July/August 2016 Vol.36 No.1
PP100007394

what's new in electronics

Keysight Source/Measure Units (SMU)

Measure with confidence down to 10fA

KEYSIGHT TECHNOLOGIES

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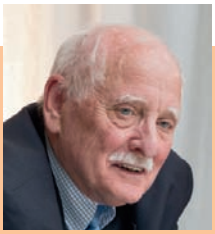

VALE MIKE SMYTH

It is with great sadness that we report the passing of Mike Smyth, radiocommunications industry legend and journalist extraordinaire.

Over the years Mike was at the helm of many of our publications — including *What's New in Electronics* — and was involved in every other magazine in the Westwick-Farrow stable. His experience, technical knowledge and passion for quality journalism were huge assets.

Mike was affectionately known as Mr Grumpy — immortalised with his Grumpy page in *WNIE*. But in reality, he was always ready to help. There probably hasn't been a single editor in the company who hasn't turned to Mike for advice or a witty headline.

On behalf of everyone in the Australasian radio and electronics scene, we extend our sympathies and thoughts to his family.

COVER STORY

Keysight's B2900A Series of Precision Source/Measure Units are compact and cost-effective benchtop Source/Measure Units (SMUs) with the capability to output and measure both voltage and current. B2900A Series have broad voltage (210 V) and current (3 A DC and 10.5 A pulsed) sourcing capability, high precision (minimum 10 fA/100 nV sourcing and measuring resolution) and high measurement throughput. They also support an arbitrary waveform generation function. In addition, the instrument's graphical user interface in various viewing modes helps to improve test productivity, debug and characterisation. The new multiple instrument software control options are available at little or no cost: BenchVue, B2900A Graphical Web Interface, B2900A Quick IV Measurement Software, and EasyEXPERT group+.

The **M9111A** is Keysight's first PXI Express source/measurement unit, purpose-built for design validation and production test of next-generation power amplifiers and front-end modules supporting cellular and wireless connectivity formats. The high-speed M9111A changes voltage, stabilises and accurately measures microamps, all in less than 1 ms. The one-slot, two-quadrant PXIe module delivers up to 18 W of power at up to 13 V, ±1 A or up to 6 V, ±3 A. It combines the capabilities of a voltage source, a current source, an ammeter and a voltmeter.

Keysight Technologies Aust Pty Ltd
www.keysight.com.au/find/SMU

KEYSIGHT TECHNOLOGIES

CHARGE AND BATTERY CONTROL SENSORS AND SOLUTIONS

Jon Gabay

Not long ago, the term 'sensor' was synonymous with 'transducer'. However, that is no longer the case. Sensors and sensor systems have come a long way and are taking advantage of new and diverse technologies. Higher integration is yielding monolithic mixed-signal systems on a chip that can be embedded everywhere. The modern smartphone is perhaps the best example of a mass-produced, battery-powered mobile sensor array that can be accessed globally in a wireless fashion.

As older battery technologies are replaced by newer battery chemistries and architectures, sensor challenges arise. Both onboard and on-chip sensors must be optimised for a design to take advantage of the newest battery technologies. While some sensors can be as simple as a resistor, others require high resolution and mixed-signal technologies to provide more accurate data so as to ensure the long life, optimal performance and safety of the mobile device.

This article looks at embedded sensors as part of an integrated solution for optimising and protecting battery-based designs. Both standalone and peripheral topologies will be discussed using specific parts as examples. All parts and technologies referenced here can be found on the Digi-Key website: www.digikey.com.

Battery controllers

Electronics for modern battery-powered systems should be able to operate in two states: while line power is available and when it is not. While line power is connected, operational power as well as charge power is metered, monitored and controlled. When disconnected from line power, battery-only energy is used and should be carefully monitored. The protection schemes employed can be distributed between the chargers and the handheld or mobile units themselves, and each should hold the specific sensors and protect against the conditions they are potentially exposed to.

For example, battery-powered systems are line isolated and will not be subjected to power-line surges and spikes. These types of sensing and suppression components may not be needed in the handheld and mobile design. However, these should be used in a charge cradle since line faults can potentially propagate through circuits and take out unprotected batteries.

Modern battery technologies may pose other challenges for battery-based sensors that were not issues of concern in the past. For example, many new battery technologies in current use have been known to ignite and flare up rapidly at very high temperatures when stressed in certain ways. Designers may need to implement new battery system designs to include real-time temperature monitoring of each individual cell in the battery array. Older, intrinsically safer battery technologies would never require this.

Many of the newer battery management chips incorporate special-purpose hardware specific to a particular battery technology. For example, the Microchip MCP73855T-I/MF targets lithium-ion and lithium polymer battery technologies providing a 400 mA rapid charge, constant-voltage single-cell solution that includes individual cell temperature monitoring as well as overcurrent sensors.

The MCP73855 parts are targeting low-cost and space-limited designs. The 16-lead 4 x 4 mm package houses a standalone linear implementation for charge management and control (Figure 1).

Some nice features include a cell preconditioning mode that allows precise control over trickle charge rate, thresholds and timeouts using external resistor selection. This can act as a safety check before entering the constant-current charge mode (Figure 2). Another benefit to choosing this part is the access to EDA and CAD models.

The standalone Microchip Technology MCP73855T-I/MF can provide status outputs of alert and alarm conditions and be digitally enabled and disabled. This allows switch controls to disable the part automatically when no battery is inserted in the charger. This also permits LED status indicators for the user to monitor.

Adding an MCU

Higher levels of control and functionality are possible when using charge peripheral devices coupled with a local microcontroller. Take, for instance, the AMS AS8510-ASSM that is designed to be an ideal solution for digitally controlled and monitored shunt-based battery sensors.

This part features an integrated pass transistor to reduce component count and a high accuracy (±0.5%) preset voltage regulator. It also includes two digitally filtered 16-bit Sigma Delta A/D converters as well as a programmable current

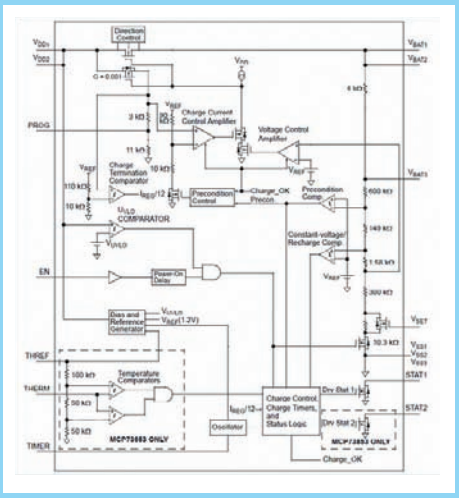

Figure 1: Highly integrated standalone charge and safety controllers for specific modern battery chemistries integrate sensors as part of the charge management algorithms. Thresholds, rates, and timeouts are typically performed using external bias components.

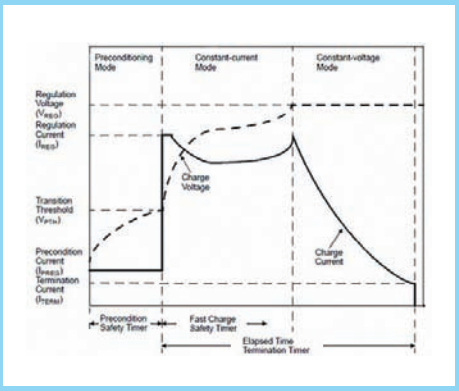

Figure 2: Precharge safety modes allow generation of fault flags and cessation of constant-current charging modes unless safety checks pass. Thresholds and timeouts are programmable through external bias resistors. Note that this plot does not contain temperature-dependent waveform control.

Figure 3: Low-cost off-the-shelf modules allow fast testing and development. This one implements thermal coefficient compensation for loads up to 60 A and uses an SPI interface for easy connection to an embedded controller.

source for use with external temperature sensors. Either a single differential temperature sensor can be used, or two single-ended sensors or an integrated internal temperature can be multiplexed into the A/D conversion stage to provide the most flexibility.

A unique feature of this part is the ability to bypass the programmable gain amplifier (PGA) when performing system-error compensation. By eliminating the PGA in the signal chain, gain drift is eliminated as a source of error. As a result, differential battery plus and battery ground signal paths solely rely on the production trimmed internal Vref.

Note, all of this functionality can realistically only be implemented if an intelligent microcontroller is put in charge. In this case, the AMS AS8510-ASSM and all its settings, controls and data are accessible in pure digital format thanks to the serial SPI interface. By becoming a charge controller and sensor peripheral, a higher level of more granular control can be attained. Sensor monitoring and charge controlling can be a background task of a host controller, but will involve the extra steps of coding for that host micro.

Simplifying learning and reducing development time, the AMS AS8510 DEMOBOARD uses a simple USB interface and a PC-based GUI to access all device registers and special settings. Included in this development solution are code demos that can help reduce learning and coding times.

The AMS AS8510 COPPER SHUNT MINI BOARD tests and demonstrates this copper-shunt approach and also demonstrates the current measurement with thermal-coefficient compensation. Both internal and copper-meander thermal sensors can be selected as measurement paths and this compact little unit handles up to 60 A (Figure 3).

AMS also has an instructional video using this technology called 'Shaping the World with Sensor Solutions'.

While many battery designs target smaller handheld applications with limited burst levels of current, higher-power battery sensors can also present challenges. Higher voltage and higher current techniques can use shunted and isolated design approaches, but these can add cost and impose space constraints.

For example, a 0.01Ω resistor used as a current sensor with a 1000 A range will present a 10 V full-scale range, which is easily attenuated and usable for most any mixed-signal microcontroller. However, that same unit will require a 10,000 W part, which is no small feat.

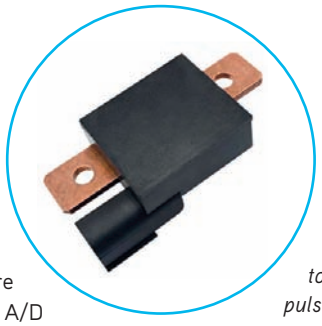

Figure 4: Power sensors for modern high-current battery-based applications include series sensors like this part that can handle up to 600 A continuous or 2000 A pulsed power using a serial bus for communications.

Specialised sensors exist for higher-power monitoring and protection of energy cells and batteries. One such example comes from Vishay with its WBPK600L0A00010001 battery sensor (Figure 4).

In order to be able to pass high currents, a very low resistance of 100 μΩ is placed in series with the current flow of the battery, which can be from 4 to 18 V. Note the high-current values this part supports. A 600 A continuous current flow can be monitored or up to 2000 A of pulsed power can pass through this battery sensor.

The low (<5 nH) inductance helps limit flyback intensity and the ruggedised automotive-capable sealed packaging operates from –40 to +155°C. This part uses a serial LIN interface and acts as a slave device that can remotely be accessed and programmed to set a variable sampling rate.

In summary, batteries are not what they used to be and sensors for batteries have had to adapt to provide safe and effective battery usage. While new technologies like thermally expanding internal contacts are being developed to help protect batteries from exploding at overtemperature conditions, it is and will remain in the foreseeable future up to sensor-based solutions to protect batteries, devices and users. So it is important not to take your battery management, control and sensing too lightly.

For more information about the parts discussed in this article, use the links provided to access product pages on the Digi-Key website: www.digikey.com.

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CURRENT WAVEFORM ANALYSER

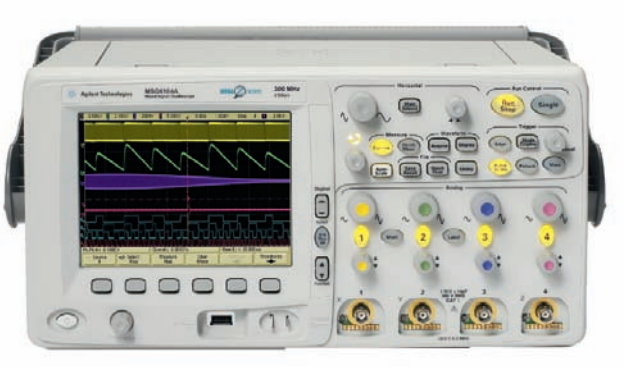
The Keysight CX3300 Series Device Current Waveform Analyzer is suitable for researchers struggling with high-speed transient current measurements during advanced device characterisation, as well as engineers working to reduce power/current consumption in low-power devices. It enables a minimum of 100 pA level dynamic current measurements with a maximum of 200 MHz bandwidth, 1 GSa/s sampling rate and 14- or 16-bit wide dynamic range.

Characterising advanced devices and evaluating low-power devices are challenging tasks and often require engineers to measure high-speed (over 1 MHz) and low-level dynamic current (below 1 μA). However, the existing methodology for this measurement is plagued by issues such as large noise, voltage drop, limited dynamic range and bandwidth. As a result, low-level dynamic current often goes undetected and unmeasured.

The device overcomes this by enabling the simultaneous measurement of wideband and low-level current waveforms. By providing a 14- or 16-bit wide dynamic measurement range, a single instrument can meet various measurement requirements without using multiple instruments.

A graphical user interface on a WXGA 14.1″ multitouch display, and measurement and analysis software, makes previously difficult low-level current waveform measurements and analyses more efficient and easier to make. Users can measure transient current even if the pulse width is narrow (less than 100 ns). This is particularly beneficial for device engineers developing semiconductor or advanced memory devices, as it allows them to visualise previously unmeasurable waveforms.

Keysight Technologies Australia Pty Ltd
www.keysight.com



DIGITAL OSCILLOSCOPE

The Keysight MSO6104A is a 1 GHz digital oscilloscope with Logic. The scope has several features that make it suitable for analysing designs with both digital and analog components. It is available to rent from TechRentals.

The product has an ultraresponsive, high-definition XGA colour display system. The 100,000 waveforms/s of real-time (sinx/x) waveform update rate is said to be over 27 times quicker than that of a typical digital scope.

Other features include: four analog channels and 16 logic channels; a deep memory, 8-digit frequency counter function; and a sample rate of up to 4 GSa/s.

TechRentals
www.techrentals.com.au

LOW-VOLTAGE CAPACITOR BANKS

Schneider Electric has announced the VarSet Low Voltage Capacitor Banks for smart, simple power factor correction. The range has been certified to AS/NZS 61439.1&2 and IEC 61921.

Reactive power and harmonic distortion can cause stress and damage to an electrical network. In addition to the risks associated with the lack of reliability and stability, many utilities charge for the reactive power consumed through kVA tariff billing. Compensating for reactive power with the capacitor banks is an easy way to maintain power factor and quality within the required limits for maximum power system efficiency and cost reduction.

The wall-mounted and floor-standing capacitor banks offer fixed, automatic and dynamic compensation for reactive power. They are specifically designed to allow users, including those working in retail, small to large industrial facilities and commercial buildings, to benefit from improved power quality.

The capacitor banks enable operations to increase energy efficiency, lower utility costs and prevent unplanned downtime due to power loss. Designed for easy installation and maintenance, they are available in a wall-mounted enclosure from 25 to 100 kvar and floor-standing enclosures from 125 to 500 kvar.

Schneider Electric
www.schneider-electric.com

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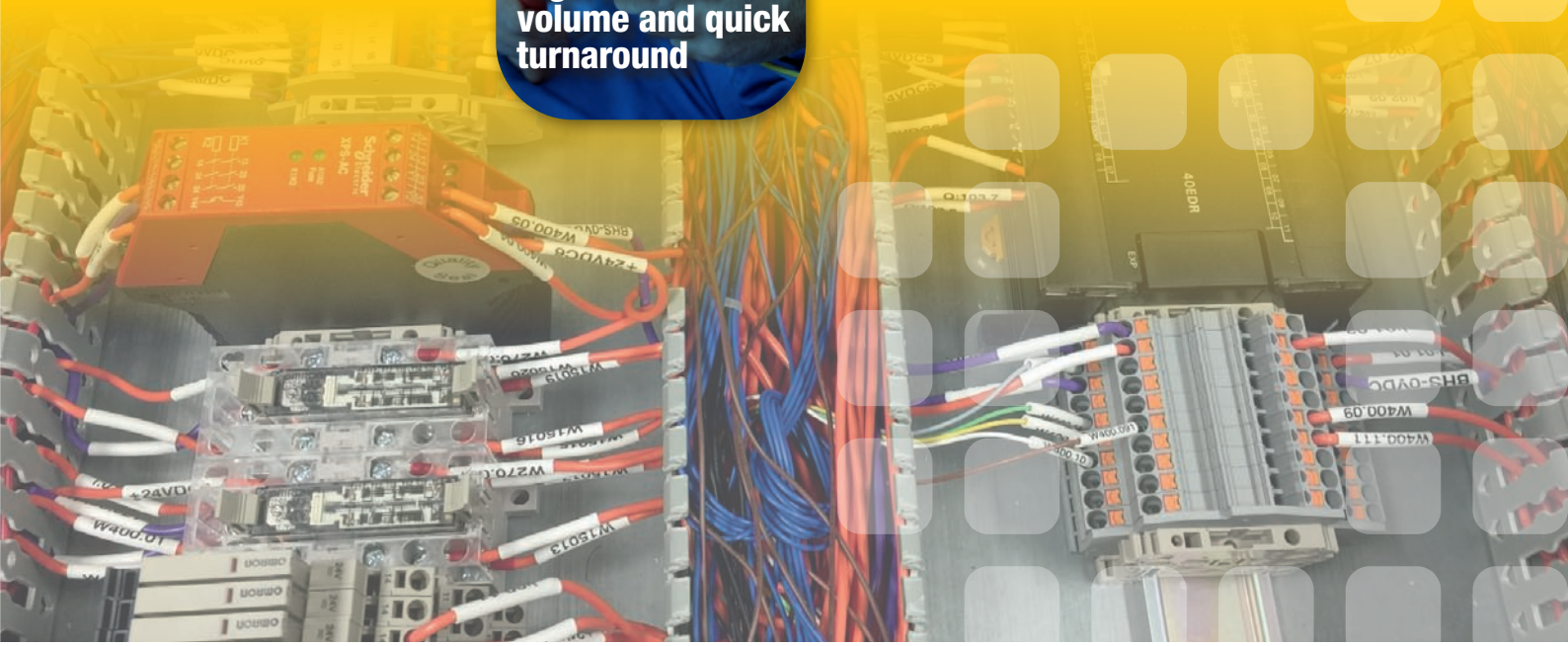

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AC-DC FRONT-END MODULES

Vicor Corporation has announced an addition to its family of high-density PFM AC-DC front-end modules in a rugged VIA package that offers good cooling performance and versatility in converter mounting. Featuring a universal AC input range (85–264 VAC), power factor correction and a fully isolated 24 or 48 VDC output, and delivering 400 W of isolated, regulated, DC output power at efficiencies up to 93%, the modules provide a power density of 8 W/cm^3 and high performance in a diminutive, 9 mm-thin VIA package. The units are suitable for use in a range of industrial, process control, telecommunications, office equipment, test and measurement, LED lighting and other offline applications.

The units integrate a full range of front-end functions required by contemporary AC line-operated power systems — transient and inrush current protection; input power factor correction; input to output isolation; and a regulated SELV (Safety Extra Low Voltage) DC output — and meet international safety and regulatory agency standards for isolation, conducted emissions, power factor correction, and susceptibility to AC line transients, flicker, interruptions and surges. VIA package configurations are available for both onboard mounting and chassis mounting and units are available in two operating temperature ranges.

Vicor Corporation
www.vicorpower.com

INTEGRATED UVA AND UVB LIGHT SENSOR

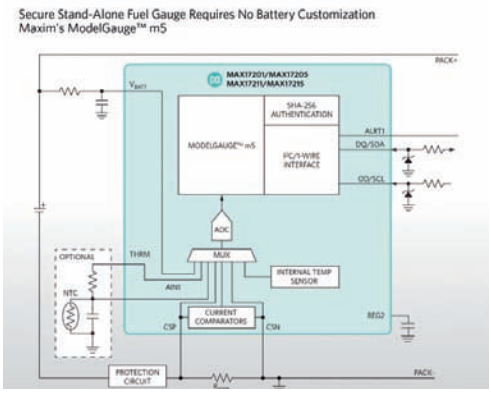
The Vishay Semiconductors VEML6075 is an integrated ultraviolet (UV) light sensor for the detection of UVA and UVB light intensity.

Featuring Filtron technology for high UV sensitivity and linearity, the product incorporates an IC with five sensitive areas and signal processing in a 2 x 1.25 x 1 mm surface-mount package while offering an I^{2}C bus interface for simple operation. It saves space and increases design flexibility by incorporating the circuitry needed for consumer, medical and industrial applications in one compact unit.

The sensor offers individual UVA and UVB channels with 16-bit resolution and good sensitivity of 365 and 330 nm, respectively. Designed to convert solar UV light intensity to digital data, it provides a measurement of signal strength and allows for true UVI calculation in smartphones, smart watches, sport bands, notebook computers and weather stations. The UVI value indicates how much UV radiation will reach human skin when outside, allowing precautions to be taken to avoid sunburns in the short term and skin cancer in the long term.

The device delivers high performance under long-term solar UV exposure and offers high temperature compensation stability from -40 to +85°C. It features a shutdown mode that reduces power consumption to 800 nA and an operating voltage range of 1.7 to 3.6 V, making it suitable for portable electronics and wearable devices.

