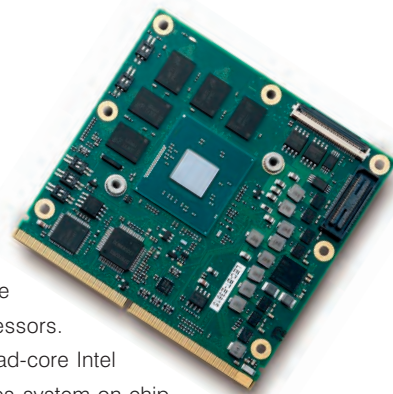
Using a single-, dual- or quad-core Intel Atom processor E3800 series system-on-chip from 1.3 to 2.2 GHz with soldered memory up to 4 GB DDR3L at 1066/1333 MHz including ECC, the ADLINK LEC-BT targets mobile applications with industrial-grade stability and reliability.

SMARC (Smart Mobility ARChitecture) is a versatile ultrasmall footprint computer-on-module; an open and global standard for embedded applications featuring low power and high performance. The ADLINK LEC-BT is an 82 x 80 mm module with onboard eMMC flash and ECC memory support.

The low-power design of SMARC (5 to 10 W) allows for passive heat dissipation and enables small, quiet and clean systems. The product provides a variety of I/O interfaces for developing applications, including both legacy PC interfaces and modern ARM-like interfaces. GbE is also provided for Ethernet connection, and other interfaces are included for a MIPI CSI-compliant camera, USB2.0 and 3.0 (host and client), GPIO and serial ports.

The module is designed for small systems with application scenarios ranging from industrial automation, medical testing and measurement, to transportation and digital signage. The modules can operate in a wide temperature range from -40 to +85°C.

**ADLINK Technology Inc**  
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**EMBEDDED WIRELESS MODULES**

The Sierra Wireless AirPrime HL Series are small embedded wireless modules which offer complete pin compatibility and are interchangeable across 2G, 3G and 4G technologies. The modules include satellite navigation support with GNSS (GPS and GLONASS) and provide device manufacturers with the ability to serve different regions, across multiple network technologies, with one device design.

The flexible hardware design of the modules is showcased in the snap-in socket or solder-down options. Using the snap-in socket, device manufacturers can quickly place the module in the device any time in the production cycle and swap 2G modules for 3G or 4G modules in the future, even in completed and field-deployed devices. Both the snap-in and solder-down options enable manufacturers to leverage one design for their 2G, 3G and 4G deployments, simply by changing the module installed in production.

The series is also designed to be futureproof. With AirVantage Management Service, an off-the-shelf, cloud-based M2M platform from Sierra Wireless, users can upgrade device firmware over the air for thousands or even millions of deployed devices at a time, ensuring they can stay in service for many years while lowering maintenance time and operating costs.

The HL6528 supports quad-band GSM/GPRS and provides enhanced multi-network coverage with Dual SIM Dual Standby technology, which allows continuous operations. The HL8548 additionally supports penta-band HSDPA/HSUPA and quad-band EDGE for global coverage. Both offer low power consumption and an extended power supply range.

The series is suitable for M2M communications applications in point-of-sale, smart grid, fleet management and tracking.

**M2M Connectivity**

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ELECTRONEX 2014 / STAND D22









# GRAPHENE DROPLETS

## COULD BE USED IN DRUG DELIVERY SYSTEMS

Researchers from Monash University have discovered that graphene oxide sheets can change structure to become liquid crystal droplets spontaneously and without any specialist equipment. This opens up possibilities for its use in drug delivery and disease detection, say researchers.

**B**ecause graphene droplets change their structure in response to the presence of an external magnetic field, it could be used for controlled drug release applications, said Dr Mainak Majumder from the Faculty of Engineering.

"Drug delivery systems tend to use magnetic particles which are very effective but they can't always be used because these particles can be toxic in certain physiological conditions," Dr Majumder said.

"In contrast, graphene doesn't contain any magnetic properties. This, combined with the fact that we have proved it can be changed into liquid crystal simply and cheaply, strengthens the prospect that it may one day be used for a new kind of drug delivery system."

Usually atomisers and mechanical equipment are needed to change graphene into a spherical form. In this case all the team did was to put the graphene sheets in a solution to process it for industrial use. Under certain pH conditions they found that graphene behaves like a polymer - changing shape by itself.

The findings, published in the journal *ChemComm*, build on existing knowledge about graphene. First author of the paper, Rachel Tkacz from the Faculty of Engineering, said the surprise discovery happened during routine tests.

"To be able to spontaneously change the structure of graphene from single sheets to a spherical assembly is hugely significant. No one thought that was possible. We've proved it is," said Tkacz.

"Now we know that graphene-based assemblies can spontaneously change shape under certain conditions, we can apply this knowledge to see if it changes when exposed to toxins, potentially paving the way for new methods of disease detection as well."

Commonly used by jewellers, the team used an advanced version of a polarised light microscope based at the Marine Biological Laboratory, USA, to detect minute changes to graphene. Dr Majumder said collaborating with researchers internationally and accessing some of the most sophisticated equipment in the world was instrumental to the breakthrough discovery.

"We used microscopes similar to the ones jewellers use to see the clarity of precious gems. The only difference is the ones we used are much more precise due to a sophisticated system of hardware and software. This provides us with crucial information about the organisation of graphene sheets, enabling us to recognise these unique structures," Dr Majumder said.

Dr Majumder and his team are working with graphite industry partner Strategic Energy Resources and an expert in polarised light imaging, Dr Rudolf Oldenbourg from the Marine Biological Laboratory, USA, to explore how this work can be translated and commercialised. Mark Muzzin, CEO of Strategic Energy Resources Ltd, said the collaboration with Monash was progressing well.

"We are so pleased to be associated with Dr Majumder's team at Monash university. The progress they have made with our joint project has been astonishing," he said.



## OSCILLOSCOPE SERIES

Teledyne LeCroy has released the WaveSurfer 3000 oscilloscope series. All functions are accessible from the device's user-friendly 10.1" touch-screen interface, MAUI, which provides one-touch access to frequently used controls.

Triggers, measurements and maths functions are easily accessible. Waveforms can be quickly dragged to new locations and details examined with a finger zoom. Intelligent display features automatically resize and reposition waveforms, measurement results, menus and other screen elements for easy accessibility and readability.

The series has the built-in capability of a 16-channel mixed-signal oscilloscope, capturing and storing signals for later analysis. A waveform generator serves as a function generator, reducing test equipment needed on the bench. A protocol analyser includes serial trigger and decode capability. An active probe interface is flexible enough to measure high voltages, high frequencies, current draw and differential signals.

Waveforms as fast as 500 MHz can be captured with up to 4 GSa/s capture rate. The waveform update rate is a fast 130,000 waveforms/s. Up to 16 digital channels can be captured at 500 MSps each. The product has a deep memory depth and can store up to 10 million signal sampling points per channel.

**Vicom Australia Pty Ltd**  
[www.vicom.com.au](http://www.vicom.com.au)

## REAL-TIME SPECTRUM ANALYSER

Aaronia's V5 real-time spectrum analyser has a frequency range up to 18 GHz, ultrafast LO sweeps, real-time data streaming, high-resolution TFT display, a tracking generator and GPS.

The Spectran V5 has up to 200 MHz real-time bandwidth, can analyse weak signals due to low noise signal processing (down to -170 dBN/HZ) and the polyphase filter technology can capture small signal detail. It can be fitted with a frequency extension down to 1 Hz.

The real-time analyser can stream data continuously and save it gap free on a PC via a high-speed USB interface. It

comes in a small, compact design and can be controlled either by the unit's touch screen, a multi-functional jog dial, motion control, hot keys or a real-time remote control (GSM, WLAN or USB).

The front end of the product is interchangeable, allowing an upgrade to the company's latest technology. Directional tracking and EMC antenna; an aluminium carrying case; battery charger and power supply, including international adapter set; and analyser

software for MAC OS, Linus and Windows are all included.

**Clarke & Severn Electronics**  
[www.clarke.com.au](http://www.clarke.com.au)



## ZIGBEE PRODUCTS FOR INDUSTRIAL CONTROL AND AUTOMATION

ICP DAS has manufactured a range of ZigBee products for industrial automation and control environments.

ZigBee is a specification based on the IEEE 802.15.4 standard for wireless personal area networks (WPANs). It operates in the ISM radio bands and defines a general-purpose, self-organising mesh network for industrial control, embedded sensing, medical data collection, smoke and intruder warning, building automation and home automation.

There are three different types of ZigBee devices in a ZigBee network. A coordinator stores information about the network and determines the optimum transmission path between any two points of the network. A full function device acts as an intermediate

repeater that passes data from other devices. A reduced function device contains a minimal amount of functionality to enable it to talk to its parent node (either the coordinator or a router); it cannot relay data directly from other devices.

The range includes analog I/O, temperature sensors, digital I/O, multifunction I/O, Zigbee sniffers, repeaters and converters (RS232/485, Ethernet and USB to ZigBee). All models feature -25 to +75°C operation, ESD/EFT protection, a 10-30 VDC wide range power supply, dual watchdog timer and Windows GUI configuration software. The products are DIN rail mountable.

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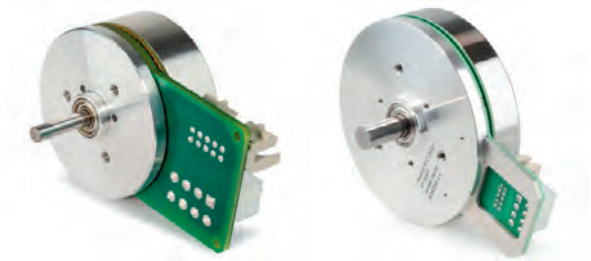
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## BRUSHLESS DC FLAT MOTORS WITH INTEGRATED ENCODER



Brushless flat motors from maxon motor feature pancake form factor and torque ratings. The product's integrated mill encoder maintains the motor's low profile and includes high-resolution encoder feedback.

The encoder operates by measuring the fields generated by eddy currents in a target disc. This is claimed to offer improvements over traditional encoder technology in the form of environmental robustness, improved speed capabilities and an increase tolerance against external interference. The integrated encoder, when used with a matching motor position control unit, will control the unit to resolutions of up to 25,600 qc/rev.

There are three power levels - 30, 50 and 70 W - in a 45 mm diameter, and also a high-torque 90 W version in a 90 mm diameter. The 45 mm version is available with both PCB-mounted connectors or a smaller footprint cable version. The product is suitable for driving loads directly with high degrees of speed and position control in robotics and factory automation applications.

**maxon motor Australia Pty Ltd**  
[www.maxonmotor.com.au](http://www.maxonmotor.com.au)

**ElectroneX**  
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STAND D17

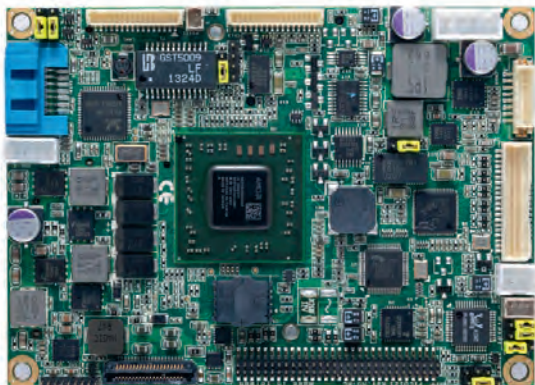


## CLEANING SOLUTION FOR PCBs

Electrolube's non-toxic, low-odour cleaning solution, Safewash Total (SWAT), is a specially formulated blend of non-flammable solvents which forms a micro-emulsion when mixed with water. The product has high solvency for efficient removal of contaminants and generates low amounts of foam.

Designed for cleaning printed circuit boards, it is suitable for the safe removal of all types of flux residues, including no-clean, and is surfactant free, which make it easy to rinse. It is suitable for removing pastes and adhesives from boards and stencils used in SMT electronic production, as well as general degreasing applications.

**Electrolube**  
[www.electrolube.com.au](http://www.electrolube.com.au)



## SINGLE-BOARD COMPUTER

Axiotek has released the PICO121, its compact fanless Pico-ITX SBC with ultralow power AMD G-Series Embedded SoC GX-210JA dual-core 1 GHz on board. The product is built to withstand wide temperature conditions ranging from -20 to +70°C. The embedded board supports DirectX 11, Open GL4.2 and Open CL1.2 to provide good graphics performance and features dual-view compatibility through VGA and LVDS with AMD Radeon™ HD8180 graphics controller.

The device supports DASH (desktop and mobile architecture for system hardware) for convenient remote management, which means the board can be used as a client device, controlled and managed by a console remotely via a Gigabit LAN port on the rear I/O. The computer is equipped with one high-speed board-to-board connector that integrates PCIe x1, USB 3.0 and DisplayPort to fulfill various application needs.

I/O features include four high-speed USB 2.0 ports, two COM ports, one SATA port up to 6 GBps, one gigabit Ethernet and HD audio. The small form factor SBC supports both half-size and full-size PCI Express Mini card slots which expand system connector ability. The full-size PCI Express Mini card supports mSATA to provide one more choice of storage. The embedded mainboard supports watchdog timer and hardware monitoring to keep the system running smoothly.

**Braemac Pty Ltd**  
[www.braemac.com.au](http://www.braemac.com.au)







**CONTRACT ELECTRONICS MANUFACTURING**

Electronic design and manufacturing company HeTech has announced its partnership with contract electronics manufacturer Surface Technology International (STI). STI, with its experience in the defence, military, aerospace, automotive, telecoms, medical, satellite and commercial sectors, is providing its high-volume manufacturing services for Hetech.

HeTech also recently moved into a larger, state-of-the-art facility after outgrowing its previous manufacturing premises. The company is now located at 33 Perrin Drive, Underwood, Qld.

**HeTech**  
www.hetech.com.au

**PANEL PC**

Advantech's Industrial Automation Group has announced that the multifunction PPC-6120 now comes with the ability to allow users to install the processor of their choice.

