PRODUCTS IN FOCUS

- EMBEDDED SOFTWARE
- INTERNET OF THINGS
- NEW APPLICATIONS
- INTERCONNECTIONS
- LITHOGRAPHY DEVELOPMENTS
- ENCLOSURES
- BATTERY TECHNOLOGY
- SWITCHES
BEST OF CLASS: BROADEST OVERALL PRODUCT SELECTION
SOURCE: ASPEN CORE 2015 DESIGN ENGINEERING AND SUPPLIER INTERFACE STUDY

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Comment

Shaping the next technological revolution

Forecasts may be predicting a tough 2016, but the strength of innovation and design in Europe remains key to the long term success of this dynamic industry.

China to the left of them, Brexit to the right. Into the valley of... Perhaps the problems facing the electronics industry aren't that severe, but the opening few months of 2016 have certainly proved challenging.

“A more solemn business environment” is how DMASS chairman Georg Steinberger described the outlook for Europe and even the most optimistic members of the UK’s Electronic Component Supply Network (ecsn) don’t expect to see significant growth in the UK’s electronic component market in 2016, with growth forecasts ranging from -2% to +2%.

According to DMASS, European distributors enjoyed a very ‘healthy’ 2015, with sales of industrial semiconductors through distribution channels growing by an impressive 11.3% to €1.75 billion, compared to the previous year, while sales in 2015 as a whole reached a total of €7.3bn, up 14.6% on 2014.

Strip out exchange rate effects and DMASS believes that growth in Europe was around 6 to 7% last year; nothing to be sniffed at.

Steinberger suggests that: “Very few standard products really made a mark in 2015 in terms of sales growth.” The difference, he adds, came mostly from ‘design products like complex logic, analogue or high end microcontrollers’.

“This trend will continue with the advent of the IoT and Industry 4.0,” he adds.

The Internet of Things, ‘Industry 4.0’ or the Smart Factory covers a diverse range of applications and Europe remains a hotbed of innovation and design, especially when it comes to the industrial market. Despite current uncertainty, the industrial space remains creative and in good health.

The contribution the sector makes to the European economy remains immense and that depth and breadth of product can be summed up in this issue of Products in Focus with contributions from HCC Embedded, OKW, Mentor Graphics, Metz Connect and Schurter.

Neil Tyler
Editor, New Electronics
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Embedded Software

Protecting embedded IoT data

Tackling the challenges associated with network communications

The powerful new generation of connected IoT microcontrollers and applications brings a new set of challenges requiring careful thought and engineering. Networked communications entails data security risks and storing data in flash can cause problems both with data security and reliability. As things stand today, most file systems can’t ensure reliable, safe flash storage and many network stacks are vulnerable to security risks.

Responsible development requires an assessment of how data can be communicated and stored safely, reliably and securely.

Safe, reliable storage:

HCC supplies an extensive range of file systems, media drivers, file translation layers (FTL), smart meter software, bootloaders and encryption technology.

These products are designed to operate securely and reliably with any type of flash or storage medium including NAND, NOR, SSD, eMMC or any removable media. Developers often use inadequate, general-purpose file systems with only vague references to quality, reliability and security.

HCC storage products can be optimised for any hardware and the detailed requirement specifications that ensure a system is reliable by design are always provided. Without these specifications it is not possible to create a system that can cope with power-fail or unexpected reset.

TCP/IPv4, IPv6, Encryption, TLS/SSL, IPSec/IKE:

The key to a successful embedded application is to use high-quality software that is verifiably developed and ensures a stable, low-risk development platform.

HCC’s TCP/IP stack was developed with a rigorous approach to quality using a strongly typed subset of the ‘C’ language. The approach incorporates a strong adherence to the MISRA-C:2004 standard and was validated using advanced verification tools.

All software is provided with optimised Ethernet drivers and will integrate easily with any RTOS. The implementation was designed for high performance on a microcontroller. There are no unnecessary copies, well thought out static memory management and dedicated memory areas and cache are fully exploited.

HCC’s mission is to ensure that any data stored or communicated by an embedded IoT application is secure, safe and reliable. Most embedded software used to transmit or store embedded data is not developed using recognised quality standards.

Most flash file systems can’t ensure reliable, safe storage and many network stacks are vulnerable to security risks. HCC applies quality practices used to develop functional safety applications to ensure that software is robust, reliable and that quality claims can be verified. All drivers and abstractions are provided meaning virtually no integration is required. This means any embedded system can be upgraded to be safer, more reliable, and more secure.