Mouser Electronics
www.mouser.com



FUEL GAUGES FOR BATTERY PACKS

Implementing pack-side battery gauges in portable devices is now easy and secure with the ModelGauge m5 portfolio of MAX17201/MAX17205 and MAX17211/MAX17215 from Maxim Integrated Products. They are suitable for any rechargeable battery-operated device, such as wearables, drones, tablets, smartphones and other IoT applications.

Fuel gauging can be difficult because battery voltage varies with temperature and load, while coulomb counting requires sophisticated compensation to eliminate offset accumulation errors. Maxim's ModelGauge m5 fuel gauges include an algorithm that converts raw measurements such as battery voltage, current and temperature into state of charge (SOC%), absolute capacity (mAh), time to empty and time to full (while charging), all of which improve the user experience of the host device while enabling maximum runtime.

Battery packs need to be replaced every few years — when batteries age, their characteristics change over time and no longer provide adequate run time. The fuel gauge's robust algorithm detects the smallest changes in the capacity of the battery to predict how long the battery will last before the capacity degrades rapidly. With the Cycle+ age forecast information, system designers are able to adjust charger parameters to extend the battery life or to plan a timely replacement of the battery.

Avnet Electronics Marketing
www.em.avnetasia.com

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EMBEDDED PROCESSORS

Analog Devices' ADSP-BF706 Blackfin+ embedded processors with 1 MB L2 SRAM and ECC protection, deliver performance up to 400 MHz and maintain a low static power consumption rating of <100 mW.

With its integration of a rich set of system peripherals and large on-chip memory, the processors provide a suitable platform for next-generation applications that require RISC-like programmability, multimedia support and leading-edge signal processing in one integrated package. These applications cover a wide range of markets, from automotive systems to embedded industrial, instrumentation, video/image analysis, biometric and control applications.

Mouser Electronics
www.mouser.com

CABLE DRUM ROLLER

Adept Direct has upgraded its cable reel rollers to handle up to 200 kg cable reels. The Adept Direct 350 mm Cable Drum Roller is a simple yet effective means of storing and unreeling cables and leads.

The flanges of the plastic or timber cable drum rest on the galvanised steel rollers. The free-wheeling rollers ensure that cable is paid out safely without tangling or the drum rolling away. With no reels of cable rolling around on a building site or manufacturing area, workplace safety is improved.

The compact cable rollers are versatile as the spacing of the rollers can be changed from the narrow setting through to medium or wide settings. This means the cable roller can be used for dispensing small diameter telecommunications cable reels one day and electrical cable drums the next.

The cable rollers are designed and made in Australia utilising robotic welders. The heavy-duty rollers incorporate 'sealed-for-life' bearings and the rigid steel frame is powdercoated high-visibility yellow. The low-profile and compact rollers can be part of every electrician's or telecommunications technician's tool kit.

Adept Direct - Cable Rollers & Lead Stands
www.adeptdirect.com.au

IoT GATEWAYS

Advantech has launched its full range of IoT gateways to fulfil a wide array of application environments. The gateways, powered by Intel IoT Gateway Technology, comprise the ultrasmall series UTX-3115, ARK-1123L and ARK-1123H, multiple I/O ARK-2121L, in-vehicle series ARK-2121V and ARK-2151V, outdoor video surveillance series ARK-2121S and ARK-2151S, fleet management series TREK-570 and TREK-572, as well as the automation series UNO-1252, UNO-1372G and UNO-2272G units. The gateways provide a foundation for connecting devices seamlessly and securely, delivering trusted data to the cloud and adding value through analytics. They enable machine-to-machine (M2M) communication, Integrated Services Router (ISR) and cellular connectivity for areas such as industry, smart buildings, retail and transportation. The Intel IoT Gateway Technology solution is designed on the Wind River Intelligent Device Platform XT to speed innovation and maintain interoperability with legacy systems. Developers can quickly develop, prototype and deploy intelligent gateways that meet emerging IoT market requirements, while maintaining interoperability with legacy systems including sensors and data centre servers. The solution is completely preconfigured and pre-validated with hardware, software and security capabilities.

Standards-based interfaces enable Intel IoT Gateway Technology to easily connect and integrate with legacy systems, down to sensors and controllers and up to data centres and the cloud. Intel provides an integrated software stack, with drivers and scripts that support the built-in, hardware-based root of trust.

Advantech Australia Pty Ltd
www.advantech.net.au

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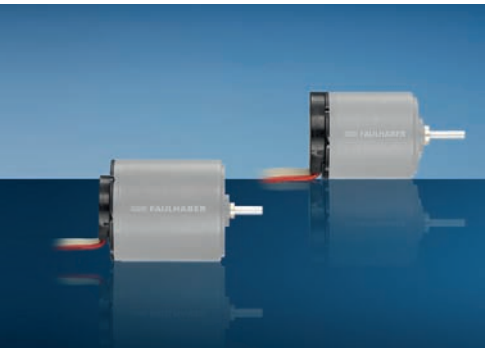

INTEGRATED ENCODER

The IEH2-4096 integrated encoder from FAULHABER IEH2 offers high resolution, an expanded operating temperature range and improved speed control in comparison to the company's previous models.

The previous components — sensor and circuit — are replaced in the product by one single-chip Hall module. This developed circuit board is more thermally robust than the previously used magnetoresistive sensors and integrated circuits. As a result, the operating temperature range has expanded to -40°C to +100°C.

At 4096 pulses, the encoder has a resolution four times higher than the previous model, which leads to improved control dynamics. The model also offers improved speed control, particularly at low speeds. The product remains mechanically compatible with the previous models.

The integrated encoder can be used in application areas including equipment technology, camera technology and precision optics. These application areas are characterised by sophisticated engineering in which the individual components cannot occupy much space. The integrated encoder satisfies these requirements.

The unit can be combined with precious-metal commutated motors with diameters from 15 to 22 mm and lengthens them by just 1.4 mm. Encoders with a separate attachment housing require several times more installation space.

ERNTEC Pty Ltd
www.erntec.net

MEDIUM-POWER PLANAR TRANSFORMER

Vishay Intertechnology has introduced a planar transformer offering power from 1 to 3 kW in a compact 70 x 53 x 22 mm size. Compared to devices built on traditional winding technology, the Vishay Sfernice PLA51 is said to deliver the same power transfer/conversion while offering higher efficiency and a lower weight and profile.

The device is optimised for DC/DC power converters, onboard chargers for electric vehicles, UPSs, power control cooling units and solar inverters. In these applications, its high typical efficiency of >99% typical reduces losses, while its low profile of 22 mm saves space in subassemblies. In addition, the transformer's reduced weight of 170 g is a key parameter for power supplies in avionics applications.

Providing good repeatability, the product features a frequency range of 50 to 400 kHz and operates over a temperature range from -55 to +125°C with heatsink dissipation. Offered in full-bridge, half-bridge and forward power supply topologies, the transformer features tapped outputs for fast and easy connection. The RoHS-compliant device is also available in custom designs on request.

Digi-Key Corporation
www.digikey.com

ENCAPSULATION RESINS

Electrolube has recently developed three strategically important encapsulation solutions: an epoxy, a silicone and a polyurethane.

Available in 250 g resin packs and 25 kg kits, the ER4001 epoxy system is a high-temperature resistant, thermally conductive, two-part encapsulation compound that provides full protection up to 150°C. Due to its enhanced thermal conductivity, the product is suitable for those applications that require effective heat dissipation, particularly for units with limited spacing. Free from abrasive fillers, it will have minimal wear impact on dispensing equipment.

Available in 50 g duo-dispenser, 250 g resin pack and 50 kg kits, the SC2006 UL94 V-0 compliant, two-part silicone encapsulation compound offers not only good thermal conductivity but also high temperature performance, making it suitable for applications operating up to 200°C. The product is soft and flexible, making it suitable for those encapsulation and gap-filling jobs involving delicate components and assemblies. It is formulated for a 1:1 mix ratio, greatly simplifying processing operations.

Available in various-sized kits, UR7002 is a two-part, high-performance encapsulation resin offering a high degree of flexibility for the encapsulation of delicate electronic and electrical components. It has a wide operating temperature range, maintaining its flexibility from as low as -70°C all the way up to 120°C. Resistant to water, tearing and impact, it demonstrates low moisture sensitivity both during and after cure. Minimal isocyanate content ensures a reduced hazard risk.

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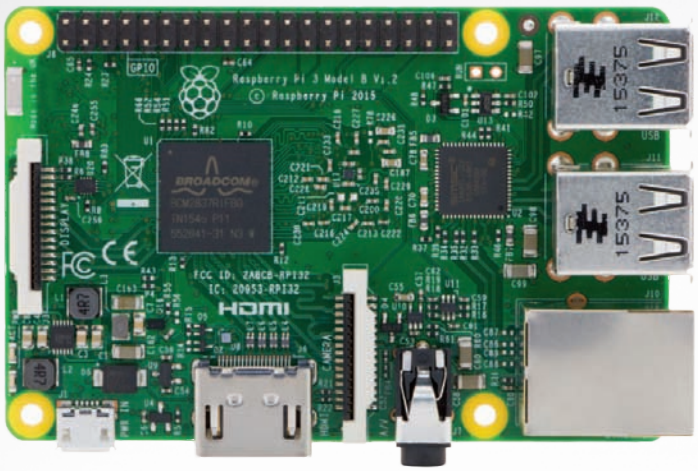
The revolutionised... Raspberry Pi 3 Model B



Built on the latest Broadcom 2837 ARMv8 64bit processor, the new generation Raspberry Pi 3 Model B is faster and more powerful than its predecessors. With built-in wireless and Bluetooth connectivity, it becomes the ideal IoT ready solution.

The credit-card sized computer plugs into a monitor or TV and uses a standard keyboard and mouse. The Raspberry Pi is capable of doing everything you expect a standard computer to do, from browsing the internet and playing high-definition videos, to creating spreadsheets, word-processing, and gaming. The Raspberry Pi 3 is used for a wide range of projects from simple educational tools to complex design challenges such as a multimedia player, building robots, a home weather station, multi-room wireless music system, drone on-board controller, a retro gaming machine/table, homemade cloud storage server and much more.

With its easy-to-use interface, portability and versatility, this tiny but mighty computer is the perfect learning tool for any and is designed to help children and adults enhance their skills in programming and digital literacy. It is capable of running a number of coding languages including Scratch and Python which is being used by students worldwide, with the emphasis on STEM subjects being introduced to Australian schools as a core unit.

element14

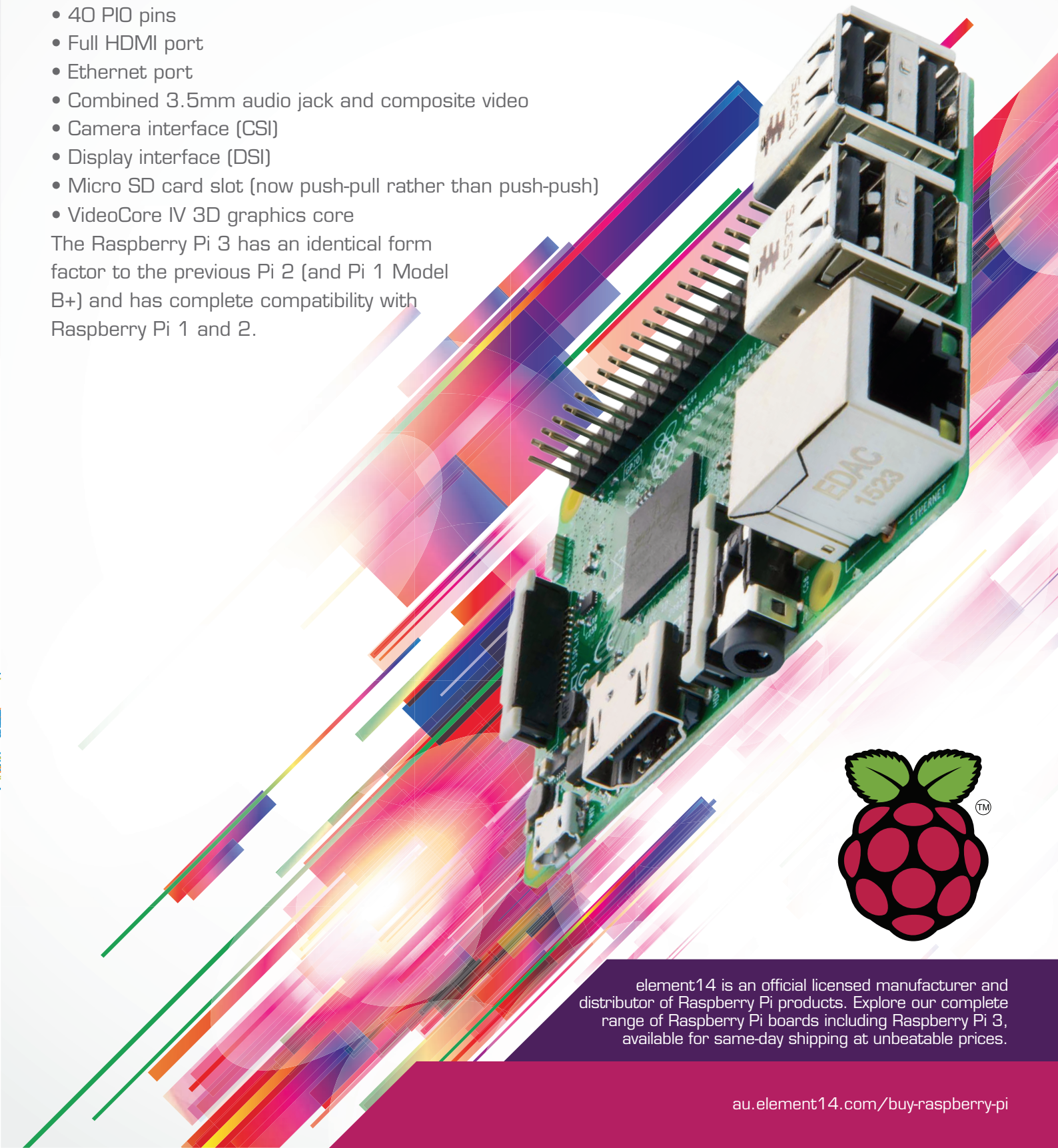
Compared to the Raspberry Pi 2 it has:

- A 1.2GHz 64-bit quad-core ARMv8 CPU
- 802.11n Wireless LAN
- Bluetooth 4.1
- Bluetooth Low Energy (BLE)

Like the Pi 2, it also has:

- 1GB RAM
- 4 USB ports
- 40 PIO pins
- Full HDMI port
- Ethernet port
- Combined 3.5mm audio jack and composite video
- Camera interface (CSI)
- Display interface (DSI)
- Micro SD card slot (now push-pull rather than push-push)
- VideoCore IV 3D graphics core

The Raspberry Pi 3 has an identical form factor to the previous Pi 2 (and Pi 1 Model B+) and has complete compatibility with Raspberry Pi 1 and 2.



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au.element14.com/buy-raspberry-pi

OPTICAL BYPASS SWITCH

The ComNet CN-OB(M,S) external bypass switches for 100M/1G/10G fibre-optic networks protect the network from failures and ensure network integrity during power loss.

Each of the fibre-optical bypass switches includes network ports and monitor ports. The network ports are used for connection to main-network connections and provide a protection mechanism, while the monitor ports are used for downlink to the local networking device.

When the power is on, the operation mode of the bypass switch is set to normal and the local networking device is connected with main network. When power failure occurs, the switch is swiftly set to bypass mode to isolate the main network from the local networking device.

ComNet Europe Ltd
www.comnet.net

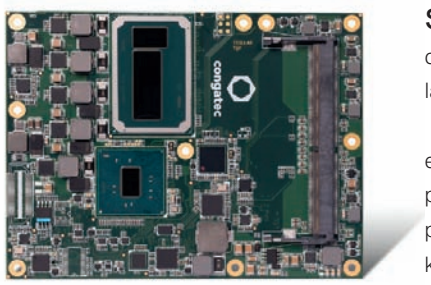
PXI DIGITISER

Keysight Technologies has introduced the M9203A PXIe 12-bit High-Speed Digitizer/Wideband Digital Receiver running up to 3.2 GS/s, with up to 2 GHz instantaneous analog bandwidth. The high-speed digitiser is suitable for applications in wireless communication, emerging communication standards, radar and satellite communication, and semiconductor automated tests.

The product features a large FPGA that can implement different functionalities depending on the selected firmware option, such as a custom firmware capability supporting the deployment of a custom processing algorithm with the U5340A FPGA development kit; triggered simultaneous acquisition and readout, allowing sustained triggered acquisitions of thousands of samples at hundreds of kHz rates without missing any events; and wideband real-time digital down-conversion on each channels, enabling the user to tune and zoom in on the signals of interest.

Custom functions can also be implemented onboard, providing support of various application bundles. Digital down-conversion streaming and recording allows users to capture and record a long duration of large frequency bands up to 320 MHz instantaneous bandwidth (IBW) on a single channel or up to 200 MHz IBW on two phase-coherent channels. Digitiser streaming and recording enables the recording of the raw acquisition data. The high-fidelity digitiser function provides enhanced performance by compensating the analog-to-digital converter (ADC) and the front-end distortion, minimising the interleaves spurs and reducing the overall noise bandwidth.

Keysight Technologies Australia Pty Ltd
www.keysight.com



SERVER-ON-MODULES FOR REAL-TIME MEDIA PROCESSING

congatec has introduced server-on-modules for real-time media processing based on the latest Intel Xeon E3-1578L and E3-1558 processors.

The modules feature the integrated Intel Iris Pro Graphics accelerated by 128 MB fast eDRAM and double graphics base frequency for high transcoding and video processing performance. They come with an extensive ecosystem, including complete board support packages, comprehensive driver support and application-ready carrier boards and evaluation kits, simplifying individual embedded server configurations.

Edge and fog computers for industrial IoT applications are one of the two major application areas for the server-on-modules. In close proximity to the field level, such servers are highly responsive and real-time capable, allowing both the horizontal and the vertical networking of any industrial IoT-connected smart sensors, actuators and complex equipment and machines. High-level media processing performance brings benefits to application fields such as autonomous driving, drone control, vision-based robotics and self-learning machines.

The conga-TS170 COM Express basic modules support up to two 4k HEVC output streams or up to 15 Full HD-HEVC (1080p) streams in real time. The modules offer the common I/O interfaces of the Type 6 pinout.

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www.congatec.com

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PORTABLE TEST EQUIPMENT

Signal Generators

High Speed DDS
250KHz-6.5GHz

SSG-6400HS

CW & Pulse
Up to 6GHz

SSG-4000HP
SSG-4000LH
SSG-6000RC
SSG-6001RC

Switch Matrices

USB and Ethernet
Controlled
Up to 18GHz

USB-xSPDT-A18
USB-xSP4T-A18
RC-xSPDT-A18
RC-xSP4T-A18
RC-xSP6T-A12

Programmable Attenuators

USB and Ethernet
Controlled
1MHz up to 8GHz
0.25dB Step

RCDAT-8000-30
RCDAT-8000-60
RCDAT-8000-90
RCDAT-6000-30
RCDAT-6000-60
RCDAT-6000-90
RCDAT-6000-110
RCDAT-4000-120

Vector Network Analyzers

Compact VNA
Up to 9GHz 145dB

S5048
S5065
S5085
C1209

Full Size 2-port VNA
Up to 20GHz 145dB

340/1
804/1
C1220

Full Size 4-port VNA
100kHz-8GHz 145dB

808/1

Power Sensors

CW Power Sensors

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PWR-6LGHS
PWR-8GHS
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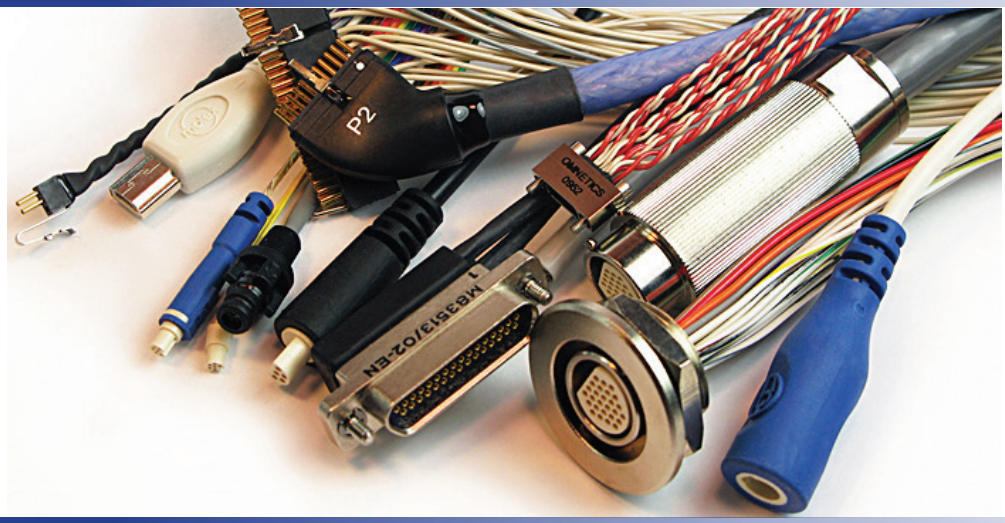
CSE PRODUCTION SERVICES

DATA CABLE ASSEMBLY



COAXIAL CABLE ASSEMBLY

OVERMOULDING

To purchase online, visit www.cseonline.com.au
For technical information, visit www.clarke.com.au

FIELD METER

The Holaday HI-3604 ELF Survey Meter is a low-frequency field meter. Designed to evaluate both magnetic and electric fields associated with 50 Hz power lines, line-powered appliances and equipment, it is a sophisticated tool for the inspection of power frequency environments. It is available to rent from TechRentals.