Users can choose any fourth-generation processor, from the low-end Celeron to the powerful i7 Intel 4th Generation Core i CPU, to meet their needs. Fourth-generation i processors are said to be 13% faster than their predecessors and have a 24% increase in graphics performance.

The compact device, with a 12.1" 5-wire resistive touch screen, is suitable for connecting directly to devices through an integrated isolated RS422/485 port, which protects the port in the event of power spikes. If a larger screen is required, users can simply attach two extra displays using the VGA and Display Port ports which can be used simultaneously with the product.

As well as the isolated RS422/485 port, the device also comes with a wide voltage input range of 12-30 V so that in factories with unstable power it will continue to work. Other features include: IP65 front bezel, so the device can be cleaned with jets of water; four RS232 and four USB 3.0 ports for added connectivity; and dual Gigabit Ethernet ports. For expandability, a PCIe4 or PCI card can also be added.

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# CALLS FOR NEW PRIVACY PROTECTIONS

## AS DRONE USE SURGES

Australia's drone industry is booming thanks to rapidly improving technology that has made drones cheaper, more capable and easier to operate.

**D**rones are revolutionising the farming, mining, science, media and other industries in Australia but they also pose a real threat to privacy. The federal parliament's House Standing Committee on Social Policy and Legal Affairs says that Australia's existing privacy laws do not protect Australians' privacy from drones.

The committee's new report 'Eyes in the sky: Inquiry into drones and the regulation of air safety and privacy' calls on the Australian government to modernise and simplify Australia's privacy laws to protect against potentially invasive new technologies like drones.

Current plans to update airspace regulation will improve safety, but the committee calls for frequent review of regulations to keep pace with the rapid development of drone technology. Committee chair George Christensen MP said that the inquiry had revealed gaps in Australia's privacy laws leaving Australians at risk. "Drones are coming - the technology is here and it is only a matter of time before they become widespread," Christensen said.

"Drones will revolutionise some industries, with a wide range of beneficial uses. All the same, we must set out clear rules that govern how the police, governments, businesses and members of the public use drones."

The committee's report draws on evidence from industry groups, privacy experts and government agencies heard at two roundtable discussions and a number of public hearings earlier this year. The report makes six recommendations, calling for:

### Broader consultation process

The committee recommends the government broaden future consultation processes it undertakes in relation to remotely piloted aircraft regulations so as to include industry and recreational users from

a non-aviation background. Future consultation processes should identify and seek comment from peak bodies in industries where remotely piloted aircraft use is likely to expand such as real estate, photography, media and agriculture, amongst others.

### Drones and privacy

The committee recommends inclusion of information on Australia's privacy laws with the safety pamphlet CASA currently distributes to vendors of remotely piloted aircraft. The pamphlet should highlight remotely piloted aircraft users' responsibility not to monitor, record or disclose individuals' private activities without their consent and provide links to further information on Australia's privacy laws.

### New legislation

The committee recommends that the government consider introducing legislation by July 2015 which provides protection against privacy-invasive technologies (including remotely piloted aircraft), with particular emphasis on protecting against intrusions on a person's seclusion or private affairs. The committee also recommends that in considering the type and extent of protection to be afforded, the government consider giving effect to the Australian Law Reform Commission's proposal for the creation of a tort of serious invasion of privacy, or include alternative measures to achieve similar outcomes, with respect to invasive technologies, including remotely piloted aircraft.

### Harmonised laws

The committee recommends that, at the late-2014 meeting of COAG's Law, Crime and Community Safety Council, the Australian Government initiate action to simplify Australia's privacy regime



## DRONES AND PRIVACY

by introducing harmonised Australia-wide surveillance laws that cover the use of: listening devices, optical surveillance devices, data surveillance devices and tracking devices. The unified regime should contain technology neutral definitions of the kinds of surveillance devices and should not provide fewer protections in any state or territory than presently exist.

### RPA regulation

The committee recommends that the Australian Government consider the measures operating to regulate the use or potential use of RPAs by Commonwealth law enforcement agencies for surveillance purposes in circumstances where that use may give rise to issues

regarding a person's seclusion or private affairs. Further, the committee recommends that the government initiate action to harmonise what may be determined to be an appropriate and approved use of RPAs by law enforcement agencies across jurisdictions.

### Air safety regimes

The committee recommends that the Australian Government coordinate with the Civil Aviation Safety Authority and the Australian Privacy Commissioner to review the adequacy of the privacy and air safety regimes in relation to remotely piloted aircraft, highlighting any regulatory issues and future areas of action. This review should be publicly released by June 2016.



STAND A8

### NON-STRIPPING, MULTICONNECTION CONNECTORS

Jow Connector has 14 types (I-type and T-type) of multiconnection connectors which can cover up to 600 V with 30 currents

depending on wire gauge from 0.2 to 4 mm<sup>2</sup>.

Features include no stripping or splicing of wires; electric shock prevention; water and dust resistance (IP33); no loss of power in connection; low carbon. For high-voltage, high-current connections, the product offers expanded connectivity, with unlimited expansion of the contact points; increased diameters to accommodate all specs

of electrical wires; minimal resistance, reducing electrical loss.

Jow Connector patents are based on non-stripping and multicontact point electrical connector technology, called Insulation Displacement Technology with Multiple Connection Points (IDTMC). IDTMC could be applied in almost all walks of modern industry where electricity is used, such as construction, automotive, electronics, aerospace, shipbuilding, advertising, lighting, home appliances, defence, LED, telecommunications, power generation and transmission, and more.

**Unixon Pty Ltd**

[www.unixon.com.au](http://www.unixon.com.au)



### SPECTRUM ANALYSER

The BB60C spectrum analyser streams 140 MBps of digitised RF to a PC utilising USB 3.0, providing an instantaneous bandwidth of 27 MHz and sweep speeds of 24 GHz/s.

The analyser is said to have significantly improved performance compared to the BB60A. It has improved spurious-free dynamic range (SFDR) by 20 dB, flattened the noise floor and band transitions by more than 8 dB and extended operating temperatures from -40 to +65°C.

The BB60C also adds new functionality in the form of configurable I/Q streaming bandwidths which will be retroactively available on the BB60A.

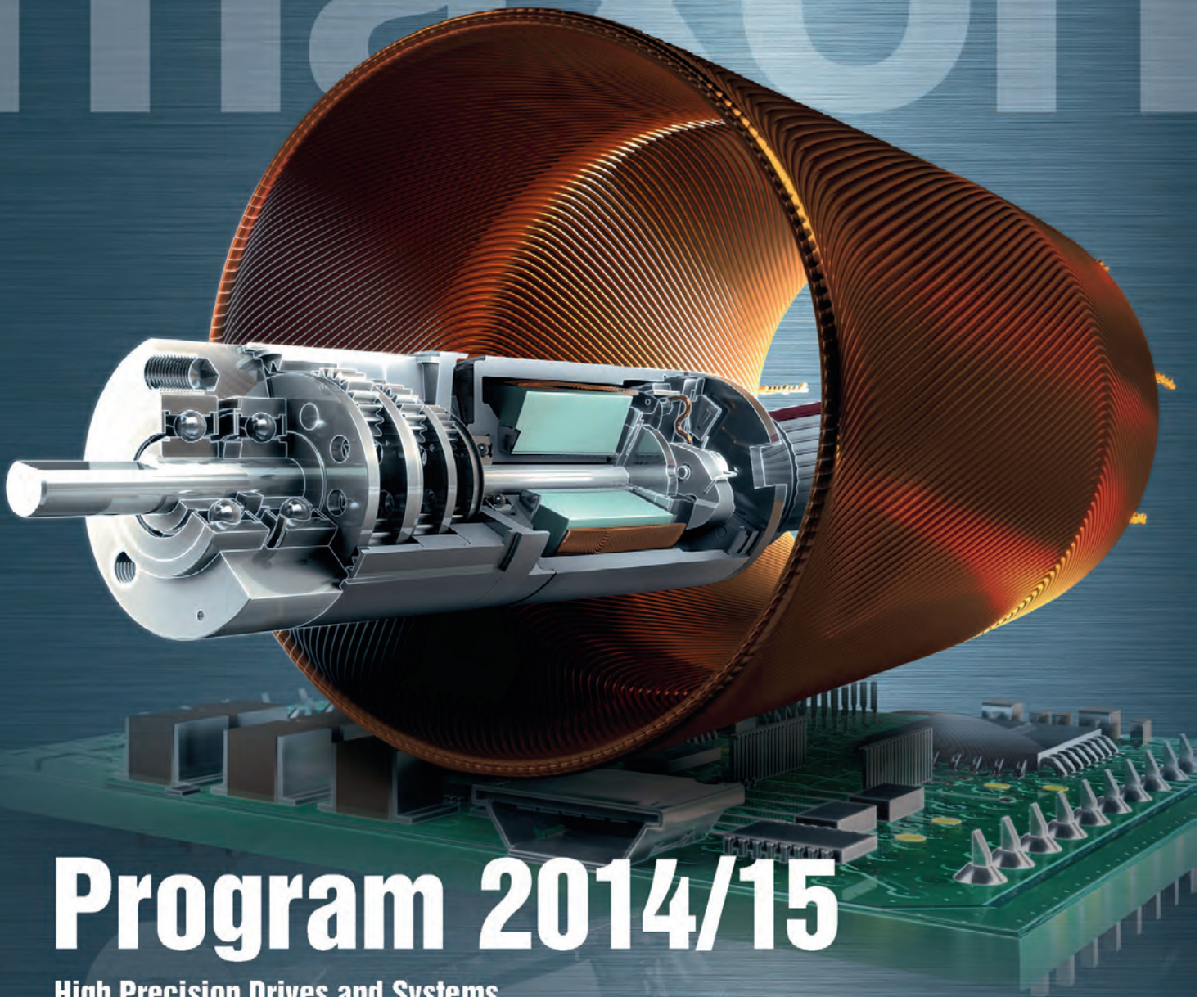
Other features include: RF frequency range from 9 kHz to 6 GHz; up to 24 GHz/s sweep speed ( $\geq 10$  kHz RBW); wide dynamic range from -158 to +10 dBm; resolution bandwidths available from 10 Hz to 10 MHz; powered solely through USB, no external power supply needed; powerful digital signal processing happens on the PC; software and hardware included; digitised IF data at 80 million Sa/s; 27 MHz instantaneous bandwidth; compatible with Windows 7/8 64-bit operating systems; USB 3.0 communications providing 140 MBps sustained throughput to PC; measures under 9" long.

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## DATA BOOK FOR EMC FILTERS

TDK's data book for EPCOS EMC filters covers a comprehensive range of filter solutions for applications in industrial electronics, telecommunications and data technology. Frequency converter solutions are treated in particular detail; they make use mainly of power chokes, output chokes and filters.

Product highlights include IEC inlet filters and sine-wave filters; SineFormer; 2-line SIFI filters with low leakage currents; and a series of filters designed specifically for frequency converters in renewable energy applications.

In addition to a detailed description of products, the 528-page data book provides extensive basic and additional information on EMC and corresponding standards, network configurations, stress capacity of filters, application examples and an overview of the services of the EPCOS EMC laboratory in Regensburg.

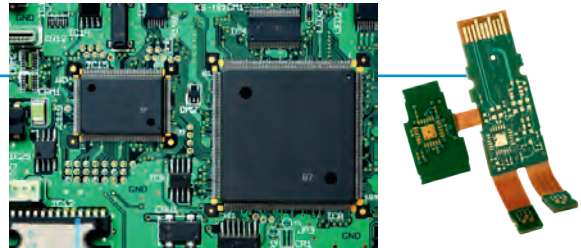
**Ramelec Pty Ltd**  
[www.ramelec.com.au](http://www.ramelec.com.au)

## EXPRESS PCB AND ASSEMBLY SERVICES

QualiEco Circuits provides quality electronic manufacturing services and solutions. The company has recently launched express services in all product categories, with customised delivery solutions.

The company offers technical support and attention to detail. Its services cover rigid PCBs (up to 32 layers), flexible PCBs (single- and multilayer), rigid-flexible PCBs (single- and multilayer) and metal core PCBs (single- and multilayer).

**QualiEco Circuits Ltd**  
[www.qualiecocircuits.co.nz](http://www.qualiecocircuits.co.nz)



## SMALL DC SERVO MOTORS EXTENDED ENCODER RANGE

maxon DCX motors have online configuration and an automated production facility. This allows the user to directly modify the features of the motor and select various gearhead and encoder options suitable for many sustainable manufacturing applications.

The selectable range of encoders has increased with the 3-channel range of optical 2RMF and SCH sensors. Once the encoder is selected, the resolution option is given with selectable counts per turn from 3000 to 5000. The encoders feature a wide input voltage range from 4.5 to 30 VDC. The output signal is EIA standard RS422 using an 26C31 driver.

With the configuration tool, the user can select a low backlash gearhead or maxon can supply zero-backlash, high-reduction gearheads that, when used in conjunction with the 5000cpt, will give the user a 20,000 quad count position capability. Multiply this by the gearhead ratio selection and the result is an accurate positioning drive.

**maxon motor Australia Pty Ltd**  
[www.maxonmotor.com.au](http://www.maxonmotor.com.au)

## MICROCONTROLLERS

The Kinetis V Series KV1x MCU family is the entry point to Freescale Semiconductor's Kinetis V series, a scalable microcontroller (MCU) family that targets digital motor control applications. Based on a 75 MHz ARM Cortex-M0+ core, the range includes an integer divide and square root co-processor that reduces the CPU load caused by motor control algorithms.

The MCUs include an analog and timing peripheral set with two 12/16-bit analog-to-digital converters (ADCs) capable of 1.2 MSps in 12-bit mode for fast signal acquisition and conversion; a 12-bit digital-to-analog converter (DAC); and two analog comparators said to reduce bill of material (BOM) costs while providing fault protection against overcurrent/overvoltage conditions. Multiple Freescale FlexTimers generate high-resolution PWM signals, while a programmable delay block detects rotor positions in sensorless applications.