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<th>Product range</th>
<th>TCP/IPv4 &amp; IPv6</th>
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<td>Verifiable IPSec/KEV2</td>
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<td>Verifiable SSL/TLS</td>
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<td>USB Device, Host &amp; OTG Software</td>
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| Standards and certifications | Fail-safe File Systems for NAND/NOR/eMMC |
|------------------------------| Flash Translation Layers |
|                              | Smart-meter File System |
|                              | Advanced bootloaders |

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<th>Specialist sectors / industries served</th>
<th>Consumer, Industrial, Communications, Medical, Transport</th>
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Customisable IoT gateway

Mentor Graphics looks to fulfill the need for an innovative, end-to-end, IoT solution.

Comprised of a customisable gateway System Design Kit (SysDK), cloud backend services, and multiple runtime environments to build innovative IoT edge devices, the Mentor Graphics IoT solution enables customers to create compelling IoT deployments quickly while reducing risk, cost, and development cycles.

Highlights include:

- The proven gateway SysDK can be used as-is, or customised in both hardware and software to meet specific intelligent gateway requirements while reducing cost and time to market.

- Customisable and highly secure edge devices can be built on the following runtime environments: Nucleus RTOS, Nucleus SafetyCert RTOS, Mentor Embedded Linux, Mentor Embedded Multicore Framework, Mentor Embedded Hypervisor, Android, bare metal environments, and high performance graphics solutions.

- Designed for performance and scalability, Mentor’s customisable cloud solution enables remote provisioning, management, and monitoring of global deployments. The integration of cloud middleware supports the functionality provided from the cloud backend.

- Ideally suited from small to global enterprises, activities include: event logging, firmware updates, remote driver install/ update, remote feature unlocking, data collection for analytics, mobile applications for service access, and remote management.

Secure convergence in the gateway
As intelligence moves from the cloud toward the edge, a gateway with strong security parameters is paramount to ensuring the integrity of the gateway itself, edge devices, and anything connected in the network or cloud. Mentor’s support for secure convergence begins by leveraging ARM TrustZone. By using ARM TrustZone, the Mentor gateway SysDK can be customised to enable secure boot and hardware-enforced secure data storage and software execution alongside a rich execution environment for functions that require less security. Gateway and edge device security is complemented by Icon Labs’ Floodgate Security Framework, and security integration with enterprise IT infrastructure is provided by Icon Labs’ Floodgate for McAfee ePO.

Mentor customisation
Experts are available to consult in the design of customised IoT gateway hardware and software architectures. Mentor’s customised services spans edge devices to cloud and has deep experience in: HW/SW performance optimisations; multimedia applications; and security and safety certifications, including industrial IEC 61508 and medical IEC 62304.
Battery-based systems are proliferating for large scale energy storage, ranging from hybrid and electric vehicles (tens of kWh) to grid energy storage systems (ESS) capable of storing tens of MWh.

ESS systems are used for a range of applications, including power back-up and stabilisation, power level loading (to use low cost off-peak energy during periods of peak demand) and to store energy captured by renewable sources such as solar and wind.

Large battery packs are made up of battery cells connected in series to form high voltage stacks. Batteries lose capacity with time and use, and batteries within a large pack lose capacity at different rates. This is because of differences within the cells, as well as exposure to varying operating conditions such as thermal gradients. The differences in battery ageing cause mismatches in capacity from cell to cell within a stack that grow over time. Unfortunately, pack capacity is limited by the weakest cell in the stack.

Traditional passive battery balancing can only protect the stronger cells during charging, creates heat in the process and cannot compensate for weak cells. Alternatively, active balancing adds the capability of transferring charge from stronger cells to weaker cells, increasing pack capacity and run time. Recently, integrated controllers such as Linear Technology’s LTC3300 (see illustration right) offer high balance currents and high efficiency. This is a bidirectional, active battery balance controller that can balance up to six series cells independently and simultaneously. It manages currents up to 10A at greater than 90% efficiency.