The unit has a frequency range of 30 to 2000 Hz. The LCD display indicates in mG, G, V/m and kV/m, with the meter measuring magnetic fields from 0.1 mG to 20 G and electric fields from 1 V/m to 200 kV/m. The data logging feature allows for a maximum of 112 readings to be saved in the internal memory storage of the device.

TechRentals
www.techrentals.com.au

BRUSHLESS DC SERVOMOTOR

FAULHABER's series 3274 BP4 brushless DC servomotor, measuring 32 mm in diameter and 74 mm in length, has a large continuous torque of 165 mNm. It weighs in at just under 320 g, which is half that of conventional motors with comparable power.

The four-pole brushless DC servomotor is suitable for applications in which high power and dynamic start/stop operation with low total weight is an important factor, eg, in link drives of humanoid robots, electric grippers used in process automation or high-performance traction drives used in inspection robotics.

The product is overload-resistant and operates without wear-prone mechanical commutation. As a result, its operational lifetime is many times longer than that of a conventional DC micromotor. The slope of the motor characteristic curve delivers what the application demands even under harsh ambient conditions, such as at low temperatures or high mechanical loads (eg, in aerospace applications). This is made possible by a robust stainless steel housing and the omission of adhesives which are otherwise usually used for assembly.

The motor is equipped with digital hall sensors. High-resolution optical and magnetic encoders can be attached simply to the rear multifunction flange. The motor is also available with analog (linear) hall sensors that can replace an encoder in many application cases. A large selection of performance-optimised precision gearheads rounds off the complete drive system.

ERNTEC Pty Ltd
www.erntec.net

PXIE CHASSIS

Keysight Technologies has announced a Gen 3 PXIe chassis and set of Gen 3 system components designed for complex, high-performance applications. The products include an 18-slot PXIe chassis with x8 Gen 3 PCIe links to each slot, a set of single- and dual-port Gen 3 PXIe system modules and PC host cards, and an improved PXIe embedded controller.

The M9019A Gen 3 PXIe 18-slot chassis provides a high-performance system platform with a number of improvements, including: a Gen 3 backplane with an x8 PCIe link to each slot and x24 (two-link) system slot; two front-panel SMB trigger ports providing access to PXI Trig (0:7); one-button power control for multichassis power sequencing for large configurations; and more power for PXIe modules.

The M9037A PXIe high-performance embedded controller is now qualified for Gen 3 PXIe backplane performance when used in the M9019A chassis. This enables system designers to fully benefit from the improved backplane speed of the chassis.

Keysight Technologies Australia Pty Ltd
www.keysight.com

ULTRA-WIDEBAND MMIC MIXER

Mini-Circuits has introduced the MDB-24H+ ultra-wideband double-balanced MMIC frequency mixer, which provides an RF and LO frequency range from 5 to 21.5 GHz and an IF frequency range from DC to 5 GHz. It is suitable for wideband systems such as defence communications and radar, as well as a wide variety of narrowband applications from Wi-Fi through Ku band.

The mixer operates on +15 dBm LO power and provides low conversion loss (6.9 to 10.3 dB), 44 dB L-I isolation, 28 dB L-R isolation and +21 dBm IP3. Fabricated using InGaP HBT technology, the unit integrates LO and RF baluns and comes housed in a 4 x 4 mm, 24-pad MCLP package with low inductance, repeatable transitions and good thermal contact to the PCB.

Clarke & Severn Electronics
www.clarke.com.au

CONNECTIVITY SOLUTIONS

FOR HARSH ENVIRONMENTS

*Mike Dabrowski**

The greatest difficulty in deploying RF-over-fibre systems in military applications has been the lack of ruggedised fibre optic connectors capable of meeting the stringent return-loss requirements needed for quality signal transmissions.

Defence departments around the world are pushing systems manufacturers to provide increasingly capable and efficient systems at current or, in some cases, even reduced costs. Major systems integrators are currently dedicating substantial resources to evaluate new techniques and technologies to reduce cost, improve system performance, and provide the best possible equipment to today's warfighter. One technology that is garnering substantial attention is RF-over-fibre.

RF-over-fibre is a cognomen for the technology that allows a high-frequency data-carrying RF signal to be transmitted via optical fibre. This technology is widely used in both the CATV and wireless telecommunications markets. It is now being investigated for use in a number of defence applications such as radar, satellite communications, and battlefield wireless technologies. In its simplest terms, an RF-over-fibre system modulates light with a radio signal, transmits that resulting analog optical signal over an optical fibre, and then re-converts the optical signal to a radio signal, typically with the purpose of broadcasting that signal over the air.

Copper vs fibre

Historically, RF transmissions have been made via copper wire, but there are numerous advantages to using optical fibre in defence applications. First, fibre optic cable is much lighter than copper cable. This weight savings is advantageous in making a system lighter and more easily transported and deployed by a soldier. It also reduces the overall weight of a vehicle or ship, which results in greater fuel efficiency. The weight savings can also be used to add additional equipment to the vehicle or ship. Second, fibre optic cable is not affected by electromagnetic interference nor does it create electromagnetic interference that might be detected

Image courtesy of 7th Army Joint Multinational Training Command (via Flickr) under CC BY 2.0

by enemy forces. Finally, optical signals can travel much farther than equivalent signals conducted on copper wire. This allows for greater distances between communications shelters and antennas, making military personnel in the field harder to detect.

The challenge of RF-over-fibre in military applications

The greatest difficulty in deploying RF-over-fibre systems in military applications has been the lack of ruggedised fibre optic connectors capable of meeting the stringent return-loss requirements needed for quality signal transmissions. RF signals transmitted on optical fibre are analog and as a result are quite susceptible to signal degradation caused by light reflected upstream into the transmitting laser. Excessive reflected light, typically caused by connection points or passive devices in the system, causes a destructive wave interference that adds noise to the optical signal. Most analog systems require a minimum return loss of 65 dB.

In commercial applications, angle-polished connectors (like the ubiquitous FC/APC connector) minimise return loss by directing reflected light out of the optical pathway through an eight-degree angled ferrule end face. The angled end face scatters the light rather than allowing it to reach the transmitting laser. Unfortunately, commercial connectors are not rugged enough to survive military applications. They perform poorly under vibration, shock, and in extreme environmental conditions. At critical times, they do not provide a reliable solution for conducting critical fibre optic signals.

Military-grade fibre optic connectors have been used in numerous applications over the last 15 years. These connectors are designed to provide precise optical alignment under extreme mechanical and environmental conditions. Most military systems that contain fibre optics use multimode fibre, but in the last five years single-mode fibre has become much more common. The use of single-mode fibre is expected to continue to increase in the future.

Single-mode fibre and angle-polished end faces

While the military connectors used with single-mode fibre are common and readily available, they are typically not able to meet the 65 dB return-loss requirement needed for quality analog optical signal transmission. The end faces on standard military fibre optic connectors have a spherical dome shape rather than an angled one. Most standard military single-mode connectors can offer, at best, 45 dB return loss. To meet 65 dB return loss for military applications, angle-polished end faces need to be added to the military fibre optic connector product suite.

Fortunately, a number of options for military fibre optic connectors with APC end faces are in development or available today. These connectors are based on existing and field-proven military fibre optic connectors, but with modifications to support the needed return loss requirements.

M28876 and APC28876

The APC28876, manufactured by Amphenol Fibre Systems International, is based on MIL-PRF-28876 connectors that have long been used by the US Navy as its primary tactical-grade shipboard fibre optic connector. The multi-channel M28876 is designed with the precision alignment needed for a quality optical connection. Additionally, it is designed to survive extreme mechanical shocks, high vibrations, and corrosive environments found at sea. The MIL-PRF-29504 termini are made with the most robust spring mechanism available. The spring force on the terminus allows the connector system to function under extreme mechanical loads. With single-mode fibre, one can expect a typical insertion loss of 0.4 dB per connection and a return loss of 45dB. While this is truly exceptional optical performance for standard digital requirements, it is insufficient for analog signals.

Another military-grade solution for APC connectors becoming popular in the market is based on the ARINC801 standard. These connectors, made by Amphenol, Radiall, and Sabritec, are derivative of the D38999 series connector. D38999 connectors were originally designed as electrical connectors. As such, the shells are not designed for precision alignment. The ARINC801 specification overcomes this deficiency by utilising precision inserts and a custom optical terminus. The ARINC801 termini are based on the commercially available LC connector, using the same ferrule and spring as a standard LC connector. When combined with the ARINC801 precision inserts, a quality APC connection system is achieved. Insertion loss is typically 0.4 dB, and the necessary 65 dB return loss is also achieved. The ARINC801 is suitable for high-vibration environments where mechanical shocks are not expected.

A third APC connectivity solution that is emerging and will likely become the dominant military-grade APC connector is based on the MIL-PRF-64266 specification. The MIL-PRF-64266 was developed by an industry working group managed under the auspices of the US Navy. Every major military fibre optic connector manufacturer participated in this group. At its heart, the M64266 standard combines the best optical performance characteristics and alignment features of the M28876 series with the best shell characteristics of the D38999 series. The M64266 connector uses a 1.25 mm ferrule combined with a terminus design reminiscent of the field-proven M29504 terminus. A robust 4lb spring provides excellent shock and vibration resistance. Insert-to-insert bottoming between mating connectors locks the terminus in place for increased stability. A suite of purpose-built backshells provides superior strain relief for virtually any cable type. As with the other solutions available, 0.4 dB insertion loss and 65 dB return loss are expected.

Since many RF-over-fibre optical systems operate at relatively higher optical power levels, terminus end-face cleanliness is another parameter critical to a highly functional connectivity system. Debris, contaminants, and scratches can all lead to optical signal degradation. In extreme cases, these defects can result in physical damage to the terminus end face during use. Proper cleaning using lint-free wipes and laboratory grade isopropyl alcohol is usually sufficient to prevent loss due to contaminants. As with end face geometry, commercial end face quality standards (such as IPC-8497-1) are applicable to military APC termini also.

High-performance RF-over-fibre optical communication systems hold great promise for advances in numerous areas of defence technology. From state-of-the-art radars to cutting-edge wireless battlefield communication systems, RF-over-fibre technology is poised to revolutionise military network technology. Recent advances in harsh-environment fibre optic connectivity bring this technology one step closer to the warfighter.

**Mike Dabrowski is currently shipboard market manager for Amphenol Fibre Systems International. He has more than 16 years of experience in the fibre optic connectivity market including more than 11 years specialising in harsh-environment fibre optic connectivity. For more information, please contact Robin Pearce, Bishop & Associates, via email at rpearce@bishopinc.com.*

Bishop & Associates
www.connectorindustry.com

new PRODUCTS

OPEN HARDWARE PLATFORM FOR INDUSTRIAL IoT APPLICATIONS

element14 and Sierra Wireless have launched the mangOH Green Open Hardware IoT Platform. The platform allows developers to test and prototype ideas quickly and take IoT solutions to market within weeks.

The complete sensor-to-cloud platform provides an all-in-one hardware, software and cloud-based solution for industrial IoT applications. Useful for data logging in a remote location, it is suitable for remote monitoring systems as well as multiple sensor, IoT and cloud-based applications.

At the heart of the board are two industrial-grade CF3 connectors to enable the use of either an AirPrime HL Series module or an AirPrime WP Series applications processor module from Sierra Wireless. The AirPrime WP Series cellular modem provides the device-to-cloud architecture enabling IoT developers to build a Linux-based product on a single module.

element14
au.element14.com

20 W DC/DC CONVERTER

RECOM's isolated 20 W DC/DC converter, the RP20-FR series, is specially designed for railway applications. It is also a suitable choice for industrial and telecommunication applications.

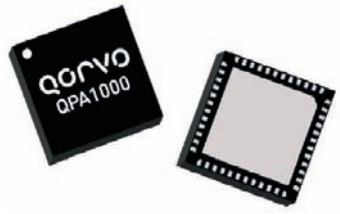
The compact 2″ x 1″ modules feature a wide 4:1 input voltage range (9–36, 18–75, 43–160 V) and therefore cover all standard battery-board levels, including the ±40% tolerance margin. Besides 3.3, 5, 12 and 15 V single outputs, dual ±12 and ±15 V outputs are also available. The control pin logic can be chosen to be positive or negative.

The converters have an efficiency of up to 89% and feature a wide Tx operating temperature range of -40 to +85°C (-HC versions with premounted heatsink). The temperature range is achieved by natural convection.

The modules are EN50155 certified with EN50121-1-3-2, EN61373 and UL/cUL-60950-1 approvals.

RECOM Power GmbH
www.recom-power.com

50 W GaN AMPLIFIER



Qorvo's QPA1000 is a high-power, S-band amplifier fabricated on the company's QGaN25 0.25 μm GaN on SiC production process. Covering 2.8 to 3.2 GHz, the product provides greater than 47 dBm of saturated output power and greater than 24 dB of large signal gain, while achieving more than 58% power-added efficiency.

The 50 W GaN amplifier can support a variety of operating conditions and system requirements. With good thermal properties, it can support a range of bias voltages and will perform well under pulse applications. It has dimensions of 7 x 7 x 0.85 mm.

The device is matched to 50Ω, with integrated DC blocking caps on both I/O ports. It is suitable for use in commercial and military radar systems.

Wireless Components
www.wirelesscomponents.com.au

ECOMPASS

Using the latest electronic compass (eCompass) from STMicroelectronics, smartphones, smart watches, fitness trackers and other wearables will get better at guiding users and mapping their sporting achievements even where satellite navigation cannot work. The product is said to offer an improvement over current eCompass solutions, which can give errors of about 10°.

ST's LSM303AGR eCompass cuts the heading error to less than 4°. This enhanced accuracy, combined with ultralow-power operation consuming up to 50% less than competing devices when in low-power mode, is well suited to high-precision pedestrian dead reckoning (PDR) on mobile devices. The product also enhances dead-reckoning accuracy in applications such as automotive navigation and maintains accuracy over the full temperature range from -40°C to 85°C.

As an all-in-one eCompass IC fabricated on a single die, the device combines a 3-axis MEMS accelerometer leveraging ST's ThELMA technology and a compact 3-axis anisotropic magnetoresistive (AMR) sensor that delivers higher sensitivity and lower noise than conventional Hall sensors. ST's AMR manufacturing process technology gives the product good temperature stability compared to alternatives made using giant magnetoresistive (GMR) or tunnel magnetoresistive (TMR) technology. The AMR sensor also has high dynamic range, which further contributes to the accuracy by preventing magnetic saturation in areas of high ambient field strength.

STMicroelectronics Pty Ltd
www.st.com

BIT ERROR RATE TESTER

Keysight Technologies has introduced the M8040A high-performance BERT for testing PAM-4 and NRZ devices. Engineers in validation labs and R&D who characterise receivers on the physical layer for the next generation of data centre interconnects will benefit from simplified test set-ups and repeatable results.

The highly integrated BERT supports PAM-4 signals up to 64 Gbaud and NRZ signals up to 64 Gbps. The pattern generator module provides built-in de-emphasis, jitter injection and an optional second channel. Engineers and designers can select PAM-4 and NRZ in the user interface, eliminating the need for external combiners, cabling and deskew to provide PAM-4 signals. The analyser module provides true PAM-4 error analysis in real time for long PRBS and QPRBS patterns. This allows for proofing even low bit error ratios and symbol error ratios with the required confidence.

Keysight Technologies Australia Pty Ltd
www.keysight.com

WI-FI MODULES WITH CONCURRENT MODE

GainSpan's latest firmware release enables a module to operate both as a Wi-Fi station and a Limited AP in a time-multiplexed manner, giving the user the perception of concurrent Wi-Fi station and Limited AP mode operation. The networking mode is made possible by the dual-core architecture of the GS2000 SoC along with large memory resources.

The Limited AP mode interface in concurrent mode supports up to 16 client devices with WPA2-PSK encryption. This client device support gives OEM designers and embedded engineers the flexibility to architect their IoT device to meet all their technical needs while providing an easy development experience and designing a cost-effective solution.

Concurrent mode creates a networking mode for IoT devices where they can act as a station and as Limited AP on two separate networking interfaces concurrently. When using GainSpan modules at both ends, concurrent mode enables battery-powered devices such as sensors to sleep longer and to maintain network connectivity without having to wake up periodically unless there is meaningful data to transmit.

Applications include concurrent mode provisioning, uninterrupted field diagnostics and creating personal area networks (PAN).

Glyn Ltd
www.glyn.com.au

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With a wide variety of Vector Network Analyzers (VNAs) to suit your application and budget, Anritsu has the perfect solution to your VNA needs.

From RF to THz and value to high performance, Anritsu allows you to select the right VNA for you. Designers can choose the VectorStar® family for premium measurement performance while manufacturers can utilize the ShockLine™ family for speed and cost-effectiveness.

Our extensive range of VNAs now includes the NEW 2 or 4-port ShockLine performance line (with NEW E-band option) and the world's first 40 GHz USB VNA.

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MICROSTEPPING MOTOR DRIVER ICS

Allegro MicroSystems' A5976, A5977 and A5979 microstepping motor driver ICs, with built-in translators, have been designed to operate bipolar stepper motors in full-, half-, quarter-, eight- and sixteenth-step modes.

The ICs have the output drive capability of 40 V and ±2.8 A and include a fixed off-time current regulator that has the ability to operate in slow-, fast- or mixed-decay modes. This results in reduced audible motor noise, increased step accuracy and reduced power dissipation.

Simply inputting one pulse on the STEP input drives the motor one step or microstep. The interface is a suitable fit for applications where a complex microprocessor is unavailable or overburdened, such as the office automation and industrial automation markets, including textile and sewing machines, vending machines, printers, scanners, copiers, closed circuit TV camera positioning, ATM machines, 3D printing systems and food industry applications.

Internal synchronous rectification control circuitry is provided to improve power dissipation during PWM operation. Internal circuit protection includes overcurrent protection thermal shutdown with hysteresis, undervoltage lockout and crossover-current protection. Special power-up sequencing is not required.

The devices are supplied in a <1.2 mm, 28-pin TSSOP with an exposed thermal pad. The package is lead-free, with 100% matte-tin lead-frame plating. The operating ambient temperature range is -40 to 105°C.

Digi-Key Corporation
www.digikey.com

FILM CAPACITORS

AVX Corporation has released a high-voltage series of dry, medium-power film capacitors for DC filtering applications, such as the DC filtering of high-frequency ripple currents and decoupling DC links in AC/AC and DC/AC motor drive inverters.

Rated for 1.5 to 3 kV, the FFLI Series capacitors comprise a combination of dry, metallised polypropylene film and a no-free-oil solution sealed in a cylindrical aluminium case filled with self-extinguishing polyurethane resin. This composition equips the series with controlled self-healing technology that prevents potential explosions resulting from the avalanche effect, enables a benign failure mode consisting exclusively of capacitance losses and ensures safe performance over lifetimes of up to 100,000 h.

Available in a wide range of voltage and capacitance values, the capacitors exhibit low DCL, ESR and ESL, high current handling capabilities and good high-frequency performance and capacitance retention with frequency. They are suitable for use in AC/DC power converters, renewable energy inverters, rolling stock and oil drilling applications.

Mouser Electronics
www.mouser.com

MEMBRANE SWITCHES

Membrane switches are a suitable alternative to mechanical switches in electronic applications where visually appealing, durable inputs are required. They are a good choice for many industries, including the medical, manufacturing, mining and transportation sectors. They can be completely sealed, making them dustproof, moisture resistant and tough in harsh environments.

There are many variations of membrane switches, but the most common are tactile and non-tactile switches. Tactile membrane switches provide immediate feedback to the user, while non-tactile membrane switches do not, and they generally have a thinner profile.

Membrane switches can be constructed with multiple circuit layers, incorporating features such as embossed (domed) keypads, tactile responsive (clicker) stainless steel domes, integrated LEDs and resistors. This can provide the designer with virtually limitless capabilities to create a custom user interface.

Screen Process Circuits has a fully equipped graphic/engineering design and artwork creation facility. Offering everything from prototypes to full production volumes, the company works closely with clients to ensure specific customer requirements for both performance and visual aesthetics are met.

Screen Process Circuits
www.screenprocesscircuits.com.au

Maintaining control has never been easier.

If decentralised drive intelligence is called for, maxon motor control provides the answer: all speed and positioning controllers are designed to match with brushed and brushless DC motors up to 700 watts power. The EPOS2 positioning controller enables you to connect quickly through the network and, using the Interpolated Position Mode, to synchronously run a preset path specified by interpolating points in real time.

maxon motor is the world's leading supplier of high-precision drives and systems.

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maxon motor

driven by precision

new PRODUCTS

PANEL INDICATOR

Marl's 690 Series, available in a range of colour options, can be used for portable, external and high-vibration applications. The product is UL approved and is suitable for status panel indication.

The series features a black anodised aluminium housing and a flat water clear lens. It is sealed to IP67, making the device weatherproof. Bipolar circuitry means the product is suitable for AC or low-voltage DC in any orientation. The optional 'D' mounting style aids anti-rotation.

