

ENGLISH

C O D I C O [®]

impulse ^{1/2021}



8DEVICES: Mango vs. Pineapple

E-Cars: Focus on Charging Infrastructure

New @ CODICO: QUECTEL Antennas

CONTENTS



04 | Mango vs. Pineapple

WiFi 6 offers higher speeds and capacities and thus forms the foundation for future-oriented networks. In the course of this, 8DEVICES has developed two new module solutions: Mango follows the approach of a SOM, where the application can be completely integrated on the module. Pineapple, on the other hand, follows the radio module approach, i.e. it only offers the radio technology.

ACTIVE COMPONENTS

- 04** | 8DEVICES: Module Approaches for WiFi 6 Applications
- 06** | QUALCOMM's Vision Intelligence Platform for IoT-Applications
- 08** | MPS: Angle Sensing & Motion Control
- 10** | Switching & Controlling With Gestures PIXART PAG7631J2 & PAJ7620U2
- 13** | Automatic Device Provisioning With 1NCE IoT SIM
- 14** | New XC9143/44 From TOREX With 18V Synchronous Boost DC/DC
- 16** | Ag5400: High Efficient Descendant at SILVERTEL
- 18** | Avoid Redesigns When Changing the Display
- 20** | ACCONEER: The A1 Radar Sensor at a Small Price



PASSIVE COMPONENTS

- 21** | New BHW Series for Automotive From RUBYCON
- 22** | How CELDUC Solid State Relays and Contactors Work
- 25** | New Capacity Level - PANASONIC's ZSU Series
- 26** | More Power, Less Loss: PANASONIC's ZU Series
- 28** | Charging Application: Focus on Charging Infrastructure
- 30** | Iron Powder Inductors With High Power Density From EATON
- 31** | EATON's PTV Series Fights Voltage Drops
- 32** | KDS and TXC Change the Structure of Their OXOs
- 33** | CODICO Expands Relay Portfolio With SONG CHUAN
- 34** | KEMET's KONNEKT™ Technology for High Voltages & Capacities
- 36** | Small Power Packs: THB X2 Film Capacitors From KEMET

CONNECTORS

- 37** | AMPHENOL LTW Sets New Standards With the ZConnect Series
- 38** | AMPHENOL's Lightning Applications for Smart Cities
- 40** | QUECTEL Antennas - Radio Frequency Front End
- 41** | AMPHENOL's Modular & Magnetic Jacks
- 42** | Ultrarobust: The New SOURIAU UTGX From EATON
- 43** | The Y-RED Product Range From YAMAICHI Gets New Additions
- 43** | YAMAICHI's Series HF301
- 44** | E-Bike Solution From SINBON
- 46** | FL CoaxBridge™ From HIROSE
- 47** | HIROSE's Interface Connectors for Sensor Units

CODICO IN-HOUSE

- 03** | Customer Satisfaction
- 48** | Megatrends
- 49** | CODICO Supports Vienna West Technical College
- 50** | The CODICO Team Says Hello

IMPRINT: Issued by CODICO GmbH Zwingenstraße 6-8, A-2380 Perchtoldsdorf
 Responsible for the content: Sven Krumpel | Editorship: Birgit Punzet
 Design: www.rittbergerknapp.com | date of issue: Ausgabe 01-01052021

Customer Satisfaction Is Top Priority!

To know and meet the expectations of our customers is a challenge we take up every single day.

Last year put a particular strain on all of us. We are all the more pleased to establish that the relationships to our customers have intensified despite or even because of the crisis. This is reflected in positive feedback and performance evaluations from many of our customers. What makes our customers happy?

Our range of services

As a design-in distributor, our declared objective has been to find the ideal solution to every application. Apart from the technical solutions, we keep an eye on prices, availability, and the latest developments. CODICO's strengths also include in-time, precise deliveries and optimised, customised logistics concepts to meet the customers' needs.

Our Sample Shop

On our website, customers can order development samples from more than 5,000 electronic components by 26 different suppliers, thus accelerating the development of new products. In addition, the Sample Shop always indicates the real specialists who will use their expert knowledge to look into queries or technical feedback.

Our logistics centre

CODICO tripled the capacity of its new state-of-the-art warehouse – opened in March 2020 – by enlarging the small-parts and pallet warehouse and the handling areas. All logistics processes – from goods acceptance to shipping and goods receipt by the customer – are computer-aided and largely automated. This has led to a considerable increase in the service level.

Our staff

CODICO employs a highly trained and motivated staff. Our engineers have many years of experience in the area of technical customer advice and will support and accompany our customers in the development process.

At CODICO, customer satisfaction is our number one priority!

D01

▶ Petra Landschau, +43 1 86305 169
petra.landschau@codico.com



Sven Krumpel
CEO CODICO



Editorial

Back to the Roots!?

Dear readers,

CODICO has indeed achieved a lot in recent months! We have tripled the capacity of our logistics centre, thus significantly increasing our service level, and also created a working environment that allows for an ideal work-life balance. Our new logistics centre, our state-of-the-art office world, and our Central Park – a leisure and recreation area for our staff members and their families – are now up and running!

Moreover, we are ready and motivated to take up current and future challenges! One of these challenges is the realisation that globalisation and growing specialisation also have their downsides, and they are not running as smoothly as they used to! We are confronted with ever increasing economic, political, and geopolitical dependencies. Though a seemingly isolated individual events (e.g. a ship stuck in the Suez Canal, a fire in an audio chip factory, winter storms in the USA impacting on certain plastic materials, and the like) carry enough disruptive potential for delivery shortages by themselves, they can have fierce consequences when combined. Not to mention the bottlenecks along international transport routes due to missing capacities, and an imbalance between exports and imports, which are just the icing on the cake.

If there is a lesson we draw from the current situation, it is the recognition that we must stop taking everything for granted! What has worked well for the last 20 years does not necessarily continue to apply. Seemingly trivial incidents can throw the world economy off balance. Security and transparency in the supply chain must be given a new, overarching priority. It is our responsibility to encourage and demand this, and to reflect on a stronger European self-sufficiency. Sometimes the good things are much closer than you think!

D02

▶ Sven Krumpel

MANGO vs. PINEAPPLE

Two Different Module Approaches for WiFi 6 Applications

802.11ax, also known as WiFi 6, succeeds 802.11ac (WiFi 5) and thus now presents the 6th generation of the WiFi standard, which was first publicly established on the market in its birth year of 1999 with version 802.11b. With the new generation, the standard has also been consistently further developed and continues to build on the advantages of WiFi 5 in terms of efficiency, flexibility and scalability. WiFi 6 also offers higher speeds and capacities compared to WiFi 5 and thus forms the foundation for future-oriented networks.

In the course of this, 8DEVICES has developed two new module solutions, both based on the latest WiFi 6 chip generation from Qualcomm. Mango follows the approach of a SOM (System on Module), where the application can be completely integrated on the module. Pineapple, on the other hand, follows the radio module approach, i.e. it only offers the radio technology, a host processor, memory and peripherals/interfaces are required to run an application.

Admittedly, the names Mango and Pineapple do sound a bit exotic and are more reminiscent of a beach vacation in the Caribbean than of 6th generation WiFi solutions. However, if you look through the IEEE standardization documents of WiFi 6 and internalize the underlying complexity and performance, the term exotic no longer seems too far-fetched for module solutions that master this technology 100%. So let's be surprised.

Mango

The SOM approach called Mango is based on Qualcomm's new SoC family IPQ60xx. The user has access to 4x Cortex-A53 clocked with 1.2GHz or 1.8GHz. Furthermore, 512MB DDR @ 933MHz and 32MB NOR Flash are available. In contrast to other SOM solutions, where the NAND flash memory is directly integrated on the module, Mango requires the connection of an external NAND memory device. However, this also results in a small advantage, because the user can dimension the memory size for his application himself and is not confronted with any memory restrictions.

2x PSGMII, QSGMII and SGMII+ interfaces are available for the connection of Gb Ethernet. On the other hand, the interfaces 64x GPIO, 1x PCIe 3.0 (Mango-I only), 1x USB3.0, 1x USB2.0, 2x UART, 3x SPI, 2x I2C, 4x PWM, 1x JTAG, 1x I2S/



Mango Development-Kit

TDM and 1x SDIO3.0/eMMC are fully integrated and don't need any external driver devices to run these interfaces. In terms of WiFi, Mango supports 802.11 b/g/n/a/ac standards in addition to 11ax and offers multi-user MIMO 2x2 mode with DBS (Dual Band Simultaneous). Mango is available in two versions:

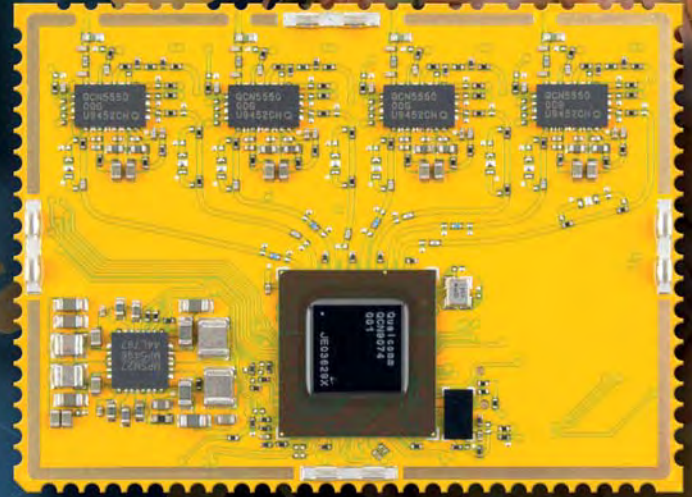
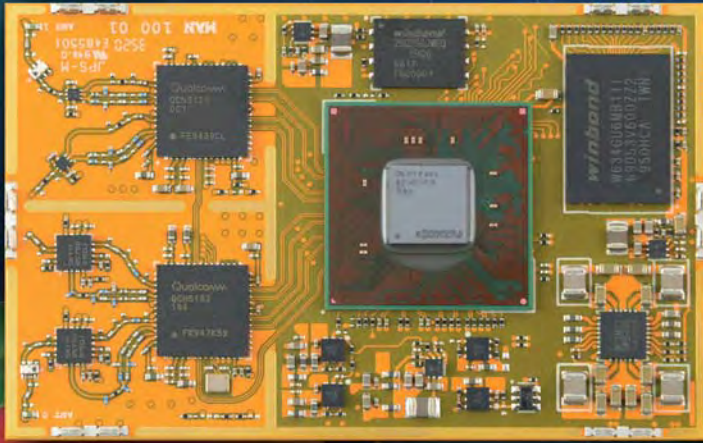
- Mango: CPU clock @1.2GHz, without PCIe, temperature grade 0 to +65°C
- Mango-I: CPU clock @1.8GHz, with PCIe, temperature grade -40 to +85°C

Samples and DVKs are available in our Sample Shop:

www.codico.com/de/mango

www.codico.com/de/mango-i-industrial-temperature-grade

www.codico.com/de/mango-dvk



Pineapple MPICE



Devices

Pineapple

Pineapple is based on Qualcomm's brand new QCN-9074 radio IC, which supports 3 bands 2.4GHz, 5GHz and 6GHz (WiFi6E) in a 4x4 MIMO antenna configuration via a PCIe interface. Accordingly, 8DEVICES offers 3 variants with the following product names corresponding to the bands:

- Pineapple 2: 2400-2500MHz
- Pineapple 5: 4920-5925MHz
- Pineapple 6: 5925-7125MHz

Pineapple 5 and 6 support up to 27dBm per antenna @ HT20/40/80/160, while Pineapple2 supports up to 28dBm per antenna, but is limited to HT20/40. Pineapple 5 and 6 achieve a maximum data rate of 4804Mbps in an HT160 and MIMO 4x4 configuration. Pineapple2 is still at a maximum of 1147Mbps with HT40 and MIMO 4x4.

All 3 variants have in common that each is offered in 4 different package designs. The LGA package, with a small form factor of 35x47mm, offers space-saving integration on a carrier PCB, where the antennas can be connected to the 4 antenna pads of the module in the form of U.FL connectors or in a PCB antenna design.

In addition, 3 other versions are offered as plug-in cards in a 50x61mm form factor with a mini-PCIe, M.2 A+E or M.2 B+M interface, where 4x U.FL connectors are already integrated on the cards. This results in 3x4=12 different module designs.

If it is taken into account here that in the course of the year each version will also be available in the industrial temperature grade -40 to +85°C (the current solutions offer 0°C to +65°C), this

results in a total of 24 different module variants. Also encouraging is the news that all modules will be supported by the Linux mainline driver from version 4.4.60 onwards. Of course like Mango, all modules will be certified according to RED, FCC and IC in the course of the year.

Samples for Pineapple 5 and 6 can be ordered in our Sample Shop:

www.codico.com/de/pineapple5

www.codico.com/de/pineapple6

More information about Mango and Pineapple is provided on our official support page:

downloads.codico.com/misc/AEH/8Devices

A01

▶ André Ehlert, +49 89 130143811
andre.ehlert@codico.com

VISION INTELLIGENCE PLATFORM



QCS410- and QCS610 SoCs for IoT Applications

There are three fundamental building blocks of IoT: Connectivity, Computing and Security.

By coupling leading connectivity with on-device intelligence combined with edge computing, the QUALCOMM® Vision Intelligence Platform featuring QCS410 and QCS610 System-on-Chips (SoCs), is designed to provide superior image processing along with superior Artificial Intelligence (AI) capabilities cost effectively, to serve a variety of IoT products. These include home security, enterprise security, video collaboration, robotics, healthcare applications and many more.

QUALCOMM
QCS410
QCS610

QUALCOMM QCS410/QCS610 SoCs are targeting high-performance and power efficient applications like edge computing for next generation smart cameras and smart home, enterprise or automotive IoT applications. These two SoCs offer support for up to 4K@30fps (QCS610) or up to 1080p@30fps

(QCS410) H.264/H.265 video capture/playback with advanced noise reduction and low light performance plus very high image quality, integrated support for Ethernet (RGMII), SD/MMC, USB3.1 and WiFi 802.11ac + Bluetooth 5.0. On-device machine learning through the QUALCOMM® AI Engine can support numerous AI networks and IoT use cases at low power consumption with exceptional thermal efficiency.

Using QUALCOMM® SoCs for vision intelligence offers the advantage of a one stop shop for all technologies that are needed in a wide variety of IoT applications. The SoCs include:

Powerful AI

The QUALCOMM® AI Engine includes a HW accelerator to accelerate custom NNs (Neural Networks) built

using the popular frameworks such as Tensor-Flow/TensorFlow Lite, ONNX, Caffe/Caffe2 and user defined layers, together with the SW SDK to be able to fully utilize the underlying HW.

Rich ISP

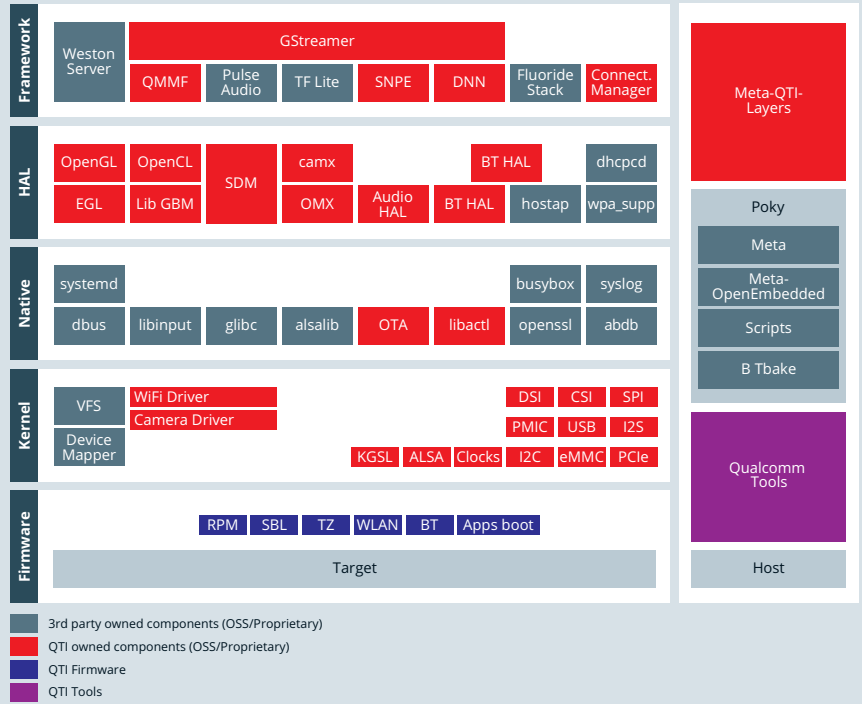
Dual 14Bit ISP (Image Signal Processing) units which includes a combination of dedicated HW blocks and SW algorithms to deliver superior image quality with 3D NR, HDR and other IoT specific features. A rich suite of SDK/tools are offered to help development and tuning easy.

Integrated Connectivity and Audio

Integrated connectivity like RGMII, USB3.1, SD/eMMC, UART, I2C, SPI, WiFi 11ac 1x1 and Bluetooth 5.0 including location/GNSS and audio solutions. Support for connecting external QUALCOMM® WCN3980 for WiFi 2x2 MIMO 802.11ac and Bluetooth 5.x is available.



Credit: iStock/Alamy from the look & master 130

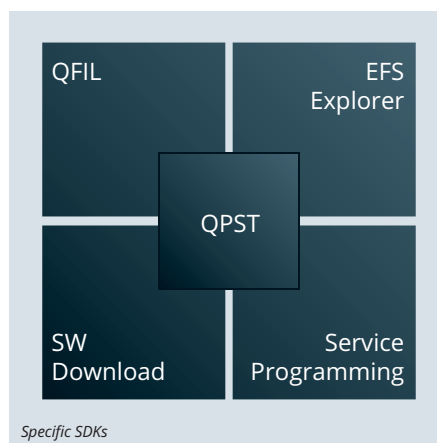


LEPDK block diagram

playback, streaming, transform, transcode and AI inferencing. The picture above is showing a simplified LEPDK block diagram.

Required tools and specific SDKs

The **QPST** package is used for configuration, flash image loader (QFIL), EFS explorer, software download, service programming. **QPM** is a lightweight, and client software that sits in the system tray to help simplify user interactions with QUALCOMM software tools packaging and licensing. **QXDM** is an enhanced debug and monitor tool, **QUD** a platform driver installer for Microsoft Windows.



Hardware Development Kit

An ODK (Open Dev Kit) is made available by CODICO. This is an IPC610-ODK and it enables faster time to launch with turnkey solution for developing Enterprise or Home Security solutions.

Development, benchmark and optimization of own AI model using popular industry frameworks is available through QUALCOMM® Neural Processing Engine running on this ODK.

QUALCOMM Vision Intelligence, QUALCOMM QCS610, QUALCOMM QCS410, QUALCOMM AI Engine, QUALCOMM ChipCode and QUALCOMM Neural Processing SDK are products of QUALCOMM Technologies, Inc. and/or its subsidiaries.

A02

▶ Joachim Strohschenk, +49 89 130143817
 joachim.strohschenk@codico.com

To allow easier applications development on such complex SoC, QUALCOMM Technologies released the Linux Embedded Platform Development Kit (LEPDK). The goal of the LEPDK is to provide a simple and flexible development platform to rapidly build IoT products with the QUALCOMM application processors. The LEPDK provides the build framework, software components, tools, and sample applications to evaluate the platform and build software images for the target product. The LEPDK is based on the Yocto Project (Poky release). Through the LEPDK, users are provided with capabilities to define build configurations for specific customization needs.

The LEPDK has built-in support for the GStreamer multimedia framework. The GStreamer is an open-source multimedia framework that supports a wide variety of media & AI related components for video, audio, image capture,

ANGLE SENSING & MOTION CONTROL

Motion control is the strongest growing motorization market, still for years. Applications require high efficiency and compact construction. Brushless DC Motors (BLDC) have a great success story. And with the demand for more torque, fine control and wide performance ranges the requirements on the involved components increased even with an economic pressure.

Controlling BLDC motors

To control brushless DC motors (BLDC) exact rotor position is required to commute the right coils in the correct direction.

Block commutation

Classic BLDC motors use three discrete hall elements with simple binary switching. Those sensors being placed manually into the stator or at the rotor's end cause a big tolerance and manual effort for adjustment. The 120° rotor segments on 3 sensors just provide a basic and very coarse position information. The sensors indicate each on a binary state where to provide power to the motor.