Automotive electronics

The automotive market for analogue electronics is growing rapidly, is forecast to maintain growth greater than that of the overall industry for at least the next several years and has grown to 20% of Linear’s business. Electronic systems are transforming the transportation experience with growing expectations for connectivity, convenience, safety and fuel efficiency. A typical mid-size vehicle now contains more than 100 processors and dozens of motors, as electronics replace traditional electro-mechanical and hydraulic systems. The proliferation of distributed systems and diagnostics in vehicles places greater demands for digital communications, which in turn drives higher data rates and increased demands on digital transceivers.

Historically, linear voltage regulators have been used to provide regulated power for digital processors, transceivers and related components. But as power demands increase, use of...
linear regulators is increasingly problematic. Linear regulators are simple, low cost components that have very compact, easy-to-design application circuits.

But these regulators have poor efficiency when converting an automotive battery voltage to the low voltages required for digital components. For example, linear conversion from 12V to 5V yields a conversion efficiency of 42%, and 12V to 3.3V conversion yields less than 28% efficiency. If the power supply load is, for example, 280mA at 3.3V, 1W of input power is required, resulting in 720mW lost as heat.

Managing system efficiency and the resulting thermal stress is a growing focus for automotive system designers. One choice for system designers is to use a switch-mode DC/DC converter in place of the linear regulator. Switchers are highly efficient, but bring their own challenges, including selection and sourcing of inductors, loop compensation, mitigation of radiated EMI and a relatively complex and large solution footprint.

A second option to traditional linear regulator applications is switched-capacitor charge pump regulators. These components share the compact solution and simple to use advantages of linear regulators while bridging the efficiency gap between linear and switching regulators.

Linear Technology offers a family of high voltage-capable charge pump regulators and these are well suited for these applications. For example, the LTC3255 (see illustration left) is capable of servicing a load up to 50mA from an input voltage range from 4V to 48V, fault-protected from -52V to 60V. Its no load quiescent current is just 20µA. Efficiency from 12V_in to 5V_out is over 80%, and from 12V to 3.3V is 55%, resulting in only about 50% of the power loss generated by a linear regulator. Unlike linear regulators, charge pumps are also available for inverting and buck-boost applications.

**Wireless sensor networks and energy harvesting**

The introduction of robust and ultra-low power wireless sensor networks, like those enabled by Linear Technology’s Dust Networks SmartMesh product lines, is transforming the way sensors are deployed in applications ranging from environmental monitoring to transportation infrastructure to the factory floor. And as sensors are deployed in remote, isolated or dangerous environments, the potential to power them from local ambient energy, free from wires and free from service, is here today.

Linear Technology introduced the first energy harvesting integrated circuits specifically designed to condition power from low level solar, piezoelectric and thermo-electric generator (TEG) outputs in 2010. Since then, the company has brought to market a family of products that allow the user to supplement a primary cell or rechargeable battery with harvested ambient energy, increasing the system run time indefinitely, or approaching the shelf life of the primary cell.

These products handle all aspects of the power system, including DC/DC conversion, PowerPath control and local energy storage.

One example, the LTC3107 (see left), conditions energy from low voltage, low impedance sources, including TEGs and thermopiles, converting inputs as low as 20mV into power suitable for powering a remote sensor node.

It provides seamless transitions between the harvested energy and a primary cell battery, giving priority to the ambient energy source and drawing just 80nA from the battery when the harvester is active.

Practical and efficient energy harvesters are a key component to bring the Internet of Things from concept to reality.

**About the author**

Don Paulus is vice president, power management products, with Linear Technology.

www.linear.com
Interconnection

A flexible solution

The personal commitment of the founding family characterises the international success of the independent METZ CONNECT group of companies – strength in innovation, highly effective processes and partner-spirited business relationships. METZ CONNECT offers a broad-spectrum portfolio of highly specialised, superior quality plug connection components. Worldwide, METZ CONNECT employs approximately 800 staff.

Product range
UC|Contact: Connection systems for Printed Circuit Boards. Spring, screw and IDC type terminal blocks, board-to-board connectors, pin headers, USB, RJ12, RJ45 jacks and M12 Ethernet connectors.
P|Cabling: Copper and fibre optic structured cabling network solutions.

Standards and certifications
METZ CONNECT products are certified by: UL, SEV, CSA, CCA, DIN EN ISO 9001:2008, RoHS

Industries served
Industrial automation and electronics, building automation controls, data and communication systems.