In order to help meet compliance with IEC-60730 safety standards for household appliances, the MCUs have two independent watchdogs to help ensure the safe operation of on-chip firmware. A hardware cyclic redundancy check (CRC) engine allows safety verification of the validity of the contents of the Flash memory, as well as checking the integrity of onboard serial communications. Target applications include brushless DC motor control, stepper motor control and low-voltage DC motor control.

**Mouser Electronics**  
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### AC/DC CONVERTERS

RECOM's 1 and 2 W AC/DC converters, the RAC01 and RAC02 series, bring AC into the user's boards with full protection and safety. They are suitable for electronics applications in home automation, telecommunications, consumer appliances, industrial controls and measurement equipment, allowing users to integrate the power supply into their equipment without having to use any external device, such as desktop or wall-plug power supplies.

With its ultracompact packages, the series provides protection and safety from AC lines and delivers clean DC voltage to power the user's board components. The 1 and 2 W converters cover an input voltage of 90-277 VAC and are available with 3.3, 5, 9, 12, 15 or 24 VDC outputs. They have a low no-load power rating of only 30 mW at 115 VAC.

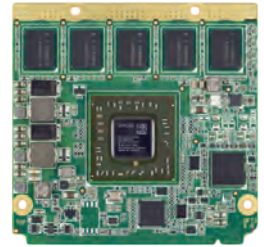


The converters can operate over a temperature range of -25 to +85°C and offer efficiency up to 77%. Input voltages are regulated with ±2% and load variations with ±6%. The series measures 33.7 x 22.2 x 17 mm. The MTBF (+25°C) to MIL-HDBK 217F is specified at >1,000,000 h. They come with 3 kVAC/1 min isolation, a built-in EMC Class B filter and are short-circuit and overload protected. All converters are CE and UL certified (EN 60950-1/UL 60950-1).

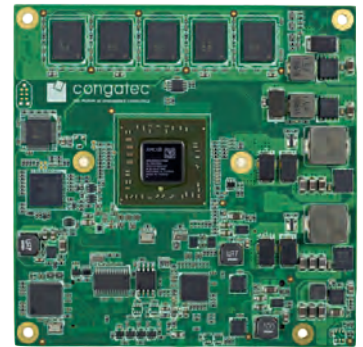
**RECOM Asia Pte Ltd**  
www.recomasia.com

### COMPUTER-ON-MODULES

congatec has expanded its Qseven and COM Express product range with modules based on the second generation of AMD Embedded G-Series SOC (system-on-chip) processors.



Compared to the current AMD Embedded G-Series SOC platform, the modules are said to provide higher performance and a lower power draw due to an improved Jaguar+ CPU architecture and AMD Radeon 8000 graphics core. The graphics engine speed has been increased



up to 800 MHz and the DDR3 interface up to 1866 MT/s. The G-Series includes Core Boost Frequency to ensure appropriate processor overlocking.

The second generation of AMD G-Series SOC on Qseven and COM Express modules is designed for low-power embedded applications, with high performance per watt and low TDP. The fanless module design is therefore suitable for cost-sensitive applications in the control and automation industry, digital gaming, communication infrastructure and graphics-intensive devices such as thin clients, digital displays or medical-imaging equipment.

In the Qseven standard, congatec supports two processors from the AMD Embedded G-Series SOC platform. For the COM Express Compact Type 6 standard, there is the quad-core AMD GX-424CC 2.4 GHz (2 MB L2 cache) with a TDP of 25 W.

**congatec Australia Pty Ltd**  
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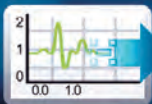
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**PCIE-1751**  
48-ch TTL Digital I/O  
and 3-ch Counter



**PCIE-1753**  
96-ch TTL  
Digital I/O





**INTERFERENCE AND DIRECTION ANALYSER**

The Narda Interference and Direction Analyser IDA 2 has been specially developed for identifying and localising interference, impairments and unknown sources. It is not simply a receiver with antennas attached but a complete all-in-one measuring system that is tailored precisely to its application: efficient source localisation. It is a true direction finder with the qualities of a receiver in a handheld format.


RF impairments or interference is often difficult to detect, particularly if it is sporadic or hidden beneath the regular signals. The product has I/Q analysis functions to allow reliable location of such signals, recording the I/Q data in real time and saving up to 250,000 I/Q data pairs without compression, ie, without loss of data.

smartDF is a process for systematic, rapid localisation of suspect signals, interference sources and leaks using handheld direction finders developed by Narda and implemented in the device. It is useful under difficult conditions or in the presence of complex signals, processing the bearing results and automatically determining transmitter locations. Interference sources are said to be localised faster using the product than with conventional handheld direction finders.


The unit features a frequency range of 30 MHz to 6 GHz; 12 GHz/s fast sweep; 32 MHz real-time bandwidths; a direction-finding mode with automatic azimuth determination; built-in GPS receiver and electronic compass; map display; high-resolution oscilloscope display; I/Q data recording for high-resolution spectrogram and persistence spectrum generation; I/Q streaming via Ethernet. The product weighs only 3 kg.

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# GEARING UP FOR A DRIVERLESS FUTURE

Mike Smyth, specialist technical writer

Cars speeding along a motorway set in a futuristic landscape populated by beings dressed in silver metallic suits used to be the stuff of comics and those deep into science fiction. However, some of those imaginative images could well become reality within the next 10 years as autonomous or driverless vehicles steer out of the laboratory and onto the roads.

**T**he concept of driverless cars is almost as old as motoring itself. It has been a dream of enthusiasts for many years, but only now has the technology caught up with the vision to create a practical vehicle that can be both safe and efficient, and some of this work is going on in Australia.

The history of autonomous cars goes back to at least the 1920s when a radio-controlled car was demonstrated travelling up Broadway and down Fifth Ave in New York. The car, called the 'linrrican wonder' contained circuit breakers and small electric motors that were controlled by radio signals transmitted from a following vehicle.

At the heart of this new generation of vehicles are sensors, but they have to be almost human to be aware of the vehicle and surrounding objects - particularly other vehicles. To do this they use a variety of technologies including proximity sensors, radar, lidar (light detection and ranging), GPS and cameras combined with sophisticated computer software and artificial intelligence.

The potential advantages of this utopia are enormous - better traffic management and, most importantly, fewer accidents with a consequent lessening of hospital treatment and trauma.

## Wireless communication channels

Dedicated short range communication (DSRC) technology is a vital component of autonomous vehicles. It is based on published standards developed by international organisations and, with the backing of global vehicle manufacturers, the system ensures that vehicles from different manufacturers can interoperate.

The system combines radio connectivity, accurate positioning using GPS and vehicle dead reckoning, and, of course, an onboard computer. This allows vehicles to communicate with each other

using what are called V2V links and to roadside units (vehicle to infrastructure or V2I links).

Using a dedicated radio frequency of 5.9 GHz, just outside the Wi-Fi band, the system allows vehicles to 'see around corners' and 'see through' other vehicles, and it permits infrastructure to know about detailed traffic movements and communicate with vehicles.

It also provides an open standardised platform for traffic flow management, road and conditions monitoring, traffic scheduling and route selection. DSRC-equipped vehicles that broadcast basic safety messages 10 times a second give information of latitude and longitude, speed, heading, four-way acceleration, brake status, steering wheel angle, throttle position and vehicle size. It can also avert possible intersection crashes, rear-end collisions, dangerous overtaking and lane drift, and an onboard unit can alert drivers visually or audibly.

## Australia's role

At the forefront of these developments is Australian company Cohda Wireless, which was formed by researchers at the University of South Australia's Institute for Telecommunications Research and now has headquarters in Melbourne with offices in Germany and the US. The company works closely with shareholders, Cisco Systems and XPP Semiconductor.

"V2X (vehicle-to-vehicle and vehicle-to-infrastructure) communications need reliable sensors to fulfil their potential," said Cohda's CEO, Paul Gray.

"V2X allows vehicles to share their sensor data with other vehicles around them. Standard sensors such as radar, optical, ultrasonic and lidar are all line-of-sight and can only detect visible risks. V2X is a non-line-of-sight sensor with 360° awareness that



## AUTONOMOUS CARS

“

IN EUROPE, THE FIRST SELF-DRIVING VEHICLE FOR COMMERCIAL SALE WAS RELEASED BY FRENCH COMPANY INDUCT TECHNOLOGY IN JANUARY THIS YEAR. CALLED THE NAVIA, IT IS LIMITED TO 20 KM/H AND RESEMBLES A GOLF CART SEATING UP TO EIGHT PEOPLE.

can detect hidden-from-view threats,” he said. He went on to add that the system’s reliability is critical for not only between two cars that are driving down a straight road but also for two cars approaching each other around a blind corner, over the crest of a hill, at freeway speeds or when there are trucks between them.

Autonomous vehicles could revolutionise the huge trucking industry in this country and revitalise the industry, according to Dr James Ward, a researcher with the Intelligent Vehicles and Safety Systems Group, Australian Centre for Field Robotics at the University of Sydney.

Among other lines of research, this group, too, is looking at how vehicles can understand and react intelligently with their environments. He says that vehicles can become a distributed sensor network and that far from taking away the pleasure of driving these new systems could add fun to their experience as society changes its views on driving and vehicle ownership.

### Developments around the world

Outside special equipment manufacturers, there is plenty of action going on by car makers and other research organisations. For example, Mercedes, General Motors, Nissan, Toyota, Audi and Volvo are actively engaged in developing driverless systems. In 2010, four electric autonomous vans drove 21,000 km from Italy to China in a project backed by the European Union and Vistab of the University of Parma.

In July 2013 a robotic vehicle, without any human interference, drove through Parma, navigating roundabouts, pedestrian cross-

ings and traffic lights. In the meantime, Nissan says it is building a dedicated proving ground in Japan and will announce several driverless vehicles in 2020. The company’s electric Leaf is being used in some of the trials and as an autonomous vehicle it has already been allowed on Japanese roads.

In Europe, the first self-driving vehicle for commercial sale was released by French company Induct Technology in January this year. Called the Navia, it is limited to 20 km/h and resembles a golf cart seating up to eight people. It will be used to shuttle people around large industrial sites, airports, theme parks, university campuses, vehicle-free city shopping centres and hospital complexes.

Now Google has come onto the scene - in May it said it plans to unveil 100 prototypes built inside the company’s secret lab.

### Challenges remain

So advanced are some of the systems becoming that last year four states in the US - Nevada, Florida, California and Michigan - passed laws allowing driverless vehicles. In Europe, Belgium, Italy and France plan to operate transport networks using driverless vehicles.

However, some major issues with this form of transport still have to be overcome. These include software reliability and cybersecurity where a car’s computer could be hacked to destroy the integrity of the vehicle.

Today, driverless vehicles raise as many ethical issues as they do technical because once some sort of human control is removed, who then do you call to account in the event of a human death caused by such a vehicle? But this then comes down to whether or not a human inside the vehicle has any control. If s/he is just a passenger then s/he surely cannot be held responsible for the vehicle and its performance. If s/he does have some sort of control, how much and was s/he capable of avoiding a hazardous situation?

Questions like these and the question of insurance liability are not for engineers to answer. However, in creating an autonomous car they have produced devices that will have ethicists and lawyers scratching their heads for a few years yet.

## 365-DAY TIME SWITCH

The Mig2 series 365-day time switch has many time- and energy-saving features. It includes two parts connectors for quick wiring, removal and re-installation; fast programming; easy cover removal; positive cover fixing; and an optimised start and economy cycle.

With 24 or 240 VAC operation, the product features an easy-to-read, high-contrast OLED display. It has extreme temperature detection, with the air conditioning forced on outside ON times. It also includes after-hours-access push-buttons, up to 12 single holidays and up to four block holidays.

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## VOLTAGE REFERENCE

The ZXRE330 3.3 V shunt voltage reference from Diodes has been introduced to help achieve improvements in both stability and power consumption. Pin-compat-

ible with industry-standard parts, the product is offered in surface-mount SOT23 and through-hole TO92 package options.

With a typical temperature coefficient as low as 20 ppm/°C, the precision micropower device provides stable performance across an industrial operating temperature range of -40 to +85°C. Output voltage tolerance is tight at ±2% at +25°C for the ZXRE330E and ±0.5% at +25°C for the ZXRE330A. The product's low-power performance is a result of its low knee current, 1 µA typical, with good performance maintained over the device's full operating current range of 2 µA to 5 mA.

The reference has been designed to be tolerant of capacitive loads and requires no output capacitor. Its low-output noise performance of 55 µV<sub>RMS</sub> ensures a clean output from 10 Hz to 10 kHz.

### Future Electronics

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STAND B36

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Mean Well has a range of power supplies with medical safety approvals.

The MPS-65-24 has two means of patient protection (2x MOPP) medical safety approvals. The user is provided with a reliable power supply that provides the maximum protection level to the patient. The device can be used in a dental product, for example.

The RPD-160, suitable for use in a dialysis machine, has the ability to supply +24 VDC and +5 VDC simultaneously, allowing users to simplify the power architecture design of their dialysis equipment. The compact power supply also features in a number of monitoring functions, such as 'power signal good' which allows for enhanced reliability.

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## MINI-ITX EMBEDDED MOTHERBOARDS

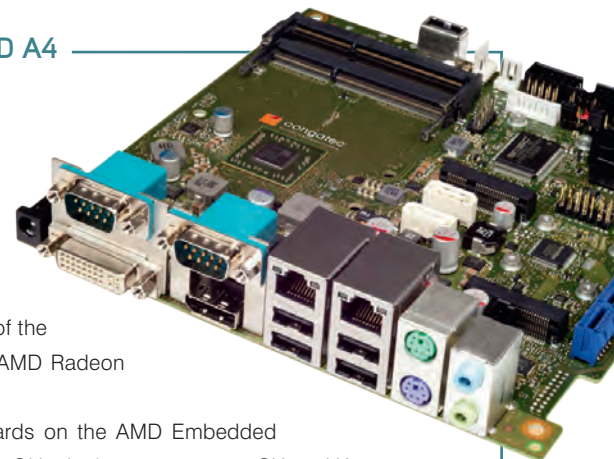
congatec has released its Mini-ITX embedded motherboard. The conga-IGX Mini-ITX board is based on AMD Embedded G-Series SOC technology and integrates the computing power of the Jaguar-based processor and high-performance AMD Radeon graphics cores in a compact package.