The series is also available in infrared. LED colours, voltage options and flying leads are available for semicustom projects.

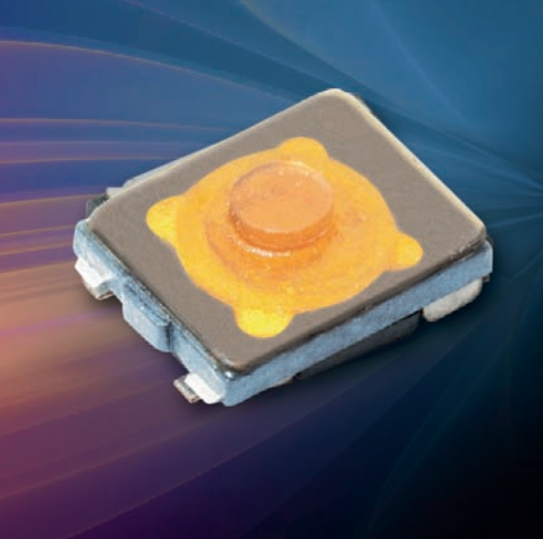
Aerospace & Defence Products
www.aerospacedefenceproducts.com.au

POWER-CONVERSION ICS FOR 48 V DATA CENTRE ARCHITECTURE

STMicroelectronics has implemented direct digital power conversion from 48 V by developing a family of ICs to support the complete range of data centre power-conversion applications. The direct digital power conversion eliminates intermediate conversion stages to minimise power loss in data centres from power distribution, as well as to reduce space and cooling requirements.

The STRG02, STRG04 and STRG06 ICs are fully compliant with Intel's VR12.5 (Haswell and Broadwell), VR13 (Skylake) and DDR3/4 voltage-regulation specifications and all FPGAs and ASICs for data centre applications. The three chips, together with ST's low-voltage StripFET power-MOSFET family, assure robust and efficient system operation at input voltages from 36 to 72 V, with output voltages between 0.5 and 12 V. These specifications confirm power efficiency of >97% at 12 V/500 W and high system bandwidth using minimal PCB space.

STMicroelectronics Pty Ltd
www.st.com



DOUBLE-ACTION SWITCHES

C&K Components has introduced the KXT2 Series of compact, long-lifetime, double-action switches. The top-actuated switches feature an ultraminiature 3.7 x 3 x 1.05 mm footprint, an integrated actuator with a 1.2 mm-diameter surface area and 100,000 cycle life spans.

Suitable for use in next-generation, ultracompact electronics, including wearable electronics, mobile phones, hearing aids, portable electronics, personal healthcare monitoring systems, and action and surveillance cameras, the series offers two actuation forces, each with their own distinctive and stabile tactile feeling, which helps users differentiate between the first and second actions. They are well suited to infrared reflow soldering in accordance with IEC61760-1.

The switches feature a dual-action, single-pole, double-throw, normally open (SPDT NO) contact arrangement and G-type SMT terminations designed to take up minimal board space (4.4 x 3.1 mm). Maximum voltage for the momentary action switches is 12 VDC and maximum current is 50 mA. Insulation resistance at 500 VDC is 100 MΩ, contact resistance is less than 500 mΩ and bounce time is less than 10 ms. The operating temperature spans -40 to +85°C.

Switches Plus Components Pty Ltd
www.switchesplus.com.au

STRAIN RELIEF HOUSING

ODU has developed a strain relief housing for the ODU-MAC. This is an add-on housing that protects the termination against harsh environmental conditions such as blows, dirt and liquids and provides optimal strain relief of the cables, as well as easier handling.

The aluminium housing allows for individual strain relief and the addition of extra circuit boards and component parts in the protected interior. A feed-through ground connection is also available.

The product has been made specifically to take the challenges of the automatic docking situation and is available for all six automatic docking frames.

Clarke & Severn Electronics
www.clarke.com.au

COMPACT UNIVERSAL 100 AND 150 W POWER SUPPLIES

RECOM's compact RACG100 and RACG150 modules supply 100 or 150 W continuously without active cooling, regardless of whether they are horizontally or vertically mounted.

The RACG100 series power supplies are capable of delivering a constant 100 W output and feature short circuit and overload protection. They can be safely operated between -20 and +60°C and come with outputs of 5, 12, 24 or 48 VDC.

With additional features, the RACG150 series has overvoltage and overtemperature protection and is capable of delivering 150 W power. The modules can be safely operated between -20 and +70°C and come with 12, 24 or 48 VDC outputs.

At 120 x 98 x 37.6 mm (RACG100) and 160 x 98.3 x 37.6 mm (RACG150), the power supplies are said to be more compact than comparable industrial units. High-quality components and professional manufacturing methods ensure long life and trouble-free operation in critical industrial applications.

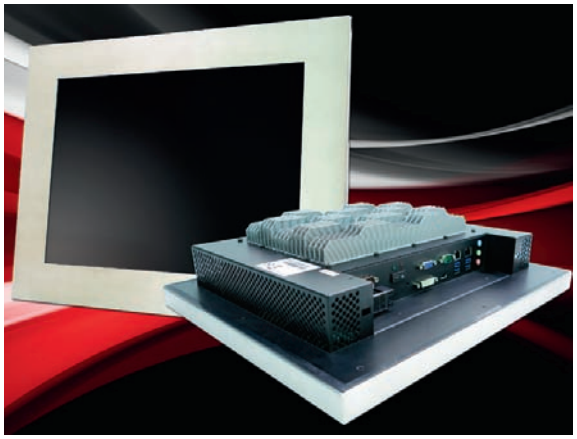
Both series operate at an efficiency of 88% at a wide input voltage range of 90–264 VAC (120–370 VDC). Their integrated Class B filters (EN55022), high isolation between input and output (3 kVAC/min) and full safety certifications (EN/UL/CSA 60950) ensure a high-quality product.

RECOM Power GmbH
www.recom-power.com

RUGGED TOUCH PANEL COMPUTERS

Perfectron's LIF Series of rugged touch panel computers features onboard Intel CPUs. The systems support a wide operating temperature range of -30 to +60°C and a wide voltage input range of 9–24 VDC or 100–240 VAC (optional). The series supports rich I/O features such as VGA, DVI, COM, LAN, USB, audio and an mPCIe expansion slot.

The specially designed anti-removable USB 2.0 port at the rear of the panel PC provides a secure space for a USB connection and avoids unexpected removal or theft. The port has a cover that provides resistance against dust, making it suitable for outdoor applications.



The series is based on the Intel Atom/Core i7 processor and features a high-brightness LCD panel for easy readability under industrial conditions. The 15″ LCD support XGA resolution (1024 x 768) with 5-wire resistive touch, which makes it suitable for applications such as automation, HMI and warehouse management.

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

IoT PORTAL

The Telit IoT Portal is a unified platform of services that makes it easy for people to connect their things to their apps. Seamlessly integrate any edge device, production asset or remote sensor with any app or back-office system.

Whether the user is managing thousands of global IoT devices or just starting out, the portal provides complete access to a range of enterprise-grade features, tools and resources. In addition, it offers full access to maintenance, 24/7 support and ongoing upgrades.

Powered by the deviceWISE IoT platform, the portal allows users to connect, integrate and manage with visibility, control, interoperability and intelligent insight across the IoT value chain. The single-vendor, single-portal management solution features services, resources and tools enabling application, administration and security, data management, device management, connectivity management and connectivity data plans.

The portal offers petabytes of scalable storage with built-in redundancy and data backup. The multitenant structure also provides full separation between cloud organisations to ensure complete privacy and security.

The service enables users to quickly and easily integrate data from any number of devices with their cloud applications. Combining multiple streams of IoT data enables users to populate their dashboards with real-time information and transfer actionable-intelligence to their web-based and mobile apps. It also allows users to send device data to back-office databases and analytic systems, enabling them to gain insights about their operations.

Glyn Ltd
www.glyn.com.au

HIGH-SPEED BRUSHLESS DC MOTORS

maxon motor has released the ECX series of high-speed brushless DC motors. With speeds up to 120,000 rpm, quiet operation and little heat emission, the motors are suitable for handheld tools and industrial spindles.

The brushless DC motors come in three sizes with diameters of 8, 16 and 19 mm. The drive systems can be configured online with the option of planetary gearheads and encoders. The user can select, for example, different shaft lengths, winding types or ball bearings. The processes are automated and the product is dispatched within 11 working days.

In addition to the ECX brushless DC motors, maxon motor will expand on the X drives range. The ECX22 brushless DC motor will be added, along with two power stage options and the ability to be sterilised.

maxon motor Australia Pty Ltd
www.maxonmotor.com.au

DESIGNER CRYSTALS

FOR MORE POWERFUL ELECTRONICS

A new process to grow designer crystals, known as 'metal organic frameworks' or MOFs, could lead to a new breed of faster, more powerful electronic devices. The process uses vapour — rather than liquid — to grow crystals.

"Just like your smartphone doesn't like being dropped in water, electronic devices don't like the liquid solvent that's used to grow MOF crystals," said CSIRO researcher Mark Styles.

While crystals could significantly boost the processing power of microelectronics, until now they could only be grown and applied using a liquid solvent, making them unsuitable for electronics applications.

The method, invented by an international team of scientists from CSIRO, the University of Leuven in Belgium and the National University of Singapore, has been published today in the journal *Nature Materials*.

"On the atomic scale, MOF crystals look like bird cages that can be tailor made to be different shapes and sizes.

"They have an extremely large surface area, meaning they can be up to 80% empty inside," said Styles.

"The net result is a structure where almost every atom is exposed to empty space: one gram of MOF crystals has a surface area of over 5000 square metres — that's the size of a football field.

Dr Mark Styles alongside CSIRO's specialist X-ray analysis equipment.

"Crucially, we can use this vast space to trap other molecules, which can change the properties of a material.

"In the case of electronics, this means we can fit a lot more transistors on a microchip, making it faster and far more powerful."

The international team, which was led by Ivo Stassen and Professor Rob Ameloot from the University of Leuven in Belgium, drew on specialist X-ray analysis techniques from CSIRO and the Australian Synchrotron to understand how the vapour process works, and how it can be used to grow the MOF crystals.

According to Dr Styles, the applications for MOFs are only be limited by your imagination.

"Another potential use for this technology would be in portable chemical sensing devices that could be used in hazardous environments such as chemical processing plants and underground mines," he said.

ELECTRONEX 2016

ELECTRONICS DESIGN AND ASSEMBLY EXPO

When: 14–15 September 2016
Where: Australian Technology Park, Sydney
Website: www.electronex.com.au

ElectroneX, Australia's only dedicated trade event for the electronics industry, returns to Sydney on 14–15 September at Australian Technology Park. With around 100 exhibitors and a technical conference featuring leading international industry experts, this is truly an event not to be missed.

This year's event continues to reflect the move towards niche and specialised manufacturing applications in the electronics sector and will also cater for the increasing demand from visitors for contract manufacturing solutions. There is expected to be a record number of exhibitors participating in this year's event as the industry is seeing an upturn in demand from local manufacturers and specialist applications that are recognising the expertise and quality that is available from Australian-based suppliers.

The event targets electronics design professionals; electronic and electrical engineers and technicians; along with OEM, scientific, IT and communications professionals and service technicians. ElectroneX was launched in 2010 to provide professionals across an array of industry sectors with the opportunity to learn about the latest technology developments for systems integration and production electronics, and the last Sydney show in 2014 attracted over 1000 trade and industry visitors. The SMCBA Electronics Design & Manufacture Conference (founded in 1988) will bring together local and international speakers to share information critical to the successful design and development of leading-edge electronic products and systems engineering solutions. A series of free seminars with overviews on key industry topics will also be held on the show floor throughout the two-day event.

The conference will include the following presentations and the complete conference and seminar program can be found on the show website at www.electronex.com.au.

- Dr S Manian Ramkumar, Director – Center for Electronics Manufacturing and Assembly, Rochester Institute of Technology, will deliver three presentations: Defect Analysis and Process Troubleshooting; Characterising and Minimising Voids in QFN Device Assembly Using Lead Free Solder Alloys; and Root Cause Analysis for Reliability Issues in Electronics Packaging.
- Dale Lee, Plexus Corporation, Staff DFX Process Engineer, will deliver two presentations: DFX Design for Excellence: DFM, DFA, DFT and More; and Flex PCB Design and Assembly.
- Simon Blyth, Director of Engineering, LX Group, will deliver a presentation on the Internet of Things.
- Dr Hamish Laird, ELMG Digital Power, will deliver a presentation on High Performance Digital Control.
- Mark Steiner, Managing Director, Hetech, will deliver a presentation entitled To Design or not to Design a Commercial View to Product Development.

STAND C8
DIN RAIL TIMER

The S0080 is a versatile timer with a 35 mm DIN rail mount, including four switched 24 V output and four closing contacts that activate simultaneously. It also features a terminal cover.

The product allows a total of 50 event switching times. Each can be set to turn on any single day of the week or on multiples days for up to 24 h. Switching events programmed for multiple days count as only a single station and each of the 50 event times may be set to any output. Manual override is provided.

Altronic Distributors Pty Ltd
www.altronics.com.au

STAND B17
PRESSURE MOULDING MACHINE

The LPMS Beta 300 is a low-pressure moulding machine for small-, medium- or high-volume production. It enables the efficient encapsulation of various electronics including PCBAs, cable connections, connector terminations and other items.

The low-pressure moulding process is said to remove the manufacturing steps and costs associated with other traditional processes such as potting into machined enclosures, producing a better finished product. The machine allows this technology to be introduced into any workspace with its reduced footprint and bench-mountable design.

The unit is fully featured in spite of its compact size, with in-built ejection, safety features and PLC operation included. Melt-on-demand technology can be fitted to increase efficiency.

Tarapath Pty Ltd
www.tarapath.com.au

STUDENTS ARE USING

'SMART' SPY TECHNOLOGY TO CHEAT IN EXAMS

Ritesh Chugh, CQUniversity Australia

Students at a medical college in Thailand have been caught using spy cameras linked to smartwatches to cheat during exams. They used wireless spycams in eyeglasses to capture exam questions, transmit them to associates elsewhere and receive responses through linked smartwatches.

But the entrance exam in question was cancelled after the plot was discovered and Arthit Ourairat, the rector of Rangsit University, posted pictures of the hi-tech cheating equipment on his Facebook page.

The cheating attempt has already been compared to Hollywood's classic spy dramas but it shows how easily such high-tech devices are available to those who seek to gain an unfair advantage in educational pursuits.

Unfortunately, it's a problem that will only get worse when devices such as smartglasses become cheaper and more readily available.

Smartglasses such as Google Glass have the capability to take photos, send information and also display information on the lens itself, eliminating the need to connect to a smartwatch.

Smartwatch ban

It was around this time last year that universities globally started banning, or at least exploring a ban on, smartwatches in exams.

Smartwatches are considered an aid to cheating in exams because they give easy access to stored text and images, language translation, mathematical calculations and internet access.

Subsequent bans on smartwatches were also introduced by school boards for Year 12 exams in Australia.

But a blanket ban on all watches – traditional or smart – could be on the horizon, especially because it is difficult and impractical for exam invigilators to differentiate between the two in an exam environment.

Other gadgets

It's not just smartwatches we need to worry about. A plethora of hi-tech cheating gadgets exist that would also not look out of place in a James Bond or Mission Impossible film.

These are devices such as special glasses with a built-in transmitter and a separate wireless earpiece, aimed at establishing a two-way secretive audio communication between people during exams.

There is a device marketed as a Cheating Watch that can store PDF, Word and other documents. But it also has a super-fast emergency button that locks other buttons and displays only the time when approached by any suspecting exam invigilator.

Many other devices are offered for covert cheating in exams through wireless audio transmission.

There is even an Invisible Watch that appears to display nothing when the watch is switched on. But when viewed with special glasses sold with the watch, the screen becomes visible and you can see any uploaded content, such as your exam cheat notes.

An open market

Before you criticise me for giving away details of these devices, I should point out that there is a very open marketplace where they are being spruiked and sold as gadgets to aid cheating in exams. They are not hard to find.

Similar devices are also being sold on Amazon and eBay, companies that appear to claim no ethical responsibility for what is being sold on their platforms. Prices range from as little as A$40 up to A$600, depending on the features.

Although these devices could be used for legitimate purposes, the marketing of such gadgets to students for cheating in exams is an issue that is plaguing educational institutions.

Globally, educational institutions abhor the erosion of academic integrity and want students who are smart with gadgetry – not smart-cheaters. The dilemma facing exam administrators is deciding which devices to ban and how.

Spy camera glasses used by the exam cheats. Arthit Ouraira/Facebook

Similar to the ban on mobile phones in exams, any devices capable of storing, transmitting, receiving and displaying digital information should also be banned.

So, as a starting point, a ban on watches – traditional and smart – for now is the way forward.

In order to eliminate the problem of differentiating between watches in an exam environment, some Australian universities have already implemented bans on all wristwatches. Others across Australia and the world should follow suit.

As newer surreptitious technologies emerge, educational institutions will have to come up with better plans to combat these new ways of cheating, and devise solutions that could range from banning devices to scanning for radio signals as was done using drones in an exam in China!

Ritesh Chugh, Senior Lecturer (Information Systems Management), *CQUniversity Australia*

This article was originally published on The Conversation.

ElectroneX 2015

STAND A19

150 V, 20 ADC POWER SUPPLY

The Sorensen DCS150-20E power supply is suitable for a wide range of applications requiring DC power in small form factors. Applications range from manufacturing test and burn-in of automotive components, avionics electronics, telecommunications and consumer products, to beam steering, process control and laboratory R&D. It is available to rent from TechRentals.

The power supply features high power density with low ripple and noise. It offers constant voltage and current mode as well as remote sensing. The user-friendly device can be controlled from the front panel with 10-turn potentiometers to adjust current, OVP and voltage settings.

The unit has LEDs that indicate remote programming, overtemperature, overvoltage protection and shutdown. It can be operated via remote control through the use of LAN or RS232. The design platform ensures the power supply is suitable for years of continuous use.

TechRentals
www.techrentals.com.au

STAND D24

UNSEALED ENCLOSURES FOR INDOOR USE

OKW has launched an unsealed (IP41) version of its robust DATEC-COMPACT handheld enclosures for indoor applications. Modern and ergonomic, the product offers integrated contacts as an option, providing an all-in solution for charging and data transfer.

The enclosures are manufactured from ASA+PC-FR (UL 94 V-0) for added strength and UV stability. They are assembled with tamperproof Torx T10 screws. Applications include mobile data recording, measuring and control, stock and sales logging, medical, laboratory and environmental technology.

Cases are available in three sizes: S (136 x 74 x 32 mm), M (172 x 92 x 39 mm) and L (206 x 110 x 47 mm). The top section features a large recess for a membrane keypad or product label. Accessories include battery contact kits (AAA and AA), desk stations, wall holders, non-slip feet, self-tapping PCB screws (PZ1 2.5 x 6 mm), carry cases (four sizes) and a Torx T10 screwdriver.

All units in the range — enclosures, desk stations and wall holders — can be specified with built-in contacts for charging 3 x 1.5 V AAA or AA cells. Units can be specified with or without a battery compartment and in two standard colours: off-white or lava grey.

Customising options include: custom colours; EMC shielding; CNC machining; lacquering; digital, tampo and silk-screen printing; membrane keyboards; installation and assembly of accessories; display windows; adhesive foils; and plastic and aluminium panels.

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

STAND A6

ARBITRARY FUNCTION/ARBITRARY WAVEFORM GENERATOR

The Tektronix AWG4000 Series portable three-in-one signal generator, with its basic, advanced and digital modes, can be easily shared across design teams to meet a wide variety of signal generation needs, ranging from radar and wireless communications to embedded systems design and research applications.

For many modern electronics designs, engineers need to generate frequently used waveforms easily and quickly, but may also need to generate more complex waveforms with many degrees of flexibility. The signal could be as simple as a clock with constant frequency in an embedded design or as complex as a mix of modulated waveforms in parallel with digital patterns in radar and communications designs. The AWG4000 Series has the flexibility to meet such a broad set of requirements.

As a signal generator, the product is up to nearly any task. It offers two analog channels, up to 2.5 GS/s sampling rate, 750 MHz bandwidth, 14-bit vertical resolution, up to 64 Mpt/ch arbitrary memory, sequence with up to 16,384 entries and 32-bit digital channels.

For simple tasks, the unit offers a basic arbitrary/function generation (AFG) user interface. For more complicated tasks, the instrument offers a user interface to generate complex sequences and modulated signals in parallel with digital outputs.

Vicom Australia Pty Ltd
www.vicom.com.au

STAND D11

VACUUM SOLDERING PROCESS

ASSCON's invention of the vapour-phase vacuum soldering process has set a milestone for industrial electronic production, according to the company. The vacuum soldering process has proved a successful solution for constantly challenging soldering tasks while process windows were getting continuously smaller.

In the MultiVacuum process, PCBs are subjected to several vacuum applications during the soldering stages, with the option of applying vacuum both before and during the melting of the solder paste.

Applying vacuum before the liquidus temperature is reached is particularly useful for removing any voids encapsulated and caused by printing or pick-and-place processes — eg, while scooping out the soldering paste during the printing process — even before the soldering paste is molten. This way the voiding opportunity is eliminated before the heating process is even started.