Contact
METZ CONNECT GmbH
Im Tal 2
78176 Blumberg
Germany
Email (sales): SMAeder@metz-connect.com

Benefits
• Connection convenience through push-in technology
• No additional components necessary (such as pin header or female connector)
• Single spring clamp terminal block in SMT and THR designs
• Reflow-capable to JEDEC 20 MSL 1
• Automation-compliant packaging (Tape and Reel)
• Connection direction 90°
• Compact design (SM99: 5.8 x 6.6 x 14.5mm)
• Finger pushbutton
• Wire connection indicator
• Test plug socket
• Single-core cable range 0.2 to 1.5mm²
• Nominal current 9A
• Colour variants for finger latch

SM99 and SR99: single pole spring clamp terminal blocks offering safety and convenience

METZ CONNECT has developed the SM99 and SR99, a safe and simple single pole spring clamp terminal block aimed specifically at compact and low profile devices. The flexible circuit board connection solution suits most industrial and building automation applications and meets today’s safety, reliability and convenience requirements.

In the race to stay ahead of the competition, demand for smaller devices as well as additional functionality continues to grow. Within the industrial and building automation market, new product design trends focus on integration, migration, miniaturisation, and of course, reliability. As a result, the space available for components on the PCB board becomes more and more limited. METZ CONNECT provides ideal solutions for innovative PC board connection to meet these requirements.

As a single pole connector solution and also its compact size, SM/SR99 allows design engineers to take a flexible approach to connector placement on a PCB with the very limited space that is often available to them. At just 6.6mm in height and 5.8mm wide SM/SR99 carries a very small PCB footprint and can be placed on the circuit board in any number of orientations.

For such a compact connector, the SM/SR99 is feature rich. Accepting solid core and stranded cables with cross sections ranging from 0.2mm² to 1.5mm² and rated up to 9A, SM/SR99 features a unique finger operated actuator that not only allows for quick and easy wiring, but which also enables the operator to make multiple connect and disconnect cycles should they require. Once the cable is inserted, the operator will find an inspection window on the top side of the housing allowing a quick visual check to be made. Next to the inspection window, the operator will find a continuity test point to ensure that a quick, safe, and reliable connection has been made.

SM99/SR99, is also offered with different colour actuators for additional colour coding benefits. The single pole spring clamp terminal blocks in SMT and THR versions are available in bulk packaging or on tape and reel.

Push-In technology
Push-In – contact directly and in an easy way without tools. Special spring clamps enable a simple plug-in assure with a high contact quality. Easy and direct insertion of solid and stranded conductors featuring ferrules and a large finger push-button for wire release.

Colour options
METZ CONNECT also offers the single pole terminal block in seven different colours for the finger latch for your individual coding on the pc board.
Enclosures

Innovation on two fronts

OKW unveils new CONNECT enclosures for cable connected electronic devices

SUSPENDING an enclosure on a wire creates a problem for electronics designers because without a solid mounting surface such as a desk or wall, the housing inevitably twists and turns in the air – exposing the ‘wrong’ side and any fixing screws used.

OKW has developed a simple solution: its new CONNECT enclosures have two ‘fronts’ (and therefore no underside!)

That may sound like a contradiction in terms, but it works: two front enclosure shells that clip together without fixing screws (speeding installation times). But CONNECT’s two fronts are not the same:

• One is convex for comfortable handheld use. This also allows plenty of space for LEDs.
• The other is flat, with a recess to allow a membrane keypad or product label to be fitted.

CONNECT has been designed for a wide range of applications, including medical and wellness devices, data systems engineering, network technology, building services systems, measurement and control.

The medical sector – a key market for OKW – will be particularly significant for the CONNECT range.

The cases’ long flat sides can accommodate a bank of USB connections – ideal for diagnostics or monitoring equipment that involves large numbers of sensors being attached to a patient.

Also, accessories for CONNECT include a bedrail clamp for storing a unit when it is not in use.

CONNECT has been designed to be tough. Instead of being moulded from ABS (which is used in many enclosures), the devices are made from ASA+PC-FR. This material is UV-stable and is flame retardant to UL 94 V-0.

The enclosures’ soft touch TPE cable glands feature integrated strain relief to stop cables from kinking. They fit into cutouts at either end of the case. These apertures can be blanked off with end parts if required.

Inside the case, there are four attachment domes for mounting a PCB with self-tapping screws.

CONNECT is available in three sizes: 54 x 22mm in lengths of 76, 116 or 154mm. The standard colour is off white (RAL 9002) but custom colours are available on request.