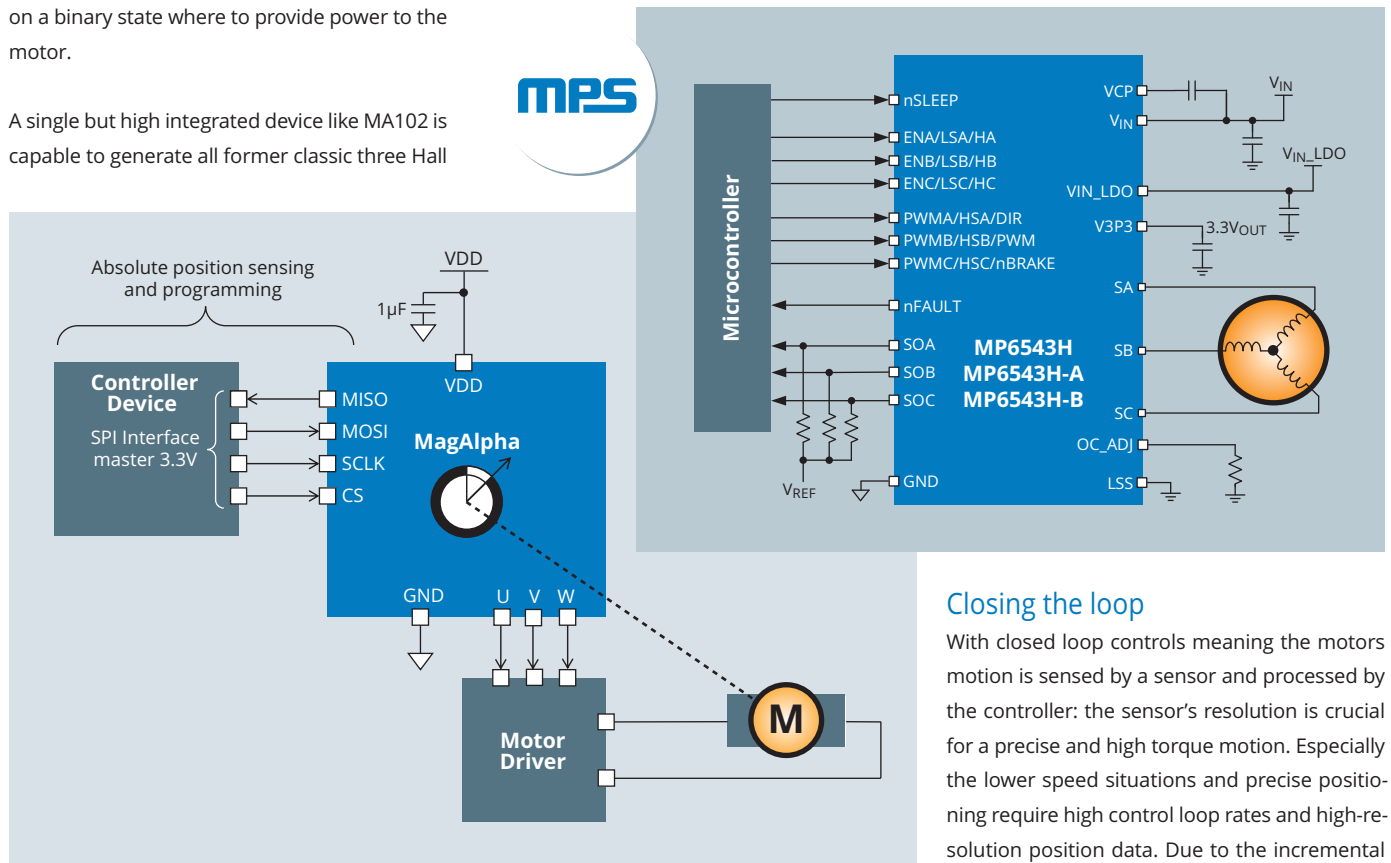
A single but high integrated device like MA102 is capable to generate all former classic three Hall

signals. A big benefit comes for the adjustment that is done on one device, non-volatile and simple to program into. But also pole pair counts and angular adjustments are covered by parameters of the device. Smaller board space demand, flexible position adjustment and field monitoring. Due to factory calibration of all sensors no individual calibration in production is required, saving time and effort.

The Motor Driver IC MP6543HB creates a synergistic accessory to MA102. With its six built-in mo-

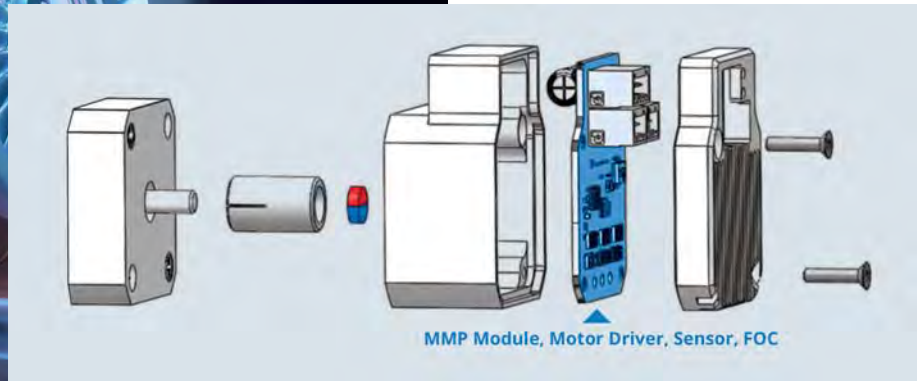
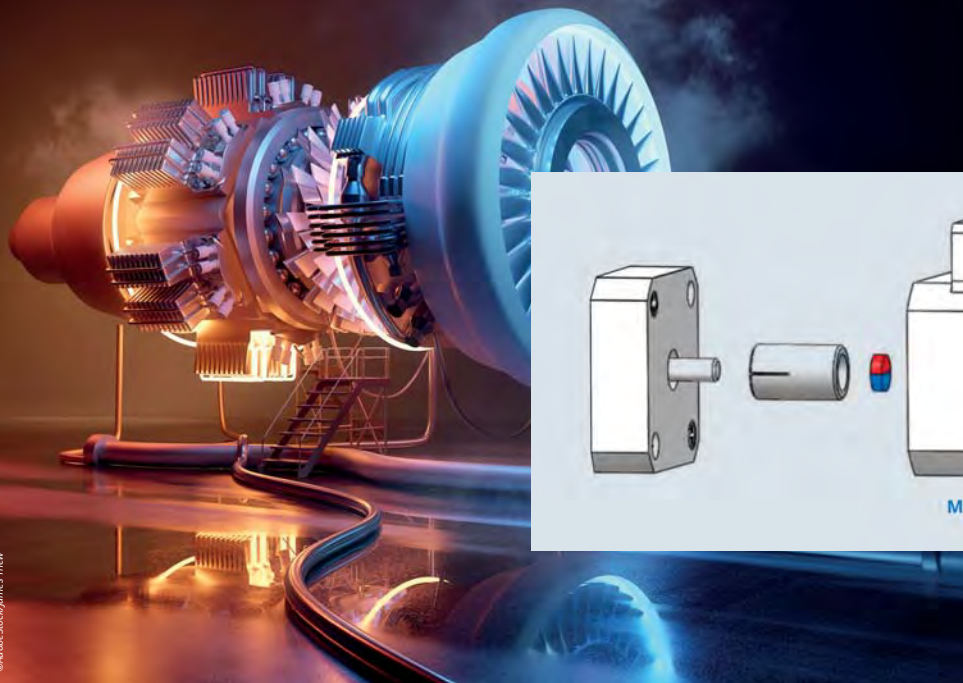
nolithic power MOSFET, it can drive a BLDC motor directly without the need for any external MCU. MP6543HB utilizes the Hall Signal information from MA102 and works as a standalone Block Commutation Motor Driver.

For precise motion control the demand on position and speed information is much higher. Higher resolution Hall sensors based on the Spin Axis™ technology can be used for more than just a simple UVW commutation. Those sensors provide true absolute angle information at up to 14Bit and angle update rates of 1MHz with parallel available popular standard quadrature interface (ABZ signals, 12MHz). Comparing ABZ and UVW signals by resolution shows that a 12Bit ABZ signal provides a much finer angular information than the 3x2 (<3Bit) commutation signals by a factor of >500.



Closing the loop

With closed loop controls meaning the motors motion is sensed by a sensor and processed by the controller: the sensor's resolution is crucial for a precise and high torque motion. Especially the lower speed situations and precise positioning require high control loop rates and high-resolution position data. Due to the incremental



MCSxxxx Series). Beyond dedicated voltages and seizing the benefit of isolated current sensors are popular in motion control systems. From single supply to individual motor phase current sensing: the currents of the motor phases bring the motion controller additional data of the present operating point and motion control optimization.

Diverse requirements require flexible solutions

The wide ranges of applications are coverable with different levels of motors, sensors and controllers. The application requirements define the range of compatible components.

MPS offers the full range of semiconductor solutions for BLDC-Drivers, current sensors and rotor sensors that are suitable for applications from only a few Watts to several Kilowatts.

A03

▶ Thomas Berner, +49 89 1301438-15
thomas.berner@codico.com

Download catalogue:



character of ABZ signals the demand for full absolute position data, cycle by cycle is even with a single Hall based sensor feasible. Popular embedded SPI or standard industrial SSI interfacing is provided by the MPS Angle-Sensors to the controller in parallel, too.

Complete system vs. modular components

Motion control systems are more and more highly integrated: all components are part of a single system: motor, sensor, control. In this case the motor commutation and sensor communication happen inside the system and on an embedded base and direct connection, sometimes even on the same PCB. MMP-modules offer a compact and fully integrated module solution driving a BLDC. Angle Sensor, FOC commutation, RS485 interface and a motor driver IC fit on a tiny PCB, that can be retrofit to any BLDC motor.

But there are still applications that use separate modules: in worst case there is a motor, an attachable encoder and the motion controller/drive each as a separate unit. Combining those components successfully requires common standards on mounting, cabling, signals and communication protocols. Here the industrial standards enable a seamless and scalable combination. With MPS MMP motor driver modules we offer complete PCB assembly solutions that incorporate position sensor, driver power stage, and field orientated control algorithms for integration into brushless motors.

Field Oriented Control (FOC)

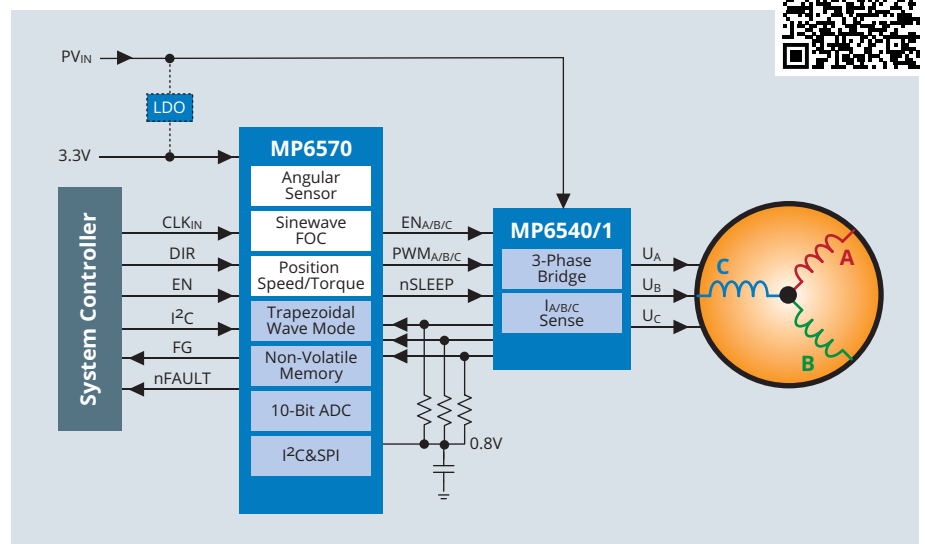
With Field Oriented Control the system is optimized to the kinematic dynamic system and the

magnetic properties. The control provides adaptable power to the BLDC motor for perfect motion.

Here the resolution and update rates on position data and motor currents are higher and provide angular information at a low latency for the closed loop high performance motion controller. MPM6570 for example integrates the FOC Controller and the Angle-Sensor in one single IC. In combination with an external Power-Stage like MP6540 they are able to deliver and also measure and feedback the necessary motor-currents.

More sensors provide more data

In motion control system the angular information of the rotor is not the only data that is processed for improved control. The motor current information is also relevant to be used on the controllers current control loop. Motor current can be sensed either within the driver (e.g. MP6540) or by external current sensors (MPS



MAKE A GOOD GESTURE



In times of increasingly stricter hygiene requirements for control elements, today we are often seeing a trend away from mechanical switches to touch or gesture control. Conventional touch navigation requires the user's full attention during operation.

Gesture control eliminates the shortcomings of the existing human-machine interaction by allowing users to control their product with simple and intuitive gestures.

In principle, it is possible to use this type of control in many application areas. For instance, it is ideally suitable for controlling car infotainment systems. But also in industrial environments and in medical areas, where hygiene regulations put restrictions on touching surfaces, gesture control is an interesting alternative to conventional switches/knobs.

There are various different ways of implementing gesture control, such as simple photodiode solutions, or conventional camera solutions cou-

pled with software gesture recognition on a computer system.

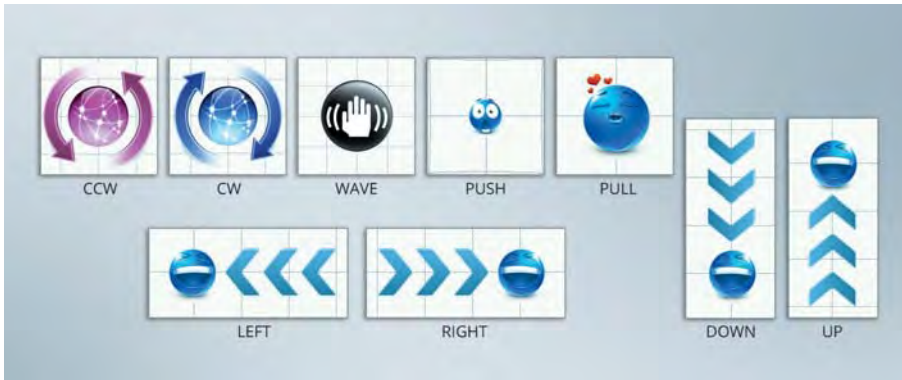
PIXART Imaging takes a different approach: using invisible infrared light, a three-dimensional gesture area with a depth of at least 15 centimetres is created above the component. This area is also monitored by the sensor, and the value of the recognised gesture is stored in a register, so that the user can interact with the system without any physical contact.

This allows for a hands-free operation of equipment, using simple hand gestures. Gesture control takes place directly in the sensor component and not on an external host controller, as with comparable systems. The integrated recognition

algorithm operates discreetly in the background, and communicates the result via the register. PIXART Imaging integrated the gesture recognition function in the PAJ7620U2, and at a strikingly competitive price.

The PAJ7620U2 sensor, including its evaluation system, is packaged in a 13Pin LGA module (5.2×3×1.8mm) and can recognise 9 gestures. Power consumption does not exceed 2.82mA, and is only 1.5mA in standby state, from which it can be woken up by gesture. The more powerful PAG7631J2 requires 7mA, and just 0.2mA in sleep mode.

The interface to the µC is an I2C. The nine user gestures (up, down, left, right, forward, backward,



circle-clockwise, circle-counter clockwise) allow for an intuitive interaction with devices. Thanks to its small form factor and the standard I2C interface, the sensor can be easily integrated in existing designs. Users must simply control their own application with these sensor signals. A proximity detection function is also built in. Here are some examples for the use of gesture controls:

- Switching on the display/Starting up the system
- Basic navigation (up, down, left, right) for scrolling in menus or on websites
- Rotation gestures for forward and backward movements, and volume control of audio or video systems
- Motion detection for wake-up and sleep function of displays or entire systems.

When replacing a mechanical light switch with gesture control, for instance, additional functions become possible – apart from switching on and off, one can also assign dimming or colour changing functions to defined gestures. Applications in different areas, ranging from simple to

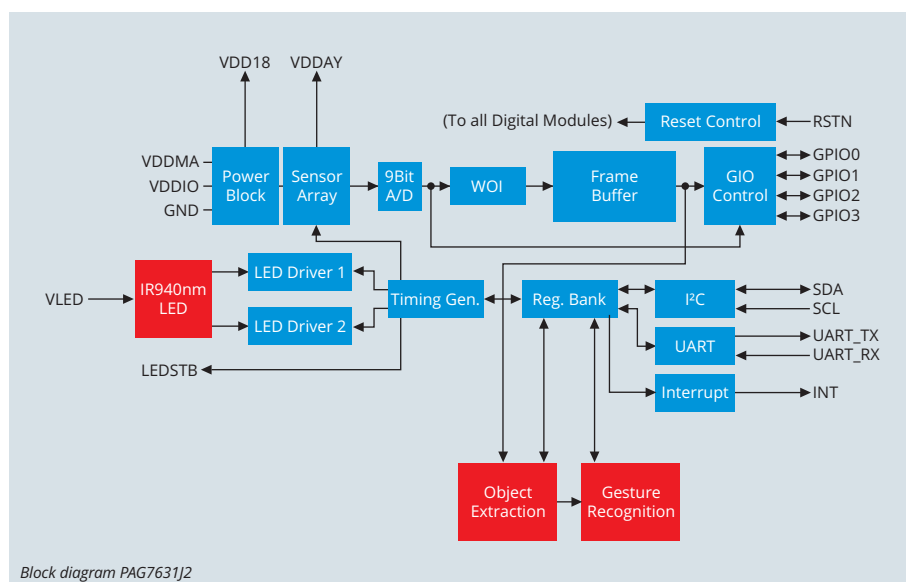
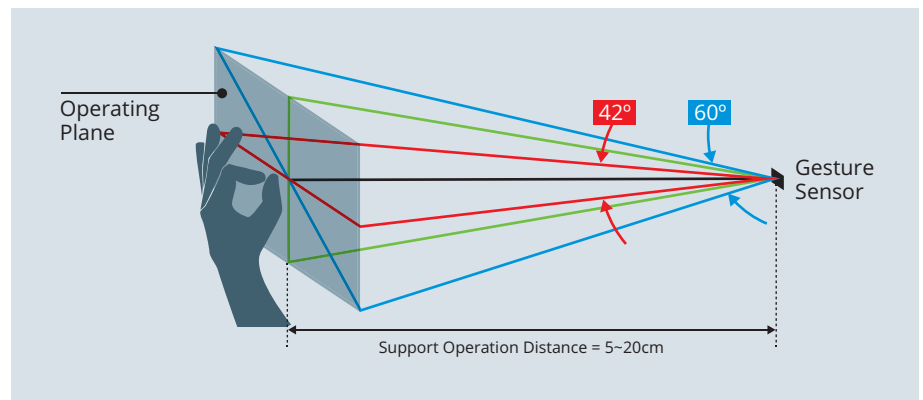
complex controls, can now be executed with natural hand movements with the help of gesture control.

In addition, developers can individually adjust the actions of the gesture evaluation, and thus determine their user interactions, so as to meet the requirements and expectations of the users. This sensor stands out with properties such as low power consumption, large range, ambient light immunity, compact size, as well as immunity

to capacitive and magnetic interference fields, so that it can be easily built into or combined with various other systems. An example for this are capacitive touch fields or magnetic switches. Moreover, this sensor possesses an internal function that can eliminate non-constant disturbances caused by short »flashes« (e.g., the flicker of a 50Hz lamp), which can cause individual changes in values.

Since a transparent cover is usually positioned above the sensor, which already causes a reflection of the emitted infrared signal, the sensor features an internal calibration function.

The cover above the PIXART PAJ7620U2 imaging sensor may not exceed a thickness of 0.8mm (1.8mm in case of PAG7631J2), since the LED is integrated in the sensor module and this would otherwise cause undesirable reflections. We recommend glass or plastic with a >90% transparency, placed as close to the sensor as possible (<0.2mm). As a result of the individual correction



Block diagram PAG7631J2

possibility, dirt, scratches, and raindrops on the user interface are negligible. A disturbance caused by a cover (sticker) directly above the optical sensor will be detected and can be displayed as a fault message.