The process also enables void-free solder joints where products with an above-average outgassing opportunity are concerned (eg, a high number of layers in multilayer, large processors). Gases entering the solder joint in a first vacuum stage can additionally also be effectively removed from the still liquid solder joint in subsequent vacuum stages.

Suba Engineering
www.suba.com.au

STAND A9

HDI PRINTED CIRCUIT BOARDS

Lintek is offering its clients copper-filled 'via in pad' technology for BGA devices down to 0.35 mm pitch. The company provides blind, buried and castellated vias on multilayer circuit boards manufactured on a wide variety of dielectrics.

Lintek creates total solutions for the most demanding environments. Its boards are used in a wide range of industries, from cutting-edge military EW systems to amateur electronics projects. The company says it values all clients, no matter what the requirement.

Lintek has IPC-A-600 certified staff and trainer on-site. All PCBs are manufactured to IPC Class 2 minimum. Certification is available on request.

The company is compliant with Quality System AS/NZS ISO 9001:2008. Subject to material and process constraints, it is able to produce boards with Underwriters Laboratories (UL) approval.

Lintek Pty Ltd
www.lintek.com.au

STAND D9

POWER MODULES

The second-generation SEMITOP fulfils SEMIKRON's aim to offer a safe supply chain to users. The packages represent the SEMITOP platform's natural evolution at the same high performance levels, set to offer a good footprint, a flexible architecture and high-performing solutions.

The platform is centred around modules with 12 mm height without baseplate, with two lateral mounting screws coupled with a solder-free pin grid philosophy. Full compatibility with existing standard industrial packages is ensured.

The latest Si and SiC chip technologies can be integrated, offering a competitive platform that is able to address the power modules demanding environment where high performance, innovation and differentiation are the key winning factors. Due to a comprehensive portfolio with a large variety of configurations, SEMITOP E1 and E2 can address markets such as UPS, solar, motor drives, power supplies and the emerging EV battery charger market.

Semikron Pty Ltd
www.semikron.com.au

STAND C6

MINIATURE ENCLOSURES

To house small PCBs using USB as the external power and signal interconnect, Hammond Electronics is launching more sizes of its 1551 miniature family. They are 35, 50 or 65 mm long, 20, 25 or 30 mm wide and all 15.5 mm high.

The 1551USB IP54 ABS enclosures are a traditional lid and base design. The sizes have been chosen to provide prototype builders and small volume OEMs generous room for their PCB. All versions feature a dedicated cut-out for a standard USB Type A plug in one end and have a recess in the lid for an inlay, label or HMI keypad.

Each size is available in five colours with a satin texture finish: RAL 9011 black, RAL 7035 grey, translucent clear, translucent smoke and translucent red. Custom colours can be supplied.

To reduce time to market and modification costs, all 1551USB enclosures are available factory modified with machining and silk screening to the user's specification. To help with the design process, AutoCAD and PDF dimensioned drawings can be downloaded from the Hammond website.

Hammond Electronics Pty Ltd
www.hammondmfg.com

STAND A12

ELECTRONICS CONTRACT MANUFACTURER

GPC Electronics is an electronics contract manufacturer whose business model centres on providing manufacturing solutions at low overall cost and risk. The company's focus is on making customers more competitive by managing complex business issues.

The company specialises in the introduction, manufacture and support of complex mid-to-high-volume and high-mix products. Its capabilities and expertise 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
www.gpc.com.au

STAND D9

MEDIUM-VOLTAGE POWER MODULE

The SEMITRANS 20, from SEMIKRON, overcomes the limits of conventional medium-voltage module concepts and provides a design approach for inverters in applications such as transportation, industrial drives and grid infrastructure. Optimised for the medium-voltage market with the latest 3.3 kV IGBTs, the product is designed as a half-bridge configuration featuring a built-in temperature sensor and opposite DC and AC power terminals.

Compared to conventional modules, the stray inductance is said to be reduced by up to 75%, thus providing higher operational safety and easy paralleling. The device allows a high degree of scalability and flexibility in medium-voltage inverter design. The standardised package meets the increasing demands for higher efficiency and durability for power electronics in industry, transportation and infrastructure.

Semikron Pty Ltd
www.semikron.com.au

STAND C18

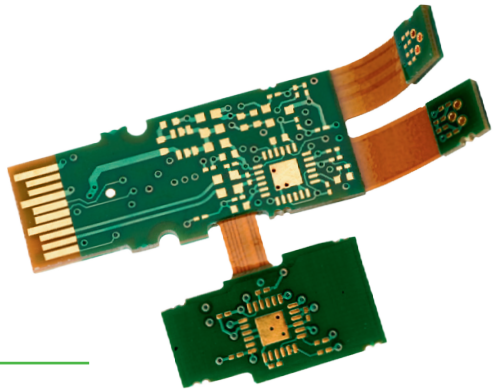
ELECTRONICS DESIGN AND MANUFACTURING

Electronics design and manufacturing has been the foundation of Hetech for 25 years. The company is committed to providing innovative design and manufacturing solutions whilst building relationships of trust with its customers.

Hetech's design resources are backed by a team of qualified and experienced in-house and contracting electronic engineers. The collaboration of various skill sets has resulted in the design and manufacture of a range of innovative products for the defence, avionics and mining industries.

Based in Brisbane, the company's state-of-the-art facility offers 800 m^2 of manufacturing space. An additional 4000 m^2 of space, enabled through partner companies in the Philippines and China, allows Hetech to service high-volume production requirements for its customers.

Hetech
www.hetech.com.au



STAND A14

EXPRESS PCB AND ASSEMBLY SERVICES

QualiEco Circuits provides quality electronic manufacturing services and solutions. The company offers express services in all product categories, with customised delivery solutions. Customers can choose from fast to semifast and normal delivery options based on their budget and urgency.

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

STAND D13
DIGITAL MULTIMETER

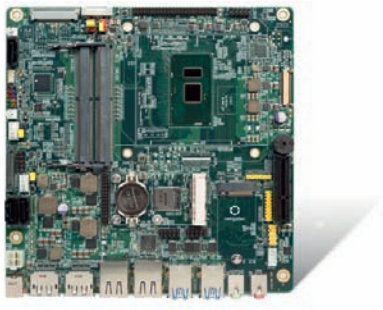
The NI PXIe-4081 7½-digit high-performance DMM and 1.8 MSa/s isolated digitiser offers engineers the flexibility, resolution and isolation needed to tackle challenging applications that require smarter test systems in industries ranging from consumer electronics to aerospace and defence.

The PXI Express DMM features 15 ppm accuracy for DC voltage measurements up to two years after calibration. It is capable of voltage measurements from nanovolts to 1 kV and resistance measurements from micro-ohms to giga-ohms. A solid-state current shunt configuration offers eight DC current ranges from 1 μA to 3 A and six AC rms current ranges from 100 μA to 3 A.

The product occupies a single 3U PXI slot and provides good channel density for high-channel-count systems, delivering 17 DMM channels in a single PXI chassis occupying 4U of rack space. For high-throughput applications, the isolated digitiser mode can acquire DC-coupled waveforms in all voltage and current ranges with a 1.8 MSa/s maximum sample rate. By changing the digitiser sampling rate, engineers can vary the resolution of the digitiser from 10 to 23 bits for speed and accuracy.

National Instruments Aust Pty Ltd
www.ni.com/oceania

STAND B20
THIN MINI-ITX BOARD



congatec has introduced the Thin Mini-ITX boards with Intel processors with high scalability, ranging from 2 GHz Intel Celeron processors up to 3.4 GHz Intel Core i7 processors. The product offers a fully configurable thermal design power (TDP) from 7.5 to 15 W and up to 32 GB of DDR4 RAM as well as 4K multiscreen support.

The boards are suitable for a wide variety of industrial applications such as fanless HMIs, control and SCADA systems, powerful and robust kiosk or retail systems, to slot machines and digital signage. Due to their flat design with a height of just 20 mm, they are also suitable for slim panel and industrial all-in-one PC designs.

The boards are equipped with the dual-core U-series SoC versions of the 6th generation Intel Core processors. The scale starts with the entry-level 2 GHz Intel Celeron 3995U processor and then ranges from the Intel Core i3 6100U (2.3 GHz) and i5 6300U (2.4 GHz, 3 GHz turbo) up to the Intel Core i7 6600 with a maximum turbo clock rate of 3.4 GHz. Depending on the processor variant, the boards offer a configurable TDP from 7.5 to 15 W, making it easy to align with the energy concept of the application.

congatec Australia Pty Ltd
www.congatec.com

STAND D24

ENCLOSURE CUSTOMISATION SERVICE

OKW Gehäusesysteme has a versatile range of design-oriented plastic enclosures and tuning knobs. However, the requirement for customisation can also be fulfilled by the company's in-house service centre. All conceivable technologies are used to adapt the products to specific customer requirements.

One possibility is mechanical processing, such as milling, drilling, tapping, stamping or engraving. A customer-specific appearance can be achieved with screen or tampo printing, and digital printing directly on the enclosure is particularly impressive; images, colour gradations and more can be printed in photographic quality.

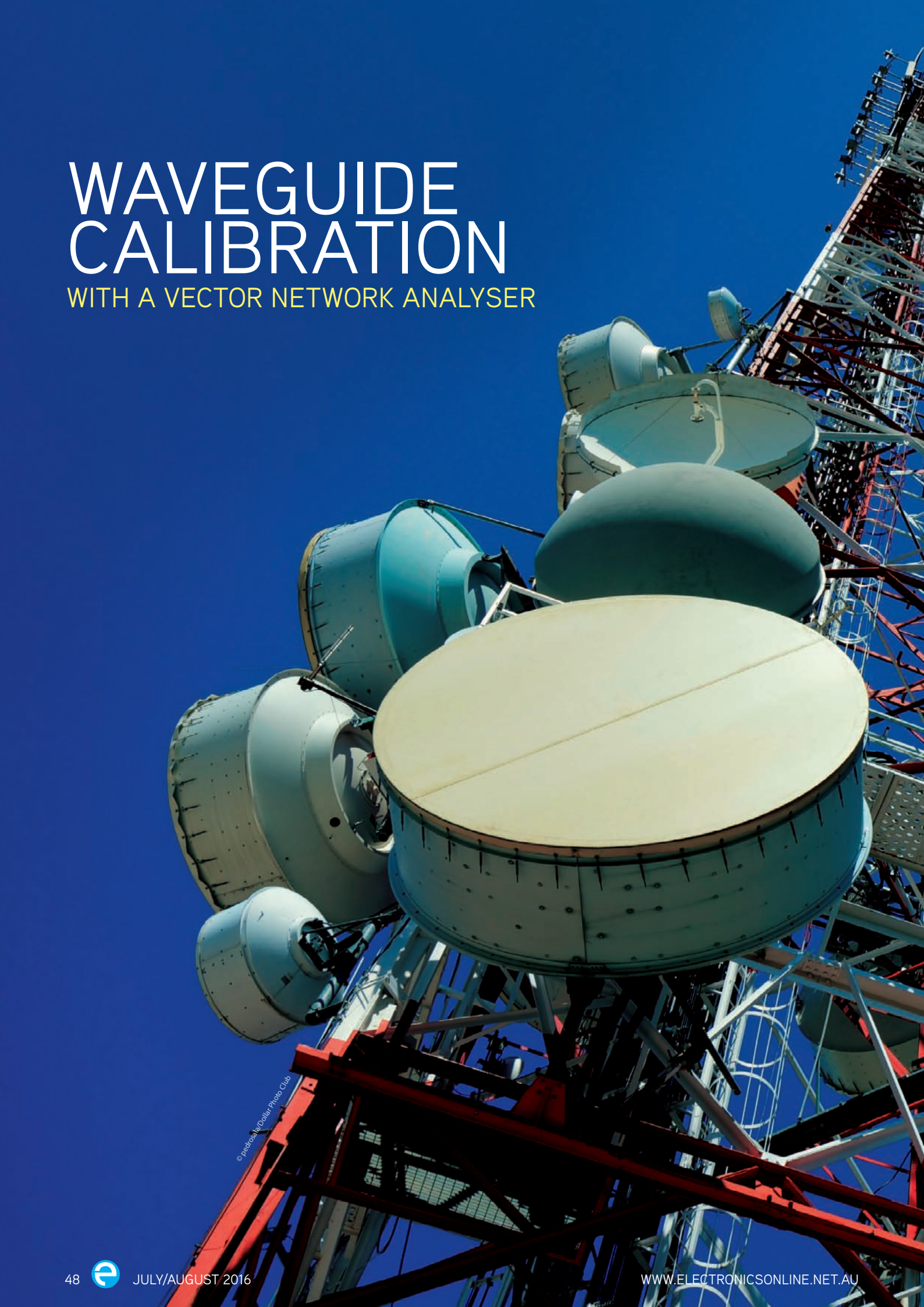
The company offers custom moulding in special materials and colours, coloured lacquering in different degrees of gloss and metallic and soft-touch coatings. To protect electronics from external interference and from emission noise, EMC aluminium coating of the internal surfaces is also possible.

For the optimum operation of components, finished decor foils and membrane keypads can be integrated on request. High quality is guaranteed by certification in accordance with DIN EN ISO 9001 and 14001, as well as with UL 746C for the ALVACOAT (EMC coating) method. As a further service, the company can offer the assembly of accessory parts, eg, cable glands, display windows and handle sets, the application of foils or additional attachment pillars.

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

WAVEGUIDE CALIBRATION

WITH A VECTOR NETWORK ANALYSER



Waveguide components possess certain advantages over their counterpart devices with coaxial connectors: they can handle larger power and exhibit lower loss. Therefore, it is very common to employ waveguide interfaces in high-power devices, such as microwave transmitters.

The performance of waveguide components at microwave frequencies is typically measured with a vector network analyser (VNA). However, when measuring the performance of waveguide components with a VNA, non-idealities of any uncalibrated VNA introduce uncertainty in the measurement results. This article describes how to perform an SSL (SHORT-SHORT-LOAD) calibration with a Copper Mountain Technologies VNA.

Calibration

Measurement errors can be classified as random errors or systematic errors; examples of random errors are noise fluctuations and thermal drift in electronic components, changes in the mechanical dimensions of cables and connectors subject to temperature drift, repeatability of connections and cable bends, etc. Thus, random errors are unpredictable and cannot be compensated by calibration.

On the other hand, systematic errors include impedance mismatch, frequency response of cables and adapters, leakage of signals in the test set-up, etc. As systematic errors are repeatable, their effects can be reduced by applying mathematical corrections to the measurement results. In most cases, systematic errors are the dominant sources of measurement uncertainty, so calibration is an important step for maximising measurement accuracy.

Systematic errors are calculated by measuring precision devices with predefined characteristics. The process is called calibration and the precision devices are called calibration standards. Commonly used calibration standards are SOLT (SHORT-OPEN-LOAD-THRU), SSLT (SHORT-SHORT-LOAD-THRU) and TRL (TRANSMISSION-REFLECT-LINE). The measured results of the calibration standards are then used to correct the measurement results, and the process of correction is called error correction.

Numerous mathematical models are presented in the literature, with the most commonly used being 12-term and 3-term error models for 2-port and 1-port measurement respectively. This article is limited to 1-port calibration and the 3-term error model, but the same concepts extend to the 2-port tests with correspondingly more sophisticated error models.

Mathematical model for 1-port calibration

1-port calibration measures and removes three systematic error terms (directivity, source matching and reflection tracking) from reflection measurements. A directivity error (E_d) occurs when a portion of the generated signal — the incident signal — leaks to the reflected signal path. A source match error (E_s) results from mismatch between the source port and the input of the DUT. The reflection tracking (E_r) error is caused by the differences between the frequency responses of the reference receiver and the test receiver. The signal flow diagram for 1-port measurements is shown in Figure 1, where the a_0 and b_0 receivers are measuring the incident and reflected signals, respectively.

It can be seen in Figure 1 that the actual S11a of the DUT is different than the S11m that we measure with a VNA due to the presence of the three systematic error terms. Solving the signal flow diagram yields a bilinear relationship between the actual and the measured S11, as shown in Equation 1.

Calibration standards for 1-port calibration

The bilinear relationship between the actual and the measured S11 of the DUT depends on three error terms, as shown in Equation 1. Therefore, at least three independent calibration standard measurements are necessary to obtain the three error terms. The most commonly used calibration standards in 1-port measurement scenarios are SHORT, OPEN and LOAD. These calibration standards provide very distinctive reflection coefficients that are helpful to solve the 3-term error model in the case of coaxial measurements.

However, a waveguide OPEN standard acts more as an antenna rather than a calibration standard. Therefore, for waveguide calibration, SSL standards are more often used as the calibration standards with the lengths of the two SHORT standards separated by at least λ/4 at the centre frequency of operation. The differences in length of the two SHORT standards are necessary for effective variable separation of Equation 1.

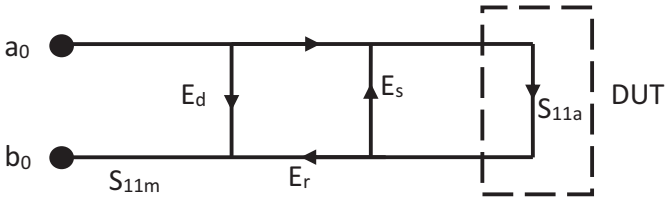


Figure 1: Signal flow diagram for 1-port measurement.

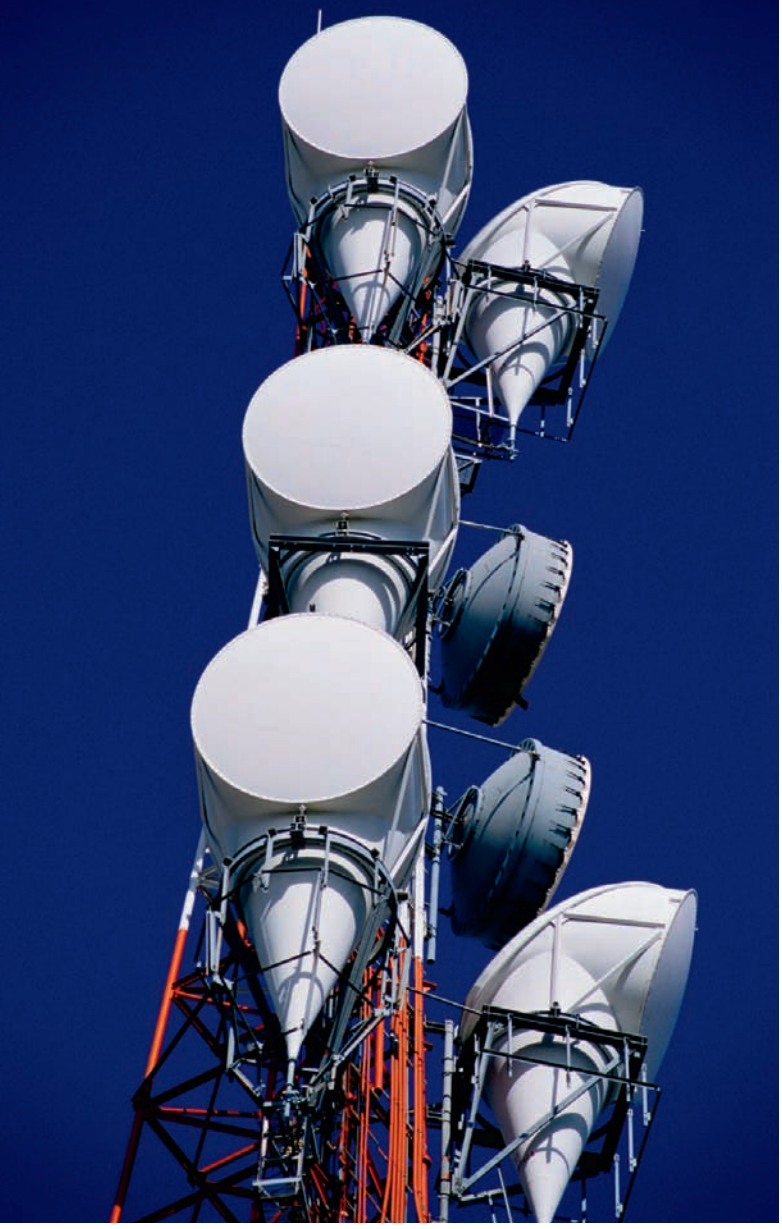
$$S_{11a} = \frac{S_{11m} - E_d}{E_r + (S_{11m} - E_d)E_s}$$

Equation 1.

Defining waveguide calibration standards in CMT VNA

CMT VNAs support any standard waveguide calibration kit, and more recent software versions include a predefined assortment of widely used waveguide calibration kits. However, if a special waveguide calibration kit needs to be defined in the VNA, parameter calculations might need to be performed.

The required parameters for defining the calibration kit in the VNA include the waveguide cut-off frequency, the operating frequency range and the delay of the offset SHORT calibration standards. These parameters can be calculated from the information provided in the waveguide calibration kit manufacturer's datasheet.



Model no.	Waveguide size	Passband operating frequency (GHz)	Min passband return loss (dB)	Max passband insertion loss (dB)	Reject band (GHz)	Min rejec-tion (dB)	Length (in)
M1052-4	WR229	3.7 to 4.2	28	0.035	5.785 to 6.425	60	6.5

Table 1: Datasheet of the MITEC M1052-4 bandpass filter.

$$f_c = \frac{c}{2a}$$

Equation 2.

$$f_{low} = f_c \times 1.25 \qquad f_{high} = f_c \times 1.89$$

Equations 3 and 4.