The company offers three Mini-ITX motherboards on the AMD Embedded G-Series SOC platform: a low-energy 9 W TDP 1.0 GHz dual-core processor GX-210HA SOC with integrated AMD Radeon HD 8210E graphics; a dual-core 18 W TDP GX-217GA SOC processor model with integrated AMD Radeon HD 8280E graphics; and a 2.0 GHz quad-core AMD Embedded GX-420CA SOC with integrated AMD Radeon HD 8400E graphics.

The boards support DirectX 11.1 and OpenGL 4.0 for fast 2D and 3D imaging and OpenCL 1.1. Interface options include single/dual-channel 18/24 bit LVDS, DisplayPort 1.2 and DVI/HDMI 1.4a, and enable the direct control of two independent displays. Users benefit from good multimedia performance, high performance per watt and flexible task allocation on the CPU and GPU. Due to these features, the board is suitable for visualisation and control applications.

Services provided by the company include 7+ years' availability, global technical support, extended manuals, specifications and customised design services.

**congatec Australia Pty Ltd**  
www.congatec.com



## RISC COMPUTERS

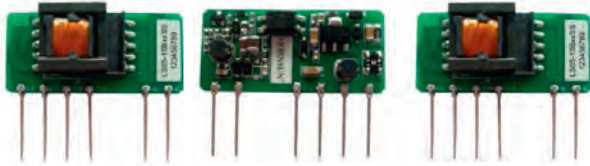
Moxa has released the small form-factor UC-8100 wireless Linux computer, designed for large-scale, big-data WAN computing solutions. The product is built around an ARMv7 Cortex-A8 processor and comes with up to two RS422/485 serial ports alongside dual 10/100 Mbps Ethernet LAN ports. The computers also feature a Mini PCIe socket that supports a cellular interface and other modules. The unit can be adapted to a wide variety of complex communication and processing solutions, useful both as a communications platform in large-scale distributed applications and as a secure gateway for data acquisition and in-the-field processing.

The computers combine high-performance RISC architectures with ample storage capacity, allowing users flexibility when developing new automation systems. Programmable LEDs allow integrators or end users to define unique event signalling, to aid when building troubleshooting tools into a system.

The computers also come with strong protection from network attacks, with the Trusted Platform Module featuring an integrated secure boot algorithm that delivers protection against kernel corruption of any sort. With the kernel protected, the computer will be able to work securely with the guarantee that any communications it makes via TPM will remain confidential and safe from the possibility of exposure via a rooted system.

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### 5 W AC/DC CONVERTER

The Mornsun LS05-15BXXSS series has a wide input voltage suitable for either AC or DC input (85-264 VAC/100-400 VDC), high efficiency, low loss, 3000 VAC safety isolation, green power modules with overcurrent and short-circuit protection.

The series is suitable for industrial control, electric power, instrumentation and smart home designs where less-demanding EMC applications are required. It comes in an ultraslim SIP package.

A recommended circuit is provided on the data sheet where a higher EMS requirement is needed. The product meets IEC60950, UL60950 and EN60950.

DLPC is the Master Distributor in ANZ for Mornsun Power Products, with official distributors in Victoria and South Australia (Fairmont Marketing) and in Auckland (Fero).

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www.dlpc.com.au

### PICK-AND-PLACE MACHINE

The Mechatronics P30 is a desktop automatic pick-and-place machine with dispensing head. Capable of placing up to 1200 CPH and dispensing rate of 1200 dots/h, the product can accommodate up to 40 automatic 8 mm feeders along with 40 manual 8 mm strips and two IC trays while maintaining an A4-size workable PCB area of 200 x 300 mm.

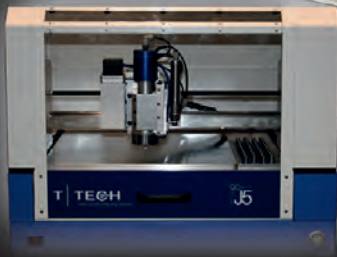
The machine has a placement accuracy of 30 µm and is qualified for placement of standard and fine pitch components including SOIC, PLCC, BGA, µBGA, CSP, QFN and LEDs, targeting the prototyping and low-volume production area. Additional features include a CAN bus smart feeder system; vision-assisted touchless component alignment; automatic fiducial recognition; six-tool automatic nozzle changer; vision inspection of placement and dispensing accuracy; and an internet remote service port.

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### ALL-IN-ONE INSTRUMENT

NI has announced VirtualBench, an all-in-one instrument that integrates a mixed-signal oscilloscope, function generator, digital multimeter, programmable DC power supply and digital I/O. Users interact with the product through software applications that run on PCs or iPads.

Because the instrument uses today's consumer computing platforms, engineers and scientists can take advantage of technologies like multitouch displays, multicore processors, wireless connectivity and intuitive interfaces. The simplification and increased capability through software leads to more efficient circuit debugging and validation.

The product takes up minimal space on a desktop or benchtop and simplifies instrument configuration through consistent, user-friendly interfaces. It offers a consolidated view of multiple instruments, visualisation on larger displays and quick functionality to save data and screenshots. It also integrates seamlessly with LabVIEW system design software.

**National Instruments Australia**  
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### RFID TRANSPONDERS

The HARTING Ha-VIS RFID VT 86 (HT) transponder was designed for the aviation industry, meaning it can be deployed worldwide. Product features include robustness, temperature resistance, high protection class and performance in difficult environments.

In other applications, eg, MRO scenarios (maintenance, repair, operations) in industrial environments, transponders are frequently used exclusively on site. The company offers this field of applications RFID transponders from its Ha-VIS RFID VT series, which are designed and optimised for the respective band in use. The result is an increase in read ranges with no impact on minimal design size.

Another market trend in the Industry 4.0 field is the demand for RFID transponders that are capable of recording and storing extra information. An example of this type of application is the documentation of the maintenance history of a safety-critical object. The company has a variant of the series that is characterised by high user memory of more than 3 Kb, all while continuing to withstand rugged everyday industrial der

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### LEAD-FREE SOLDER STATION

The Quick 202D lead-free soldering station features microcomputer digital PID temperature control, switching power supply for short-circuit protection, overheating or overpowering protection and fast heating and thermal recovery.

A temperature-locking function is available, as well as auto sleeping and auto shut-off function. The soldering stations are ESD safe by design and various types of tips are available.

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### IMMUNITY TESTER

Based on the user-friendly touch panel and colour graphics interface, IMU4000 builds on the success of the EMC Partner operating system.

The system introduces a graphical user interface that every mobile device user will recognise. An ethernet interface enables control, communication and report generation using the Tema 3000 software with custom report generator. The system provides easy navigation via a touch panel and rotary knob. Modular architecture enables on-site upgrades saving time and money.

Surge voltages up to 4 kV with EFT up to 5 kV make the tester a suitable choice for manufacturers and test labs wishing to cover all international standards. Other benefits include: one or many disturbance sources; fully modular design; grow the system as needs evolve; minimum learning time; easy-to-follow user interface; get test report information as HTML file; expandable to include many disturbance tests; covers all EMC testing needs; and service friendly.

**Test & Measurement Australia**  
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### WIRELESS MCU

The CC3200-LaunchXL is a wireless MCU that integrates a high-performance ARM Cortex-M4 MCU and peripherals, allowing users to develop an entire application with a single IC. The product includes an M4 core running at 80 MHz with flash memory options up to 1 MB and RAM options up to 256 kB.

Features include: an 802.11 b/g/n station with fully integrated auto-calibrated radio, baseband and MAC; a Wi-Fi connection manager with no host processor involvement; 2 x UART, 2 x SPI, camera, audio, I2C, 4-channel 12-bit ADC, four timers, 16-bit PWM, 27 GPIOs; a Wi-Fi network processor with on-chip WLAN and TCP/IP stacks; an embedded crypto engine with 256-bit encryption, secure boot, WPA personal and enterprise security; integrated DC-to-DC with a wide-range single supply.

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## INDUSTRIAL HMI PANEL COMPUTER

The Apex ARCHMI-712 is a rugged industrial all-in-one HMI computer housed in a fanless silver aluminium case that provides IP65 front panel protection.

The product is supplied with an internal 12.1" SVGA 800 x 600 resolution LCD with either a resistive or projected capacitive touch screen, making it suitable for operator panel and HMI control applications.

The unit features a built-in, energy-efficient Intel dual core Atom N2600 1.6 GHz processor with 2 GB of DDR3 memory. An internal 2.5" hard drive bay and an internal SD slot are provided for system and data storage.

Rear I/O connections include two COM ports, two USB 2.0 ports and two Gigabit Ethernet ports. An internal Mini-PCIe slot allows half-size Mini-PCIe cards to be installed. The APC-3565 requires a 9-36 VDC power source and can operate in temperatures ranging from 0 to 50°C.

The product can be panel or VESA 75 x 75 mounted for operator convenience. It is compatible with Windows XP and Windows 7 operating systems, allowing it to support a wide range of off-the-shelf and custom-developed industrial applications.

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The moulding machine has been designed specifically for the encapsulation of sensitive electronics, cable harnesses and plugs, as well as the emerging area of LED lighting.

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# SHAPE-SHIFTING ROBOTS

A new phase-changing material built from wax and foam could allow robots to switch between hard and soft states.

Working with robotics company Boston Dynamics, based in Waltham, Massachusetts, MIT researchers began developing the material as part of the Chemical Robots program of the Defense Advanced Research Projects Agency (DARPA). The agency was interested in 'squishy' robots capable of squeezing through tight spaces and then expanding again to move around a given area, says Anette Hosoi, a professor of mechanical engineering and applied mathematics at MIT. Hosoi worked on the project with former graduate student Nadia Cheng and researchers at the Max Planck Institute for Dynamics and Self-Organization and Stony Brook University.

The material could be used to build deformable surgical robots. The robots could move through the body to reach a particular point without damaging any of the organs or vessels along the way. They could also be used in search-and-rescue operations to squeeze through rubble looking for survivors, Hosoi says.

Controlling a very soft structure is extremely difficult: it is much harder to predict how the material will move, and what shapes it will form, than it is with a rigid robot. So the researchers decided that the only way to build a deformable robot would be to develop a material that can switch between a soft and hard state, Hosoi says. To build a material capable of shifting between squishy and rigid states, the researchers coated a foam structure in wax. They chose foam because it can be squeezed into a small

fraction of its normal size, but once released will bounce back to its original shape.

The wax coating, meanwhile, can change from a hard outer shell to a soft, pliable surface with moderate heating. This could be done by running a wire along each of the coated foam struts and then applying a current to heat up and melt the surrounding wax. Turning off the current again would allow the material to cool down and return to its rigid state.

In addition to switching the material to its soft state, heating the wax in this way would also repair any damage sustained, Hosoi says. "This material is self-healing," she says. "So if you push it too far and fracture the coating, you can heat it and then cool it, and the structure returns to its original configuration."

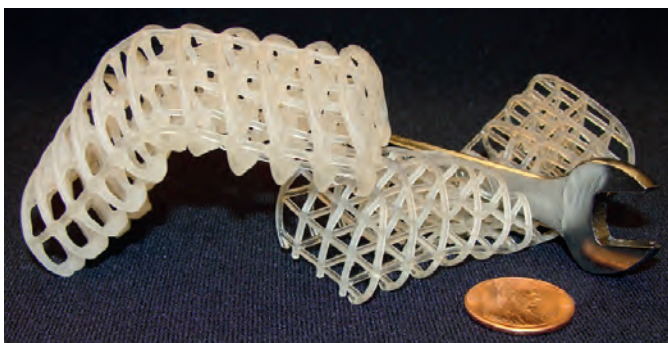
To build the material, the researchers simply placed the polyurethane foam in a bath of melted wax. They then squeezed the foam to encourage it to soak up the wax, Cheng says. "A lot of materials innovation can be very expensive, but in this case you could just buy really low-cost polyurethane foam and some wax from a craft store," she says.

In order to study the properties of the material in more detail, they then used a 3D printer to build a second version of the foam lattice structure, to allow them to carefully control the position of each of the struts and pores.

When they tested the two materials, they found that the printed lattice was more amenable to analysis than the polyurethane foam, although the latter would still be fine for low-cost applications, Hosoi says.

The wax coating could also be replaced by a stronger material, such as solder, she adds. Hosoi is now investigating the use of other unconventional materials for robotics, such as magnetorheological and electrorheological fluids. These materials consist of a liquid with particles suspended inside, and can be made to switch from a soft to a rigid state with the application of a magnetic or electric field.

When it comes to artificial muscles for soft and biologically inspired robots, we tend to think of controlling shape through bending or contraction, says Carmel Majidi, an assistant professor of mechanical engineering in the Robotics Institute at Carnegie Mellon University, who was not involved in the research. "But for a lot of robotics tasks, reversibly tuning the mechanical rigidity of a joint can be just as important," he says.



Two 3D-printed soft, flexible scaffolds: the one on the left is maintained in a rigid, bent position via a cooled, rigid wax coating, while the one on the right is uncoated and remains compliant (here, it collapses under a wrench). Image courtesy of the researchers.





### MIXED SIGNAL OSCILLOSCOPES

Rigol Technologies has launched the MSO1000Z series mixed signal oscilloscopes. The series offers four channels, the choice of 70 and 100 MHz bandwidth and 16 digital channels.

The sampling rate is 1 GS/s and units come with 12 Mpts memory with an optional 24 Mpts. The series provide a fast 30,000 wfms/s waveform capture rate and an optional 60,000 frames real-time waveform record and play-back, as well as the UltraVision technology that provides multilevel intensity grading display.