The field of view (FOV) at a distance of 20cm to the object measures 15.4×15.4cm. The horizontal and vertical view angle of the sensor is 60 degrees, so that the FOV will change depending on the distance. Using the register of the module, it is not only possible to read the recognised gesture but also to make a few settings such as e.g., operation distance adjustment, up/down/left/right sensitivity adjustment, push/pull sensitivity and wave adjustment, as well as rotation adjustment.



The sensor can be operated at 2 speeds: Normal mode (gesture speed 60°/s to 600°/s) or gaming mode (gesture speed 60°/s to 1200°/s).

The 4-wire SPI interface can also read out the »image« (image mode = 60×60 raw data). The data sheet indicates a detecting range of 5cm to 15cm, and 15cm is the recommended maximum distance for the PAJ7620U2 sensor. Using the auto-exposure (AE) and window-of-interest (WOI) settings, customers can influence the detecting range and test this change directly in their application. Thanks to the proximity detection function, movements can be detected in the three-dimensional gesture space in real time and wake up the system while only the sensor is active (always-on) in an energy-saving mode, leading to a better standby power consumption of the entire system.

The PAJ7620U2 provides additional values about the objects in its area of coverage, such as object size, brightness, and position. This information can be used, for instance, for the following purposes:

- Detecting light leak: When there is no object in front of the sensor, the ObjectSize and ObjectAvgY values are zero.
- Measurement of the relative distance of the object: When the object stays in front of the

sensor, the ObjectSize and ObjectAvgY values are not zero. If it approaches, the values will rise.

- Recording of the object's »movement«: It is possible to record the movement using the values from »ObjectSize«, »ObjectAvgY« and »Object Position«.

PIXART has another sensor in its product range, the PAG7631J2, which comes with the following key features: Max. detecting range 30cm, 10 recognisable gestures (up, down, left, right, forward, backward, circular clockwise, circular counter-clockwise, waving and hover): This sensor is also available in a version with »AEC-Q100 Grade 3« specifications (PAJ7635U2). The IR LED and the lens are integrated in all PIXART Imaging gesture sensors, so they can also operate in complete darkness. In addition, the 763x family supports multi-sensor frame sync to synchronise several sensors, and also offers the possibility of controlling external LEDs.

In a nutshell

PIXART Imaging's gesture sensors with integrated evaluation allow for contactless user interaction

with simple and intuitive gestures at an affordable price. You can order samples and evaluation kits of the PIXART Imaging sensors from the CODICO Sample Shop.

You can order samples and evaluation kits of the PIXART Imaging sensors from the CODICO sample shop:



A04

▶ Joachim Strohschenk, +49 89 130143817
joachim.strohschenk@codico.com



1NCE IOT SIM

Automatic Device Provisioning

The Amazon Web Services (AWS) IoT Core consists of a managed cloud service that can process trillions of messages from billions of connected devices and interact with other AWS services in a simple manner. As a result, users can develop IoT solutions without having to set up their own server structures. This saves time and money. As an AWS Advanced Technology Partner, Cologne-based 1NCE GmbH has developed a tool that now also automates and optimises device provisioning in the AWS IoT Core.

When developing mobile IoT solutions, companies are faced with a wide array of challenges: How can I automate the secure and cross-platform authentication of my devices? How can I integrate and configure these devices quickly and easily in my overall solution? How can my devices communicate with the cloud for the longest time and lowest power consumption possible?

It's no witchcraft, provided one has the necessary know-how. But it takes resources to create the technical requirements. These are resources that would be better devoted to where the company's core competencies lie: In improving its own product idea.

1NCE GmbH, which specialises in worldwide mobile device communication, is now offering the 1NCE IoT Connectivity Suite for AWS, a comfortable tool for a quick and automated integration of device connectivity in the AWS IoT Core. The suite is included in the 1NCE IoT Flat Rate, a global data rate for all common mobile telephony standards at a fixed price of 10 euros for 10 years. Starting from the very first SIM card, users have the full range of functions at their disposal free of charge.

Integration made easy

1NCE uses the SIM card as an identification instance: IoT devices can thus be automatically and quickly integrated in the AWS IoT Core environment without having to enter a PIN (the cards are "pre-activated"). In addition, the SIM card can be used as a security module for the creation of device certificates and their transport to IoT terminal devices.

Optimising battery life

The integrated Data Broker adds leaner transport protocols such as UDP and CoAP to the native MQTT support so as to extend the battery life of the mobile devices. The conversion to binary data for UDP further optimises the data lo-

ad, and also contributes to a longer product life in the corresponding application cases.

Simple IoT product development

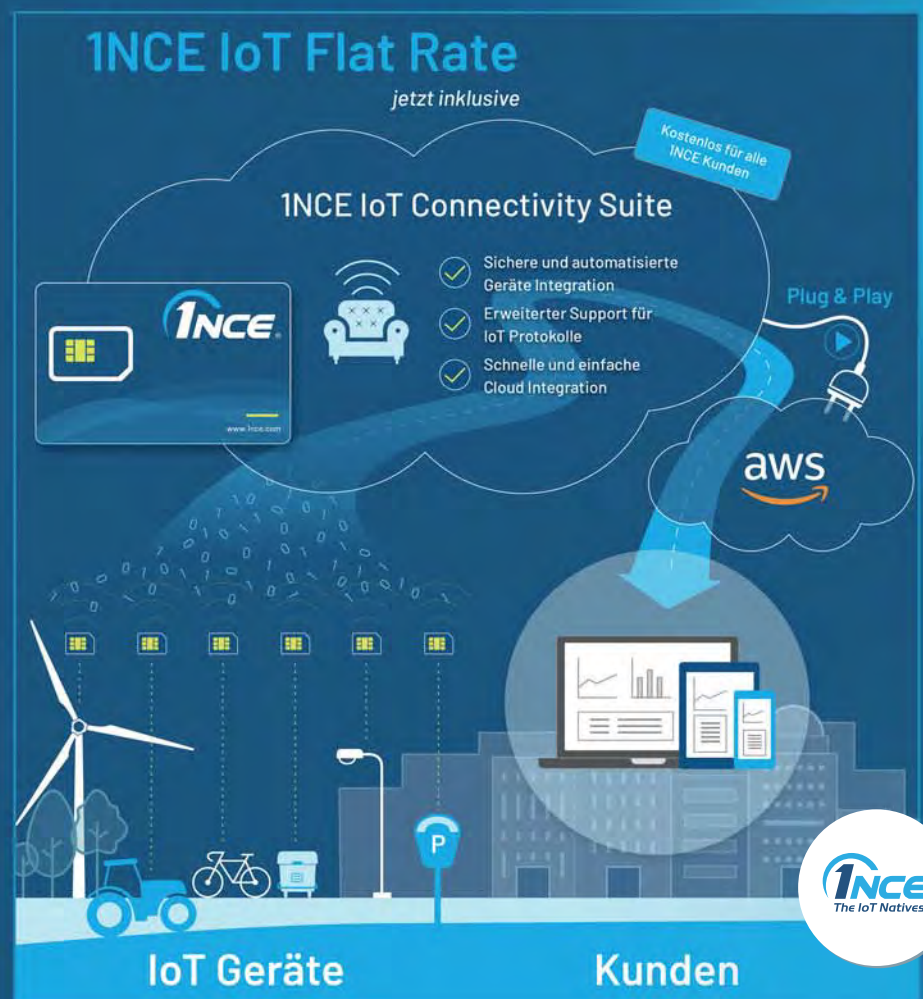
The 1NCE Rule Engine enables real-time actions based on preconfigured events and parameters. Together with the 1NCE Software Development Kit (SDK), they offer a comprehensive solution toward further acceleration of IoT device development.

Test the 1NCE IoT SIM free of charge

Feel free to ask us for the 1NCE For All SIM card. With the card, IoT product developers can use all functions unrestrictedly and without any contractual limitations for 12 months.

A05

▶ Joachim Strohschenk, +49 89 130143817
joachim.strohschenk@codico.com



XC9143/44

18V Synchronous Boost DC/DC

TOREX
SEMICONDUCTOR LTD.

The XC9143/44 is a 18V 1.0A synchronous step-up DC/DC converter that can operate within a wide range of 1.7V to 16V and can support output voltages of between 7.0V to 18V (set externally).

There are two switching frequency options available, 1.2MHz and 3.0MHz and this new boost DC/DC can support output currents of up to 400mA ($V_{OUT}=7.0V$, $V_{IN}=3.3V$) or 300mA ($V_{OUT}=12V$, $V_{IN}=5.0V$).

This new synchronous boost DC/DC is an ideal solution for use in a variety of applications where there is a requirement to step-up from either a battery or DC inputs such as 5V and 12V to power displays, motors, actuators, or various analogue circuits. An efficient step-up circuit can be configured using only a minimum of external components and a small 2.2uH inductor (3MHz version) which also helps reduce output ripple voltage – see Figure 1.

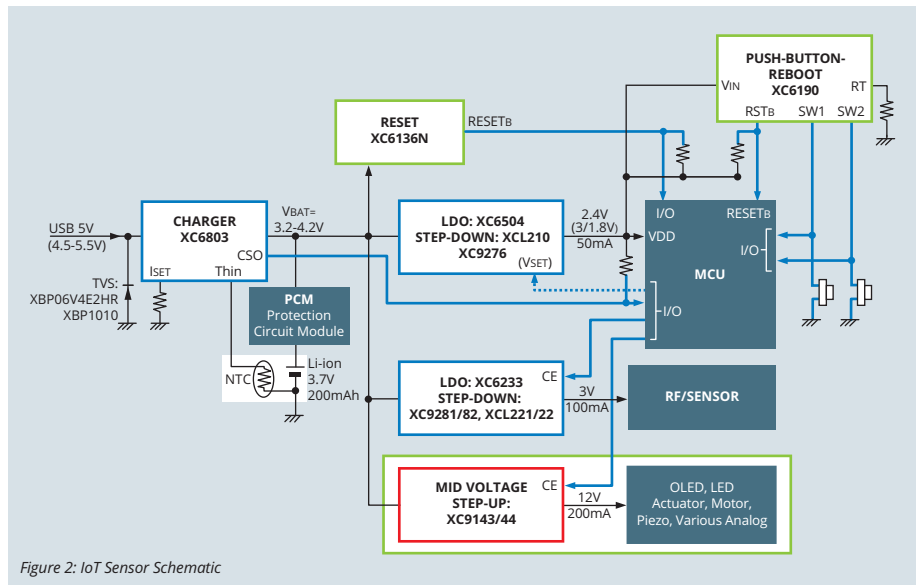


Figure 2: IoT Sensor Schematic

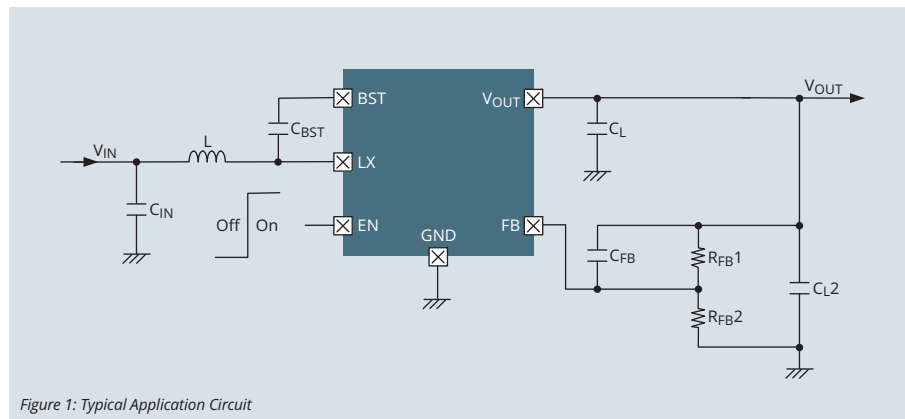


Figure 1: Typical Application Circuit

APPLICATION EXAMPLE 1

IoT sensor

Powered by a re-chargeable Li-Ion single cell battery (3.7V), a typical IoT sensor application will require not just a charger IC, a step-down DC/DC or LDO for managing power to the MCU and/or sensor, but probably an efficient boost DC/DC to step-up from the battery to 12V@200mA for possibly powering OLEDs, LEDs or a motor. The XC9143/44 is ideal for this boost function and the typical power schematic for such a sensor is shown in Figure 2.

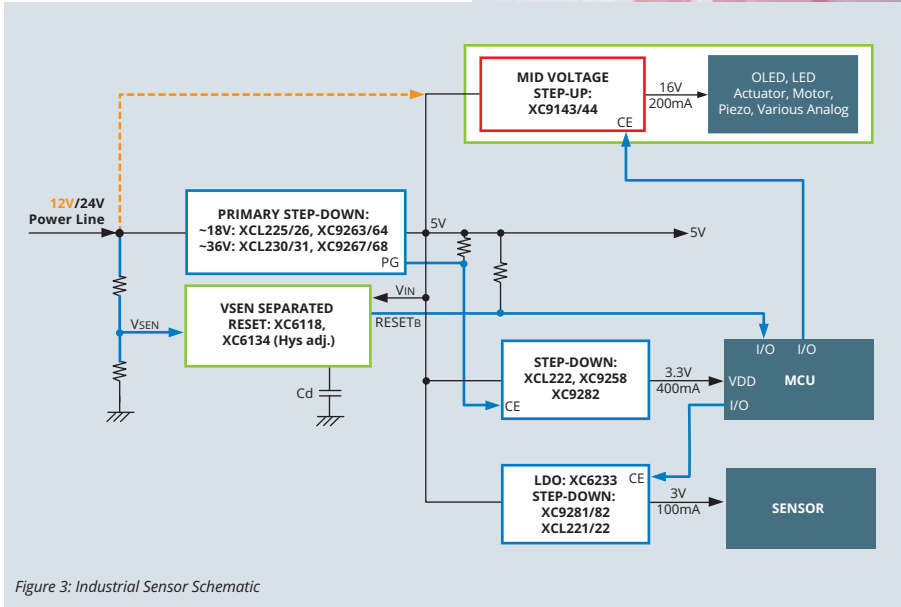


Figure 3: Industrial Sensor Schematic

APPLICATION EXAMPLE 2

Industrial sensor

Power is typically from either a 24V or 12V rail. If the power line is 24V, a buck DC/DC would be required to initially step-down to 5.0V, for example, and then the XC9143/44 can be implemented to step-up to 16V. If, on the other hand, the power rail is 12V then this can be directly connected to the VIN pin of the XC9143/44 to step-up to 16V. A typical power schematic for such a sensor is shown in Figure 3.

Load disconnect function

Although a load disconnect function is not included with the new XC9143/44, one can be easily configured externally if required. If VOUT is higher than (VIN + VGS von Pch) then the following circuit will provide the load disconnect function:

LED supply

The XC9143/44 is also a suitable to drive multiple LEDs in series (Figure 5). The LED current is re-

gulated as: $I_{LED} = V_{FB} / R_{SENSE}$ (where the $V_{FB} = 1,0V$) so if the I_{LED} is 50mA, the R_{SENSE} is: $R_{SENSE} = 1,0V / 50mA = 20\Omega$.

Package options

The XC9143/44 series is available in TSOT-26 and USP-6C (1.8x2.0x0.6mm) packages (see Figure 6).

If you want more information, just ask us or order samples in our Sample Shop www.codico.com/shop. We can also supply an evaluation board according to your technical specifications. The CODICO Team will be happy to support you.

A06

▶ Johannes Kornfehl, +43 1 86305 149
johannes.kornfehl@codico.com

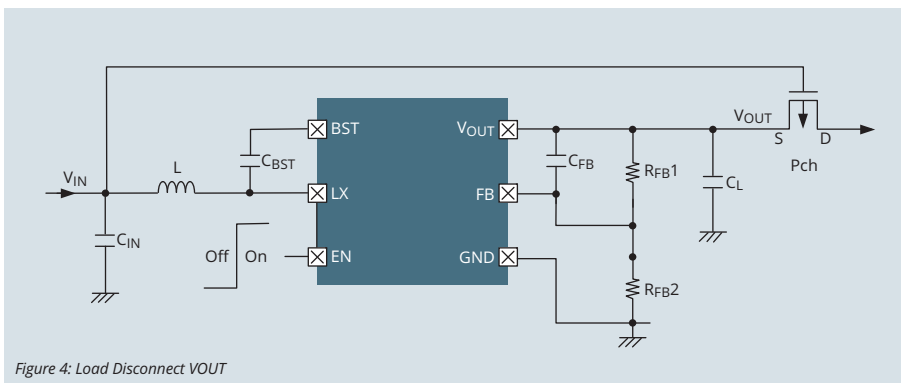


Figure 4: Load Disconnect VOUT

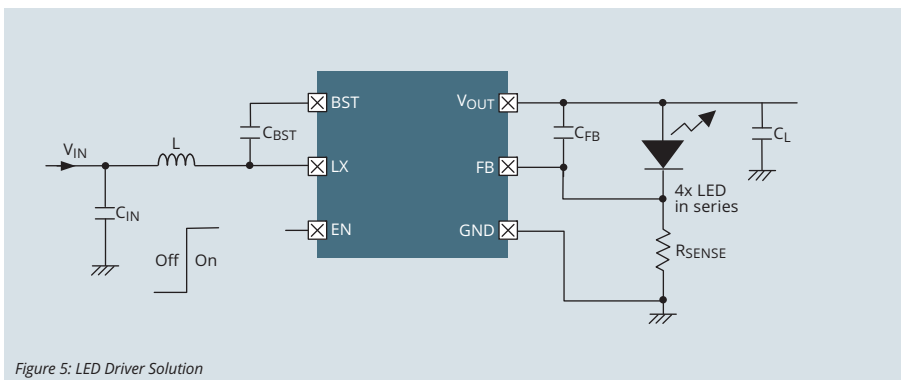


Figure 5: LED Driver Solution

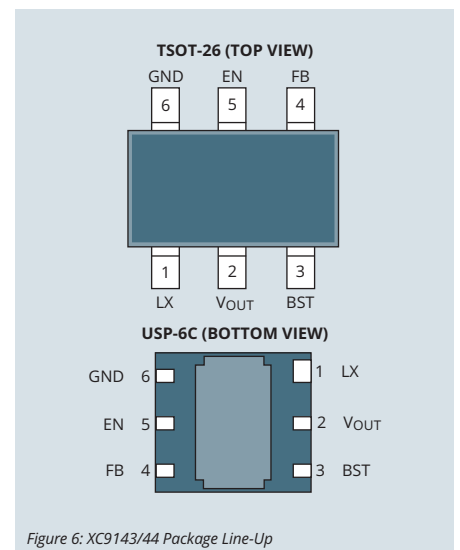


Figure 6: XC9143/44 Package Line-Up



AG5400: HIGH EFFICIENT DESCENDANT

The Welsh manufacturer of miniaturized, high efficient PoE modules comprehends their product range with three new members.



©AndriiStock/Gettyimages

In addition to the well-established Ag5300 series, SILVERTEL announces the launch of a high efficiency version of this popular range. As with its predecessor, the Ag5400 family is an IEEE802.3at compliant PoE PD module with a 5V, 12V or 24V output. The 57×18×14mm single-in-

line module is the smallest 802.3at solution in the world and is ideal for space-constrained applications such as Single Board Computers, Wireless Access Points and Door Access Equipment.

The Ag5400 family provides efficiency of over 93%, and reduces wasted power by 50% and enabling the product to be used in systems with elevated ambient temperature. The Ag5400 family is pin-for-pin compatible with the Ag5300 family and provides a very easy migration route for the design engineer who wants greater efficiency, less heat generation and more useable power available to the peripheral device.

The Ag5400 range is a fixed Class 4, Type 2 PD module incorporating the identification and classification features necessary for PoE interoperability, 1.5kV isolation and efficient DC-to-DC Conversion.

Complementary DCDC modules to support PoE range

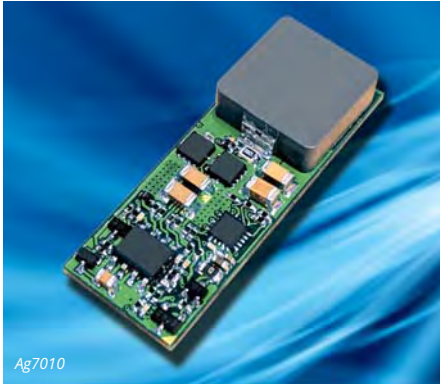
The newest addition to SILVERTEL's popular DC-DC Converter modules is the Ag7010. The module is a Buck Converter, with a very wide input voltage range of 4.5VDC to 28VDC and output between 3.3VDC and 12VDC at a massive 120W.