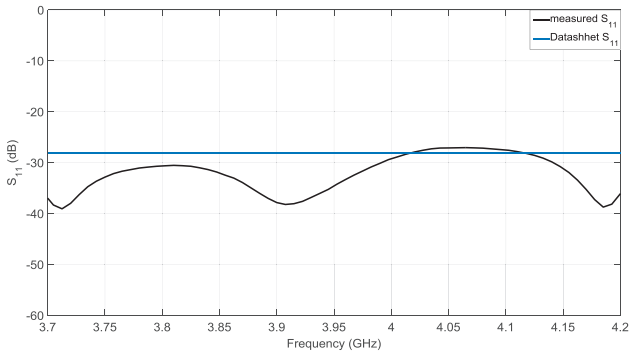


Figure 2: Measured S11 of the waveguide bandpass filter.

> ONCE THE CUT-OFF FREQUENCY AND THE OPERATING FREQUENCY RANGE ARE DETERMINED, THEN THE DELAY OF THE OFFSET SHORT CAN BE FOUND FROM THE DATASHEET PROVIDED BY THE MANUFACTURER.

The definition of calibration standard parameters for waveguide calibration kit is different than that of coaxial calibration kits. Waveguide does not support the TEM (transverse electromagnetic) mode of wave propagation as do co-axial components; instead it supports TE (transverse electric) and TM (transverse magnetic) modes. TE and TM modes have limited bandwidth; in fact, none of these modes can propagate at frequencies below a minimum frequency known as the cut-off frequency.

Therefore, the first parameter to be calculated is the cut-off frequency. The cut-off frequency depends on the largest dimension of the waveguide as shown in Equation 2, where *a* is the larger dimension of the waveguide.

The lowest and the highest operating frequency are related to the cut-off frequency by Equations 3 and 4.

Once the cut-off frequency and the operating frequency range are determined, then the delay of the offset SHORT can be found from the datasheet provided by the manufacturer. All the calculated values can be inserted in the calibration standard table of the CMT VNAs. Once the calibration standards are defined, the VNA is ready to be calibrated with a waveguide calibration kit.

Example of 1-port measurement of a waveguide device with CMT VNAs

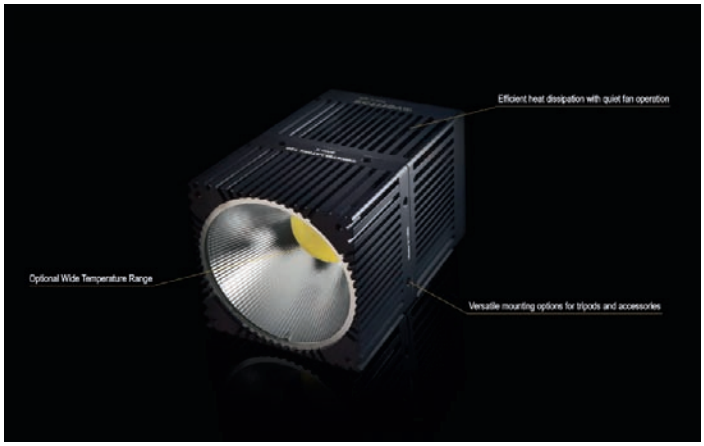
In this section, 1-port reflection (return loss) measurement of a waveguide bandpass filter will be demonstrated. The WR229 waveguide calibration kit has been used to calibrate out the 3-error terms. The calculation of the calibration standard coefficients is as discussed in the last section. The DUT (device under test) for this measurement was chosen to be an old M1052-4 from MITEC of unknown condition. The datasheet of the DUT is provided in Table 1.

It can be seen in Table 1 that the S11 of the DUT should be -28 dB or lower in the frequency range of 3.7 to 4.2 GHz. The measured S11 of the DUT is shown in Figure 2. As can be seen, the device under test is not quite meeting its datasheet specifications.

Conclusion

In this article, calibration of CMT VNA with a waveguide calibration kit has been explained. The calculations for defining calibration standards in the VNA have also been presented. Finally, the VNA was calibrated with a WR229 waveguide calibration kit and the calibrated VNA was used to measure the S11 of a suspect bandpass filter.

Clarke & Severn Electronics
www.clarke.com.au



HIGH-SPEED ILLUMINATION LIGHTS

Veritas illumination lights are used for high-speed imaging applications and use LED technology coupled with multifunctional digital controls to achieve efficient illumination. Compact and energy efficient, the systems yield high luminous outputs in both continuous and pulsed operation. Cool operation and portability make them suitable for laboratory as well as studio use.

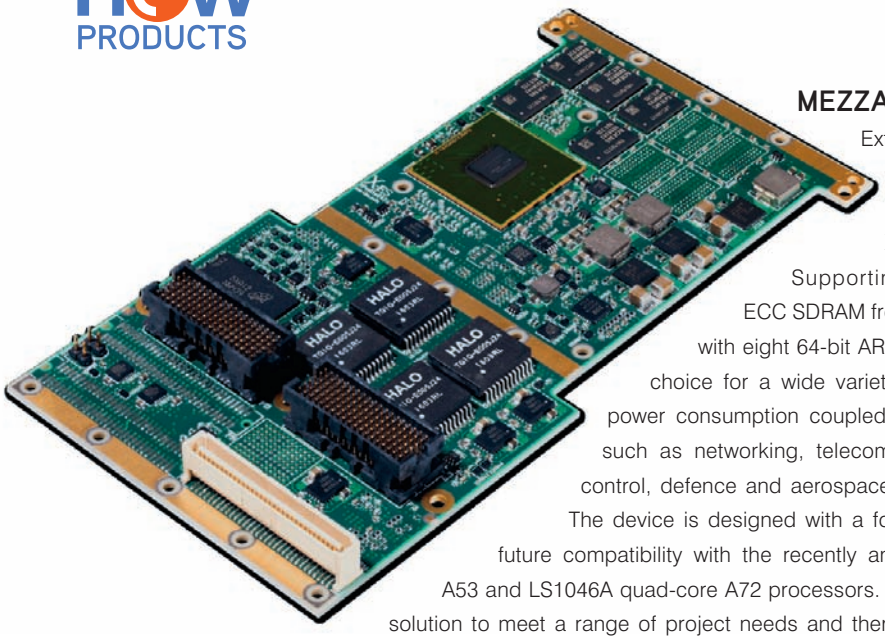
The illuminators can be used as standalone units or in multiples when combined with the LED Access Point and support operation in continuous or strobe mode. The Constellation luminaires are offered in either a 60 or 120 W configuration.

The Constellation 60 series comprises a 12 LED array designed to deliver maximum light output in an ultracompact and lightweight arrangement. Active cooling allows extended use, lensing provides uniform light distribution and the lights have compact construction and anodised surfaces for increased durability. White light colour temperature is 6650K and the estimated LED lifetime is 35,000 h.

The Constellation 120 series provides a high-intensity luminous output (20,000 lm). Specially designed accessories and flexible mounting options make the light easy to deploy in a wide range of applications. White light colour temperatures of 2700K, 3000K, 3500K, 4000K, 5000K and 5600K are available, while the estimated LED lifetime is 40,000 h.

The Constellation 500Quad system combines four miniConstellation light heads into one package. 4″ spacing between the centres of each LED creates a symmetrical grid. Designed for use as a standalone unit or stackable in user-defined configurations, white light colour temperatures of 5000K, 2700K, 3000K, 3500K and 4000K are available. The estimated LED lifetime is 40,000 h.

SciTech Pty Ltd
www.scitech.com.au



MEZZANINE MODULE

Extreme Engineering Solutions (X-ES) announces its first NXP QorIQ ARM-based board, the XPedite6401 XMC/PrPMC mezzanine module. Supporting up to 16 GB of DDR4-2100 ECC SDRAM from its NXP LS1088A ARM processor with eight 64-bit ARM A53 cores, the product is a good choice for a wide variety of applications that demand low power consumption coupled with high-performance processing such as networking, telecom, wireless infrastructure, industrial control, defence and aerospace applications.

The device is designed with a focus on long life cycle support and future compatibility with the recently announced NXP LS1088A octal-core A53 and LS1046A quad-core A72 processors. It will provide a scalable processing solution to meet a range of project needs and thermal requirements.

The product's pinout is compatible with previous X-ES products, giving users the ability to upgrade XMC/PrPMC modules with a current ARM processor. It can be built with both P16 and P14, providing up to four 1000BASE-T ethernet ports.

For those requiring additional ethernet ports or faster connections, the unit can be built optionally with a QSGMII and XFI connection to P16, providing four Gigabit Ethernet ports and one 10 Gigabit Ethernet port. The LS1088 processor configuration can be built with two QSGMII and two XFI connections to P16.

Metromatics Pty Ltd
www.metromatics.com.au

CXPI TRIGGERING AND DECODE OPTIONS FOR OSCILLOSCOPES

Keysight Technologies has announced the clock extension peripheral interface (CXPI) decoding and triggering options for InfiniiVision 3000T and 4000 X-Series oscilloscopes. These are claimed to be the only oscilloscopes available, which can decode and trigger on the CXPI bus, that are used primarily in automotive applications.

Using an oscilloscope to test and debug the signal integrity (physical layer) of CXPI signals is critical for ensuring error-free transmission of data. InfiniiVision oscilloscopes can decode and trigger on specific errors (optionally filtered by frame ID) such as CRC errors, parity bit errors, data length errors, interbyte space errors, interframe space errors, sample errors and framing errors. Detection and elimination of bus errors during the design phase is crucial for automotive safety.

Keysight Technologies Australia Pty Ltd
www.keysight.com

AUTOMOTIVE MICROCONTROLLERS

STMicroelectronics has launched the SPC58 family of automotive microcontrollers, heralding the advent of more secure and connected cars.

Dedicated to car body and security applications, the MCU family is composed of three product lines — the SPC58 B-Line, the SPC58 C-Line and the SPC58 G-Line — which offer from 512 KB to 6 MB of embedded Flash memory. The high level of scalability allows the range to address the need for in-car automotive networks with high bandwidth and strong in-vehicle security.

The devices combine ethernet and ISO CAN FD communication interfaces with the latest hardware security module (HSM) technology to ensure functional integrity of the car's electronic control units (ECUs), intrusion detection and protection against malicious attacks. ST's in-house embedded Flash (eFlash) 40 nm process technology integrates high performance and automotive-grade reliability in a small package, enabling car gateways and body modules to be smarter, smaller and lighter.

Suitable for in-car standalone and integrated gateways, the product is a good companion MCU for camera or telematics applications. There is easy portability of applications from SPC56 to SPC58, with high re-use of existing software, development tools and hardware experience. Other features include ASIL-B compliance; multicore architecture, high system frequency and fast memory-access time; and assured security via the built-in HSM and related security firmware.

STMicroelectronics Pty Ltd
www.st.com

IoT-SPECIFIC GATEWAYS

Running on the Intel Quark X1000 Series SoCs, AAEON's AIOT-QA, AIOT-QG and AIOT-QM IoT-specific gateways are created and built to enable an IoT lifestyle both indoors and outdoors. The devices ensure a flexible and secure option for implementing IoT.

The AIOT-QA and AIOT-QG are built for indoor use, with the former attuned for industrial automation with a DIN rail-mountable design while the latter tends towards general-purpose applications. Both devices carry I/Os such as analog-to-digital converters (ADC) and DI/Os that are beneficial for allowing the system to understand parameters such as temperatures, humidity, luminance, water level, etc, for autonomous monitoring and control.

The AIOT-QM has an IP67 design and a wide operating temperature range of -20 to 70°C, making it conducive to outdoor use. All of its onboard I/Os, such as LAN, USB, COM, ADC and DI/O, are specially designed with M12 connectors to discourage intrusion of solid and liquid and reinforce protection against them. As such, mating connectors are required to realise the device's true potential.

The IoT gateways enable users to securely aggregate, share and filter data for analysis and edge processing, thereby reducing cloud network traffic in cases where raw data does not have to be sent to the cloud. Edge processing also leads to faster response times and lower data subscription costs, especially if cellular technology is used for backhaul connection to the cloud.

Glyn Ltd
www.glyn.com.au

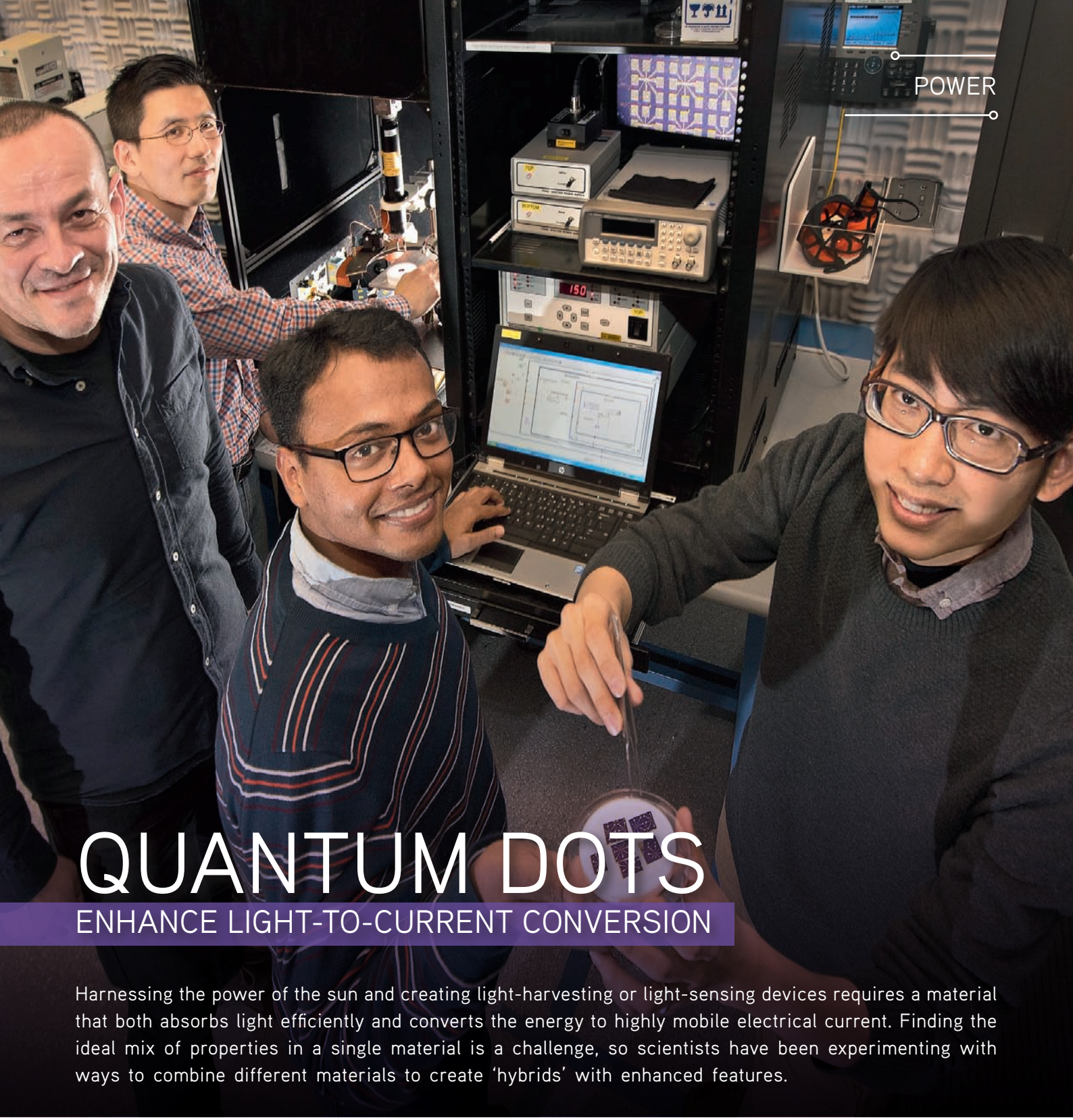
MCU DEVELOPMENT KIT

Texas Instruments' MSP CapTIvate microcontroller (MCU) development kit is a comprehensive, easy-to-use platform providing real-time sensor tuning, all without writing a single line of code. The modular design, easy-to-access data and application-orientated approach of the MSP430FR2633-based MCU board contained within the kit make it suitable for application in thermostats, whitegoods and personal electronics.

The kit contains a CAPTIVATE-FR2633 target MCU module, CAPTIVATE-PGMR eZ-FET with EnergyTrace technology and HID communication bridge, CAPTIVATE-ISO UART, I2C, SBW isolation board, CAPTIVATE-BSWP self-capacitance demo, CAPTIVATE-PHONE mutual capacitance demo with haptics and guard channel and CAPTIVATE-PROXIMITY proximity detection and gesturing demo.

The MSP430FR2633-based MCU board, a programmer/debugger board with EnergyTrace technology, measures energy consumption with the TI's Code Composer Studio integrated development environment (IDE) and sensor boards to evaluate self-capacitance, mutual capacitance, gesture and proximity sensing. Users can evaluate the MSP430FR2633 microcontroller with CapTIvate touch technology, which provides a high-resolution capacitive-touch solution. MSP MCUs with CapTIvate technology are low-power capacitive-touch MCUs with 10 V_{RMS} noise immunity and support for dirtproof, glove-friendly designs.

element14
au.element14.com



QUANTUM DOTS

ENHANCE LIGHT-TO-CURRENT CONVERSION

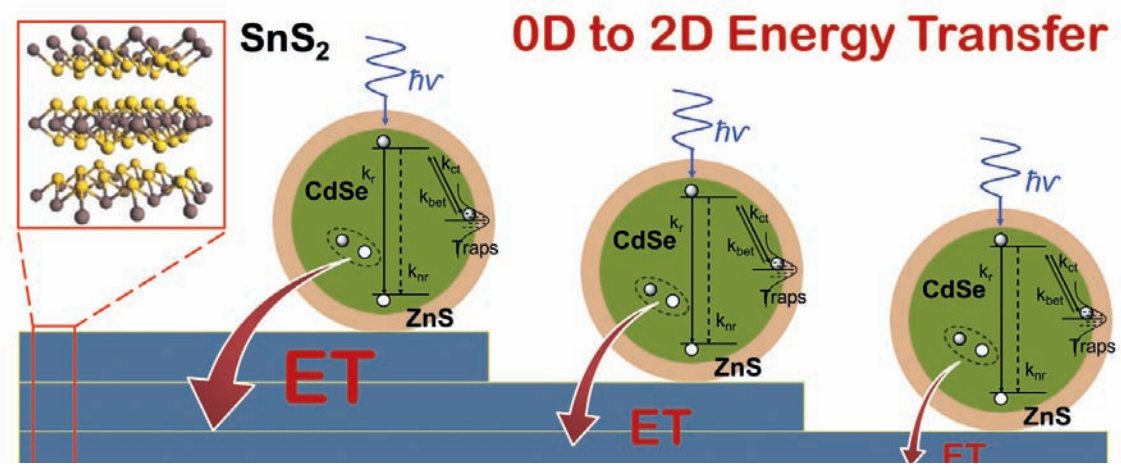
Harnessing the power of the sun and creating light-harvesting or light-sensing devices requires a material that both absorbs light efficiently and converts the energy to highly mobile electrical current. Finding the ideal mix of properties in a single material is a challenge, so scientists have been experimenting with ways to combine different materials to create 'hybrids' with enhanced features.

Researchers from the US Department of Energy's Brookhaven National Laboratory, Stony Brook University and the University of Nebraska have described one such approach that combines the light-harvesting properties of quantum dots with the tuneable electrical conductivity of a layered tin disulfide semiconductor. The hybrid material exhibited enhanced light-harvesting properties through the absorption of light by the quantum dots and their energy transfer to tin disulfide, both in laboratory tests and when incorporated into electronic devices.

"Two-dimensional metal dichalcogenides like tin disulfide have some promising properties for solar energy conversion and photodetector applications, including a high surface-to-volume aspect ratio," said project leader Mircea Cotlet, from Brookhaven Lab's Center for Functional Nanomaterials. "But no semiconducting material has it all. These materials are very thin and they are poor light absorbers. So we were trying to mix them with other nanomaterials, like light-absorbing quantum dots, to improve their performance through energy transfer."

A paper published in the journal *ACS Nano* describes a fundamental study of the hybrid quantum dot/tin disulfide material by itself. The work analyses how light excites the quantum dots (made of a cadmium selenide core surrounded by a zinc sulfide shell), which then transfer the absorbed energy to layers of nearby tin disulfide.

"We have come up with an interesting approach to discriminate energy transfer from charge transfer — two common types of interactions promoted by light in such hybrids," said Stony



Single-nanocrystal spectroscopy identifies the interaction between quantum dots and two-dimensional layered tin disulfide as a non-radiative energy transfer, whose strength increases with increasing number of tin disulfide layers.

Brook University graduate student Prahlad Routh, co-first author of the paper. "We do this using single-nanocrystal spectroscopy to look at how individual quantum dots blink when interacting with sheet-like tin disulfide. This straightforward method can assess whether components in such semiconducting hybrids interact either by energy or by charge transfer."