The scopes also offer a variety of trigger and serial bus decoding functions (RS232, I<sup>2</sup>C and SPI), a wide vertical range (1 mV/div-10 V/div) and a low noise floor. It is suitable for small signal capturing and has an optional in-built 25 MHz dual-channel function/arbitrary waveform generator.

All units offer a wide range of interfaces - such as USB Host, USB Device, LAN (LXI) and AUX - and include a 7" TFT(800 x 480) WVGA with multi-intensity waveform display.

**Emona Instruments Pty Ltd**  
[www.emona.com.au](http://www.emona.com.au)

### MINI-ITX MOTHERBOARD

iBase's Mini-ITX motherboard, the MI805, features the Intel Celeron J1900 quad-core processor with a clock speed of 2.0 GHz. The versatile and low-power consumption motherboard is designed to accept a wide range of DC power input from 12 to 24 V.

With an Intel Gen7 graphics engine, the product delivers smooth video performance with dual independent display functionality from onboard interfaces including CRT, DVI-D and 24-bit dual channel LVDS. Meeting EuP/ErP compliance, the device features iSMART software that allows power-failure detection, auto scheduling, low-temperature monitoring and intelligent firmware update in the BIOS to improve the overall environmental performance.



The board has two memory sockets to support DDR3L SO-DIMM modules with a total capacity of up to 8 GB. It also provides a DC jack, two serial ports, CRT and DVI-D, two RJ45, three USB 2.0, one USB 3.0 and audio connectors in the rear. The board carries a total of six serial ports, seven USB 2.0 ports and two SATA II connectors. Expansion comes in the form of one Mini PCIe and a PCIe(x1) slot.

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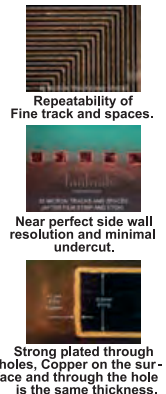


Incorporated in 1986, Lintek is a quality Australian manufacturer of Microwave printed circuit boards. Lintek's patented High Vacuum Deposition process enables the production of extremely accurate microwave circuit features on a wide variety of conventional and exotic substrates including precision milled metal backed carriers. High bond strength to PTFE and minimal side wall undercut are two key features synonymous to Lintek's process. This innovative process allows Lintek to provide PCB's for the latest high frequency commercial or military designs as well as the standard FR4 Single sided, DSPTH and Multilayer circuit boards.



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## DIGITAL OSCILLOSCOPE

The R&S HMO1002 digital oscilloscope from the Rohde & Schwarz Value Instruments product range offers high sensitivity and multifunctionality. From embedded developers to service technicians and educators, the product addresses a broad group of users. Powerful technology in a fanless design meets users' high requirements, including a wide range of upgrade options.

The digital oscilloscope features a high waveform update rate and high vertical sensitivity, and is available with bandwidths of 50, 70 and 100 MHz. The instrument offers a sampling rate of 1 GS/s and a memory depth of 1 MS. The product includes a mixed signal function and a separately available R&S HO3508 logic probe can be used with all R&S HMO oscilloscopes.

For communications between embedded systems and the environment, the device includes hardware-based signal triggering and decoding for all common protocols (I<sup>2</sup>C, SPI, UART, CAN and LIN). This option can be activated with an upgrade voucher at any time. The unit offers time domain, logic, protocol and frequency analysis in a single instrument.

**Rohde & Schwarz (Australia) Pty Ltd**

[www.rohde-schwarz.com](http://www.rohde-schwarz.com)



## RF SP4T SWITCH

Peregrine Semiconductor has released an RF single-pole four-throw (SP4T) switch. The broadband PE42441 operates from 10 MHz to 8 GHz and features four symmetric RF ports, low insertion loss (0.8 dB at 3 GHz), good isolation (45 dB), high power handling (+31 dBm P0.1dB) and +58 dBm IIP3 at 8 GHz.

An on-chip CMOS decode logic facilitates a 2-pin voltage CMOS control interface. In addition, no external blocking capacitors are required if 0 VDC is present on RF ports.

The device is manufactured on Peregrine's UltraCMOS process, a variation of silicon-on-insulator (SOI) technology on a sapphire substrate, offering the performance of GaAs with the economy and integration of conventional CMOS.

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## FIELDBUS PRODUCT RANGE

ICP Electronics Australia has released a range of fieldbus products based on different protocols. In addition to Modbus TCP, Modbus RTU and Modbus ASCII, the products cover industrial communications protocols such as CANbus, CANopen, DeviceNet, J1939, Profibus, Profinet, Hart, EtherCat, Ethernet/IP and BACnet/IP. The range includes a selection of gateways, converters and remote I/O solutions.

For Profibus, ICP offers isolated repeaters, Profibus to fibre converters, Profibus to serial converters and Profibus to Ethernet converters. In the Gateway range there are Profibus Gateways to Modbus RTU/TCP/ASCII and Profibus to Hart. For multiple I/O applications there are remote I/O units in 1-, 2-, 4- and 8-slot that support various

I/O functions. In discrete I/O modules there is a selection of DIN rail-mount digital and analog I/O modules.

User-friendly and convenient libraries and development tools based on VB, VC, BCB, Delphi, VB.Net and C#.Net are available. For SCADA applications, InduSoft, LabVIEW and DASyLab drivers are provided. In order to protect against harsh environments, protection mechanisms are built into the hardware, such as galvanic isolation, photocoupler isolation, reverse polarity protection, overvoltage, EMI, ESD, EFT and surge protection.

All Fieldbus Solutions products feature an operating temperature of -25 to +75°C and wide-range DC power support (unregulated +10 to +30/40 VDC).

**ICP Electronics Australia Pty Ltd**

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STAND A21

### TWEezer KIT

Soldering equipment manufacturer Thermaltronics has released a tweezer kit as an add-on accessory to its Flagship soldering station TMT-9000S-2. The TZ-KIT-1 encompasses an ergonomically designed tweezer handpiece that is suitable for reworking even the smallest components, making repairs and assembly rework a simpler task.

The handpiece features dual lockable arms and adjustable alignment of tips in both X and Y directions. The kit also comes with a work stand for easy storage of the tweezer handpiece. It uses the MTZ series of tweezer tips and the handpiece is also compatible with Metcal MX500 and MX5000 stations.

**RMS Parts Pty Ltd**  
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## SIGNAL CONVERTER FOR LED LIGHTING

The easy installation and programming of the individual components makes the DALI lighting network suitable for a system in single rooms. RECOM Lighting's signal converter RELI-DA01/R is a link between dimmable LED drivers and DALI components from other manufacturers' devices such as switches, dimmers and sensors.

The converter communicates with the controller and receives commands which it converts into PWM, 0-10 V or 1-10 V signals. Up to six LED drivers can be connected to the control output.

A built-in relay can be used to switch off the LED drivers under software control to give zero no-load consumption.

Due to a wide input voltage ranging from 90 to 264 VAC,

the product can be used worldwide without further modifications. Measuring 150 x 40 x 30 mm, it is very compact and weighs only 100 g. It is compliant with the DALI IEC62386 standard.



**RECOM Asia Pte Ltd**

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## PCB DESIGN SERVICE


Lintek has enhanced its printed circuit manufacturing capabilities by developing Via in Pad technology around vacuum metallisation.

This will enable the formation of copper-filled microvias laser drilled down to copper capture pads on multilayer PCB stacks. The copper-filled vias will simplify the assembly of BGA devices down to 0.4 mm pitch and this capability will be a first for Australia. Another capability the company is developing is improving the aspect ratio of its vacuum metallisation process. Lintek currently offers an aspect ratio of 4.5:1 (substrate thickness: hole diameter) and hopes to soon commercialise 5:1.


The company received grant funding for this project through DMO under the PICIP (Priority Industry Capability Innovation Program). Lintek is also working with the team from 'Enterprise Connect' at DIIC (Defence Industry Innovation Centre) to take its business to the next level.


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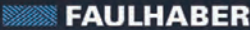
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## ETHERNET MODULES

Acromag's BusWorks XT series of ethernet I/O modules now includes the XT1210 and XT1220 models, providing an 8-channel interface for analog voltage or current input signals and EtherNet/IP, Modbus/TCP, Profinet or peer-to-peer communication.



Differential inputs have good noise rejection for reliable measurements when radio-frequency or electromagnetic interference is present. Internal software helps eliminate the effects of network traffic loads for more reliable messaging.

The design features dual ethernet ports, removable front-facing terminal blocks and DIN rail power bus support. Its USB-to-PC connection makes configuration fast and simple with Windows software. Suitable for use in harsh environments, all modules operate from -40 to 70°C with high voltage isolation, surge protection and CE approval.

The units employ Innovasic PriorityChannel technology, which makes certain that critical data is received on time regardless of traffic on the network. PriorityChannel provides determinism at the device for consistent transmission of time-sensitive data with any of the ethernet protocols.

The XT1210 model accepts current inputs of 0-20 mA, 4-20 mA,  $\pm 20$  mA DC, or 0-20 A AC with an optional toroid sensor. The XT1220 accommodates  $\pm 5$  V,  $\pm 10$  V, 0-5 V or 0-10 V DC input ranges. All units run off a 12- 32 V DC power source (2.8 W) at the terminals or through an integrated power connector bussed along the DIN rail that can provide primary or redundant power.

Dual 10/100 ethernet ports allow daisy-chaining units together to simplify cabling and minimise the network switches required.

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The company has expertise in the introduction, manufacture and support of complex mid-to-high volume and high-mix products. Its capabilities include supply chain management, product development, project management, SMT assembly, box build, full turnkey assembly, customisation, test, materials procurement and logistics.

**GPC Electronics Pty Limited**

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### HANDHELD THERMAL IMAGER

The U5855A TrueIR thermal imager allows engineers to safely and efficiently identify potential faults without shutting down the systems or disrupting the productivity of an industrial plant.

The product comes with fine resolution capability, which en-

hances the quality of thermal images by reconstructing the image based on multiple continuously captured infrared frames. This allows the device to achieve an effective image resolution of 320 x 240 pixels from a 160 x 120 pixel detector.

The product is said to provide four times more resolution than typical 160 x 120 thermal imagers. Together with a 4x digital zoom, the device reveals fine details, especially when inspecting small cracks on industrial pipelines even from a distance.

The unit's light and ergonomic design allows engineers to comfortably use the thermal imager for longer periods of time and operate it single-handedly in tight locations. Users can also easily change settings or access frequently used functions such as torch light and laser pointer, auto scaling or trigger with quick access buttons.

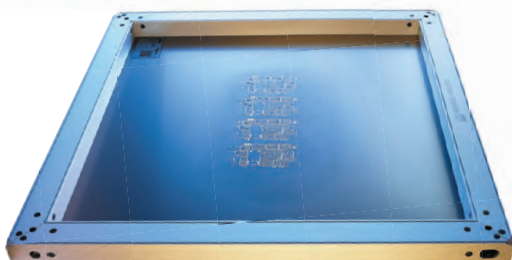
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### 60 V MOSFETS

International Rectifier has announced the expansion of its StrongIRFET MOSFET portfolio to include 60 V devices for a wide variety of industrial applications including power tools, light electric vehicle (LEV) inverters, DC motor drives, Li-ion battery pack protection and switched mode power supply (SMPS) secondary-side synchronous rectification.

The 60 V StrongIRFET power MOSFETs feature ultralow on-state resistance for improved performance in low-frequency applications, high-current carrying capability, soft body diode and 3 V typical threshold voltage to improve noise immunity. Each device is 100% avalanche tested at industry-highest avalanche current levels to ensure a robust solution for demanding industrial applications. The devices are available in through-hole and surface-mount D2-PAK packages.

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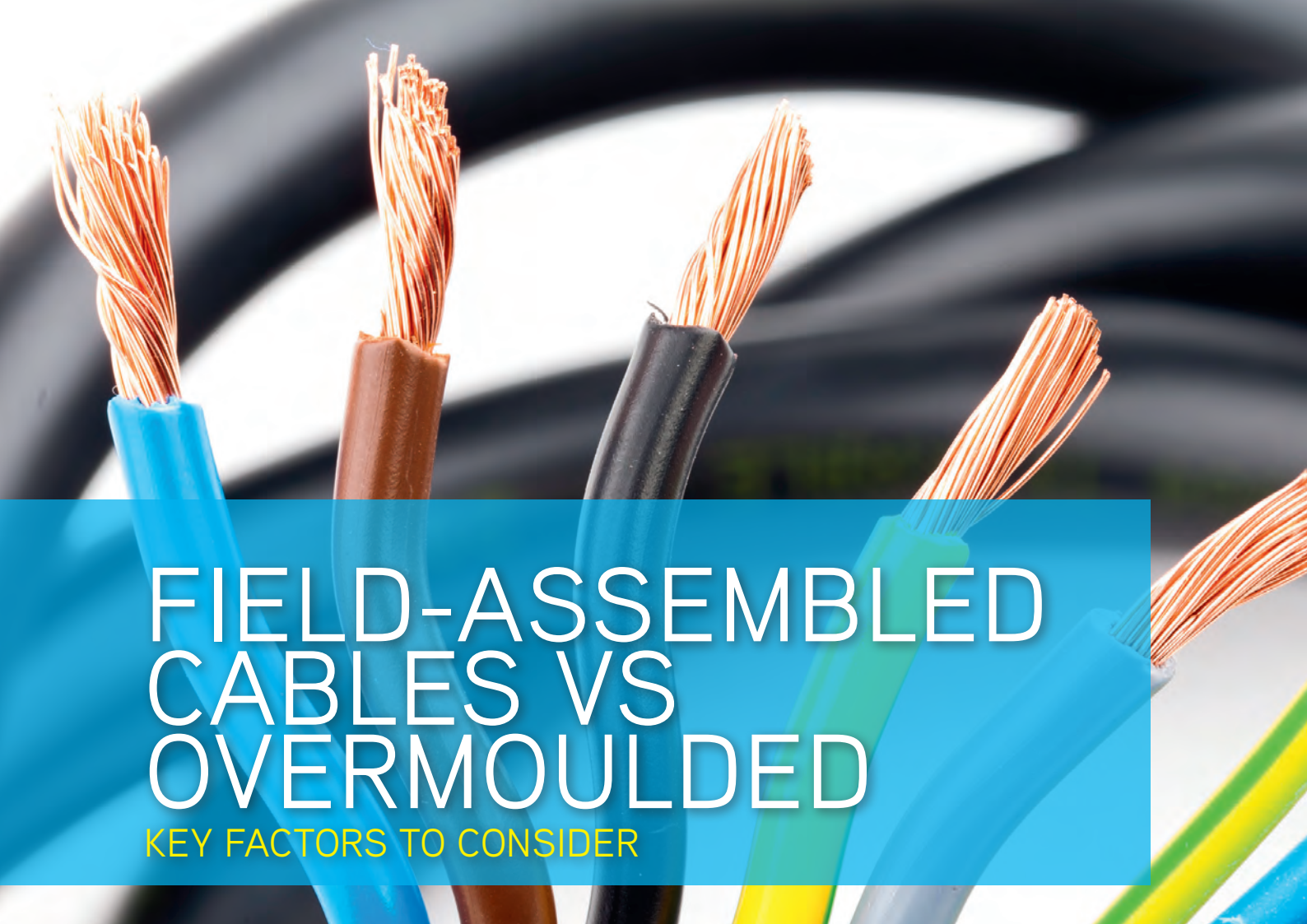
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# FIELD-ASSEMBLED CABLES VS OVERMOULDED

## KEY FACTORS TO CONSIDER

Cable assemblies are the core components for the most critical connections. In many instances, there is an option of choosing between field-assembled cables or overmoulded cables. For some designs, the choice is clear cut, for others not so much. This article explores the design differences between moulded cable assemblies and field-terminated cables.