The non-isolated design is optimised for USB-C Power Delivery input (5V/9V/15V or 20V) including Thunderbolt (Intel) and Lightning (Apple) but is equally-suited for distributed 12V/24V systems.

At typically 95% conversion efficiency, the module offers superior performance in a leadless, SMT package measuring 37×14×7mm (LxWxH). The Ag7010 has PMbus control by means of an I2C interface allowing remote monitoring and control of the output.



Ag5400



Ag7010

The Ag7010 is ideal for applications powered from USB-C such as Monitors/TV's, Gaming Consoles and Virtual Reality systems, 2D & 3D scanners/printers, Bluetooth Speakers, Media converters/extension hubs as well as camera/surveillance systems, monitoring systems and other industrial applications which are typically powered from 12V or 24V supplies.

Battery charge controller Ag105

The Ag105 is a Lithium-Ion Battery Charge Controller module, designed to charge Lithium-Ion and Lithium Polymer batteries from a fixed DC source or solar panel feed. Using an intelligent and safe charging profile, the module delivers pre-charge, constant current and constant voltage profiles. The Ag105 uses Maximum Power Point Tracking (MPPT) to optimise charging from solar panels. It has a wide input voltage range of 11VDC to 36VDC and can charge Li-Ion and Li-Po batteries with capacities from 0.2Ah to 12.5Ah, via selectable charging profiles.

On-board I2C interface allows control and monitoring of the battery under charge. Available in a Dual-in-Line (DIL) format and measuring only 51×30×16mm (L×W×H), the module occupies very little area whilst offering an impressive feature list.

Contact CODICO to ensure that you register your interest and for sample availability. SILVERTEL's Applications Support team and evaluation tools, makes implementation and design-in an extremely low risk route to series production.

A07

▶ *Andreas Hanausek, +43 1 86305 131
andreas.hanausek@codico.com*



Ag105



DESIGN FOR LONGEVITY

How to Avoid a Redesign when Displays Change

You may already have asked yourself the question: What do I do when the display in my design is no longer available?

Contrary to the consumer electronics environment, one is interested in keeping products longer "alive" in an industrial setting. The development effort involved is often considerable and, compared to mass products, these costs must be distributed over a smaller number of units. In this case, longevity thus does not refer to the period during which a product will function – provided it is properly designed, it will do so for quite a while –, but to how long I can manufacture the device without any externally imposed modifications, e.g. as a result of discontinued parts.

The display is one of those components that may in some circumstances render it necessary to redesign a product. In this case, short product life cycles can become a problem. Therefore, one must pay particular attention to the availability of a display. This topic is currently becoming increasingly actual. In times of bottlenecks, it may become necessary to replace a display.

With its year-long knowledge of the market and its technical expertise in the area of displays, CODICO is your partner of choice if you want to avoid or solve such challenges.

Let us now take a closer look at this issue. In general, one must make sure that the manufacturer offers a reasonable end-of-life (EOL) process. As a distributor, we also put a great emphasis on this requirement when choosing our partners.

Of course, one can also take preventive action to avoid difficulties in the future, and to minimize the effort involved in any modifications. There are different ways of assessing the long-term availability of a product depending on the display technology used.

Monochrome LCDs

Let us begin with monochrome liquid crystal displays (LCDs) and liquid crystal modules (LCMs). In this particular case, the display glass is non-critical. The manufacturing of such displays is relatively simple, and the machinery required comes at a comparably low price. Therefore, there is a large number of manufacturers who can produce such displays. Moreover, due to its simplicity, this type of LC display is rarely affected by discontinuations. In most cases, these will occur when demand for a certain type no longer exists.

When it comes to LCMs (those are display modules that also include a controller and/or backlight), the situation is different. The risk here is present at two levels. When it affects the backlight – the LEDs used are subject to constant improvement and are replaced by newer types –, at least a mechanically compatible solution must be found, probably through a redesign of the background lighting by the manufacturer. This helps avoid changes on the user side, and costs will remain under control. If the controller on the display needs to be replaced, one must usually expect changes in the control software. The dimensions of the display itself remain the same, and a possible modification of the controller's pin assignment can be catered to with affordable methods, such as a different FPC.

So all in all, it can be said that the use of monochrome LCDs almost certainly spares you the risk of insurmountable difficulties. CODICO offers solutions from different manufacturers in this respect, so that, if the worst comes to the worst, a satisfactory solution can be found quickly.

OLED displays

In the following we take a look at so-called passive matrix OLED displays. Since active-matrix OLED (AMOLED) displays are primarily aimed at

smartphones, which are generally short-lived, these products are rare or non-existent in industrial settings.

OLED displays are manufactured using a semiconductor process, making their production significantly more complicated than that of LCDs. For this reason alone, manufacturers are interested in making these products for a longer period of time. With regard to these displays, a long-term availability of over 10 years is quite realistic.

The high cost of the manufacturing facilities, and also the research and development effort involved mean that there is only a small number of manufacturers out there. In order to benefit from each other in the market, they consciously or unconsciously settled for a range of identical or at least very similar display sizes. This provides the user with an additional degree of safety. As in the case of LCMs, the only critical issue is the controller. Unlike these, however, there are only a few companies manufacturing controllers for PMOLED displays. Solomon Systech (SSD) is the market leader by quite a margin.

Though there are a few small manufacturers such as Sino Wealth, these are not used on a large scale. Considering the size of SSD and its good financial condition, however, one should not expect any problems to arise. The manufacturer complies with all customary EOL procedures.

Therefore, PMOLED displays do not pose a significant risk to long-term use. In addition, different suppliers at CODICO minimize the risk of suddenly being left without a display.

TFT LCDs

Thin-film-transistor (TFT) LCDs are even a class above OLED displays in manufacturing. The factories making these are correspondingly expensive, so that such a major investment is not economically sensible for smaller undertakings. Therefore, the manufacturers are divided into those who own their own factories and produce correspondingly large quantities, and a much larger number of companies who purchase so-called 'cells' from them and focus instead on the subsequent steps for making a finished display. Essentially, the latter (i.e. the large majority) are completely dependent on the TFT glass manufacturers. If, for any reason whatsoever, one no longer has access to a specific glass, some good

advice will be needed, but it will come at a cost. The first, albeit slightly theoretical approach is to have an identical, fully compatible display developed and manufactured. Depending on the size, the initial costs for this are somewhere between 100,000 USD and above 200,000 USD. Not every project can afford such sums. Get in touch with us and discuss your project with us. A lot of questions can be clarified beforehand, so that such problems don't even emerge.

So, what is important to consider in order to avoid any (at least major) problems and to keep possible additional costs at bay?

Mechanics

A basic rule is to opt for standard display sizes and to avoid using any exotic versions. There are always several manufacturers available for standard sizes, so that one can divert should the eventuality arise. Yet the devil is in the detail. Though the glass may have the same active area, the mechanical dimensions of the module may be different. This means that casings may have to be adapted.

This can prove expensive, especially in the case of injection moulding plastics, when moulds need to be modified or even new ones made. A cover glass may help remedy the situation. Based on our experience, around 90% of all designs feature a capacitive touch screen, and thus a front glass. The latter is designed in a slightly larger size, so that a display with of moderately different dimensions can still be integrated. There are also standard thicknesses for the glass. One must take into account that the TFT module thickness may also be different, e.g. due to a different backlight. This also calls for a more flexible design of the casing to accommodate this. Now and again, a display replacement can be done without further ado. Should a display with TN glass no longer be available, one may be able to find this type with IPS glass.

As a result, it is possible to have the display replaced 1:1, since there are no electrical or mechanical differences. The advantage here is that such a replacement would even mean an upgrade to a higher visual quality. As previously mentioned, at CODICO we make sure to offer products from several manufacturers also for TFT LCDs. This way, we can offer a solution approach quickly by resorting to them.

Electronics

Even if the dimensions are identical, there may be differences in the interface. Again, this already begins with the mechanics of the display, i.e. its connection. It is very likely that a replacement product will use a different connector. Unfortunately, it has become a habit among manufacturers to use different connectors (even for the displays of the same manufacturer) wherever they can. I am familiar with this issue for several years.

If need be, the most affordable remedy will be to work with an adapter board, or to fit the connection cable with the corresponding mating parts. Some (cable) manufacturers offer both options off the shelf. The only silver lining here is that, once a display is connected via FPC, the whole issue is often reduced to the pin assignment. This gets us right to the topic: In many cases, the pin assignment is different despite the same interface standard, even if the signals, and usually the voltage levels are basically identical. Here, adapter boards or the correct (modified) cabling can also remedy the problem.

If a replacement is only possible with a completely different interface, however, users will have to dig deeper in their pockets. Unfortunately, such cases will require the use of an interface converter. The costs for this are higher, and the adjustment may need some development time. With experienced partners on the manufacturer side like those you get at CODICO, however, it may be possible to integrate the interface in the display.

Standards do change in the course of time; one only has to remember the 4:3 ratio that is now being replaced by wide formats. If you want to develop a future-proof design, ask us where the journey is heading in the long run, so as to avoid taking any risks.

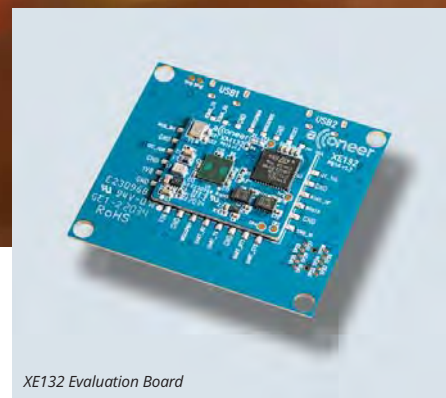
Take advantage of our expertise from the very start of your project, and should problems arise unexpectedly and you have to replace the display, get in touch with us – we will find a solution together.

A08

▶ Christian Forthuber, +43 1 86305 158
christian.forthuber@codico.com

XM132 ENTRY MODULE

Brings the A1 Radar Sensor to an Integration-Ready Format



XE132 Evaluation Board

The XM132 Entry Module from ACCONEER is an integration-ready low-power module with outstanding system cost, optimized for use cases such as presence detection and contactless monitoring of tank levels.

With a solderable design featuring a land grid array and software adapted for specific use cases, cost and time-to-market are streamlined. On the XM132 Entry Module the A111 pulsed coherent radar sensor is integrated with a 32Bit 64MHz Arm® Cortex® M0+ MCU, with

128KB of Flash memory and 36KB of RAM. The module supports a single supply operating voltage range from 1.8V to 3.6V.

The XM132 Entry Module was developed to complement ACCONEER's module offering, which also includes the XM112 High-Performance Module and XM122 IoT Module. With the XM132 Entry Module, ACCONEER takes the next step in providing a module designed for smooth integration into customer products.

With the ARM Cortex M7-based XM112 High-Performance Module it is possible to evaluate high performance embedded applications, while the XM122 High-Performance Module targets connected battery-powered use cases, combining the A111 radar sensor with an ARM Cortex M4 MCU and integrated connectivity such as Blue-

tooth. With the XM132 Entry Module complementing ACCONEER's product offering, customers can quickly bring solutions to the market in a power-efficient and cost-optimized way. For a quick and easy start, ACCONEER provides the evaluation board XE132, which has the XM132 entry module soldered to it. The XE132 has support for UART communication over USB, which enables a straight-forward way to flash and debug the module, as well as easy access to all interfaces from the XM132 module via pin-headers.

All ACCONEER's modules, as well as the A1 pulsed coherent radar sensor, can be purchased through the CODICO Sample Shop.

A09

▶ Johannes Kornfehl, +43 1 86305 149
johannes.kornfehl@codico.com



XM132 Entry Module

READY FOR THE EV MARKET



RUBYCON's New BHW Series

RUBYCON announced a new radial type electrolytic capacitor, the BHW series (105°C 10,000-12,000hrs) for automotive high voltage use (400-450V). This capacitor was developed specifically with EV charging applications in mind.

The increasing number of electric vehicles is leading to a rise in demand for electrolytic capacitors, which are often used in the PFC circuits of electric vehicle charging units. Due to high voltage, greater capacitance and ripple currents, larger sizes like snap-in types come into play in those areas.

The RUBYCON VXK series is one of the most recommendable series for snap-in type capacitors. Where the power requirements are smaller, how-

ever, radial type (THT) capacitors are often used due to their compact size. Thanks to its long lifetime and high specifications, the RUBYCON BXW series (105°C 10,000 to 12,000hrs) is the most popular radial type (THT) capacitor.

The BHW series is a newly developed radial type, which is a size smaller than the BXW series. This series features up to 20% higher capacitance and also has a higher ripple current than the BXW series.

Key features BXW series

- Radial-/THT-Type
- Lifetime: 105°C, 10.000h (≤20mm) or 12.000h (≥25mm)
- Voltage: 400V-450V
- Size: ø16×20 – ø18×50mm

For automotive applications, RUBYCON applies very stringent internal inspection methods. At the smallest failure, RUBYCON takes appropriate action, introducing improvements in the production process to increase quality. The brand is well-known for its robustness, which often exceeds the customers' conservative specifications.

The current BHW series was subjected to the same severe scrutiny. To achieve the desired quality, RUBYCON is now using different material combinations than those of standard items. Not only the electrolytic liquid was changed: foils, separators, rubbers, etc. were also redesigned. Even if the specs look similar, the robustness and reliability of RUBYCON products is far superior. This reliability will tolerate zero defects in automotive applications.

For more information, please feel free to contact:

RATED VOLTAGE [VDC]	SIZE [øD×L/mm]	CAPACITANCE [µF]		RATED RIPPLE CURRENT [mA _{rms} /125°C, 100kHz]	
		BHW Series	BXW	BHW Series	BXW
420	16×35	110 (+10%)	100	800 (+9%)	730
	16×40	130 (+20%)	120	910 (+4%)	840
	18×40	160 (+6%)	150	1,030 (+3%)	1,000
	18×50	220	—	1,310	—
450	16×35	100 (+20%)	82	780 (+13%)	690
	16×40	120 (+20%)	100	870 (+13%)	770
	18×45	180 (+20%)	150	1,120 (+12%)	1,000
	18×50	190 (+5%)	180	1,200 (+9%)	1,100

P01

▶ Yasunobu Ikuno, +43 1 86305 276
yasunobu.ikuno@codico.com

SOLID STATE RELAYS NEWS

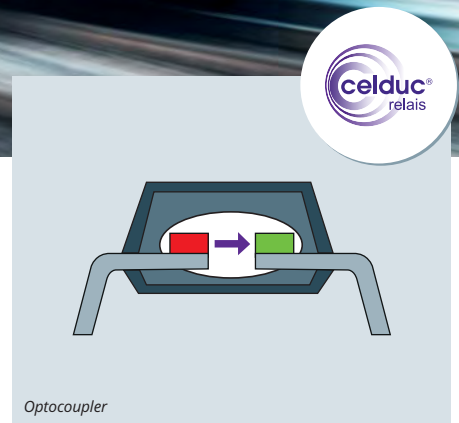
How Do CELDUC's Solid State Relays and Contactors Work?

Solid state relays are switching devices made using electronic components. Unlike electro-mechanical relays (EMR) which use coils, magnetic fields, springs and mechanical contacts to operate and switch a supply, the solid state relays, or SSR, have no moving parts but instead use the electrical and optical properties of solid state semiconductors to perform its input to output isolation and switching functions. There are two main parts that make up a solid state relay:

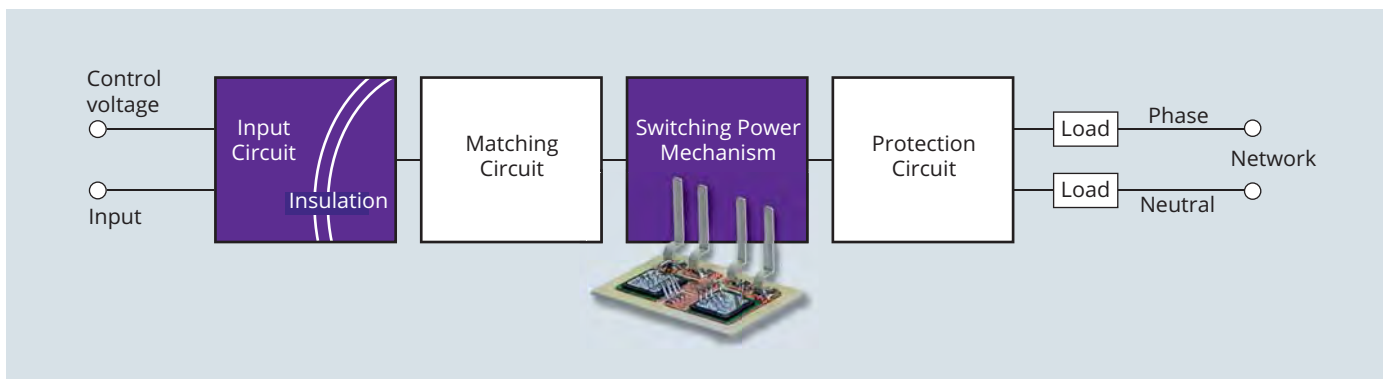
- the input circuit
- the switching circuit.

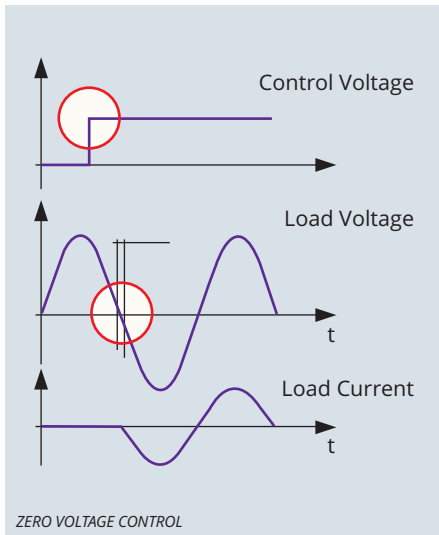
SSR's provide complete electrical isolation between their input and output contacts. For the input circuit, an optocoupler (also named opto-isolator) is used. An optocoupler contains of one (or more) infra-red light-emitting diodes (=Transmitter), and a photo sensitive device (Photo triac = Receiver) within a single case.

The optocoupler isolates the input from the output. CELDUC® has selected the best optocouplers on the market. The switching circuit consists of an element providing for the electrical power to be switched to the load.



For AC solid state relays, this component could be a triac or back-to-back thyristor (also named Silicon Controlled Rectifier, SCR). CELDUC's back-to-back thyristors are using TMS² technology. TMS² technology gives to CELDUC's Solid State Relays a very high life-time expectancy compared to the majority of products on the market. CELDUC's research and development regularly





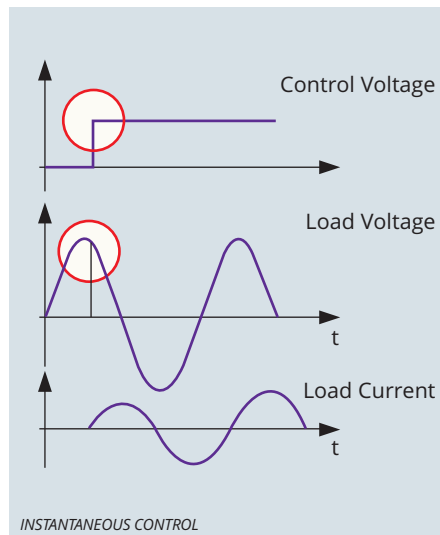
improves the production process, constantly increasing the number of cycles.

For DC solid state relays this component may be either a bipolar transistor or a MOS transistor or a IGBT. The matching circuit processes the input signal received and switches the output circuit and guarantees the desired switching mode. CELDUC® is offering Solid State Relays with different switching modes:

1. For ZERO VOLTAGE CONTROL (OR ZERO CROSS RELAY), power switching only takes place at the beginning of the alternation after the control has been applied. In fact, switching the power component only takes place at close to zero volts. For resistive or capacitive loads, it is preferable to use zero cross relays which can limit the di/dt , disturbances on the network and increase the service life of the load and the relay.