Customisation options include EMC shielding, CNC machining, lacquering and adhesive foils, digital printing of parts and labels, membrane keyboards, display windows, plastic and aluminium panels, installation and assembly of accessories.

OKW Enclosures is a leading designer and manufacturer of standard and customised plastic and metal enclosures for OEM electronics equipment and is the UK subsidiary of OKW Gehäusesysteme GmbH of Germany.

Product range

OKW’s award-winning range of enclosures includes 16 handheld models, 18 wall mount enclosures and six desktop/keyboard cases.

The company also manufactures wired enclosures, portable instrument enclosures, suspension arm mountable enclosures, DIN rail enclosures, potting boxes and enclosure accessories.

Its metal enclosures division METCASE manufactures standard and customised aluminium instrument enclosures for desktop/portable and 19in rack mount applications.

OKW also offers partner product lines from Rolec, Teko and Serpac.

Standards and certifications


Specialist sectors include:

Access and security, automation, biometrics, building services systems, communications, data systems engineering, digital control, emergency systems, environmental technology, HVAC, industrial image processing, infrared technology, laboratory equipment, medical, mobile data recording, network technology, opto-electronics, peripherals and interfaces, safety engineering, sensors, test and measurement, wireless technology.

Contact

OKW Enclosures Ltd
15 Brunel Way
Segensworth East
Fareham PO15 5TX
The continuation of Moore's Law requires a combination of both physical and functional scaling, where our main challenge in lithography is to continue pushing the physical scaling limits in a controlled and cost-effective way. By serving as the collaboration hub of the industry in this area, imec is playing a key role in helping the industry to address the major technical challenges towards continued physical scaling. This is being done on multiple fronts.

First, work is ongoing on optical lithography where we try to squeeze everything we can out of immersion lithography by enhancing resolution and controlling variability. Resolution enhancement for immersion is being achieved through an increasing degree of multiple patterning and by leveraging the properties of novel materials, such as in directed self-assembly (DSA). In DSA, sub-resolution patterns are created by the micro-phase separation of specially engineered polymer chains called block copolymers, which are directed in specific orientations by lithographically generated guide patterns. The impact of variability is minimised by developing techniques to measure, optimise and control the patterning process window, and by the employment of clever patterning tricks to neutralise any remaining variability. Examples of such tricks include the variety of self-aligned integration schemes that are being developed.

But, of course, all eyes are on EUV lithography. Research institutes such as imec are helping industry to understand when and how to insert this technology. Certainly the performance of the tool – or more specifically the ramp in stable power of the light source – is a prerequisite. While ASML has made some promising developments, there is a whole ecosystem involved with EUV lithography, such as materials, masks, understanding the imaging fundamentals and development of computational techniques – and imec is focused on that ecosystem.

EUV resolution is currently material-limited, so imec has set up a programme to work with materials suppliers to develop novel photoresist platforms. This now serves as the centrepiece for such work. There is also work on various aspects of the photomask. Our strong collaboration with the Japanese consortium EIDEC is aimed at understanding the capabilities of new mask inspection systems and to link this with printing performance. Additionally, imec launched a successful pellicle programme in 2015 – the pellicle is a very thin free-standing film designed to protect the mask surface from particles. We are now exploring various novel films and have set up a testing facility for characterisation of samples developed around the world. Finally, various efforts are focused on understanding the complex interactions between the light source, mask, lens system and photoresist and to use computational techniques to optimise the resulting pattern.

With these issues in mind, it becomes clear that collaboration is key to continue the path of lithography. Many parties are involved and all have to contribute their piece of the puzzle.

It’s imec’s role to bring these parties together and understand how the pieces fit together. This is done in our core CMOS programme, where all the main chip manufacturers, tool and material suppliers are gathered. But the supplier hub that imec set up a few years ago has evolved as a very important aspect of the collaboration platform. Tool and material suppliers can evaluate their products in an early phase of technology development and get valuable feedback on how to further optimise them. In the collaboration process, they not only bring state-of-the-art tools and materials, but also valuable insights that help fuel imec’s developments and thus strengthen the core CMOS programme.