**W**ith field-assembled cables, the connectors are manually assembled to the cables. For many designs field-assembled cables will work just fine, and in certain instances they will be your only option.

For example:

- For specific or custom installations that require a specific length or varied lengths of cable, depending on the install.
- You have to route a cable through a channel or piece of conduit and the design dictates a connector size. We see this, for example, in some vehicle-related installations.
- Your cable will be in a protected environment and once connected it will seldom be disconnected and reattached, ie, no repetitive use.
- For prototype installations where the quantity required is small.

A number of factors such as cost, quality, market, product/application and end-user requirements also need to be considered when deciding between field-assembled cables and overmoulded cables. How qualified, how experienced, how good is the personnel assembling your cables? We're taking it on faith that your cable and connector suppliers are providing you with top-quality, highly functioning components. The field-assembled cable connections are only as good as the people in the field doing the assembling. So, if you're highly confident about the experience and skills of your employees - or those of your contract manufacturer - and this confidence is borne out by product performance, then overmoulded cables would not seem necessary.

But assembly personnel - in-house and outsourced - can and do make mistakes. For example, we once worked with a manufacturer that had a problem with its contacts opening up. When we researched the problem we determined that during the cable assembly process the contractor overheated the contacts when applying solder. And that resulted in melted plastic and open contacts. The customer switched to overmoulded cable assemblies and the problem was resolved. In another instance, the contract manufacturer used a sealed IP-rated connector in a cable assembly for a refrigerator ice maker - but left out the O ring. This mistake rendered the connector's IP rating meaningless and severely degraded the performance of the connector and the ice maker.

By no means is the above information intended to be an across-the-board slam against contractors. There are many outstanding contract manufacturers and we're familiar with most of them. Here's a bit of common-sense advice: before you commit to using the services of a contract manufacturer, make sure you ask how they will - and how often they will - test your cable assemblies. And be sure you're comfortable with and confident in the answers you get. This is especially important if your cable assemblies are being used in critical-functioning applications such as bomb suits, commercial pilot headsets or mission-critical industrial applications.

Comparing the cost of field-assembled cables to overmoulded cables is, for the most part, like comparing apples with oranges. The product costs for field-installable cable assemblies are obviously less expensive. But add in the cost of labour and the costs



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associated with higher error rates for field-installable cables and you may well come to the conclusion that overmoulded cables offer you a lower total cost of ownership.

An overmoulded cable seamlessly combines the cable and connector into a single part. In overmoulding, molten material is injected into a mould cavity and the cooled material conforms to the shape of the mould.

The resulting mould cavity can be plain and simple or quite elaborate, replete with your company name, logo, flanges, an extended strain relief area and more. Overmoulded cable assemblies give you ease of installation and a commonality among installs that you won't get with field installs.

There are many applications and products for which an overmoulded cable assembly is your only choice or clearly your preferred choice. Key factors that commonly drive the specification of overmoulded cable assemblies are:

**Environmental concerns:** Unlike with a field-installable cable that's subject to human error, there's little or no chance that the sealing on the overmoulded cable assembly will be compromised. The rear of the connector area is sealed and, barring extraordinary circumstances, will forever remain sealed. Additionally, you can be confident that the connector part of the overmoulded cable will perform as rated in harsh weather. This is particularly important for equipment that is continually exposed to moisture or machinery and devices that get regular high-pressure washdowns - such as those used in food preparation and health care. For solar applications, you most likely want a harsh environment seal and some UV protection. You can get that with overmoulded cable assemblies.

**Strength and security of connection:** Overmoulded cable assemblies have integrated strain relief, giving them the ability to absorb up to 32 kg of pull-out force. Getting this strength of connection in a field-installable cable is typically more difficult.

**Aesthetics:** If you want to enhance the aesthetic appeal of your medical equipment; high-end, high-tech hardware; any expensive, sleek, high-performance machinery or equipment - overmoulded assemblies are your preferred choice.

For example, a customer and manufacturer of an expensive communications device we work with had been using field-installable cables and electrical tape to form a Y junction on its cables. As you can imagine, the look didn't exactly scream quality and prestige. We suggested an overmoulded Y junction cable assembly; the customer implemented our suggestion and loved the new, more professional look.

**Flex relief:** Overmoulded cable assemblies offer the option of a secure flex relief, which will help limit the cable bend radius at the exit of the connector - you'll always get consistent flex relief and higher, longer fatigue. That's not often the case with a field-installable cable.

In addition, overmoulded cable assemblies can be used for EMI shielding applications and can be custom designed for right-angle exits or any exit configuration you might require. Plus, overmoulded cable assemblies can be colour coded to foolproof equipment installation or usage.

Example: A manufacturer of auto-diagnostic equipment we work with colour codes its cables and receptacles. This way when the shop guys hook things up it's always quick, easy and, most importantly, accurate.

### Summary

To succinctly sum up the gist of this article: in a controlled environment, for volume installations of equipment and for devices with a limited number of mating cycles and with competent field-assembly personnel, field-assembled cables will usually serve your purposes just fine. In all other instances, give strong consideration to using an overmoulded cable assembly.

Three points should be considered when choosing overmoulded cable assembly manufacturers.

- Is the manufacturer overmoulding its own product or somebody else's? The supplier that manufactures and overmoulds its own connectors controls every aspect of its production. It stands to reason then that the manufacturing and overmoulding process will involve a higher degree of precision and uniformity and result in a higher quality component. In addition, by utilising the connector supplier manufacturer to mould your cable assembly, you are ensured that the connector interface you specified is utilised in the assembly. Not some cheap knock-off sometimes supplied by contract manufacturers to increase their profits and typically not found out about until it's too late, after the product has failed.
- Is the manufacturer local to your continent? Simply put, shipping cable is expensive. So whether your operations are in the US, Europe or Asia, you're almost always better off sourcing local product.
- Does the overmoulding supplier have its own equipment and is the overmoulding done in-house? As with number one, this question speaks to precision, uniformity, quality - and quality control. It's highly unlikely that you'll get the same level of attention to detail and quality control if the entity you're dealing with is farming out your product. From design and production of your connector and overmould to precision-assembly of the finished unit - there are stringent quality control checks every step of the way.





**DIGITAL MIXED  
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The Axioline F I/O system from Phoenix Contact is now extended with a digital mixed module that is especially appropriate for signal acquisition in the control cabinet.

The F DI8/1 DO8/1 1H I/O module is intended for use within an Axioline F station. It is used

to acquire and output digital signals. The filter times of the inputs can be adjusted to achieve high noise immunity. Filter times of 100  $\mu$ s enable the user to implement a counting function with a maximum input frequency of 5 kHz in the application. The outputs are protected against short circuit and overload.

The 35 mm wide I/O module offers eight digital inputs and outputs, each with one-wire technology, in one module. This allows compact I/O stations to be set up within a control cabinet. The digital mixed module can be operated as a local bus module of the Axioline F I/O system on all Axioline F bus couplers.

**Phoenix Contact Pty Ltd**  
[www.phoenixcontact.com.au](http://www.phoenixcontact.com.au)

**STEP-DOWN SWITCH-MODE  
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The MPM3805 and MPM3810 are monolithic step-down switch-mode converter modules with built-in internal power MOSFETs and inductors. The DC/DC modules have a small surface mount and are available in a 2.5 x 3 x 0.9 mm QFN package.

The MPM3805 and MPM3810 achieve 0.5 and 1.2 A continuous output current from a 2.5 to 6 V input voltage and good load and line regulation. Their output voltage can be regulated as low as 0.6 V. Only input, output capacitors and FB resistors are needed to complete the design.

The constant on-time (COT) control scheme provides fast transient response and eases loop stabilisation. Fault-condition protection includes cycle-by-cycle current limiting and thermal shutdown.

Other features include: ultralow IQ of 17  $\mu$ A; default 3.5 MHz switching frequency; EN and power good for power sequencing; short-circuit protect with hiccup mode.

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## SOLDERING SYSTEM



The FX100 soldering system brings induction heat soldering technology to a high performance level. A small, compact station includes microprocessor control that boosts the recovery performance of the soldering iron tip.

The user-selectable power activity display provides constant dynamic feedback to the operator about the thermal load on the soldering iron tip. T31 Series tip cartridges provide high tip life with greater power at each of the two temperature selections, and the tip sleep function reduces tip temperature to preserve tip life and reduce oxidation when the iron is not in use.

The large backlit display provides a clear and simple interface with the operator. An activity monitor provides cumulative data on tip heater loads and tip running time to aid in process control and managing operating costs. An auto-power-off safety feature is also included.

**HK Wentworth Limited**  
[www.hkwentworth.com.au](http://www.hkwentworth.com.au)

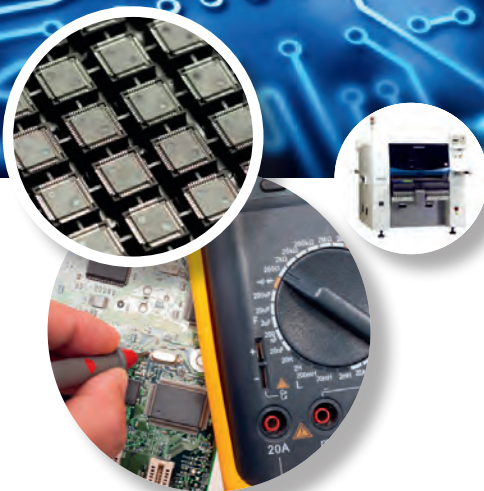
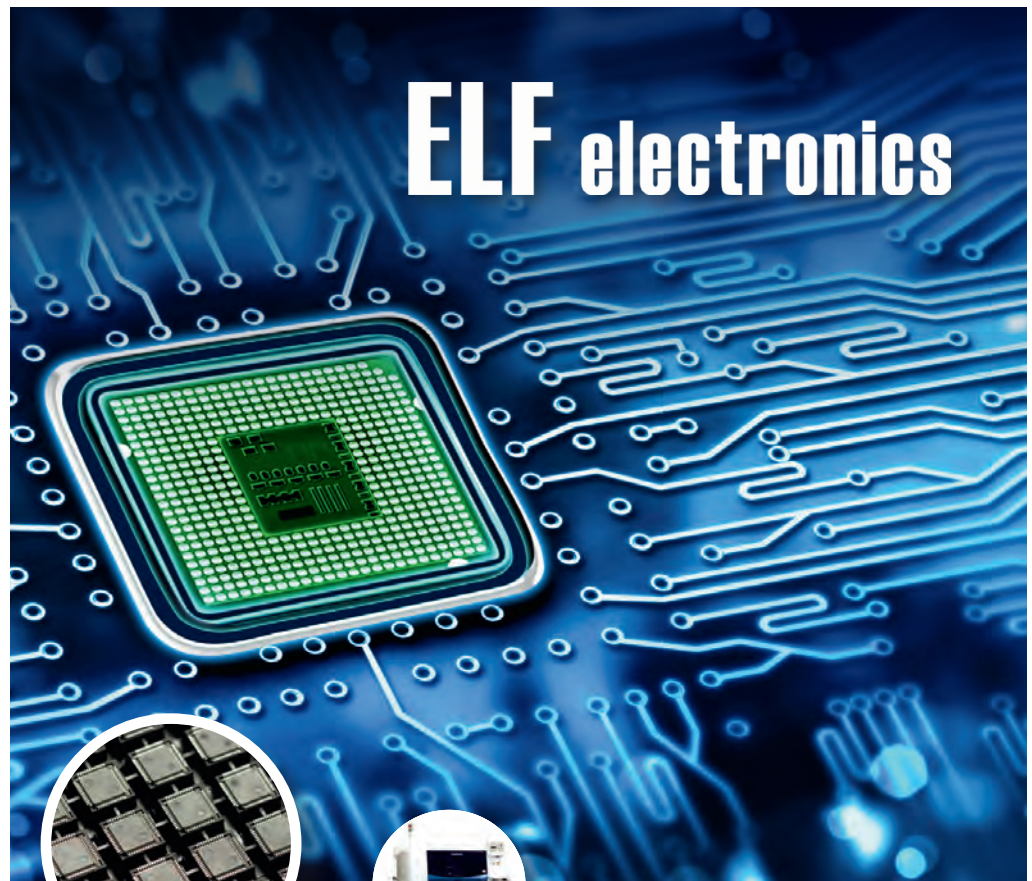
## LOCKING SYSTEM

Harting is expanding the Han B product portfolio with the addition of a locking system. The system is made entirely of a resistant elastomer, providing optimum protection against external mechanical forces as well as good resistance to oils and gases.