2. For INSTANTANEOUS CONTROL (OR RANDOM RELAYS), power switching takes place as soon as the control voltage has been applied (turn-on time less than $100\mu s$). This type of control is used for all INDUCTIVE loads where the phase shift between voltage and current can cause problems with zero-crossing relays. It is also used in applications where precise control of power to the load is required (phase-control applications).

3. For PEAK STARTING RELAYS, The power switching only takes place at the voltage peak of the half-cycle following the application of the control. This control is particularly suited to



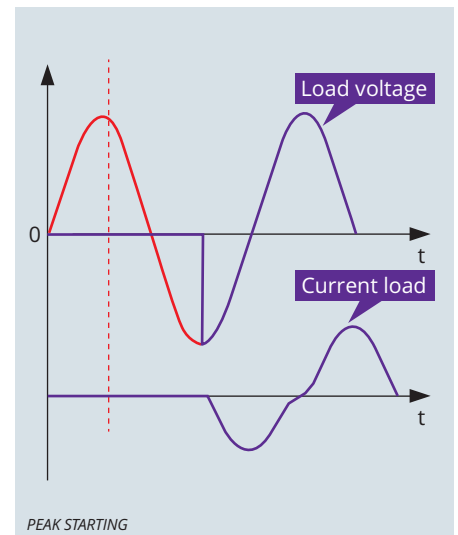
the control of TRANSFORMER type inductive saturating loads. This prevents the transformer from being saturated and also significant magnetising current peaks.

Solid State Relays (SSR) vs. Electro-Mechanical Relays (EMR)

This technology gives solid state relays many advantages:

LONG SERVICE LIFE: solid state relays do not have any moving mechanical parts so they are not subject to wear and tear or deformation. When used correctly, a solid state relay has a service life that is 200 times longer than that of an electromechanical relay (EMR). Very low consumption: Very low control output, directly adapted to voltage and current.

A MORE PRECISE SWITCHING TIME: One of the biggest advantages of solid state relays over electromechanical relays is the ability to switch



»OFF« AC loads at the point of zero load current, thereby completely eliminating the arcing, electrical noise and contact bounce associated with conventional mechanical relays and inductive loads.

A LOWER ENERGY CONSUMPTION: a low drive power will allow solid state relays to switch heavy power loads.

VERY HIGH SWITCHING FREQUENCY: for a very accurate temperature control. With an SSR, fast switching reduces hysteresis (this is made possible thanks to its huge switching capacity).

SILENT OPERATION: this technology does not generate acoustic noise while the outputs are changing state, which is a very important advantage when it comes to domestic and medical uses.

SHOCK AND VIBRATION RESISTANCE: no risk of accidental switching with solid state technology.

MORE FUNCTIONS: Solid state relays offer more possibilities in terms of diagnostics, protections and communication.





SGT



S07

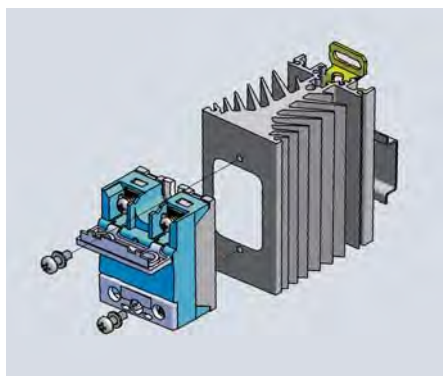


SUL

What do you have to consider when using your solid state relay:

Solid state relays must cool down sufficiently so that the junction temperature (at the core of the power element) does not exceed the specified values: typically 125°C or 150°C (this value depends on the power components).

Cooling will prevent it from reaching heatsink temperatures (parts that can be touched) that are too high (90 or 100°C). To select the appro-



appropriate heatsink for your needs, use a calculation or refer to the graphs provided by CELDUC relays in the technical data sheets available on www.e-catalogue.CELDUC-relais.com or contact our product manager who will support you!

CELDUC offers a wide range of Solid State Relays

CELDUC manufactures a wide range of solid state relays up to 125 Amps single phase two-phase or three-phase, I/O interface modules, SSRs for printed circuits and diagnostic relays. CELDUC is also offering solid state relays for motor control loads.

Typical Applications for CELDUC's Solid State Relays

Solid state relays are used in a wide range of applications. Every day, more and more new applications that require reliability, silent operation, and a long service life use our innovative SSRs. Here is a small selection of possible areas of application:

HEATING ELEMENTS: commercial food processing machines, plastic injection molding/extrusion, furnaces, HVAC, textile, residential heating, infrared heating, drying, thermoforming, soldering equipment

MOTOR STARTING: pumps, compressors, conveyor systems, fans, elevators, lifts, hoists, motorized exercise equipment

LIGHTING: theaters, municipalities, cinemas and stages, airport runways, streets and roadways, warehouses, office spaces, hazardous locations and beacons

AUTOMATION: automation interfaces, heating element control, electrovalves, contactor coils, sensor optical isolation

MISCELLANEOUS: power transformers, electromagnets, switching power supplies, regulators, Inverters, power converters, uninterruptible power supplies, power factor correction capacitors, solenoid valves, and more

P02

▶ Arnold Geitzenauer, +43 1 86305 124
arnold.geitzenauer@codico.com

NEW CAPACITANCE LEVEL



Check out our new **Sample Shop:**
www.codico.com/shop

PANASONIC's Hybrid Cap ZSU



PANASONIC Industry introduces new ZSU series of electrolytic polymer hybrid capacitors type – standing out with a capacitance increase of 80% in comparison to the recent ZS series, while keeping the same dimensions and other electrical characteristics.

Reliability, efficiency, performance – this triad of automotive engineering applies in particular to the crucial components a modern car consists of. And there is an increasing number of them, as the level of comfort, functionality and safety is increasing with every new car generation. Acknowledging those prevalent industry trends, PANASONIC Industry has developed its popular ZS series with outstanding successors – such as the ZSU series, that comes with an almost unrivalled capacitance.

»The ZSU series takes our capacitance specs for hybrid caps to an entire new level«, says Yusuke Nagata from PANASONIC Industry Europe. »For dimensions of 10×12.5mm with 25VDC we achieve 680µF for the 10×16.5mm equivalent 1000µF.« Moreover, the ZSU hybrids reveal a 4,000 hours endurance at 125°C and full rated ripple current capability.

Speaking of tough conditions »under the hood« or elsewhere in industrial environments, PANAS-

ONIC Industry offers vibration proof versions for 6mm diameter or above, withstanding shocks of as much as 30G.

The ZSU series is currently available in 25-63 VDC/120-1,000µF – and an interesting option whenever high temperature withstanding and next-gen capacitance is the criterion of choice. That would be – first and foremost – many automotive 48V applications such as oil pumps, EPS, e-com-

pressors or ADAS applications. The latest capacitor innovation of course is AEC-Q200 compliant.

»Components serving their functional purpose immaculately under severe automotive conditions are also often the perfect choice for other fields of applications«, points out Yusuke Nagata. And indeed: When looking at a suitable capacitor for base station power supply, industrial motor inverters or contemporary communication devices, ZSU series is definitely worth a closer look.

P03

▶ Roland Trimmel, +43 1 86305 144
 roland.trimmel@codico.com

10×12.5	25V	35V	50V	63V
Panasonic ZS	470µF 3500mA rms	330µF 3500mA rms	150µF 3200mA rms	100µF 3000mA rms
Panasonic ZSU	680µF 3500mA rms	470µF 3500mA rms	180µF 3200mA rms	120µF 3000mA rms
10×16.5	25V	35V	50V	63V
Panasonic ZS	560µF 4000mA rms	470µF 4000mA rms	220µF 3700mA rms	150µF 3500mA rms
Panasonic ZSU	1000µF 4000mA rms	680µF 4000mA rms	270µF 3700mA rms	180µF 3500mA rms

*mA rms rated ripple current at 125°C/100kHz

ZU



More Power, Less Dissipation: New Hybrid Cap ZU



Panasonic
INDUSTRY

PANASONIC Industry introduces new ZU series of electrolytic polymer hybrid capacitors type with remarkable ripple current and temperature features for a wide range of particularly demanding applications.

Capacitors for next gen automotive applications, but also in the field of communication, power supply and industrial devices are expected to equally and immaculately meet efficiency, durability and performance requirements.

In this light, the latest PANASONIC Industry polymer hybrid capacitor ZU series is a remarkable evolution of the current popular ZS series.

»For this version of the latest types, we have been concentrating our efforts particularly on reducing power dissipation«, as Yusuke Nagata from PANASONIC Industry Europe summarizes. »ZU series is able to withstand ripple currents up to 53% better than its predecessor. For dimensions of 10×12.5mm with 25VDC we achieve 5A rms, for the 10×16.5mm equivalent 5.8A rms at 125°C.« These values are currently the best on the market and offer the possibility of miniaturizing the design and saving costs by reducing the number of parts.

Next to the also improved leakage current, ZU series stands out with a 4,000 hours temperature endurance at 135/125°C.

ZU series is currently available in 25-63VDC at 100-560µF and suits wherever high temperature tolerance and capacitance is the criterion of choice. That would be – first and foremost – many automotive 48V applications such as Integrated Starter Generator (ISG), DC/DC, oil pumps, water pumps or fan motors. The latest capacitor innovation of course is AEC-Q200 compliant and available in a vibration-proof version for harsh environments.

»Components serving their functional purpose immaculately under severe automotive conditions, are also often the perfect choice for other fields of applications«, points out Yusuke Nagata. And indeed: When looking at a suitable capacitor for power supply inverter or rectifier, industrial mo-

tor inverter or contemporary communication devices, ZU series is definitely worth a closer look. When your application requires smaller dimensions, especially lower height, new PANASONIC ZT series could be the solution.

Advancing the performance specifications of the currently popular ZC series of hybrid capacitors, PANASONIC Industry now brings new ZT series into play, which stands out with an exceptional persistence and robustness for a vast number of demanding applications.



4,000 hours at 125°C (8,000 hours at 115°C, 16,000 hours at 105°C) in addition to a high ripple current capability in compact dimensions render ZT an ideal choice for the rather demanding types of modern industrial, automotive or power supply applications.

Currently available with a rated voltage of 25-63VDC and a significant increase of 75-118% in ripple current capability by keeping the compact case sizes 8x10.2 and 10x10.2mm, PANASONIC's new series meets also the ambitious AEC-Q200 requirements. Yusuke Nagata, Capacitor Section Team Leader at PANASONIC Industry, summari-

zes the field of relevant real world applications: *»Next to many others, it reliably qualifies for being applied to inverters, converters, robotics, rectifier circuits – and in particular for automotive parts under the hood where conditions turn out to be exceptionally harsh and hot“.*

Good to know for that harsh matter:

PANASONIC Industry also offers a vibration-proof version of their hybrid capacitors. Those are able to handle shocks of as much as 30G, clearly exceeding standard vibration tolerance of 10G. In the specifications, we are talking about the ra-

ted ripple current at the rated temperature and the specified guaranteed lifetime under these conditions. Depending on ambient temperature and duration, PANASONIC Industry's hybrid capacitors can also withstand higher ripple currents.

Let us know your requirements, in best case a mission profile, and we will offer you the best technical and commercial solution.

P04

▶ Roland Trimmel, +43 1 86305 144
roland.trimmel@codico.com

10x12.5	25V/470µF 125°C/4,000h	35V/330µF 125°C/4,000h	50V/150µF 125°C/4,000h	63V/100µF 125°C/4,000h	25V/470µF 135°C/4,000h	63V/100µF 135°C/4,000h
Panasonic ZS 125°C series	3,500mA rms	3,500mA rms	3,200mA rms	3,000mA rms	-	-
Panasonic ZU 135°C series	5,000mA rms	4,800mA rms	4,600mA rms	4,600mA rms	3,500mA rms	3200mA rms
10x16.5	25V/560V 125°C/4,000h	35V/470µF 125°C/4,000h	50V/220µF 125°C/4,000h	63V/150µF 125°C/4,000h	25V/560µF 135°C/4,000h	63V/150µF 135°C/4,000h
Panasonic ZS 125°C series	4,000mA rms	4,000mA rms	3,700mA rms	3,500mA rms	-	-
Panasonic ZU 135°C series	5,800mA rms	5,500mA rms	5,200mA rms	5,200mA rms	4,000mA rms	3600mA rms

*mA rms rated ripple current at 100kHz and mentioned temperature



CHARGING APPLICATION



Focus on Charging Infrastructure

In this article, we will focus on the topic of e-mobility with an eye on the charging infrastructure. Our world is undergoing a transformation towards an electrified transport society. This requires higher efforts and demands on development, politics and urban planning. The reduction of the CO₂ footprint plays a crucial role for that. We at CODICO want to support you in the implementation of your e-mobility strategy and act as a long-term partner on your side.

The charging infrastructure is one of the most important factors in the implementation of the new mobility solution. It is about the question, how do people charge, where do people charge and how fast does it have to be. The following structures have developed into the current status.

Main harbor charging: this describes the charging stations that are located in the home area. In most cases, there are different versions. On the one hand, this is limited by the house connection power or the possibility of charging. At a standard socket (220V/10A) a power of 2.2kW is available. With the so-called wallboxes it is possible to charge up to a power of 22kW, a common value for home applications is 11kW, as the typical connection power is around 14kW.

Destination charging: this describes charging stations located in front of shopping centers, for example. Here, there is a higher connection capacity of the power grid and therefore a higher charging capacity is available. This amounts up to 50kW. The limiting factor here is the on-board charger (OBC), which is defined according to the manufacturer and is not subject to any European standard.

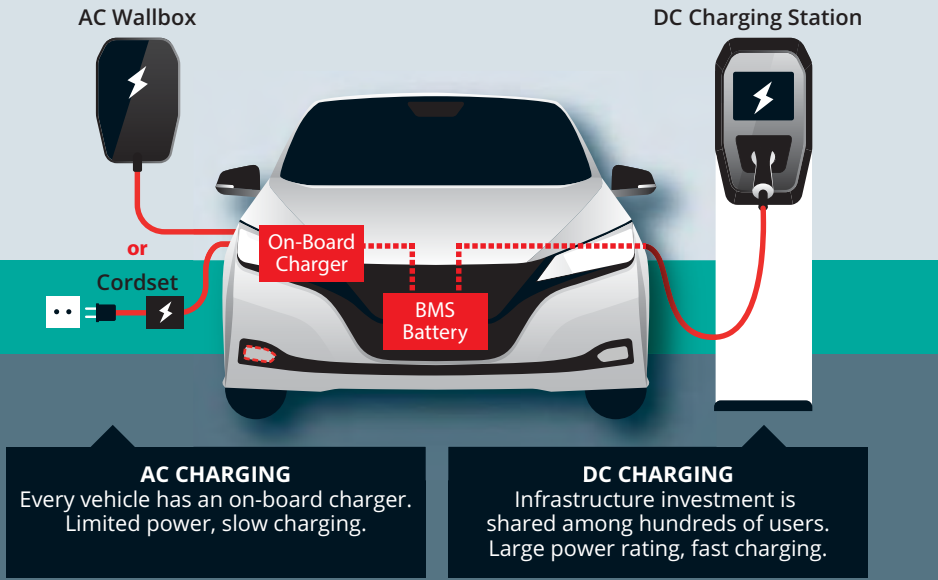
Range extension charging: this describes charging stations located along highways that can provide a lot of energy very quickly. The charging power is well over 50kW and is limited to about 320kW. Here is no limitation from the OBC, because it is bypassed by a bypass line and the power is directly available to the battery management system (BMS).



Charging stations in detail

Let's now take a closer look at what the OBC, bypass line and the rest are all about. With the three different forms of charging, there is always talk of AC charging and DC charging. This is a bit confusing at first, because according to general knowledge, batteries can only be charged with direct current.

Figure 1 roughly shows the difference between AC and DC charging. With AC charging it is meant that the alternating current coming from the grid is fed into the OBC. As described in Main Harbor Charging with a power of 2.2 to 22kW depending on the house connection power. The OBC transforms the AC power into a DC power. In simple terms, the AC charging station does nothing else, i.e. to release the power and establish communication with the OBC, which is also noticeable in the unit cost. Between the AC chargers and the DC chargers is a price difference of about a factor of 10.



Trends in charging stations

- Bi-directional power flow capability
- High peak efficiency
- High power density

The possibility of Grid to Vehicle (GTV) or Vehicle to Grid (VTG) represents a fantasy for new business opportunities, especially in Asia. GTV and VTG mean nothing else than that the car is available as electricity storage and vice versa. For this reason, more and more products are being developed that can have bidirectional power flow. For this, however, an appropriate hardware architecture must be selected. Our specialists will be happy to assist you in this case as well. High efficiency is of high importance for a broad area application, in order not to load the power grids unnecessarily. It is quite conceivable that in the near future charging stations can also be used as a grid balancing mechanism and this will be possible especially with bidirectional power flow. High power densities are an important issue for many customers, and we see they want to produce smaller circuit boards by using even faster components. And they increasingly use GaN (Gallium Nitride) technology or SiC (Silicon Carbide) technology for semiconductors.

For more information, please contact:

P05

➤ Rainer Scalick, +43 1 86305 366
rainer.scalick@codico.com

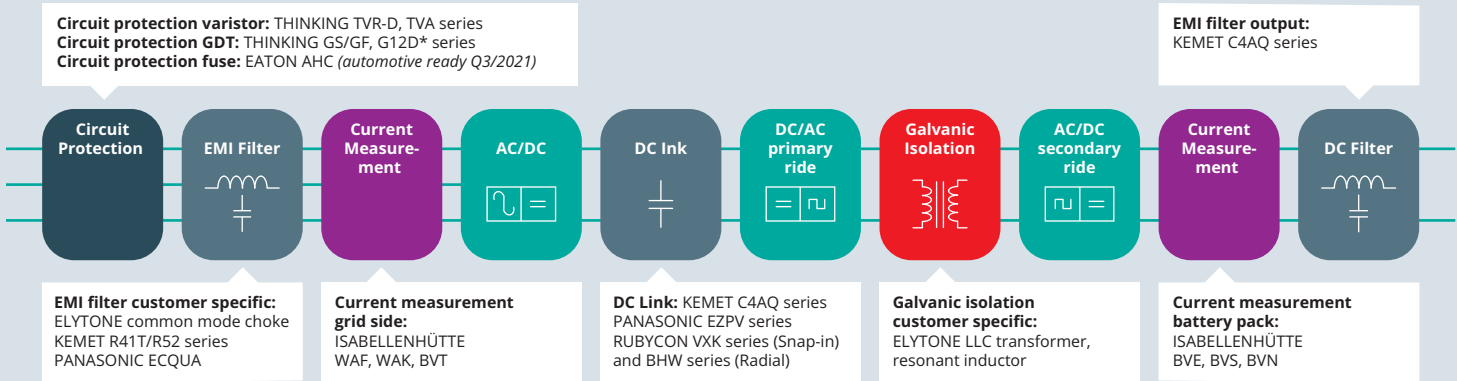
DC charging stations are designed according to the topology in Figure 2. In the first step, so-called fast transients are diverted, which can be caused by lightning, for example. This is achieved by using varistors and/or gas discharge tubes (GDT).

In the second step, filter elements are used to reduce or suppress the interference from the mains to the device on the one hand, and to minimize the interference from the device to the mains on the other hand. This is realized by CMC, and X/Y capacitors. Next, the voltage is converted from AC to DC by power supply technology. The DC Link capacitor block is the key element in charging station applications, it ensures constant voltage flow and is responsible for battery longevity.

The capacitor block provides a low impedance jerk current path for the switching currents. In summary, these capacitors are essential for battery life and EMC radiation performance. The DC voltage is then transformed back into AC current for transmission via a galvanic isolation path.

These transformers are customer-specific transformers, which are specially manufactured to offer the customer the best possible result. The AC voltage is then transformed back to DC, generating voltages of up to 1000V at a current of approximately 200A. In the penultimate step, the DC voltage is smoothed by means of an output filter. In the last step, the current flow is measured by means of a shunt.