In 2015, various supplier interactions ramped up and have definitely started to pay off. In summary, by serving as the collaboration hub of the industry, imec is playing a valuable role in pushing the limits of physical scaling.
Replacing solid-state

‘The best electrolyte material for solid-state batteries hasn’t been found yet,’ according to Philippe Vereecken

These days, we all walk round with a smartphone and laptop – which has mainly been made possible by lithium-ion batteries. At the moment, these batteries still operate with a liquid electrolyte which limits miniaturisation. The flammable liquid also poses safety risk especially for use in wearables and medical implants. But because we also intend using sensors just about everywhere in our environment soon, we need to find a worthy successor to replace it. And this is the solid-state lithium-ion battery. This new type of power unit will be more compact, as well as safer. And if you manage to combine this battery with thin film technology, it will also be possible to recharge that battery very quickly. This makes a handy solution for small batteries, which will always have a limited capacity. In a larger format, this battery would also be ideal for flexible electronics and who knows, eventually maybe even for powering electric cars. In fact, you could say that it is the holy grail of rechargeable batteries.

The main problem with solid-state batteries is that we have not yet found the ideal electrolyte. Of course, we have made plenty of progress in this direction – just look at the many scientific papers that have already been published on the topic. But the fact remains that the world of batteries is still not much further down the road than the first generation of lithium solid-state batteries of the type that are used, for example in pacemakers. And which only deliver a very small amount of current.

Our research center (imec) is on a quest to find the best electrolyte material for solid-state batteries. We are currently focusing on composite electrolytes. There are two other types of electrolytes, but they still have quite a few disadvantages. The first of these types, polymer electrolytes, do not have sufficient conductivity, while inorganic electrolytes require a high process temperature, which results in the electrodes becoming damaged.

Last year, we succeeded in developing a composite electrolyte that not only has good conductivity (2x10⁻⁴ S/cm), but is also compatible with the materials used for electrodes (lithium-manganese-oxide as a positive electrode and lithium-titanium-oxide as a negative electrode in our lab). This electrolyte is made mainly from silica, a material with which we have a great deal of experience in the chip industry.

Now the challenge is to combine our 3D electrodes and our silica-based composite electrolyte to produce a genuine 3D thin film solid-state battery. If everything goes to plan, we will have a first demonstration set ready in 2016. And hopefully we will then be able to demonstrate that 3D thin film solid-state batteries are more than just hype and are a real new step forward in battery technology that will enable us to produce ultra-small electronics and batteries that will charge up in no time at all!
Switches

New multicolour switch with status display

New metal line switches offer multicolour illumination and variable input voltage from SCHURTER

SCHURTER is expanding its PSE piezo metal switch and MCS 30 mechanical metal switch series, with new illumination possibilities powered by variable input voltages. Based on RGB colour technology, it’s now possible to indicate up to seven illumination colour options with just one switch. The variable power supply offers a homogenous and brilliant illumination within a voltage range of 5 to 28V DC.

Illumination

Multicolour illumination of the PSE and MCS 30 series is made easy using convenient colour-coded wires in each of the illumination colours. Each colour is given a specific voltage between 5 to 28V DC. The constant brightness intensity is maintained, regardless of applied voltage.

The standard version is offered in red, green, and blue. Additional colour options include yellow, cyan, magenta and white, which can be made through additive colour mixing.

As soon as the two or three wires are supplied with the applied voltage at the same time, the result is a mixed colour. The traffic light colours of red, green and yellow (RGY) for status indication are also available as a standard version. No additive colour mixing is required to produce the colour yellow.

Expanded application range

The RGB multicolour illumination option expands the application range of the PSE and MCS 30 button style switches.

The PSE is available in diameters of 22, 24, 27 and 30mm diameters, while the MCS 30 has a diameter of 30mm. The PSE has an IP69K ingress protection rating. It has no moving actuator and is thus impervious to any leaks or accumulation of dirt underneath or around the switch surface. This technology is ideal for hygiene-related applications such as medical equipment and food processing equipment, as well as for outdoor applications subject to vandalism, such as ticketing machines.

The MCS 30 is an alternative to the highly robust, solid state PSE. It is also designed for demanding applications, although it uses a tactile switch that provides a clear haptic feedback. It has a lifetime rating of 1 million actuations, as opposed to the PSE’s 20m operations. The switch contacts are sealed from the front and rated IP65.

Technical Data:

- Input voltage variable from 5 to 28V DC
- Multicolour illumination with seven different colours
- Red, green, yellow configuration for status indication
- Customer specific adjustments are possible
- IP69K for the piezo switches
- Easy to clean

Applications:

- Medical equipment
- Public applications
- Industrial applications
- Household appliances
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