A special contour and internal seal enable the connection of two standard Harting 16B hoods while simultaneously achieving an IP65 degree of protection. The product locks and seals in a single system, while housings can be quickly assembled and disassembled with minimal effort and without tools. A further variant permits housings to be locked together with both bulkhead- and surface-mounted housings.

A simple and robust locking element is advantageous in stage technology, due to the risk of connectors falling from heights and the associated damage to the locking device upon impact. This impact can be prevented by the elasticity of the product, which enables mechanical forces to be absorbed from the outside. Furthermore, extending cables in machinery can be performed quickly and conveniently.

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## EMBEDDED COMPUTERS

MPL's ultracompact fanless computer product line, the CEC Series, is based on Intel Atom processors. Measuring 62 x 162 x 120 mm, the range has been designed for use in industry, maritime, railway and automation applications.

To ensure long-term availability and seamless operation in extended temperature environments and to minimise power consumption, onboard soldered industrial-grade Intel Atom processors are used in combination with the Poulsbo US15WPT chipset. This allows the series to run at full load in an operating temperature range from -40 up to +85°C.

Several Gigabit Ethernets, USB 2.0, serial ports (RS232 or RS422/485), PS/2 and DVI-D are available. The industrial PC can be expanded via the onboard Mini PCI-Express interface to provide functionality such as WLAN, Bluetooth or UMTS.

All connectors are soldered onboard; therefore, no internal wiring is required and the system has a high level of operating safety and reliability. The interfaces are available on the bottom and top of the robust housing. The wide input voltage range is specified for 8 to 36 VDC and is polarity- and load dump-protected.

Up to 2 GB DDR2 SO-DIMM memory modules can be used. To guarantee the long-term availability of storage media, two onboard SATA

interfaces are provided. This allows an integrated SATA Disk-On-Module (DOM) and or 2.5" SATA hard drive to be installed. For easy mounting, the device has a DIN rail holder on the back as well as an optional wall-mount kit.

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STAND C2

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## HIGH-DEFINITION OPTICAL INSPECTION SYSTEM

The Optilia is a professional, high-definition inspection camera microscope with optical zoom and autofocus. Together with any of the company's articulated boom or XY-stands, the system offers full control over a large work area for ergonomic and fast visual inspection work.

Image attributes, such as brightness, contrast, focus, iris, image sharpness, colour and other parameters, are automatically set but can be controlled manually by the user through the software or from the joystick-based multifunction control unit, without the need for a PC.

The system offers flexibility to users with different inspection and monitoring needs. Apart from transferring details from the object to the high-definition monitor, it grants ease of use and minimal interaction with controls and settings.

By deploying quick auto focus together with the company's optics, the time spent on inspecting objects is said to be reduced compared to other video systems. The integrated laser pointer is a good guide to locating the areas of interest on the object.

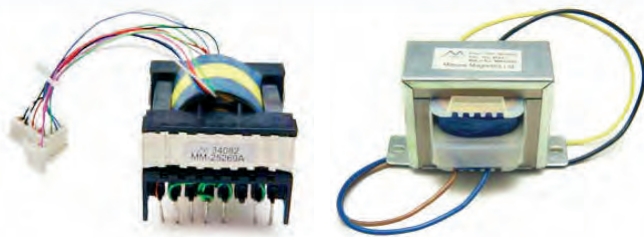
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### MOBILE ENCLOSURES

The Datec-Compact range of mobile enclosures from OKW has been given a robust design and an ergonomic shape to give the user a secure hold of the enclosure. This allows fatigue-free operation in a variety of situations.

Through the use of a UV-resistant, flame-resistant material, a foamed-in seal and the resulting protection class IP65, the product is suitable for indoor and outdoor applications. The enclosures consist of a top part and a bottom part which offers a steady grip due to the finger recess at the rear. The individual components are connected with 4 x T10 corrosion-resistant stainless steel Torx screws. Bottom parts are available with and without battery compartments for 3 x AAA batteries (S version)/3 x AA batteries (M/L versions); the batteries are kept safely in a sealed compartment.

The version with battery compartment offers space for SD cards and/or USB connectors. There are also versions available from stock with two gold-plated contact pins for data transmission and charging purposes. Accessories such as a specially shaped wall suspension element which is open at the bottom for possible contacts or cable connections, or a desk station including bottom panel, allow many different application options.

The range is available in off-white and lava-grey colours. Three sizes are available with the dimensions 136 x 74 x 32 mm, 172 x 92 x 39 mm and 206 x 110 x 47 mm. Applications include measurement and control technology, mobile data recording, medical, laboratory and environmental technology, numerous outdoor applications and more.

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# PAVING THE WAY

## FOR THE INTERNET OF THINGS

Carl Fenger

It's set to be the perfect combination: the rapid growth of high-speed cellular networks and the introduction of IP version 6, which has enough IP addresses for every grain of sand on Earth. Add to this mix the proliferation of the ARM-embedded computing architecture, now the de facto global standard for low-power, high-performance mobile computing thanks to its successful integration into virtually all mobile phones on the market.

**T**he result is a perfect ecosystem for the rise of the Internet of Things (IoT): a world where every car, phone, sensor, meter, machine, sales terminal, sign, toy, camera and healthcare device is wirelessly connected to the internet via high-speed connection. Add a GPS/GNSS positioning receiver and you have a compact, always-connected, location-aware internet 'thing' that possesses the computing power of an ARM processor with complete freedom of mobility.

The potential for new attractive applications is huge. Here are just four examples:

### Remote metering and security

The IoT will enable cost-effective and covert installation of web-connected devices that will wirelessly transmit utilities' usage data, report the location of pets and people, and provide 24/7 monitoring of vehicles, storage facilities, shops and public facilities. Ubiquitous surveillance of schools, airports, shopping malls, office buildings and healthcare facilities will become common. Monitoring services can even be outsourced to security or healthcare firms located thousands of kilometres away, similar to the way low-cost telephony enabled the outsourcing of call centres.

### Vending machines

Vending machines are expected to generate over \$190 billion in revenue by 2015, according to industry analysts. The machines are already connected via wireless networks to report tampering or when a refill is necessary, or simply to report where the machine is located (in case a vending machine's location is often forgotten). Cellular connectivity will bring multimedia advertisement and social media possibilities to vending machine displays. Coca-Cola experimented with this concept in 2011 by installing networked vending machines around the world allowing customers in differ-

ent countries to interact with each other, and even 'buy a Coke' for a new friend thousands of kilometres away.

### Tele-health terminals

As healthcare costs soar and the doctor-to-patient ratio increases, wireless networks will lower healthcare costs by enabling remote care via a high-quality video link. Instead of sick, elderly or far-away patients having to travel to the doctor's office, a mobile, location-aware tele-health terminal at home will provide instant access to a healthcare professional giving people freedom of movement and choice of where and how to live, significantly improving quality of life.

### Car infotainment systems

Vehicle-mounted LTE routers will enable high-speed downlink of up to 100 Mbps (LTE category 3) to the car. This is enough to support five parallel high-definition TV channels and more than enough to support the more typical mix of video, voice, internet access and social media applications used by passengers. Location-awareness facilitates delivery of position-relevant information such as multimedia-enhanced navigation or video-rich electronic 'tour-guide' services.

To help engineers jumpstart their design IoT applications, u-blox and ARM have developed the C027 ARM mbed-enabled IoT starter kit providing out-of-the-box wireless internet connectivity based on a compact u-blox 2G, 3G or CDMA cellular modem plus global positioning module. The kit is powered by an ARM Cortex-M3 32-bit processor with cost-free access to the resources of the ARM mbed development platform.

*u-blox Singapore Pte Ltd  
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KaRaTec Power Supplies offer a comprehensive range of standard and custom DC/DC railway converters for onboard train applications. The compact, low-profile converters range from 60 to 300 W.

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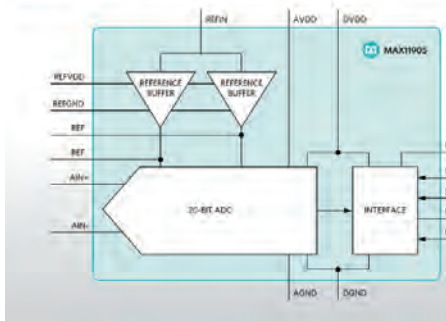
Engineers can achieve high resolution and a fast sampling rate with the MAX11905, a successive approximation register (SAR) analog-to-digital converter (ADC).

The converter achieves a 98.3 dB signal-to-noise ratio (SNR) and -123 dB THD; improves static and dynamic performance; guarantees monotonic function; and provides good power consumption. It delivers 20-bit resolution, with no missing codes, at 1.6 MS/s of speed and 9 mW of power.

The product is available in a 20-pin, 4 x 4 mm TQFN package. It integrates internal reference buffers and has an operating temperature of -40 to +85°C. It is suitable for a wide range of applications, including process control, automatic test equipment, medical instrumentation and battery-powered devices.

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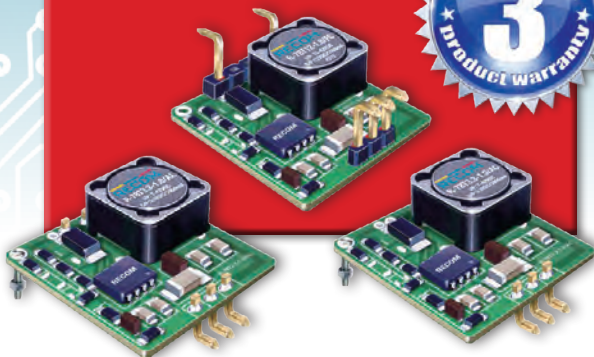




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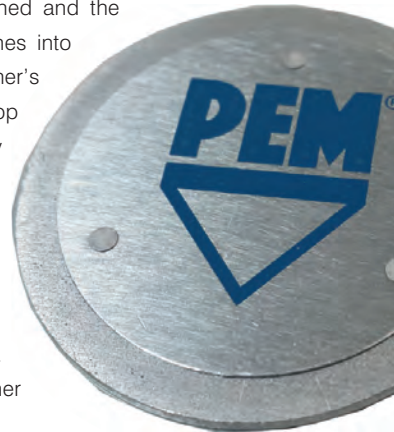
### FASTENERS

The microPEM TackPin fasteners are designed for compact sheet-to-sheet attachments, replacing screw installation in applications where disassembly is not required. The product is said to contribute to faster production times by eliminating tapping operations, the potential for stripped hardware or the need for patches, and all screw-related concerns.

The fasteners are pressed into properly sized mounting holes in the sheet to be attached and the base panel. The fastener clinches into the base panel and the fastener's head subsequently holds the top sheet (as thin as 0.2 mm) firmly and permanently in place. The fastener's tapered tip assists in location - interference fit eliminates hole-tolerance issues - and the self-clinching action results in full 360° metal contact. Loosening due to vibration or other factors is not a concern.

Benefits include: no cross-threading; assembly design for lighter, smaller and thinner products; full metal contact for grounding/conductivity; elimination of torque settings required for a screw; no excess cost due to screw breakage/overinstallation.

**Ampec Technologies Pty Ltd**  
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### OPTICAL TRANSCEIVER IC

Engineers can achieve high performance in optical modules with low power consumption using the highly integrated MAX3956 10GBASE-LR SFP+ optical transceiver IC from Maxim Integrated. The company says the product delivers better than 50% transmit mask margin performance (1 k waveforms, zero mask hits) with <0.8 W total SFP+ module power dissipation. This reduced power dissipation lowers operational expenditures and improves thermal reliability in data centres.

Additionally, the device integrates accurate analog monitors for digital diagnostics monitoring, including temperature,  $V_{CC}$  and RSSI sensors, to ensure a compact design and save bill-of-material cost. By integrating analog monitors and a 12-bit analog-to-digital converter, the product enables the use of an all-digital external microcontroller.

The device is available in a 5 x 5 mm, 32-pin TQFN-EP package. It operates over the -40 to 95°C temperature range.

**Avnet Electronics Marketing**  
[www.avnet.com.au](http://www.avnet.com.au)

## EMBEDDED COMPUTER FOR VIDEO ANALYTICS AND SURVEILLANCE APPLICATIONS

Neousys Technology's Intel 3rd-Generation Core i7/i5/i3 fanless embedded controller, the NUVO-3000LP Series, is designed for rugged fanless applications such as video analytics and surveillance.

NUVO-3005LP/3003LP is the low-profile version of NUVO-3000 Series, which has been designed for projects with space limitations. It features a chassis with height reduction from 88 to 69 mm, but still remains reliable in the -25 to 70°C operating temperature range.

The series incorporates the 3rd-Generation i7 quad-core processor and I/O functions such as Gigabit Ethernet ports, USB 3.0 ports and dual independent display outputs. The embedded computer also offers optional PoE ports, isolated digital IO and ignition power control for a wide range of vehicle and surveillance applications. The computing power ensures video capture and analytics tasks operate seamlessly.

The industrial computer offers one fixed 2.5" HDD accommodation and one hot-swappable 2.5" HDD tray. Users can take advantage of its storage design for applications that requires frequent HDD replacement or redundancy. The product is a suitable platform for surveillance and security systems.

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



STAND A25



## PRODUCT DATA MANUFACTURING PROCESS TOOL

Mentor Graphics has released its product data manufacturing process tool, Valor MSS Process Preparation.

The current release includes features covering data preparation, BOM-CAD merging, assembly processes, SMT programming, DFT probe engineering, stencil engineering and the DFx Analysis Engine.