PART RECOMMENDATIONS



Relays used in charging applications

- AC Relays with big contact gap:**
 1 pole: 26 to 200A, series 110, 207X, 117, 118, 515, 511
 2 pole: 12 to 70A, series 210, 118, 510
Relay for DC Switch: 10 to 250A: series HD011, HD012, HD013, HD014, HD015, HD022, HD024, HD028

Figure 2: Charging topology

NEXT LEVEL

Pressed Powder High-Current Inductors

Designers of DC/DC converters for computing, industrial, energy and medical applications are facing a need to develop products with lower power consumption requirements under various load conditions, even as devices shrink further in size.

Despite miniaturization trends, power requirements are growing due to the increasing number of electronic components integrated into today's circuit boards. Some critical challenges in today's designs include electromagnetic interference (EMI) due to large numbers of parts operating in close proximity and higher operating temperatures (e.g., in industrial environments). These requirements are driving the need for high power density magnetic solutions for a broad range of applications.

DC/DC converters, including buck, boost, and buck-boost types, enable voltage regulation in electronic applications, providing various levels of voltages and load currents in multiple sections of the device. Most power converters use pulse-width modulation that produces some switching noise capable of lowering the efficiency of RF and analog circuits nearby. Filtering circuits with inductors can ensure low EMI and reject high input noise in DC/DC converters. For example, an LC filter integrated at the input and output of a power converter helps to eliminate ripple currents and output noise and allows designers

to comply with EMC radiation and susceptibility testing limits. However, inductor selection must meet today's high-power density requirements and size constraints with reliable performance at higher currents and over a wide range of operating temperatures.

EATON's EXL is a family of next generation pressed powder inductors with higher power density than conventional solutions on the market. They offer a wide range of inductance values (from 0.15 to 10 μ H) suitable for today's buck and boost converters and filtering applications as well as small-footprint constructions for more board savings in compact designs. These products have terminals that exit from the bottom of the part, allowing for smaller PCB layouts.

Applications for EATON's EXL include servers, distributed power architectures, industrial IoT equipment, solar or wind power inverters and medical equipment. Designers can leverage the EXL's high power density and operating temperature range (-40 to +125°C) to develop highly efficient DC/DC power converters. EATON's EXL inductors feature

Check out our new
Sample Shop:
www.codico.com/shop



Features

- Wide range of inductances suitable for next-gen converter and filtering applications
- Multiple SMT footprints (4, 5, 6, 7mm) to suit a wide range of applications
- Unique molded construction allowing for higher power density and efficiency
- Shielded construction for EMI immunity in any application
- Smaller SMT footprint for greater board savings
- Wide operating temperature range for a broad range of computing, industrial, energy, and medical applications
- Soft saturation characteristic to withstand high current spikes

a molded construction that allows for higher power density and better thermal dissipation characteristics, as well as magnetic shielding for EMI immunity. EATON developed its EXL with the latest materials and advanced processes to provide a performance boost with lower DCR over competing solutions.

P06

▶ Sebastian Gebhart, +43 1 86305 205
sebastian.gebhart@codico.com

SUPERHERO

Brownouts are a fairly common occurrence where there is a voltage deficiency in an electrical power supply system (even for a few milliseconds). It may be due to disruption of power supply from the grid, a problem internal to a device, or high power consumption due to intermittent loads coming online. Voltage fluctuations caused by brownouts can hugely impact the stability of equipment, leading to system malfunction, component failures and downtime.

In embedded and industrial systems, brownouts typically occur at the board level. Control circuits, signal lines and more are often affected by intermittent voltage drops. An essential requirement for industrial electronics is components having excellent tolerance for ultra-low or high operating temperatures with high current handling capacity.

Using energy storage devices is an effective way to protect equipment against brownouts and maximize productivity. These devices work by automatically maintaining the voltage to safe levels during brownout conditions. With millions of charge/discharge cycles over extended lifetimes and zero thermal runaway risk, supercapacitors offer significant benefits over secondary batteries for brownout protection.

EATON PTV series is an affordable solution for brownout protection at the board level in embedded and industrial process control systems. These capacitors are ultra-high capacitance and high-reliability energy storage devices utilizing an electric double-layer capacitor (EDLC) construction that comprises proprietary processes and materials. EATON PTV series provides backup, pulse and hybrid power (when connected to a battery) for a host of applications in industrial process control systems, automotive electronics and uti-

lity smart meters. Examples include ATMs, gambling machines, ticket terminals, dashboards and airport LED displays.

PTV series integrates two TV family cells with passive voltage management to reduce cell count, simplify designs and provide extremely long lifetimes. No additional balancing of the cells needs to be considered. It can be used as sole energy storage or combined with Li-ion batteries to optimize the lifetime, runtime and cost of existing energy systems. The combined power output can range from as little as a few microwatts up to several watts. PTV series offers 3-5 Farads of capacitance with a tolerance of -10 to +20% (+20°C).

With a working voltage of 6.0V and operating temperatures ranging from -40 to +85°C (derated voltage from 65 to 85°C), EATON PTV supercapacitors meet the higher voltage and temperature requirements of most industrial applications. For designers of brownout protection, EATON provides passive voltage balancing with ultra-low ESR and high-power density.

Those products are maintenance-free with zero thermal runaway risk and are designed using eco-friendly materials to reduce carbon waste. Each product is halogen and lead-free and RoHS and REACH compliant. PTV supercapacitors



Features

- Higher voltage (6V at 65°C) provides greater energy storage & peak power
- Ultra-high capacitance of up to 5F
- Ultra-low ESR and high power density for higher pulse power/current
- Excellent temperature withstand capability (-40 to +85°C)
- Passive cell voltage management from EATON
- Reduction of component count and assembly
- Compact dimensions 11×21.3×23mm to 11×21.3×32.5mm
- Low profile design (bent lead option for horizontal mounting available)
- Halogen and lead-free, REACH and RoHS-compliant

support thousands of charge/discharge cycles and can achieve operating lifetimes up to 20 years.*

**Operating lifetimes depend on charge voltage and temperature conditions.*

Target applications

- PLC
- Motor controller
- Embedded PC

Tasks and functions

- Industrial back-up power to safely shut down the system
- Pulse power in RF radio and automotive
- Providing stable voltage for board level brownout protection

P07

▶ Roland Trimmel, +43 1 86305 144
roland.trimmel@codico.com

SMALLER SIZE



Major Changes in OCXO Structure from KDS and TXC

5G is booming: Even if you are not involved in the communication market or have no interest in it, it's on everybody's lips. Many mobile phone manufactures are beginning to adopt 5G in their new models, and the world is getting ready for high-speed, heavy data traffic.

What about the infrastructure? Change is also under way here, but it will take more time for an extensive coverage, since 5G infrastructure needs several small base stations, due to the 5G network's higher frequency bands. Since a growing number of stations is needed, the base stations themselves are becoming smaller and smaller. As a result, the electronic components used in these stations also need to be smaller.

The Oven Controlled Xtal Oscillator – OCXO – is one of those components, and it's key to the station's operation. This ultra-precise timing device generates the clock timing of the base station. In the past, OCXOs were measured on a cm scale, but today the size has shrunk to 9×7mm.

Even the current size, however, is expected to scale down to 7×5mm in the future. The difficulty in making smaller-size OCXOs lies in their core part. Due to the high temperature inside OCXOs, heat capacity and heat dissipation pose the greatest problem. In this article, I would like to explain how our suppliers can overcome this difficulty.



KDS developed the DC7050AS OCXO using a new technology called »ArkH.3G«. »ArkH.3G« is a new structure of crystal created using wafer-level packaging. With this technology, KDS achieved the smallest crystal oscillator available (1.0×0.8mm). By using ArkH.3G in the core, further miniaturization has been achieved in the DC7050AS. An additional advantage of the DC7050AS is the smaller profile and further downsizing to 5.0×3.2mm. The products of other 7×5mm OCXO suppliers are 3mm high, the DC7050AS is a mere 2mm. Moreover, a multi-layered package will improve thermal insulation, achieving precision enhancement without an increase in size. Furthermore, the

DC7050AS is sealed in a ceramic package, which has been widely used because of its simple structure. This design is assembled in a fully automatic production line, which enables us to supply a large number of OCXOs at low prices.

TXC developed the new OCXO OH series using their patented ThermSym™ technology. ThermSym™ is using a heater embedded between the crystal blank and the IC, which provides excellent thermal performance. Another feature that sets the OH series apart is the use of a 2.5×2.0mm high-Q SC-cut crystal. With such a small-size blank, the OH series can reach a frequency stability of ±20ppb in -40 to +95°C. This product is also available for up to 105°C upon request. Moreover, the high-Q SC-cut crystal helps improve temperature stability, aging, gravity sensitivity and phase noise performance.

P08

▶ Yasunobu Ikuno, +43 1 86305 276
yasunobu.ikuno@codico.com

SUPPLIER	TXC	KDS
		
Typ	OH	DC7050AS
Size (mm)	7.3×4.9mm	7.3×4.9mm, High: 2.0mm
Frequency Tolerance	±20 ppb. (-40 to +95°C)	±30 ppb. (-40 to +95°C)
Power Consumption	120mA	0,25W typ. steady states at 25°C
Frequency Range	10 to 50MHz	5 to 100MHz



NEW ENERGY

CODICO Enlarges Relay Portfolio

In order to meet our customers' needs for their products in new energy applications we found in SONG CHUAN the ideal partnership. Below we would like to give you an insight into the history and the focus of SONG CHUAN as a first step.

SONG CHUAN was founded in 1974 and began producing specialized electromechanical power relays. The group company headquarters and corporate management are located in Taipei, Taiwan. Production is located in Taiwan & China and partnerships in Vietnam. Headquarters is responsible for research and development, new products, proto-type and pilot production, designing and assembling production equipment and tooling, material procurement, load testing, purchasing & logistics, corporate finance & administration, sales & marketing, technical assistance and coordination for global customers and services.

SONG CHUAN is a private owned company. The long history of producing and the strategic dedication and 100% concentrating on relays has given SONG CHUAN the necessary experience to produce top quality and became one of the global relay innovators especially in the area of relays need in new energy applications, which we would like to focus in this article. SONG CHUAN is one of the well known global brands and regarded as one of the drivers for innovation. Their special strategic focus to develop the portfolio in the area of green energy makes SONG CHUAN a very strong partner for the development of any kind of application in this market.

Technical strength

SONG CHUAN's technical service strategies include: Working closely with customers, manufacturing products with improving technologies, utilizing innovation and progressive thinking. Applying IATF 16949 and using the techniques of APQP secures excellent high end products.

SONG CHUAN's in-house technical team is responsible for R&D, production engineering of production machines, equipment and fixtures, design and construction of tooling for metal and plastic piece parts. Sequential processes help to provide timely technical services and quickly develop suitable products for the application and the customer's requirements.

Collecting market information and customer requirements help to assist in new product designs and to develop new products with a complete range of advanced APQP/PDCA quality control. We use our IEC 17025 certified laboratory to test for reliability from proto-type to mass production. From the product development of piece part design, tooling, and through to production process design, SONG CHUAN's in-house technical team is pursuing the goals of developing competitive products and creating value for a win-win solution for all their customers.

Focus applications

While SONG CHUAN is very active in many different segments, CODICO decided to put a focus on their latest business field of the green energy products. This includes the following two main areas:

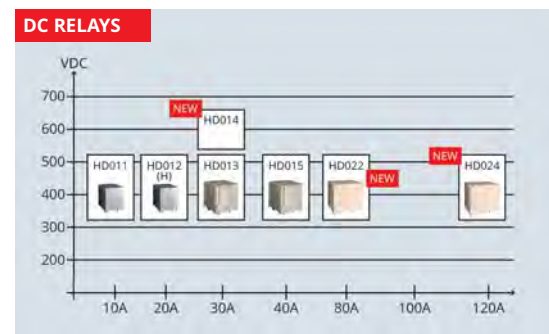
- Photo Voltaic: DC safety switch as well as isolating relays for the safe separation between DC and AC side
- E-Mobility: OBC & EVSE, means charging stations, wall boxes, charging cables

Key products

The attached table shows the main products for AC and DC switching. Most important is the miniaturization and keeping the self heating as low as possible. This is achieved by the right design of the coil system to keep the hold power as low as possible and a special focus to the contact system to keep the contact resistance as low as possible also over life.

P09

Michael Blaha, +43 1 86305 105
michael.blaha@codico.com



AC RELAYS WITH BIG CONTACT GAP	110	110E/207X	117L	515/515H	511H/E/X/Z	210/210H	118	510/510H
Poles	1NO	1NO	1NO	1NO	1NO	2NO	2NO	2NO
Contact Rating (A)	26	32	55	70/90	100/120/160/200	12/16	40A	50/70
Contact Gap (mm)	1,5/2,1	2,1/1,5	2,0/2,4	3	3	1,85/2,1	1,8	2,1/3,0
Coil Voltage (VDC)	12/24	12/24	12/24	12/24	12/24	12/24	12/24	12/24
Hold Power (W)	0,5	0,29	0,44	0,95	0,8	0,29	1	1,35
Size (LxWxH) mm	21,5x16x20,6	21,5x16x20,6/20,7	34x19x31		50x41,5x46,5	29x12,5x25,1	48,5x26x31,5	51,5x34,8x38,8
Safety approvals	VDE, UL	VDE, UL	TUV, UL	TUV, UL	TUV, UL	VDE, UL	TUV, UL	TUV, UL



KONNEKT™

Stacked MLCCs for High Voltages & Capacitances



We have already introduced KEMET's KONNEKT™ technology with U2J ceramic. KEMET now added new products with KONNEKT™ technology to their portfolio, which are the high voltage COG "KC-LINK™" and X7R capacitors with higher capacitances.

KONNEKT™ technology is a high-density and robust packaging technology that allows components to be bonded together without the use of metal frames, reducing with it the ESR, ESL and thermal resistance to capacitors.

KEMET's KC-LINK™ with KONNEKT™ technology surface mount capacitors are designed for high-efficiency and high-density power applications. This technology uses an innovative Transient Liquid Phase Sintering (TLPS) material to create a surface mount multi-chip solution for high-density placing on the PCB. By utilizing KEMET's robust and proprietary COG base metal electrode (BME) dielectric system, these capacitors are well suited for power converters and inverters as DC-link, snubber and resonance capacitors, where high efficiency is a primary concern.

KONNEKT™ technology enables a low-loss, low-inductance package capable of handling extremely high ripple currents with no change in capacitance versus DC voltage and negligible change in capacitance versus temperature. With

an operating temperature range up to 150°C, these capacitors can be placed close to fast switching semiconductors in high power density applications, which require minimal cooling.

The capacitors can also be mounted in an orientation with even lower losses to further increase power handling capability. This low-loss orientation lowers ESR (Effective Series Resistance) and ESL (Effective Series Inductance) which increases ripple current handling capability.

CHARACTERISTICS

Operating Temperature: -55 to +150°C

Rated Capacitance: 30 to 880nF (±10% tol.)

Typical ESR at 100kHz: < 2.5mΩ max

Rated Voltage: 500 to 2,000V

BENEFITS

Stable capacitance with temperature, frequency & voltage

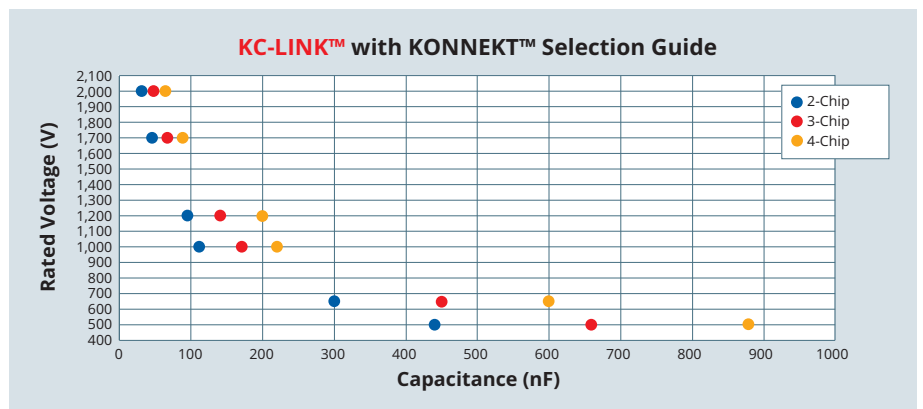
Ultra-low ESR: < 2.5mΩ

Ultra-low ESL: 0.45nH

Surface mount capable with standard reflow process

No piezoelectric noise

KEMET's X7R with KONNEKT™ technology surface mount capacitors are designed for applications where higher capacitance and voltage are needed without requiring additional board space.





boasting a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to $\pm 15\%$ from -55 to $+125^\circ\text{C}$.

In addition to their use in power supplies, these capacitors can be used in industries related to automotive (hybrid), telecommunications, medical, military, aerospace, semiconductors and test/diagnostic equipment. Automotive grade components are also available which meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements.

CHARACTERISTICS

- Operating Temperature: -55 to $+125^\circ\text{C}$
- Rated Capacitance: 2.4nF to $20\mu\text{F}$ ($\pm 10\%$ tol.)
- Rated Voltage: 25 to $3,000\text{V}$

BENEFITS

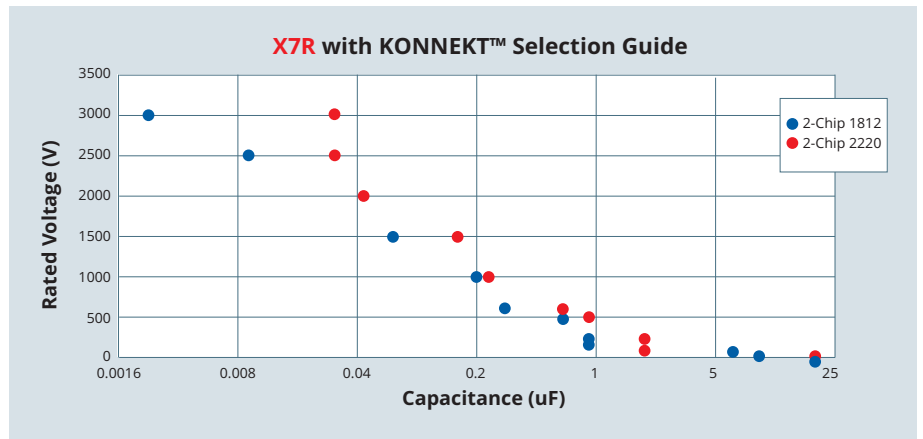
- Commercial and Automotive grade (AEC-Q200)
- Higher capacitance values with less space requirement

P10

▶ Roland Trimmel, +43 1 86305 144
roland.trimmel@codico.com

KEMET's X7R dielectric features a 125°C maximum operating temperature and is considered temperature stable.

The Electronics Components, Assemblies and Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R-ceramic exhibits a predictable change in capacitance with respect to time and voltage,



SMALL POWER PACKS

Miniaturized X2-Film Caps



KEMET recently launched a new series of their X2 film capacitor portfolio for harsh environmental conditions, so-called THB-versions. With this R52 series, KEMET is first to market in terms of THB level, miniaturized dimensions and the highest capacitance value combined in one component. The smallest pitch of 10mm (coming soon) and the high capacity density provide enormous space advantages.

Usually THB-version film caps have bigger dimensions compared to standard X2 caps due to their construction. KEMET has invested in a lot of research and long-term testing to improve this characteristic while retaining the other properties. R52 series is a miniaturized THB 500hrs 310VAC X2 film capacitor, which not only provides the same dimensions like standard X2 310VAC version, but even smaller box sizes. Furthermore, KEMET reaches the small size of R46 275VAC »mini« series while retaining the same capacitance value. Thanks to this miniaturization, highest available capacitance is 22µF now.

The R52 series is constructed of metalized polypropylene film encapsulated with self-extinguishing resin in a box of material that meets the requirements of UL 94 V-0. It is ideal for harsh environmental conditions and meets the demanding AEC-Q200 qualification requirements. The series is intended for worldwide use in electromagnetic interference (EMI) suppression in across-the-line applications that require X2 safety

classification, with special emphasis in automotive applications for severe ambient conditions. Typical applications as well include connection in series with the mains, capacitive power supplies and energy meters.