The researchers found that the rate for non-radiative energy transfer from individual quantum dots to tin disulfide increases with an increasing number of tin disulfide layers. But performance in laboratory tests isn't enough to prove the merits of potential new materials. So the scientists incorporated the hybrid material into a photo-field-effect-transistor — a type of photon detector commonly used for light-sensing applications.

As described in a paper published in *Applied Physics Letters*, the hybrid material dramatically enhanced the performance of the photo-field-effect transistors, resulting in a photocurrent response (conversion of light to electric current) that was 500% better than transistors made with the tin disulfide material alone.

"This kind of energy transfer is a key process that enables photosynthesis in nature," said Chang-Yong Nam from the Center for Functional Nanomaterials, co-corresponding author of the second paper. "Researchers have been trying to emulate this principle in light-harvesting electrical devices, but it has been difficult particularly for new material systems such as the tin disulfide we studied. Our device demonstrates the performance benefits realised by using both energy transfer processes and new low-dimensional materials."

> THE HYBRID MATERIAL DRAMATICALLY ENHANCED THE PERFORMANCE OF THE PHOTO-FIELD-EFFECT TRANSISTORS, RESULTING IN A PHOTOCURRENT RESPONSE THAT WAS 500% BETTER THAN TRANSISTORS MADE WITH THE TIN DISULFIDE MATERIAL ALONE.

The research paves the way for using these materials in optoelectronic applications such as energy-harvesting photovoltaics, light sensors and LEDs. According to Cotlet, "The idea of 'doping' two-dimensional layered materials with quantum dots to enhance their light-absorbing properties shows promise for designing better solar cells and photodetectors."

new PRODUCTS

3 W DC/DC CONVERTERS

RECOM's 3 W DC/DC converter series, RI3, features a compact size and ultrahigh power density. Despite their small size, the modules can be operated over a wide temperature range from -40°C to +85°C without derating. When derated down to 60% power, the modules can achieve up to +100°C operating temperature.

Fit into a compact SIP4 case (11.5 x 10.2 x 7.6 mm), almost the size of a coffee bean, the converters are suitable for applications where space is limited. They have an operating efficiency up to 90% and can be operated down to 0% load. The multitude combinations of input voltages (5, 12, 15 or 24 VDC), output voltages (5, 9, 12 or 15 VDC) and an I/O isolation of 1, 2, or 3 kVDC make the converters suitable for virtually any industrial application.

The modules feature an integrated input filter (in accordance to EN 55022 class A) and do not require additional components. They are IEC/EN/UL-60950-1 certified.

RECOM Power GmbH
www.recom-power.com

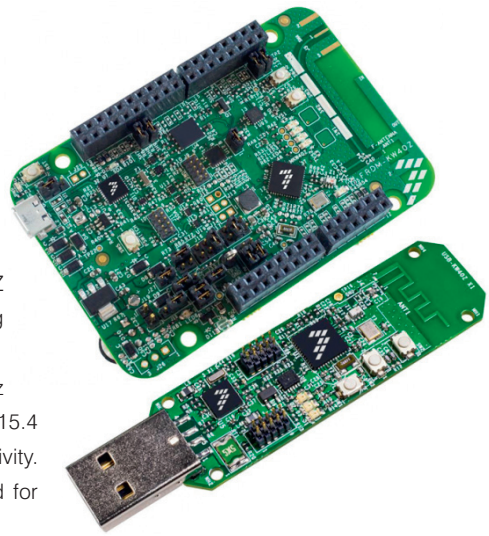
LED PANEL INDICATOR

The 524 Series is a high-quality, 8.1 mm mounting, professional LED panel indicator. Featuring a precision turned stainless steel housing and high-performance internal circuitry, the series is designed for a range of voltage options and includes a reverse protection diode.

Ingress protection and panel sealing to IP67 is offered and full mounting hardware is included. Available in a range of LED colour options, the product includes a coloured diffused Fresnel lens to enhance output and viewing angle, while eliminating potential for glare.

The series has been specifically designed for applications operating in demanding environments, such as industrial process control panels, instrumentation and switchgear, for example, for food manufacture and marine environments where the operator requires clear, decisive equipment status indication.

Aerospace & Defence Products
www.aerospacedefenceproducts.com.au



DEVELOPMENT PLATFORMS FOR IoT PROJECTS

The NXP FRDM-KW40Z development platform is enabled by the Kinetis W series KW40Z family and is suitable for applications in the IoT space, including home automation, building automation and health care.

Built on the ARM Cortex-M0+ processor, the product features an integrated 2.4 GHz transceiver supporting Bluetooth Smart/Bluetooth Low Energy (BLE) v4.1 and/or IEEE 802.15.4 standards. The kit contains two boards, enabling point-to-point, out-of-the-box connectivity. Each board can be configured as a Freedom development board or as a Freedom shield for connection to a host processor.

The hardware is form-factor compatible with the Arduino R3 pin layout, providing a broad range of expansion board options. The product also features a 2.4 GHz radio with PCB F-antenna, which can be by-passed for connection to test equipment via SMA connection, multiple power supply options, push and capacitive touch buttons, switches, LEDs and integrated sensors.

The USB-KW40Z is the same development platform as the FRDM-KW40Z but available on a convenient USB dongle form factor. It can be used as a Bluetooth Smart/Bluetooth Low Energy and/or IEEE 802.15.4 packet sniffer or development board for optimal connectivity and efficiency. Packet sniffers are important for wireless network development, allowing over-the-air traffic monitoring. BLE and 802.15.4 protocols enable the continued development of power-efficient IoT applications, including BLE functionality in health and fitness wearables.

element14
au.element14.com

POWER SUPPLIES

The TRIO 2 Power Supply range, from Phoenix Contact, is suitable for machine building, water operations, industrial and manufacturing plants, building services, renewable energy, ship building and process technology.

The devices deliver peace of mind for users as their robust design and quality components provide a continuous flow of power. They have a high MTBF (mean time between failure) value of more than 1 million hours at 40°C due to the quality components inherent in the smart design.

The series provides for the starting of heavy loads with an overload capability of 150% for 5 s, due to its dynamic boost feature. This securely absorbs starting currents and short overload situations during operation without a drop in output voltage.

The devices' rugged electrical and mechanical design ensures that they can withstand high shock and vibration. They can endure high electrical transient surges due to increased isolation between the input and output connections.

The push-in connection technology on the front of the range enables fast and easy connection. The wiring of the devices is tool-free, minimising the opportunity for human error. The range features an extensive temperature range of -25 to +70°C and device start-up at a low -40°C.

Available in three-phase or single-phase models, the power supplies deliver high performance for long-term applications.

Phoenix Contact Pty Ltd
www.phoenixcontact.com.au

AQUEOUS CLEANER

Electrolube's aqueous cleaning solution, Safewash Total, can be used for military and commercial applications. The product provides cleaning performance to military cleanliness standards (ANSI-J-001B/IPC TM-650) at minimal environmental cost.

Designed for cleaning printed circuit boards, the cleaner is suitable for the removal of leaded, lead-free and no-clean flux residues. It is also suitable for the removal of pastes and adhesives from screens, stencils, boards and accessories, as well as general degreasing applications.

The low-foam cleaner has been developed with a specially formulated blend of non-flammable solvents, which form a micro-emulsion when mixed with water. It is suitable for use in dishwasher and inline pressure systems, as well as ultrasonic and spray under immersion applications.

Supplied as a concentrate, the product has an in-built corrosion inhibitor, allowing for the safe cleaning of sensitive metals, including copper and aluminium. It is also harmless to plastics in typical application temperatures and cycle times, although testing is always advised in the specific application prior to large-scale use.

The product has the versatility to allow cleaning using an array of different equipment and methods, even at low temperatures. Being surfactant-free, it is easy to rinse. It offers a low hazard rate, VOC, odour and foam, making it environmentally and user-friendly.

Electrolube
www.electrolube.com.au

Motorised shears prevent RSI

Anyone who has suffered from mouse arm or tennis elbow knows about the painful and persistent condition known as repetitive strain injury (RSI). Even the smallest movement can cause extreme and long-lasting damage to muscles, tendons and nerves if it is repeated thousands of times.

If mouse arm results from operating computers, the equivalent for wine and fruit growers, who must trim countless branches and shoots, is shearing arm. Each hectare in a vineyard may contain between 5000 and 10,000 vines, which means that approximately 100,000 cuts per hectare must be made. Furthermore, even small fruit trees must be trimmed and pruned hundreds of times.

In order to prevent fatigue, manufacturers developed mechanical pruning shears. In the beginning, pneumatic systems were the only mechanical solution. It then became possible to replace compressed air with electrical energy by using lightweight lithium-ion batteries. This allows wine growers to simply go round the corner and move up and down in the rows without limitation. Electric shears are connected to a battery, which is normally fastened onto the wine grower's belt with a short cable while the electrical motors are integrated into the shear's handles and apply the necessary force.

With many people now using motorised shears, Italian manufacturer Campagnola decided to develop a pair of shears that simplify the wine grower's work in every respect. Campagnola's Pony model is a low-power device that works with a FAULHABER DC micromotor in order to offer high efficiency at a low weight.

"During the cutting season, the operator must often use the shears relentlessly for weeks," said Patrizio Pellicanò, the technical director at Campagnola. "This means that the operator must hold the device for the entire day and every gram of weight counts."

The motor is the crucial component, but not only in regards to its weight. As noted by Christian Lucini of FAULHABER MINIMOTOR, who is responsible for the project, "The drive must have high torque while the weight is reduced to a minimum.

"It must also work at high speeds in order to make the cuts as quickly as possible," Lucini continued. "Due to the start-stop nature of this work, with constant load changes, the shears must also provide force without warming up, while the energy consumption is minimised and the operating time maximised."

Campagnola carried out a series of tests comparing the drives of different manufacturers based on these criteria. According to Pellicanò, the 2657 CR DC micromotor from FAULHABER "clearly won the comparisons".

"With just 156 g for the motor, the entire drive system weights 80 g less than other motor gearhead combinations. In addition to this, high efficiency, in combination with low energy consumption, provides a usage duration of 10 h per charge, which corresponds to 20% more battery life in comparison to rival products."

Said to be one of the lightest pairs of shears on the market, the Pony can perform up to 70 cuts per minute and can be operated both automatically and manually. In automatic mode, the cutting blades fully close as soon as the finger presses the trigger. In manual mode, the cutting blades conform to finger movements, which means the motor reacts precisely and the output power must be adjusted exactly to the movement.

The shears also protect the drive-supporting wires. If wires are detected between the cutting blades, the shears stop cutting automatically. A cutting counter, which records the operating times, makes it possible to monitor the cutting movements in detail and allows the operator to comply with service intervals.

"The devices run constantly when trimming vines and fruit trees, particularly in large companies," said Pellicanò. "In addition to this constant load, the shears must be able to work for four or five years without any problems. The DC micromotor from FAULHABER has proven itself with its characteristics and high reliability in continuous operation. We have definitely made the right choice here."

ERNTEC Pty Ltd
www.erntec.net

FANLESS TOUCH PANEL COMPUTER

Axiomtek has announced the GOT5103W-845, its 10.1″ WXGA TFT fanless touch panel computer designed with the latest Braswell Intel Celeron dual core processor N3060. The all-in-one industrial touch panel PC supports easily accessible external AT/ATX mode selection switch, multiple mounting types and a multitouch projected capacitive touch panel to fulfil assorted needs.

The product adopts an IP65-rated front bezel, IPX1 compliant chassis to protect against dirt, dust and water under different environmental conditions. In order to enhance the convenience of the device, the widescreen PC has five membrane switches on the bottom of its front panel, providing an easier way to adjust the display, volume and brightness. With its slim and ultralightweight design, the device is suitable for limited-space installations, such as in supermarkets, shopping malls, and smart factory and smart building automation fields.

The PC's storage interfaces include an optional half-slim SATA SDD, as well as mSATA support on the full-size PCI Express Mini Card slot. It provides various I/O connectors, including one RS232 port, one RS232/422/485 port, two USB 3.0 ports, two USB 2.0 ports, one HDMI and one audio. By simply plugging in the wireless LAN card, operators can use the rugged panel unit to transfer data in wireless LAN/GPRS/GPS/4G environments.

Adept Total Turnkey Solutions
www.turnkey-solutions.com.au

RUGGED SERVERS

Crystal Group has announced the introduction of the RS4104 and RS4198L24, two high-performance and highly configurable rugged servers.

The rackmounted servers are driven by Intel Haswell or Broadwell E5-2600 V3 or V4 processors and can be configured with up to 1.5 TB Registered DDR4 of memory, delivering high performance for most processor-intense applications. They have been designed to accept GP/GPU engines such as the Xeon Phi, AMD FirePro or the nVidia Tesla platforms.

The processing power of the server-class motherboard and the parallel processing capability of dedicated co-processors make the devices suitable for data-intensive applications including digital signal processing (DSP) intelligence, surveillance, reconnaissance (ISR), radar signal processing, training and oil and gas exploration. Data can be gathered from the boards, analysed quickly and immediately made available for decision-makers.

The RS4104 supports up to 10 PCIe 3.0 x8 or 5 PCIe 3.0 x16 expansion slots for add-in cards and is powered by a 1780 W power supply. The RS4198L24 supports up to 10 PCIe 3.0 x16 expansion slots (eight of which can support double-width cards) for add-in cards and is powered by 3200 W 2+2 power supplies.

Metromatics Pty Ltd
www.metromatics.com.au

CEE CONNECTOR WITH FILTER

SCHURTER expands its range of power entry modules with the introduction of the FMAD and FMAB CEE connectors, featuring an integrated line filter for one- and three-phase industrial and power distribution applications.

The integrated filter optimises the suppression of conducted emissions by eliminating cables between the inlet and filter. It makes a direct connection between the filtered connector and its metal shield, which is grounded to the panel cut-out. The fully integrated unit can be front or rear panel mounted, directly where the power comes into the equipment.

The FMAB CEE series is suitable for single-phase AC applications. It extends the power entry module concept outlined in IEC 60320, where power input is limited to 16 A. The FMAD CEE is designed for three-phase applications.

Both connectors are rated from 16 up to 32 A. They are designed and approved according to IEC 60309, UL 1283 and CSA 22.2 no 8. The voltage rating is 250 VAC (IEC, UL, CSA) and 110/125 VAC (UL, CSA).

The filter series is suitable for use in industrial appliances exposed to temperatures ranging from -40 to +85°C. Screw terminals provide ease of installation.

SCHURTER (S) PTE LTD
www.schurter.com

DIGITAL OSCILLOSCOPE

Teledyne LeCroy's WaveRunner 8000 Digital Oscilloscope offers a bandwidth range of 500 MHz to 4 GHz and a 40 GS/s sampling rate, including a collection of math, measurement, debug and documentation tools. The MAUI user interface with OneTouch optimises convenience and efficiency by enabling all common operations with a single touch of the display.

MAUI with OneTouch has drag-and-drop actions to copy and set up channels, math functions and measurement parameters without lifting a finger. Common gestures such as drag, drop, pinch and flick facilitate instinctive interaction with the oscilloscope. The Add New button quickly enables a new channel or measurement while traces and parameters turn off with a flick of a finger. MAUI with OneTouch delivers a set of touch-screen gestures that simplifies measurement set-up and brings efficiency and intuitiveness to oscilloscope operation.

Application-specific packages enable streamlined debugging for common design/validation scenarios including digital filtering, spectrum analysis, device and switching power supply analysis and more. Customisation enables user-defined parameters and math functions, providing limitless analysis capability. The oscilloscope has a great breadth and depth of tools, ensuring quick resolution of complicated debug tasks.

Scientific Devices Australia
www.scientific-devices.com.au

DATA ACQUISITION PROCESSOR TOOLS

The DAPtools for Python API module from Microstar Laboratories extends capabilities previously accessible in C, C++, C#, Basic and other programming environments so that data acquisition applications operating under strict time constraints can be developed using the Python language. It is supplied as part of the DAPtools Basic Software that is provided with each DAP or xDAP data acquisition system.

API extension enables data acquisition applications written using Python programming language. This is not a reduced or specialised language variant — it supports the complete, full-featured Python environment.

DAPtools for Python works with the DAPL 2000 system, DAP boards for PCI and PCI-X host systems, the DAPL 3000 system, the xDAP data acquisition engines and on host systems operating Windows 10, Windows 8, Windows 7, Windows XP or Windows Server.

The product combines the regularity and precision of DAP systems with the software flexibility of the Python environment. Typical applications would be ad hoc quick tests or configurable scripting for test automation not bound to specific large application platforms.

SciTech Pty Ltd
www.scitech.com.au

COMPACT, INDUSTRIAL-GRADE USB ISOLATOR

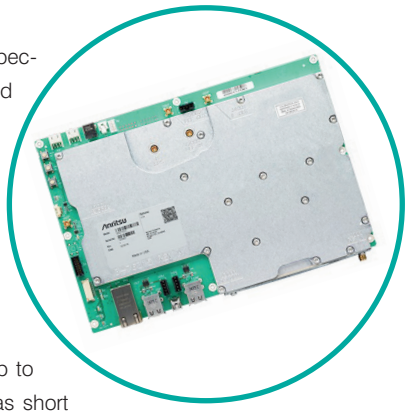
Acromag's compact, industrial-grade isolator provides a high-voltage isolation barrier between a computer and a connected USB device. The product protects equipment from electrical surges and transient voltage spikes as well as eliminating ground loop currents flowing between the PC and peripherals, which can damage instruments and cause inaccurate measurements. Additionally, isolation minimises conducted noise from static discharge, magnetic fields and radiofrequency interference.

The USB isolator is easy to use. The isolator inserts inline with the USB connection and operates transparently with no special software drivers required. The unit receives power from the PC's USB port and isolates that power to the connected device. High noise immunity and low radiated emissions ensure data transfer in sensitive applications.

A number of high-performance features help provide convenient and dependable operation. The green LED indicates that power is being received and blinks if the connected device draws too much current. The USB isolator has an internal jumper, which allows the user to switch from full-speed (12 Mbps) to low-speed (1.5 Mbps) communication. The reset button offers a simple way to reinitialise a connected device without breaking the cable connection. The USB isolator has high-retention USB sockets that keep cables securely attached under shock and vibration.

Metromatics Pty Ltd
www.metromatics.com.au

SPECTRUM MONITORING MODULE FOR OEM APPLICATIONS



Anritsu has introduced the MS27100A Spectrum Monitoring Module, bringing the company's RF spectrum analysis technology to OEM applications. Engineers designing systems to locate illegal and unlicensed interfering signals within wireless networks can integrate the product into their custom hardware to achieve a tool for security, aerospace and defence applications.

The module provides a high-performance RF engine in a compact form factor, allowing it to be easily designed into any spectrum analysis system. Engineers can write their own monitoring program applications using available SCPI commands to provide customisation and flexibility. The device also features an IF frequency output so proprietary algorithms can be used for further processing.

Covering the 9 kHz to 6 GHz frequency range, the product is capable of sweeping at rates up to 24 GHz/s, allowing many types of signals, including periodic or transient transmissions as well as short 'bursty' signals, to be captured.

As with all Anritsu field spectrum analysis tools, the MS27100A can withstand extreme environmental conditions. An integrated web server is embedded into each spectrum analysis probe for remote power cycling, automated system recovery protocols and secure firmware updates so it can be deployed up to thousands of kilometres from the control centre.

Anritsu Pty Ltd
www.anritsu.com

DC/DC CONVERTERS FOR PV SYSTEMS

The PV15/PV40-29Bxx series 15 and 40 W DC/DC converters provide 200–1500 VDC input voltage and high isolation voltage of 4000 VAC. Input voltage from 200 to 1500 VDC allows for longer strings to be used in the PV system.

A PV system converts the sun's radiation into usable electricity and also powers itself. The sunlight's intensity is often not stable, so voltage to the control system also varies. This may lead to frequent system restarts.

The series is designed with input undervoltage protection, which can protect system stability from these frequent restarts. It also features reverse-voltage, output short-circuit, overcurrent and overvoltage protection.

With a wide operating temperature of -40 to +70°C, 4 kV isolation voltage and high efficiency, the series is suitable for applications such as photovoltaic combiners, photovoltaic inverters, high-voltage switching, etc. It meets the EN62109 standard and suits high-altitude applications (up to 5000 m), ensuring system safety.

The product has been released by Mornsun and is distributed in ANZ by DLPC and in Victoria by Fairmont Marketing.

DLPC Pty Ltd
www.dlpc.com.au

RF DIGITAL STEP ATTENUATOR

Peregrine Semiconductor has released the PE4314 UltraCMOS digital step attenuator. The product is a 75Ω HaRP technology-enhanced, 6-bit RF DSA that operates from 1 MHz to 2.5 GHz and features glitchless attenuation state transitions and low distortion.

It supports 1.8 V control voltage and an extended operating temperature range up to +105°C, making it versatile for a range of wired broadband applications, including DOCSIS 3.1/0, satellite and fibre customer premises equipment (CPE) and infrastructure.

The DSA is a pin-compatible upgraded version of Peregrine's PE4304, PE4307, PE4308 and PE43404. An integrated digital control interface supports serial and parallel programming of the attenuation, including the capability to program an initial attenuation state at power-up.

The device covers a 31.5 dB attenuation range in 0.5 dB steps. It is capable of maintaining 0.5 dB monotonicity through 2.5 GHz. No external blocking capacitors are required if 0 VDC is present on the RF ports.