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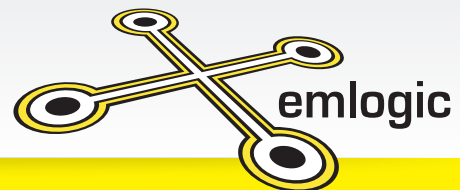
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# LIGHT BULB HACKED

Security consultant Context Information Security has uncovered a security weakness in an Australian inventor's Wi-Fi-enabled, energy-efficient LIFX LED light bulb that can be controlled from a smartphone.

**B**y gaining access to the master bulb, Context was able to control all connected light bulbs and expose user network configurations. The bulb manufacturer LIFX has since worked closely with Context to promptly patch the issue, which is now available as a firmware update. A spokesperson, Simon Walker from LIFX, says that, "Prior to the patch, no one other than Context had exposed this vulnerability, most likely due to the complexity of the equipment and reverse engineering required."

Below are some insights from Alex Chapman, Principal Consultant, Context, about how the company was able to hack the bulb.

Context chose the light bulb due to its use of emerging wireless network protocols, the way it came to market and its appeal to technophiles. LIFX CEO and founder Phil Bosua had introduced the project idea on crowdfunding website Kickstarter in 2012, where it proved hugely popular. LIFX Labs raised over 13 times its original funding target.

LIFX bulbs connect to a Wi-Fi network in order to allow them to be controlled using a smartphone application. In a situation

where multiple bulbs are available, only one bulb will connect to the network. This 'master' bulb receives commands from the smartphone application and broadcasts them to all other bulbs over an 802.15.4 6LoWPAN wireless mesh network. In the event of the master bulb being turned off or disconnected from the network, one of the remaining bulbs elects to take its position as the master and connects to the Wi-Fi network ready to relay commands to any further remaining bulbs. This architecture requires only one bulb to be connected to the Wi-Fi at a time, which has numerous benefits including allowing the remaining bulbs to run on low power when not illuminated, extending the useable range of the bulb network to well past that of just the Wi-Fi network and reducing congestion on the Wi-Fi network.

The use of emerging wireless communication protocols, mesh networking and master/slave communication roles interested the hacker in us, so we picked up a few bulbs and set about our research. The research was performed against version 1.1 of the LIFX firmware. Since reporting the findings to LIFX, version 1.2 has been made available for download.



### Analysing the attack surface

There are three core communication components in the LIFX bulb network: smartphone to bulb communication, bulb Wi-Fi communication and bulb mesh network communication. Due to the challenges involved, Context decided to begin the search for vulnerabilities in the intra-bulb 802.15.4 6LoWPAN wireless mesh network. The researchers decided to investigate how the bulbs shared the Wi-Fi network credentials between themselves over the mesh network. 6LoWPAN is a wireless communication specification built on IEEE802.15.4, the same base standard used by Zigbee, designed to allow IPv6 packets to be forwarded over low-power personal area networks (PANs).

In order to monitor and inject 6LoWPAN traffic, a peripheral device that uses the 802.15.4 specification was required. The device chosen for this task was the ATMEL AVR Raven installed with the Contiki 6LoWPAN firmware image. This presented a standard network interface from which the researchers could monitor and inject network traffic into the LIFX mesh network.

### Protocol analysis

The Contiki-installed Raven network interface enabled the researchers to monitor and inject network traffic into the LIFX mesh network. The protocol observed appeared to be, in the most

part, unencrypted. This allowed the researchers to easily dissect the protocol, craft messages to control the light bulbs and replay arbitrary packet payloads.

Monitoring packets captured from the mesh network while adding new bulbs, the researchers were able to identify the specific packets in which the Wi-Fi network credentials were shared among the bulbs.

The onboarding process consists of the master bulb broadcasting for new bulbs on the network. A new bulb responds to the master and then requests the Wi-Fi details to be transferred. The master bulb then broadcasts the Wi-Fi details, encrypted, across the mesh network. The new bulb is then added to the list of available bulbs in the LIFX smartphone application.

### Wireshark 6LoWPAN packet capture

The Wi-Fi details, including credentials, were transferred as an encrypted binary blob. Further analysis of the onboarding process identified that we could inject packets into the mesh network to request the Wi-Fi details without the master bulb first beaconing for new bulbs. Further to this, requesting just the Wi-Fi details did not add any new devices or raise any alerts within the LIFX smartphone application.

At this point, the researchers could arbitrarily request the Wi-Fi credentials from the mesh network but did not have the necessary information to decrypt them. In order to take this attack any further, they would need to identify and understand the encryption mechanism in use.

### Obtaining the firmware

In the normal course of gaining an understanding of encryption implementations on new devices, we first start with analysing the firmware. In an ideal world, this is simply a case of downloading the firmware from the vendor website, unpacking, decrypting or otherwise mangling it into a format that's usable. However, at the time of the research the LIFX device was relatively new to market, therefore the vendor had not released a firmware download to the public that the researchers could analyse. They had to fall back to Plan B and obtain the firmware themselves.

In order to extract the firmware from the device, the researchers had to gain physical access to the microcontrollers embedded within; an extremely technical process, which to the layman may appear to be no more than hitting it with a hammer until it spills its insides. Once removed from the casing, the PCB is accessible, providing the team with the access they required.

### Extracted LIFX PCB

It should be noted that public sources can be consulted if only visual access to the PCB is needed. The American Federal Communications Commission (FCC) often release detailed tear downs of communications equipment which can be a great place to start if the hammer technique is considered slightly over the top.

Analysing the PCB, the researchers were able to determine that the device is made up primarily of two SoC ICs: a Texas Instruments CC2538 that is responsible for the 6LoWPAN mesh network side of the device communication and an STMicroelectronics STM32F205ZG (marked LIFX LWM-01-A) that is responsible for the Wi-Fi side of the communication. Both of these chips are based on the ARM Cortex-M3 processor. Further analysis identified that JTAG (Joint Test Action Group) pins for each of the chips were functional, with headers presented on the PCB.





ARMED WITH KNOWLEDGE OF THE ENCRYPTION ALGORITHM, KEY, INITIALISATION VECTOR AND AN UNDERSTANDING OF THE MESH NETWORK PROTOCOL, WE COULD THEN INJECT PACKETS INTO THE MESH NETWORK, CAPTURE THE WI-FI DETAILS AND DECRYPT THE CREDENTIALS, ALL WITHOUT ANY PRIOR AUTHENTICATION OR ALERTING OF OUR PRESENCE. SUCCESS.

Once the correct JTAG pins for each of the chips were identified, a process which required manual pin tracing, specification analysis and automated probing, we were ready to connect to the JTAG interfaces of the chips. In order to control the JTAG commands sent to the chips, a combination of hardware and software is required. The hardware used in this case was the open hardware BusBlaster JTAG debugger, which was paired with the open source Open On-Chip Debugger (OpenOCD). After configuring the hardware and software pair, we were in a position where we could issue JTAG commands to the chips.

At this point we can merrily dump the flash memory from each of the chips and start the firmware reverse engineering process.

### Reversing the firmware

Now we are in possession of two binary blob firmware images required to identify which image is responsible for storing and encrypting the Wi-Fi credentials. A quick 'strings' on the images identified that the credentials were stored in the firmware image from the LIFX LWM-01-A chip.

Loading the firmware image into IDA Pro, we could then identify the encryption code by looking for common cryptographic constants: S-Boxes, forward and reverse tables and initialisation constants. This analysis identified that an AES implementation was being used.

AES, being a symmetric encryption cipher, requires both the encrypting party and the decrypting party to have access to the same pre-shared key. In a design such as the one employed by LIFX, this immediately raises alarm bells, implying that each device is issued with a constant global key. If the pre-shared key can be obtained from one device, it can be used to decrypt messages sent from all other devices using the same key. In this case, the key could be used to decrypt encrypted messages sent from any LIFX bulb.

References to the cryptographic constants can also be used to identify the assembly code responsible for implementing the encryption and decryption routines. With the assistance of a free software AES implementation, reversing the identified encryption functions to extract the encryption key, initialisation vector and block mode was relatively simple.

The final step was to prove the accuracy of the extracted encryption variables by using them to decrypt Wi-Fi credentials sniffed off the mesh network.

### Putting it all together

Armed with knowledge of the encryption algorithm, key, initialisation vector and an understanding of the mesh network protocol, we could then inject packets into the mesh network, capture the Wi-Fi details and decrypt the credentials, all without any prior authentication or alerting of our presence. Success.

It should be noted, since this attack works on the 802.15.4 6LoWPAN wireless mesh network, an attacker would need to be within wireless range, 30 metres, of a vulnerable LIFX bulb to perform this attack, severely limiting the practicality for exploitation on a large scale.

### Vendor fix

Context informed LIFX of the research findings - LIFX was proactive in its response. Context has since worked with LIFX to help it provide a fix this specific issue, along with other further security improvements. The fix, which is included in the new firmware available at <http://updates.lifx.co/>, now encrypts all 6LoWPAN traffic, using an encryption key derived from the Wi-Fi credentials, and includes functionality for secure onboarding of new bulbs onto the network.

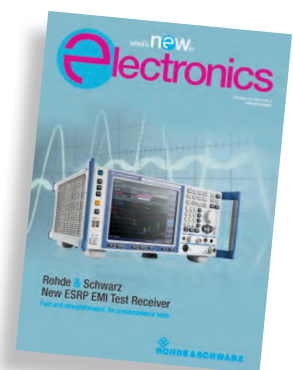
With any internet connecting device, whether phone, laptop or light bulb, there is always a chance of someone being able to hack it.

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## DIGITAL OSCILLOSCOPE

The Fluke 199C is a hand-held, 200 MHz, two-channel colour digital oscilloscope with built-in digital multimeter and recorder. It is designed to simplify testing in challenging industrial environments.

The portable unit features isolated inputs, automatic and external triggering and a full range of manual trigger modes. The 14.4 cm colour display includes persistence functionality for analysing complex, dynamic signals in a manner similar to that of an analog oscilloscope. The product can also measure electrical power properties such as VA, VAR, etc.

Features include: automatic capture and replay of last 100 screens; time-base range in scope mode 5 ns/div to 2 min/div; input sensitivity 5 mV/div to 100 V/div; 2.5 GSa/s real-time sampling.

The product is available to rent from TechRentals, which offers a set-up and download service.

**TechRentals**

[www.techrentals.com.au](http://www.techrentals.com.au)

STAND B5

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## TACTICAL DISPLAY

ROC-SOLID has released its 15" tactical display suited to all land, sea and air applications. Designed and manufactured in Adelaide, it is able to withstand rugged shock and vibration environments.



The MDP-1502-01 features 16 fully programmable function keys, a multipoint touch screen, daylight-readable display and backlit keys. Rated to MIL-STD-810 and MIL-STD-1275, it is suitable for inclusion in C4i programs.

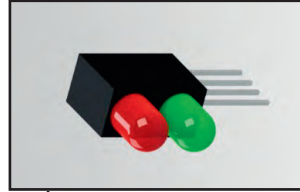
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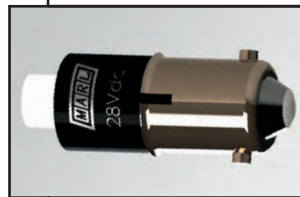
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# the GRUMPY page

Mike Smyth, specialist technical writer

**W**hen you consider how we are surrounded by technology that affects our daily lives, it is surprising that technology is not better understood and even embraced – especially by the young.

For example, how many know how a computer really works or can fathom the intricacies of digital television in the living room? Do we know how a mobile phone functions or the kitchen microwave? And then there are CDs, DVDs and BluRay technologies that beguile, amuse, entertain or irritate us.

Of course it can be argued that we don't need to know how things work to enjoy them or use them any more than we need to know the ins and outs of car mechanics to competently drive one. But it does seem to me as if curiosity has gone on holiday. Boys no longer appear to tinker with batteries and buzzers, wires and whatnots. Today it is computer games and social media, which, I think, are in danger of killing off the natural inquisitiveness of the young to the detriment of future generations. Mind you, apart from the internet, where do you go for information?

There is one, just one, excellent electronics magazine that is aimed at the keen amateur but for any other branch of science it is a long desert road that must always lead to the internet and sometime the information available there is questionable.

There have never been more outlets for disseminating information. Instead of filling up air time with ridiculous, 10-year-old yankee situation comedies complete with canned laughter, maybe one, just one channel could find the resources for a serious and not too deep program on general science.

I know there is one science program already out there but often it seems more concerned with personalities than the subject and man of the topics are far removed from everyday life that the ordinary person can relate to.

For instance, there was a golden opportunity for television to broadcast (forgive the pun) all about its own technology when the analog signals were switched off and we went purely to digital reception.

The mainstream press is only interested in the melodramatic, sensational advances in technology and usually leave the audience asking more questions than have been answered. Ground breaking progress is being made in cancer, dementia, genetics, deep space research and other fields. Some achievements are reported, but only superficially especially when you consider the amount of air time given to berating politicians.

So how timely it would have been for one of the television stations to have gathered interesting and factual information about digital TV and presented it, perhaps even as a short series. After all, there could be no better medium where pictures and diagrams and animated explanations could be so effective. I realise there could be a problem setting a level of understanding for such an undertaking but for once could we could have looked beyond the quick buck and tempted the viewer with a ground breaking program that could well have had a market round the world.

And let's not stop there. There are so many areas of science that television is ideally suited to present so where is the will and the curiosity that inspired some of our greatest inventions? Where is the enthusiasm for passing on that knowledge to the next generation? Don't leave it all to the internet that doesn't always get things right. There are people out there ready, willing and able to teach. All they need is an outlet and some little encouragement. So, perhaps we could push aside the plethora of ancient comedy in favour of something a little more up to date and certainly of value to us all.



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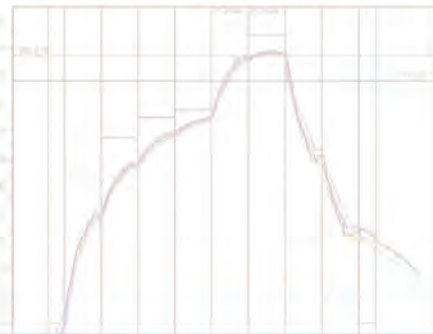
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