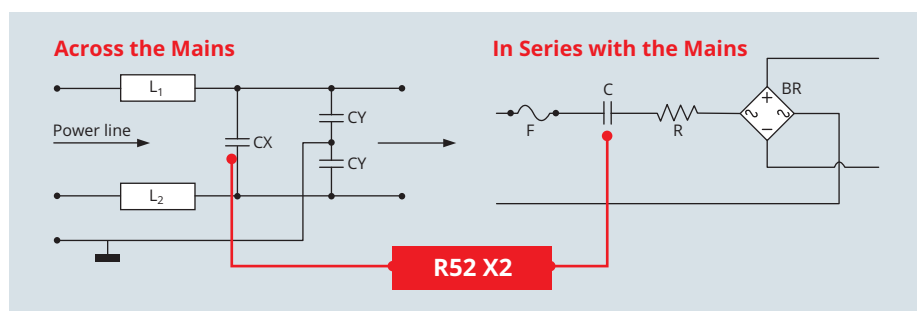
- Approvals: ENEC, UL, cUL, CQC
- THB Grade IIB: 85°C, 85% RH, 500 hours at URAC acc. to IEC 60384-14
- Rated voltage: 310VAC 50/60Hz
- Capacitance range: 0.15 to 22µF
- Lead spacing: 15.0 to 37.5mm (10mm coming soon)

- Operating temperature range of -40 to +110°C
- 100% screening factory test at 1,900VDC
- Self-healing properties
- Automotive (AEC-Q200) grade

But KEMET can also top these specifications – this year will see the launch of the even further improved R53 series, which will boast a THB Class IIIB level. This means 85°C, 85% RH, 1000h at URAC according to IEC 60384-14, first time in compact dimensions. More on that at a later date.

P11

▶ Roland Trimmel, +43 1 86305 144
roland.trimmel@codico.com



ZConnect

PCB Connection for FPCs Made Easy!

With the ZConnect series AMPHENOL LTW sets new standards! This series offers many interesting aspects for space critical applications, that require simple but effective connections are exposed to high vibrations.

The low space requirement is ensured by PCB and cable connectors which do not exceed a height of 8mm when mated. The series was developed for the pitch sizes 0.9, 1.8 and 2.7mm.

For the PCB connector it is necessary to define the pitch. The cable connector is completely independent of this! As long as the number of poles is identical, the same cable connector can be used for the 3 different pitch sizes for FPC and FFC cables, as well as for wire-to-board connections. This reduces the number of components and allows you to save costs.

By means of visual inspection, it is possible to check whether a perfect connection has been made between the FPC cable and the cable connector. This is indicated by the position of the side locks in a user-friendly way.

The design of the ZConnect series allows blind mating and has been equipped with an additional locking mechanism that locks the PCB and cable connectors with an audible »click«. This feature ensures a high level of comfort during assembly: easy and secure mating and control of the connection by means of a »click«. With this locking feature, the series is also ideally suited for applications with high vibrations.

The number of poles is available from 8 to 40. The properties of this series are rounded off by its suitability for automotive applications in accordance with LV214 (VW75174). A version with IPx67 option mated and unmated is available on request.

For further details on the ZConnect series, please contact us:

S01

▶ Christian Sichtar, +43 1 86305 134
christian.sichtar@codico.com



LIGHTING APPLICATIONS

Solutions for Smart Cities & Intelligent Buildings

Lighting plays a key role in smart cities and intelligent buildings. The use of LED Lighting products and systems is growing substantially for both new and existing applications. AMPHENOL is a leader in the Commercial and Industrial markets with an expanding range of lighting interconnect products.

Street lighting

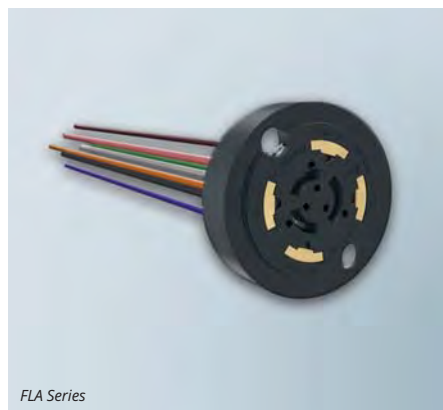
Modern lights, especially street lighting, come with sensors that sense live traffic and pedestrian information and transmit it to monitoring cen-

ters concerned about safety and resource utilization. AMPHENOL offers standardized lighting connectors for photocells with dimming and sensor capabilities equipping remote-controlled IoT-based street lighting. They also offer NEMA-compliant wired interconnects that are rugged enough to deal with the harsh environments.

PRODUCT RECOMMENDATIONS

FLA Series Dimming Receptacle – ANSI C136-41

The FLA connector series is designed with power and dimming/signal contacts to provide a connection between dimmable photocell and the luminaire for commercial and utility lighting. The locking type receptacles are compliant with ANSI C136-10. FLA Dimming Receptacle comes with



FLA Series

UL94V-0 high temperature resistant housing and are rated up to 15A per power contact.

Zhaga Book 18 Compliant – FLS Series

The FLS Series products are compliant with Zhaga Book 18. The FLS Receptacle is designed with 4 contacts for Power, DALI and Digital I/O, and mounts on a Luminaire. The mating FLS Base/Extension Module and Dome together form the housing for a Photocell/Sensor Module assembly.



FLS Series

Amphenol
ICC

©Amphenol/Eschwe Or



Interior lighting

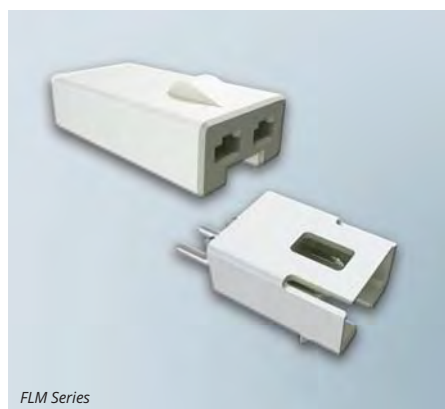
From ambient home lighting controllable by a smartphone to intelligent lighting modules that serve as radio modems inside a shopping mall, LED lights are smart, energy-efficient, cost-effective, and long-lasting.

As a member of the Zhaga Consortium, AMPHENOL is furthering innovation in LED lighting by supporting new connector design ideas. One of their lighting solutions has been selected by the consortium as the standard for Zhaga Book 20. These connectors are ideal for applications that are Power-over-Ethernet (PoE) capable, and support both Bluetooth and Zigbee connectivity.

PRODUCT RECOMMENDATION

Zhaga Book 20 Compliant – FLM Series

AMPHENOL's standardized Zhaga Book 20 FLM Series connectors allow modules to connect to the LED driver and control system. The modules can be easily field serviced and replaced when necessary. The FLM Series connectors are available in Wire-to-Wire and Wire-to-Board configurations.



FLM Series

Outdoor lighting

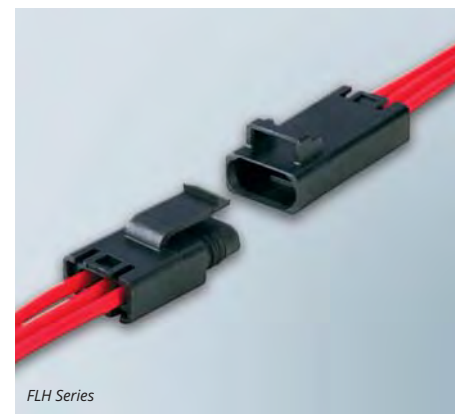
With smart cities and intelligent buildings taking over, outdoor lighting is also getting smarter. From parking lots to building lights, all modern commercial and industrial outdoor lighting installations come with enhanced capabilities. AMPHENOL offers outdoor Ethernet solutions that are Power over Ethernet (PoE) capable with Cat5E performance, as well as IP67 outdoor locking connectors for harsh environments.

PRODUCT RECOMMENDATIONS

Mini Sealed 2.50mm Pitch Connectors –

FLH Series

FLH Series waterproof wire-to-wire connectors provide a IP67 sealing in mated conditions. Its waterproof characteristics make it ideal for applications in harsh environments. These connectors can generally be used in industrial, lighting appliances, HVAC and smart home. The compact design of FLH Series is suitable for space-saving applications.



FLH Series

IP67 Harsh Industrial Connector – MRD Series

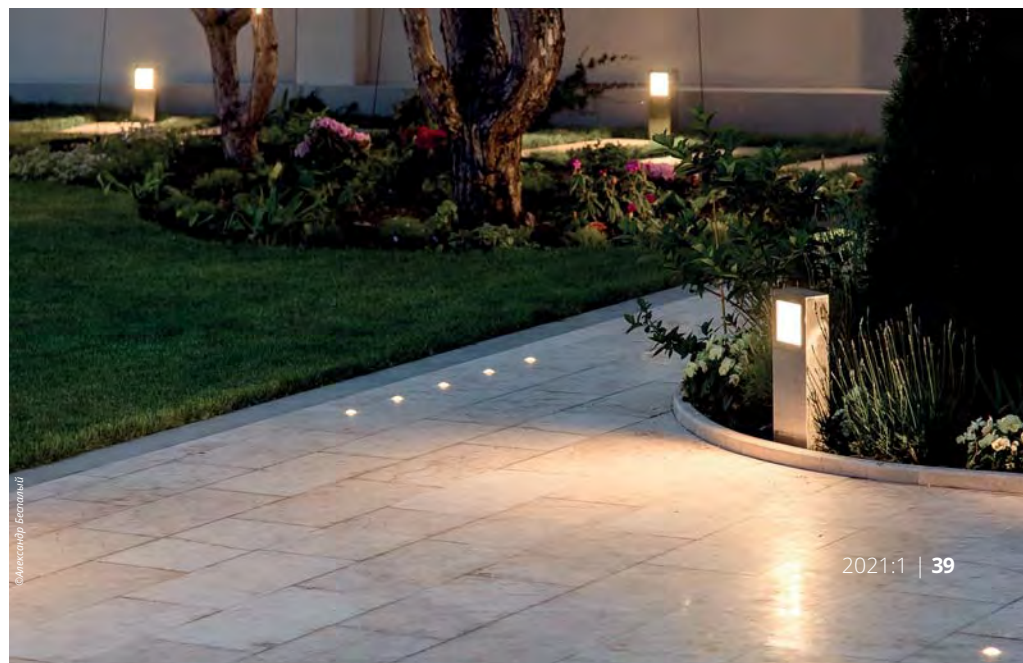
MRD Series connectors from AMPHENOL ICC are available in 2, 3 and 4 position form factors. Housing options include an all plastic construction as well as metal locking bodies for greater durability. Locking options include 1/3 turn bayonet locking as well as quick release metal latches. Panel mount and cable termination options are available with or without finger proof protection.

S02

Julia Reiterer, +43 1 86305 162
julia.reiterer@codico.com



MRD Series



QUECTEL ANTENNAS

Radio Frequency Front End Can Transform a Wireless Design



Whether we like it or not, the world is going wireless. Wireless technology is in our homes, workplaces and even in our vehicles. The technology is advancing rapidly and is now one of the fastest growing industries. The Radio Frequency Front End (RFFE) is what makes or breaks a wireless design.

There are two main approaches to designing this. Either using discrete components like an RF chip, filters, passives, and antenna, or using an integrated wireless module and antenna. The latter is often the choice of many designers because it offers a certified module for the major networks around the world, reduces design time, cost, MOQs and in many cases takes up less space. Discrete solutions are typically found in high volume applications like smart phones or tablets. However, even using an integrated module, the antenna design, position, and RF layout are criti-

cal in a system that receives and transmits electromagnetic waves. Therefore, it is important to work with an experienced supplier who understands and supplies both products. This is why CODICO has chosen QUECTEL as its preferred supplier in this area.

Why is this so important? The RFFE consists of three main parts: the antenna, the RF module, and often overlooked, the layout/connection between the two devices. Selecting the best performing, approved module and antenna counts for

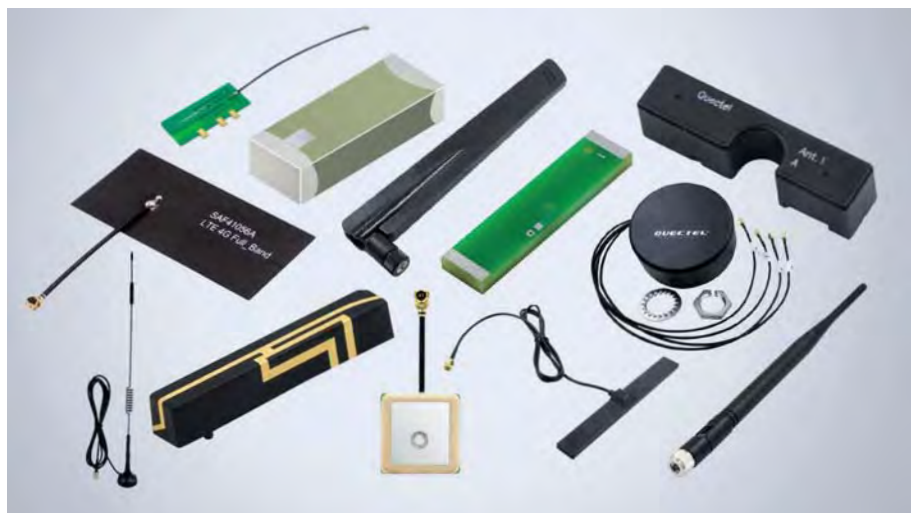
nothing if the RF layout between them is wrong. It's easy to lose 50% of your wireless performance with the wrong layout. In a cellular application, this can mean the difference between passing or failing network approval, or in a GNSS application it could reduce your position accuracy.

How to select the right antenna?

There are fundamentally two types of antenna choice for an IoT application, external or embedded.

An external antenna can either be a terminal mount which has a connector like a BNC that connects the antenna to the outer housing of your product. Or it can be a cable mount version whereby the antenna is positioned away from the main product and is connected via a cable. External antennas are needed when the device is situated in a low signal area such as a basement, or the electronics are housed inside a metal box. These antennas offer greater performance due to their design and size. They are easy to implement (plug & play), are less susceptible to noise issues because the antenna is far from device electronics and minimize TRP (Total Radiated Power) and TIS (Total Isotropic Sensitivity) risk. However, due to aesthetics, many IoT devices these days cannot use such antenna types.

Embedded antennas can be split into two types, SMD (surface mount device) or cable with connector, typically a U.FL type. These offer the smallest size and lowest cost but do require the desi-



gners to have more experience and understanding. This is where the RF layout becomes an important function of the design with regards to performance.

An SMD antenna requires a transmission line, typically a grounded coplanar waveguide (GCPW) trace connecting it to the RF module. Positioning and placement of the antenna as well as the GCPW layout are critical to the wireless performance. Return loss is a quantity used within RF circuits where impedance matching is important. The return loss is the proportion of a signal that is reflected because of an impedance mismatch. For an FPC (flexible printed circuit) or FR4 type antenna that is mounted to the underside of the product housing, a cable runs from the antenna to the RF module as the transmission line. This cable is part of the antenna, so its routing is equally important as that of the GCPW.

Sometimes a standard off-the-shelf antenna does not fit an application. That is when a custom antenna is designed specifically to meet the architecture and performance required. Embedded antennas typically only work well in certain places. So, when starting your architecture design, consider the antenna placement first. Also, pay detailed attention to surrounding devices and high-speed tracks nearby because antennas are susceptible to noise.

Many IoT products these days often require multiple radios which will require several antennas. For embedded solutions, sufficient spacing and isolation is required to achieve maximum performance. Once again, consider the antenna positions first in your design. QUECTEL is the world's leading supplier of IoT modules and has a wide range of external and embedded antennas. As an official distribution partner, CODICO can not only ensure the supply of these elements, but also draw on the help of QUECTEL's experienced engineering team, which is the largest in the industry and offers extensive knowledge and support services. We are happy to assist you with the design/connection of components to make the RFFE less complex, optimise performance and reduce time to market for your end product.

S03

▶ *Christian Sichtar, +43 1 86305 134*
christian.sichtar@codico.com

Author: Colin Newman, Director of Antenna Business Development, QUECTEL Wireless Solutions

Modular & Magnetic Jacks

Amphenol
ICC

AMPHENOL's broad range of I/O registered jacks (RJ) offer solutions to meet the increasing demand for faster speeds and greater bandwidth required by telecom and networking markets for VoIP, Ethernet, WLAN, medical, and industrial applications.

RJ45 connectors, which are known for their use in data cabling systems, can be subject to extreme environments, like telecom equipment, industrial process control, tele-maintenance, airplane equipment, tactical radios and GPS positioning equipment. Rugged, IP67-rated shells or conductive gaskets enhance protection and performance in harsh environments.

AMPHENOL ICC's magnetic jacks come with LED options and are compatible with Power over Ethernet (PoE). The series is offered with both shielded and EMI options, which provides enhanced protection. Gold plating option is also available for the contact area.

S04

▶ *Julia Reiterer, +43 1 86305 162, julia.reiterer@codico.com*

MAGNETIC JACKS: RJ45 CONNECTOR WITH INTEGRATED TRANSFORMER / COMMON MODE CHOKE



SINGLE PORT	MULTI PORT	STACKED	COMBO STACKED USB 2.0/3.0
-------------	------------	---------	---------------------------

- Designed to meet the IEEE802.3ab standard
- Data Rate: 100BASE-T, 1, 2.5 and speeds up to 10Gb/s
- PoE and surge protection
- Tab-up and tab-down, shielded and EMI options
- Standard operating temperature range: 0 to +75°C
- Extended operating temperature range: -40 to +85°C

MODULAR JACKS: ALL MODULAR JACKS SUPPORT POE AND ARE IEC 60603-7 COMPLIANT



RIGHT ANGLE		VERTICAL		RUGGED
-------------	--	----------	--	--------

Standard Speed	High Speed (Cat5e, Cat6, Cat6A)	Standard Speed	High Speed (Cat6, Cat6A)	IP67 & High Speed (Up to Cat6A)
Surface Mount Through Hole Press Fit	Through Hole Press Fit	Surface Mount Through Hole	Through Hole	Single Port & Multi Port

UTGX

Upgrading Has Never Been Easier

Check out our new **Sample Shop:**
www.codico.com/shop



UTGX Plug Family



UTGX Receptacle Family

Souriau-Sunbank
 by E.T.N

Features

- Lifespan of up to 27 years in industrial environments by qualification according to ISO21207 - Method B / 5 cycles
- UL 1977 (ECBT2 / ECBT8) qualified & IEC61984 certified
- Outdoor use qualified according to UL50/UL50E level 6P & shock-proof certified up to IK07 according IEC 62262
- Waterproof: IP68/69K dynamic mated (and unmated for Hi-Seal versions)
- 5 years resistance to UV exposure: F1 material according UL746C
- 500 mating cycles
- RoHS and REACH

Attentive readers of the CODICO Impulse will remember that the new SOURIAU UTGX from EATON is a versatile, ultra-ruggedized connector for industrial applications and harsh environments.

It is interchangeable and intermateable (under certain conditions) with the same layouts from other TRIM TRIO® family series: UTS, UTG and UT0. By using the same contacts available from AWG30 to AWG8, the switch from one connector series to another doesn't require tool or panel cut-out modifications, and a single design for machined, stamped and formed and high speed contacts makes it quick, easy and cost-effective to upgrade.

We now have integrated several launch packages into the CODICO Sample Shop so that you can experience the versatility and robustness of the new UTGX series yourself. Whether you want to upgrade an existing TRIM TRIO® connection or design a completely new interconnect system, the UTGX is the right choice if you need heavy-duty, industrial strength connectors. The UTGX series is perfectly suited for applications such as building automation & control, off-road vehicles,

mining, robotics, machinery, measurement, instrumentation, traffic monitoring, metal work and many others.

The UTGX series can be used in a wide range of configurations and electrical layouts, allowing you to save space on your equipment. While the bayonet locking mechanism ensures a quick and secure connection and disconnection, other updates to the lightweight design make the UTGX series connectors easier than ever for operators to handle quickly and safely. Particularly suitable for harsh, high-mating cycle applications, the UTGX will save time and money for your business.

Waterproof, shock-proof and UV resistant, the UTGX series can withstand continuous underwater immersion, routine pressure washing, dirt and dust exposure and other harsh conditions. Ideal for both indoor and outdoor applications

with a lifespan of up to 27 years in-application, the UL/IEC certified UTGX series connectors are a safe and reliable solution.

We can supply terminated cable assemblies to further increase sealing and stress-resistance properties on the cable termination. For more technical information or commercial requests about custom cable assemblies, please contact us.

S05

▶ Christian Sichtar, +43 1 86305 134
christian.sichtar@codico.com

Y-RED Extension

The Y-RED test contactor series from YAMAICHI Electronics is growing.