The PE4314 is manufactured on Peregrine's UltraCMOS process, a variation of silicon-on-insulator (SOI) technology on a sapphire substrate. It is offered in a 20-lead, 4 x 4 x 0.85 mm QFN package.

Wireless Components
www.wirelesscomponents.com.au

PROSTHETICS

CONTROLLED BY MICROPROCESSORS

Modern-day prostheses are light years ahead of their forebears, offering amputees greater natural movement than ever before. Microprocessor-controlled prostheses further improve on current offerings, creating active — rather than passive — prostheses, opening up new possibilities for safety and comfort.

When it comes to finding technological ways of dealing with the loss of a limb — for example, as the result of the amputation of a leg — two key things need to be taken into account. Firstly, it took nature a long time to develop the perfect 'apparatus' to allow humans to move around. Secondly, people are creatures of habit — they tend to carry on moving in the way they're used to.

All the solutions which have been tried to date, from wooden legs to high-tech prostheses using state-of-the-art materials, have worked in a purely passive way. Something that these devices all have in common is that their function doesn't change during movement.

Now, however, a new solution has been developed, centred around the use of microprocessor-controlled prostheses. Just like natural limbs, these can react automatically, adapting to the current situation. Lightweight micromotors, combined with intelligent control technology, offer the chance to walk in a way that feels very similar to natural movement — providing clear benefits for users in terms of both safety and comfort.

A prosthesis is always a complex medical device that needs to be adapted to suit the individual. Technical components, however, can only be manufactured economically on a large scale. It was thus clear to prosthesis specialist Otto Bock from Vienna that a new, advanced prosthesis would need both to be suitable for use on a global scale and to offer top performance under all possible conditions.

His solution was to develop a so-called active prosthesis, whose success is based on the reliable and smooth interaction of mechanics, electronics and the user. To achieve this, the prosthesis specialist called in the micromotor experts from FAULHABER. FAULHABER's many years of experience with micromotors translated into a custom-made motor solution for the high-tech Bock prostheses.

Following nature's lead

After leaving the factory, each prosthesis is fine-tuned by the local orthopaedic specialist to suit the individual user. This is now standard practice with high-quality prostheses. What's special about this device, however, is that it uses its electromechanical systems to adapt to the individual's walking style and create a truly natural feeling for the user.

Walking is not just a matter of putting one foot in front of the other. Therefore, simply 'improving' on a wooden leg by adding a hinge to act as the knee is not an option. Nature uses tendons and muscles to provide damping and adapt limb movement with each individual step. Hence, people are able to make optimal use of their weight and force — whatever the conditions and depending on whether they are walking, running, cycling or standing. These processes all occur unconsciously and are often pure reflexes, meaning that they are extremely rapid.

Finding a way to simulate this natural damping requires great attention to be paid to the mechanics and electronics. Thanks to

Image courtesy of The U.S. Army (via Flickr) under CC BY 2.0

modern high-power microprocessors, miniature precision sensors and micromechanical motors, the technology now exists to achieve very impressive results. Compact prosthetic technology allows the user to walk slowly or fast, run, climb slopes or cycle — without needing to pay much special attention to what the limb is doing.

In addition, the fact that the knee joint can react immediately to changes in speed or surface conditions improves safety considerably. Even in the case of a stumble, the real-time electronics will reliably prevent the prosthesis from buckling. Over the long term, the ability of the prosthesis to react intelligently safeguards the health of the user, avoiding undue wear and tear on the other joints or problems arising from poor posture and thus overstraining of the healthy leg.

A practical solution

Natural movement can only be achieved by the prosthesis reacting in a highly accurate and subtle way to the changes that occur with every step. In order to ensure that this occurs, highly sensitive sensors provide reports on the current situation and stresses 50 times per second. A knee angle sensor provides information used for dynamic control, while load sensors in the lower leg measure the pressures at the heel and front part of the foot. A high-power processor then analyses these results and passes on appropriate instructions to the damping mechanism.

Hydraulic damping has proved to be of particular value. This allows the appropriate damping values to be implemented quickly and accurately. Prosthesis specialists make use of proven technology for the interface between the electronics and the damping mechanism: easy-to-control miniature DC motors. These micromotors, equipped with precious metal brushes, offer high performance in combination with a slimline design.

The high efficiency of their motors means that prostheses can work without needing recharging for periods of up to two days, even with the limited capacities of lithium batteries. In the current example, the high-performance 10 mm motors function via friction gears in a planetary set. This serves to adjust the actual damping valve. With each step, the damping is adjusted from its maximum level to almost zero and then back again.

Durability reigns supreme

All components need to be able to stand up to years of continuous use. This is no problem for the precious metal DC motors deployed within this area. Use of the prostheses around the globe places considerable demands on the technology, which must be able to cope with temperatures ranging from -15 to +65°C. It must also be able to function without problems in all climates, from dry to wet, and withstand salty air or desert sand. With this in mind, all relevant components are sealed, with some being additionally housed within an extra casing.

Despite the use of robust and sealed components, as with all medical devices provision must be made for the possibility of the failure of all and any components, for example an empty battery. In such a case, the prosthesis will automatically provide maximum damping, in effect functioning as a wooden leg and thus providing the maximum possible level of safety. The wearer is thus always able to continue walking, albeit at a lower level of comfort.

All levels of damping between virtually zero and the highest level can be individually set by a certified orthopaedic technician, using the C-Soft software. The user is also able to choose between two settings — for example, one optimised for walking and one for cycling. The former would use active stance phase damping to allow easier standing and walking, while this would be switched off when cycling. The prosthesis can also be set for inline skating, cross-country skiing or many other activities.

The combination of modern electronics with robust, high-performance micromotors provides an enormous improvement to the comfort of those using prostheses. Dynamic motors, real-time electronics and high-resolution sensors mean that it is now possible to fit all the components required for natural movement into the limited space provided by a prosthesis.

ERNTEC Pty Ltd
www.erntec.net

INCREASE THE EFFICIENCY OF YOUR X-RAY SPECTROMETER

Researchers have developed a new design for X-ray spectrometers that lowers overall production costs and increases the efficiency of X-ray flux.

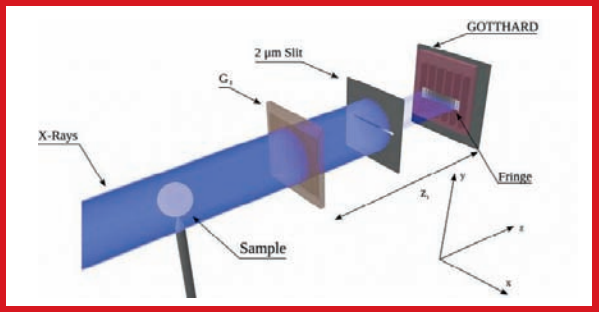
X-ray interferometry works by firing X-rays at a downstream detector. Along the way, the beams pass through a phase grating, which divides the beam into different diffraction orders based on their wavelength. The difference between these diffraction orders introduces an interference fringe . Such fringes are challenging to record directly over a large field of view, necessitating the use of highly sensitive detectors.

In response to this, a method known as Talbot-Lau interferometry was developed and adopted. The method utilises an absorption grating, G2, placed right before the detector, and senses the distortions via phase stepping. Here, the absorption grating is scanned step by step for one or more periods of the interference fringe, each time recording an image which results in an intensity curve at each pixel. This allows the interference fringe to be sensed indirectly, while obtaining absorption, differential phase and small-angle scattering signals for each pixel.

However, this ultimately causes the system to be less efficient for each dose of X-rays due to photon absorption by G2. The required area and aspect ratio of the gratings, which are millimetre-sized, further complicate matters by driving up overall production costs.

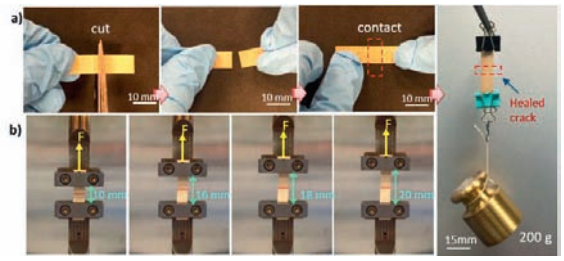
To remedy this, researchers developed an interferometer that does not use the G2 grating and instead directly exploits the fringe interference for higher resolution. Their research has been published in the journal *Applied Physics Letters*.

The researchers' set-up consisted of an X-ray source, a single phase grating and a microstrip detector developed by the SLS detector group — a simplified version of the traditional Talbot-Lau interferometer. The detector uses a direct conversion sensor in which X-ray photons are absorbed and the charge generated from one absorption event is collected by more than one channel for small channel sizes — charge sharing.



Directly resolved micrometre interference fringes help reveal subtle phase contrast in the sample. Image credit: Kagias/PSI.

FLEXIBLE ELECTRONIC MATERIAL STILL FUNCTIONS AFTER MULTIPLE BREAKS



Self-healing flexible materials are the Holy Grail of wearable electronics — but they've so far been elusive due to electronic materials' inability to function well after breaking and healing. However, an international research team has created a new electronic material that heals all its functions automatically, even after breaking multiple times.

The researchers say their breakthrough could improve the durability of wearable electronics.

"Wearable and bendable electronics are subject to mechanical deformation over time, which could destroy or break them," said Qing Wang, professor of materials science and engineering, Penn State University.

"We wanted to find an electronic material that would repair itself to restore all of its functionality, and do so after multiple breaks."

In the past, researchers have been able to create self-healable materials that can restore one function after breaking, but restoring a suite of functions is critical for creating effective wearable electronics. For example, if a dielectric material retains its electrical resistivity after self-healing but not its thermal conductivity, that could put electronics at risk of overheating.

The material that Wang and his team created restores all properties needed for use as a dielectric in wearable electronics — mechanical strength, breakdown strength to protect against surges, electrical resistivity, thermal conductivity and dielectric properties.

While most self-healable materials are soft, this one is quite tough. The researchers added boron nitride nanosheets to a base material of plastic polymer. Like graphene, boron nitride nanosheets are two-dimensional, but instead of conducting electricity like graphene, they resist and insulate against it.

"Most research into self-healable electronic materials has focused on electrical conductivity but dielectrics have been overlooked," said Wang. "We need conducting elements in circuits but we also need insulation and protection for microelectronics."

The material is able to self-heal because boron nitride nanosheets connect to one another with hydrogen bonding groups functionalised onto their surface. When two pieces are placed in close proximity, the electrostatic attraction naturally occurring between both bonding elements draws them close together. When the hydrogen bond is restored, the two pieces are 'healed'. Depending on the percentage of boron nitride nanosheets added to the polymer, this self-healing may require additional heat or pressure, but some forms of the new material can self-heal at room temperature when placed next to each other.

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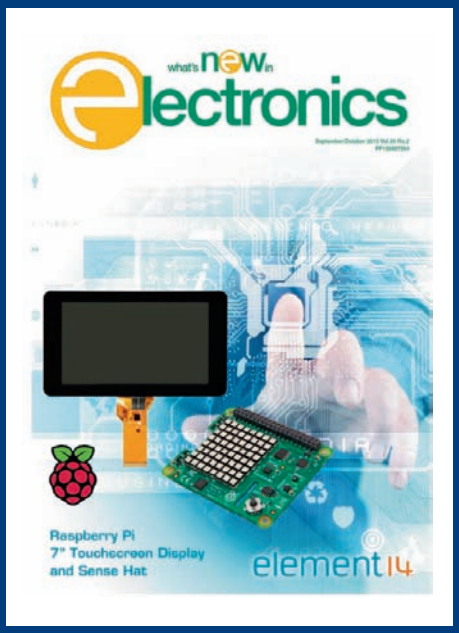

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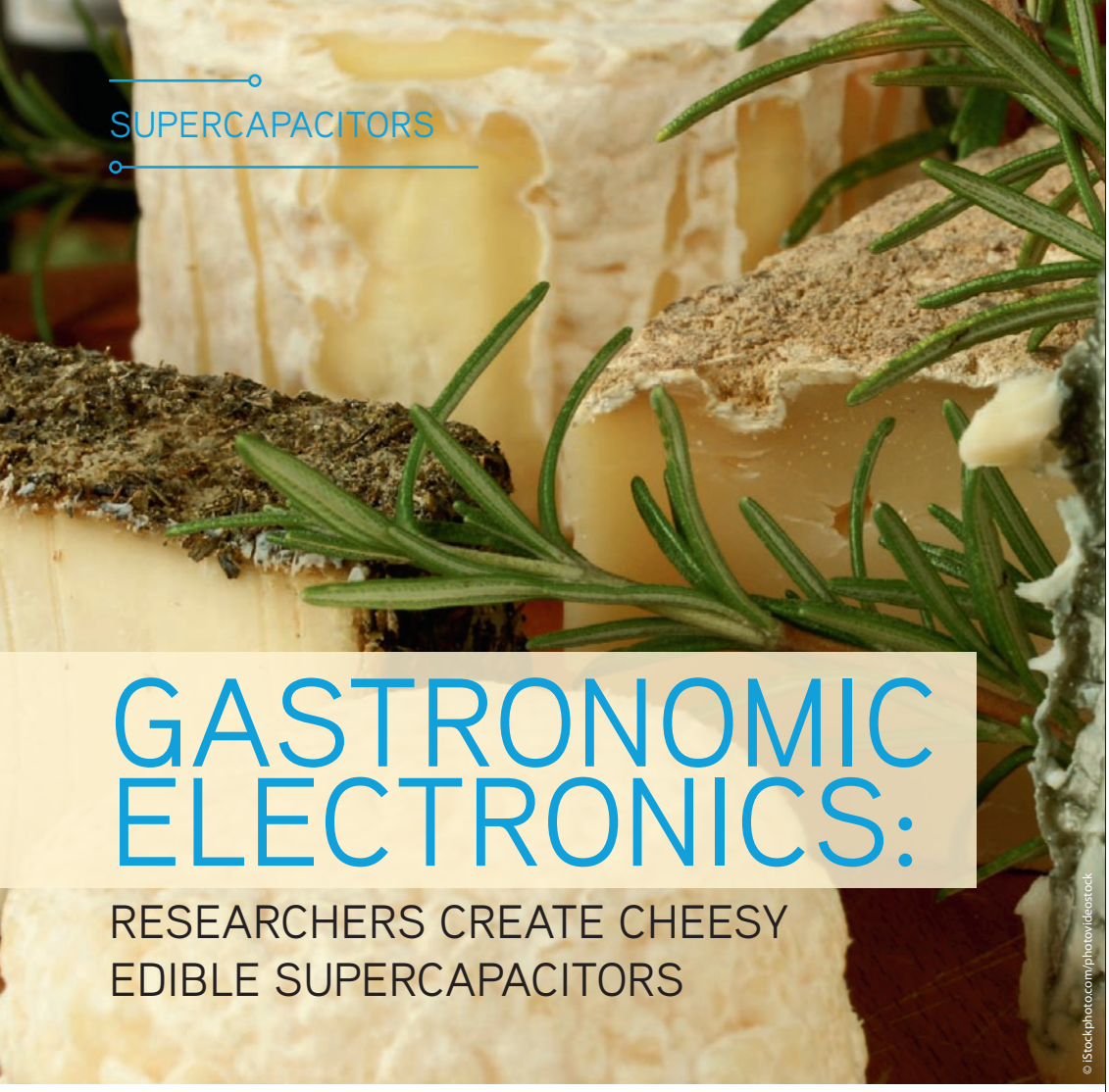

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GASTRONOMIC ELECTRONICS:

RESEARCHERS CREATE CHEESY EDIBLE SUPERCAPACITORS

What if your food could kill *E. coli*, or power a miniature camera inside your stomach? Researchers have developed a supercapacitor from food that can do just that — and it tastes like cheese, apparently.

Certain foods — cheese, egg white, seaweed, gelatin, barbecue sauce, Gatorade, gold leaf and activated charcoal, for instance — can store and conduct electricity. By combining several of these foods, researchers were able to create a supercapacitor.

From this supercapacitor, they created devices that kill *E. coli*, and are working on devices that wipe out other bacteria as well.

The supercapacitor was also able to power a camera designed to monitor the stomach.

"The main application is to pass through a (gastrointestinal) tract, doing whatever a GI doctor needs," said Hanqing Jiang, an associate professor of mechanical engineering at the Arizona State University.

The device could replace endoscopies with real-time monitoring of the gastrointestinal tract. And the best part? It tastes like cheese, Jiang says.

Ingestible electronics aren't a new concept, but previous devices haven't been digestible, meaning that they need to be passed from the body. They can also cause issues if they break.

This creation, however, overcomes a number of problems previously faced by these types of devices. Implantable electronics, for instance, require surgery. Biodegradable electronics exist, but they have low energy density and battery size is limited. Edible materials proposed in the past contain toxic components that can cause stomach pain and nausea.

Jiang and his team took elements from the food industry, material sciences, device fabrication and biomedical engineering to create the supercapacitor. They used activated charcoal and gold for their high electrical conductivity and chemical stability.

While these devices were made by hand, in future they'll be made by 3D printers and will be much smaller. (They are currently the size of a soy sauce packet.)

Jiang had trouble convincing the powers that be that his materials were for research, not for consumption.

"The funny thing is when we got all the materials in, I had a hard time getting reimbursed," he said. "It was all food."

The research was published in *Advanced Materials Technologies*.

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Subscriptions: For unregistered readers price on application

Audited Media Association of Australia cab

September 2015 Total CAB Audited Circulation
4,737 (84% personally requested)

Printed and bound by Dynamite Printing
Print Post Approved PP100007394
ISSN No. 0728-3873

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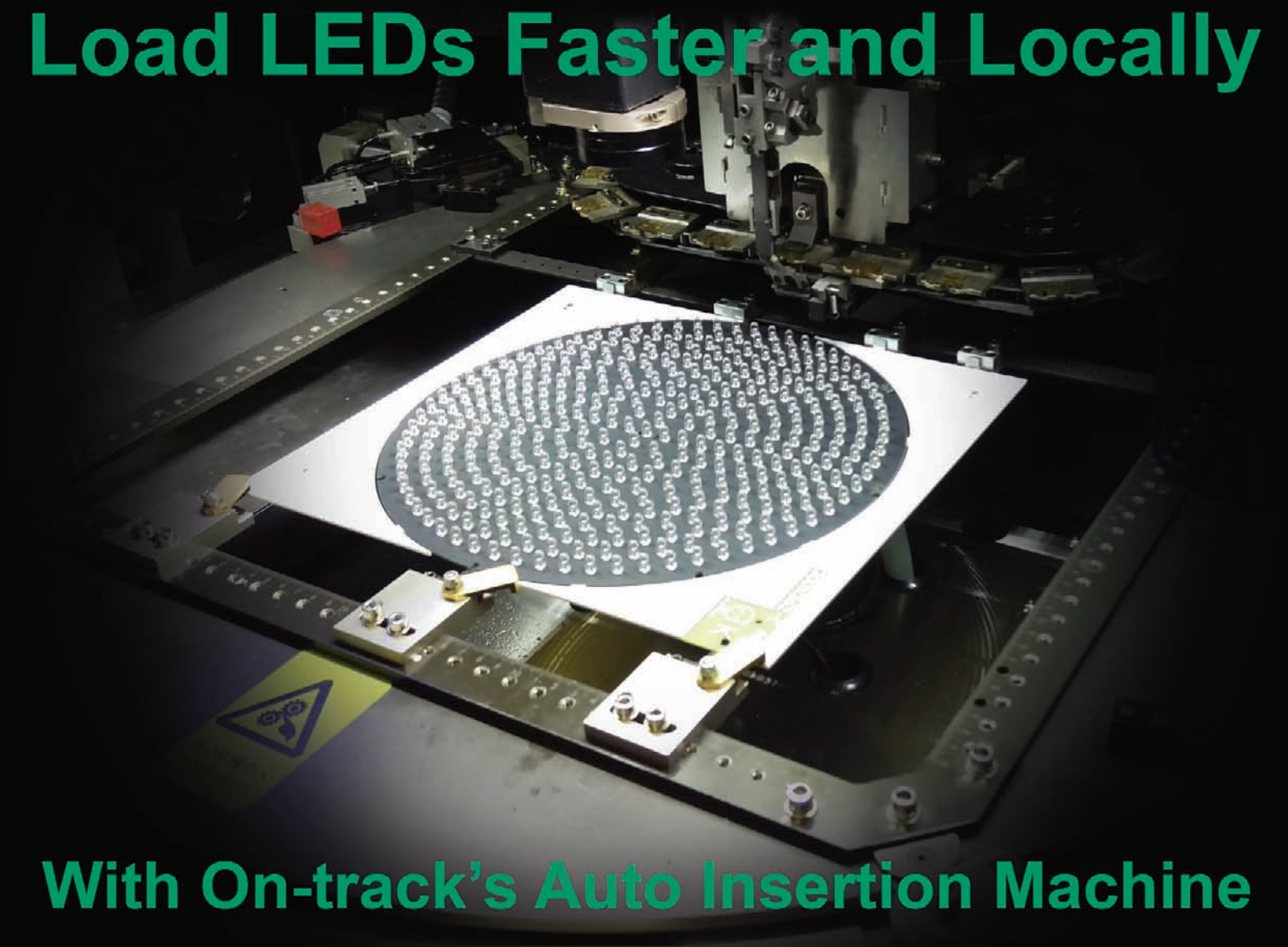

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