In addition to IC chip evaluation and validation, the focus is now on failure analysis applications and low inductance laboratory measurements. With decades of experience in designing full and semi-custom test contactors, the Y-RED combines high-grade technology and standardised single parts with simplified, user-friendly mounting procedure. As the first product of the new generation Y-RED, the standard hinged test contactor for component qualification applications was released at the end of 2019. Now, several extensions of this product series follow at once.

The Y-RED failure analysis

While the already available Y-RED is mainly used in the evaluation and validation (EV) of IC chips, the new Y-RED test contactor specialises in the sensory failure analysis (FA). Through an opening in the lid, the entire component is now visible during testing. An inlaid scratch and crack-resistant glass plate with a very wide transmission curve ensures uniform pressure distribution during contacting. These are features to perform chip analysis with Solid Immersion Lens and Emission Microscopy.

Extended size variety

For DUT package sizes between 1.5x1.5mm and 5x5mm, a smaller version is also available

for both the Y-RED EV and the new FA test contactor. The more compact design of the test contactor not only saves space on the evaluation board/PCB, but also brings the measurement closer to the component. The pitch already starts at 0.3mm, the application temperature range is specified from -40 to +150°C. For dimensions larger than 5x5mm up to a maximum of 12x12mm the large form factor Y-RED is used. Like the other Y-RED test contactors, also the smaller version is designed for LGAs, QFNs as well as BGAs/(WL)CSPs.

Low-inductance probe pin

A low-inductance pin is also available for laboratory measurements with particularly low inductance requirements. This can be installed in all the Test Contactors presented. Whereby the achievable high performance can be used in diverse areas of application, and the various advantages can be optimally combined.

With a contact height of only 2.80mm, a self-inductance of less than 0.80mm is achieved. A pitch between 0.3 and 0.5mm is provided. The application temperature range covers -40 to +125°C.

For more information on Y-RED and other test solutions from YAMAICHI, please contact us:

S06

▶ Christian Sichtar, +43 1 86305 134
christian.sichtar@codico.com



YAMAICHI
ELECTRONICS



Shock-Resistant

Floating Board-to-Board Connector for High-Speed Applications by YAMAICHI.

The floating board-to-board connectors of the HF301 series are the perfect solution for connecting two PCBs. The floating mechanism allows for the smooth functioning even during shock and vibration. The HF301 is therefore intended for use under difficult environmental conditions.

The HF301 series has a special contact construction. It combines the floating function in the X, Y and Z directions and thus mechanical stability under all vibration and shock conditions. The electromechanical system is high-speed capable with a maximum data transfer rate of 8 Gbps. Additional power pins are integrated into it.

The board-to-board connector system consists of a plug and a socket with 102 signal contacts each and 4 power contacts for up to 5A.

The HF301 series has been developed and tested based on automotive specifications. However, it is also suitable for all other applications with similar demanding requirements such as in industrial environments. The connectors are manufactured in IATF16949-certified companies. They guarantee a long service life even in the event of shock and vibration.

More details can be provided by CODICO.

S07

▶ Christian Sichtar, +43 1 86305 134
christian.sichtar@codico.com

E-BIKE SOLUTIONS



SINBON

Redefining Distance for a More Environmentally and Health Conscious Society.

E-bike, commonly known as an electric bicycle, is a bike with an integrated electric motor aligned to the bicycle pedals, which supplies differential force used for the forward movement of the bicycle. The electric bikes mainly use Li-ion chargeable battery and have a maximum of 160 km in one single charge. Mobility plays a vital role in the current society that we live in. In recent times, commuters are urged not to use their cars and to avoid public transport. Many governments are promoting the use of electric bicycles to help people get to work safely.

Additionally, the depletion of fossil fuel levels at an alarming rate has been creating concerns for sustainability for future generations. As a result, the rising demand for e-bikes is proving to be an

ideal solution to the challenges we face. The uptake of e-bikes could help to cut carbon emissions by up to 50 percent and provide a cheaper, safer and more sustainable way for people to travel. E-bikes are surging in popularity, with sales expected to top 16bn Euro in revenue by 2023.

According to a recent report, e-bike sales between 2020 and 2023 will be six times higher than electric car sales in the next decade. In Germany, the e-bike is a preferred mode of mobility, as well as for sports and leisure, also as a clean, quiet, and space-saving alternative for city logistics. Some of the major factors driving the sales of the e-bike market are innovative characteristics of the product, fully integrated batteries and drives, appealing designs, as well as the use of

high-quality materials. In 2018, the e-bike sales in Germany captured a 23.5% share in the total bicycle market.

The main trend for e-bikes is the integration of systems and technologies with the bike itself, which has an impact on size and weight. So clever design of components and selection of materials is required to ensure the bike is fit for the consumer. Another focus with the bike itself is range. Users want to ride the bicycle for longer per charge without the need to swap out with another battery pack.

Last but not least, the need for connectivity and security is vital to creating a theft-proof e-bike. Even though the price of e-bikes has been dropping recently, the need for technological advancements and support in the e-bike market is growing.



Console

RF Module

Antenna

Charging System Solution

Integrated Sensor Service

Motor System Solution

SINBON is at the forefront of this revolution in e-bike development as there is a need for high-end connectivity to be integrated within the bike, and manufacturers recognize that traditional bike builders just don't have this capability.

As a full solution provider SINBON is completely vertically integrated manufacturing PCBA, cable, connectors, plastic injection – all the way through to the full bike assembly. As part of the integrated solutions SINBON has to offer, this includes the design and manufacturing of the various systems involved in an e-bike, such as:

VCU (Vehicle Control Unit)

SINBON designs and manufactures the complete VCU – the brain of the electric bicycle which controls all the functions including the speed, battery management, sensors, IoT connectivity and more. A complete IoT (Internet of Things) solution includes RF modules and antenna design, supporting global LTE and UMTS/HSPA+ network systems and improving the efficiency of the IoT system. SINBON has its own OTA chamber for the purpose of antenna testing. This inhouse antenna testing optimizes the time and cost of the system, eliminating the need to send the products to other organizations for testing.

One of the other building blocks of VCU, and one of the most important components on an e-bike, is the Battery Management System. The BMS plays a crucial role in maintaining the safe operation

of the lithium battery electric bicycle, status monitoring and prolonging the life of the battery pack.

Motor system

The two most common electric motor styles used in today's electric bicycles are hub motors and mid-drive motors. Hub motors, which place the electric motor in the center of a bicycle wheel, were the most common form of electric bicycle motors. Mid-drive motors, which house the motor closer to the center of the bicycle and transfer the motor's power to the rear wheel via the bicycle's chain drive, are quickly becoming the most popular style.

Both have a number of unique advantages and disadvantages, so choosing the right motor will largely depend on your requirements and which advantages seem more useful to your needs. SINBON integrates the motor system and VCU which can control the speed and torque and ultimately to balance the motor output.

Also, high-end e-bikes offer a full range of speed for riders nowadays, the riders can choose higher speed or power saving mode to deal with different routes.

Bespoke connector manufacture

SINBON designs and manufactures a range of bespoke battery charging and signal connectors inhouse to suit all design concepts. Waterproofing is extremely important, ensuring its fully compliant with IP standards.

Cable assembly & charging systems

SINBON manufactures their own raw cable and bespoke connectors, enabling the production of a wide range of assemblies to meet the complex requirements of electric bicycle manufacturing, these include:

- Signal transmission cable
- Power transmission cable
- Controller wire harnesses
- Electronic lock wire harnesses
- Power switch cable
- Charging cable
- Charging battery module
- Charging battery connector
- Charging adapter (including AC travel cord + Adapter)

For more information on e-bike VCU solutions, please contact CODICO.

S08

▶ Christian Sichtar, +43 1 86305 134
christian.sichtar@codico.com

FL CoaxBridge™

Fast Track to Design Flexibility



The FL CoaxBridge™ is a solution that combines HIROSE's micro coaxial connector (supporting 50Ω/75Ω) and coaxial machining technology.

Connecting the micro coaxial connector to the adapter eliminates the need to draw a PCB pattern, thereby reducing the number of board design steps, freeing PCB space for additional component placement and increasing design flexibility. In addition, the cable connection has less loss than a board mounting solution and is ideal for antenna connection. CoaxBridge™ is a coaxial bridge that helps to solve various design challenges by connecting the output signal to the input signal.

IoT products, which connect and exchange data with a network, require wireless communication. For this kind of communication, it is common to adopt an antenna module and connection method that meets the wireless communication standard LPWA (Low Power Wide Area).

The FL CoaxBridge™ uses HIROSE's SMA antenna connector and can meet the LPWA standard while reducing space and cost. Additionally, you can choose from three connection plans to meet your board design needs.

Version 1: adjustable cable assembly length

The length of the double-ended U.FL Plug assembly can be easily adjusted. This version allows signals to flow to various parts on the board and increases design freedom.

Version 2: cable assembly that reduces labor time

Since the U.FL plug is already harnessed to SMA, the assembly is completed in the following two steps:

1. Secure the SMA to the housing with a nut
 2. Mate U.FL.
- The advantage of this type is that the mounting time is reduced.

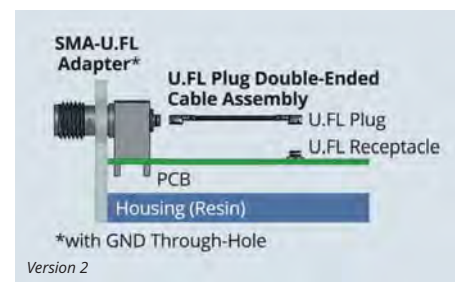
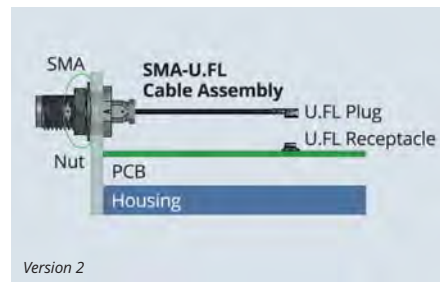
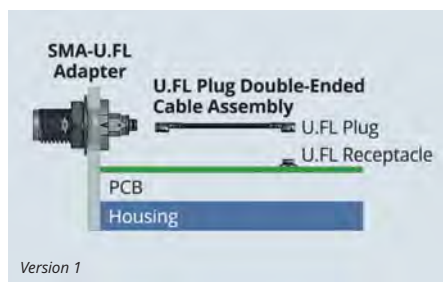
Version 3: for strengthened ground connection with the board

A ground (GND) through-hole strengthens the GND connection with the board.

The FL CoaxBridge™ with SMA-U.FL connection is suitable for all applications using wireless communication antenna modules, e.g. smart meter, WiFi router, drones, controller, automated guided vehicles.

S09

Julia Reiterer, +43 1 86305 162
julia.reiterer@codico.com



INTERFACE CONNECTORS

For Sensing Devices

HIROSE
ELECTRIC
EUROPE BV.

With the rapid spread of the IOT, sensing devices that detect the status of humans and objects and transmit that information are essential. As the demand for sensing devices increases, there is a need for technological advancement, and various sensing devices are being developed as a result.

Select the ideal connector based on connection method and operating environment. HIROSE offers a variety of circular interface connectors that are ideal for connecting sensing devices. You can choose the best connector, based on important features for the performance of the device such as waterproof/non-waterproof, grounding method, analog or digital, and locking function.

Product lineup

LF: Robust design with metal shell and resistant to noise. The LF-Series is equipped with a bayonet locking mechanism with good operability and IP67/68 protection in mated condition. There are several variations, such as straight or right angle connection and soldering or crimping types, available.

HR30: HR30 Series is a small, waterproof and low-profile connector that is IP67 and IP68 compliant in mated condition. It is equipped with a push-pull mechanism that provides good operability. In order to reduce the weight to a minimum, the connector is fully made of plastic.

HR08D: The right angle plug can be routed in 8 different directions based on 45° increments, giving you more freedom during wiring. There are two types of connection methods available: soldering and crimping and this series is IP67/IP68 waterproof in mated condition.

HR34B: The connector is IP67/IP68 waterproof and has excellent oil resistance in mated condition. The outer shell is black chrome plated for superior corrosion resistance. The right angle

plug can be routed in 8 different directions based on 45° increments, making wiring more easy.

HR25A: Small, shielded push-pull connector. The maximum plug diameters are 11 and 13mm, enabling size and height reduction. The connector's metal shell design is an optimal choice for devices that require noise shielding.

HR25: Small shielded connector. The maximum plug diameters are 10.5 and 12.5mm, enabling size and height reduction. The metal shell design prevents interferences from external noise and is ideal for applications where noise resistance is critical.

HR10: HR10 Series is widely used in devices other than sensors as well. Here are two types of lock variations available, push-pull and screw lock. A shielded type and one with built-in coaxial contact are also available.

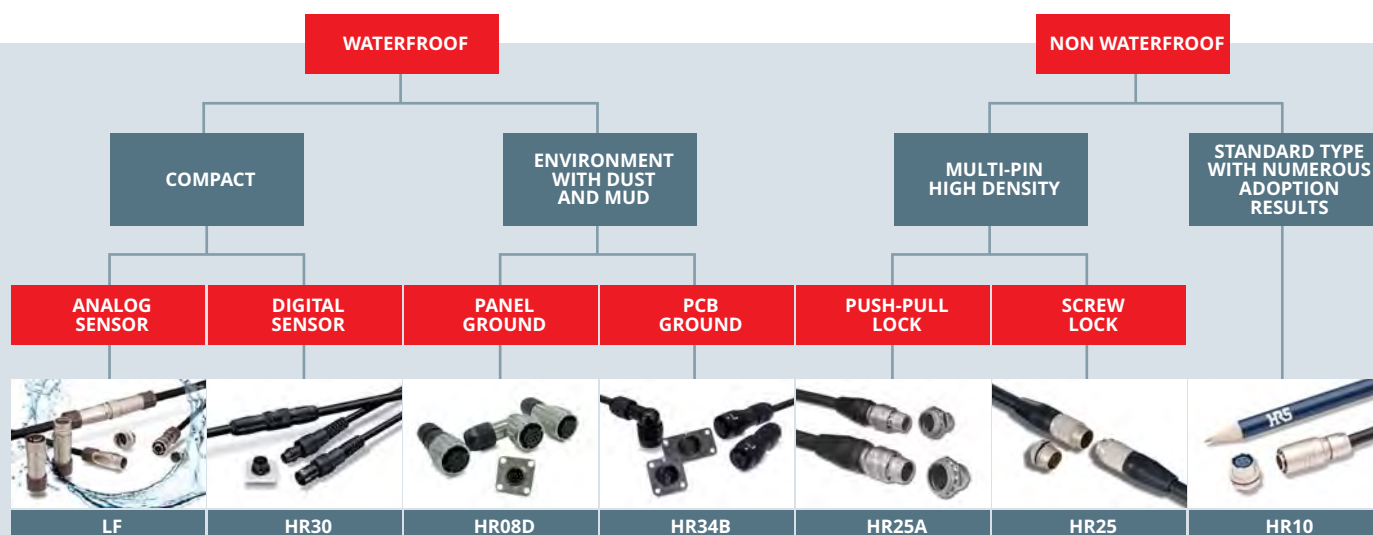
If you are looking for a compact and lightweight connector that outputs digital signal from sensors, HIROSE's ix Industrial™ is recommended.



ix Industrial™: This compact interface connector is about 75% smaller than the conventional RJ45. It has a mating durability of 5,000 times, making it extremely durable and strong. ix Industrial™ supports Cat.6A (10Gbps) Ethernet for stable high speed transmission. ix Industrial™ is the next-generation compact Ethernet connector compliant with IEC standards.

S10

Julia Reiterer, +43 1 86305 162
julia.reiterer@codico.com



MEGATRENDS

...and Their Impact on Corporate Processes

Trends – the discernible direction developments are taking – exert a direct influence on corporate processes and the quality of products and services. Trend forecasting was shaken to the core by last year's events. Unpredictable developments have accelerated some trends, while upstaging others. Megatrends, however, continue to apply, and the current events will have a particular influence on these. They have a global impact, and they comprise developments taking place over several decades.

»A megatrend impacts every single individual and spans all levels of society: The economy, politics, science, technology, and culture. Megatrends are changing the world – at a slow pace, yet fundamentally and for the long term.«

Those who wish to remain successful in the future will inevitably have to grapple with worldwide megatrends and their challenges – which had to be completely redefined in recent months. Although these are becoming increasingly complex, there are still themes that help us gain a foothold in an uncertain and volatile environment, and offer the prospect of positive developments.

CODICO has addressed these developments in depth, and has put sustainable measures in place. For example:

Megatrend Knowledge Culture

The megatrend of knowledge culture seems unabated. In addition, more complex, unforeseeable challenges in the labour market and new forms of knowledge acquisition are shifting the focus toward lifelong learning, the imparting of methods - and toward soft skills.

CODICO places a particular emphasis on the topics of knowledge and education. Each employee brings with them an individual package of qualifications, knowledge, experience, and competencies. Our objective is to encourage and demand access to knowledge.

Targeted training and upskilling programmes help expand each individual's professional and personal perspectives. Well-trained employees are the company's backbone, contribute significantly to customer satisfaction and, ultimately, to the long-term success of our company.

We see knowledge as an essential resource – but access to and expansion of knowledge is not an end in itself, but should reap direct benefits for our customers and partners!

Megatrend New Work

We no longer work to live, and we no longer live to work. In future, the ultimate objective is to find the ideal work-life balance. Digitalisation has had a major impact on CODICO as a design-in distributor: both in connection with the provision of technical support and information, and in terms of optimisation and efficiency increases in the supply chain.

For this reason, CODICO has been investing heavily in digitalisation and automation for several years. Automated orders, automated marketing activities, and individual barcode solutions to ensure traceability are just a few examples already put in place or currently in implementation. New work, however, also refers to how the working environment is designed.

Our office design incorporates the latest findings in neuroscience, as well as the question »How do I create the best conditions to allow the hu-

man brain to work in the most efficient way possible.« During the remake of our office landscape, we created additional social areas and meeting boxes for joint work, so as to promote informal communication.

In today's work environment, work-life balance is an essential motivation factor – CODICO's aim is to offer a setting that helps reconcile professional and private life. To achieve this, the company created a recreational park with sports and fitness facilities and a corporate farming project for its employees.

Megatrend Security

Society is in a constant state of alert – we are lurching from one crisis to another? Is everything getting worse? That is a fallacy: Despite the fact that our perception points us deeper into uncertainty, the world is not becoming less safe. At the same time, however, we have never been so keen on security as we are today. To further increase the level of service, the capacities, and thus supply chain security, we made significant investments in the enlargement of our logistics centre, resulting in a threefold increase in capacity. Our new, highly automated CODICO warehouse, equipped with state-of-the-art conveyor technology, now measures around 5,000m².

We introduced leaner and more transparent processes, and we are now able to store even more information in the system and provide it to our customers. Thanks to automation, we can now focus on the important tasks at hand, while still maintaining a high degree of flexibility. New technologies are helping us ensure transparency and traceability, enabling us to offer customised, sustainable solutions.

We attach a particularly high importance to the partnership with our service providers. Regular contacts and annual audits ensure that performance is under close scrutiny and subject to continuous improvement.

These investments in warehouse/logistics and in long-term, solid partnerships are readying CODICO for future success.

Megatrend New Ecology

The new ecology megatrend reaches into every single area of our daily life and, driven by technological innovation, is increasingly evolving into

one of the major determinants of our time. This megatrend is not only bringing about a realignment of the values of global society, culture, and politics, it is also transforming the fundamental way companies think and act.

The responsible stewardship of resources has always been one of CODICO's core values. The topics of environmental protection and sustainability are now the fundamental underlying conditions for the refurbishment project at CODICO.

The office and logistics building was erected and equipped taking environmental aspects into consideration, such as an energy-efficient cooling system, the use of LED technology and energy-efficient machinery, and the reduction of electromagnetic smog.

CODICO is using a special waste management concept, and has introduced operational measures for waste avoidance, recycling, and disposal. The way we perceive our corporate responsibility in the future is reflected in our sustainability guidelines.

Megatrends reveal profound changes that will ultimately lead to economic and social restructuring. Change happens on the foundations of trust, empathy, courage, and patience.

D03

► Petra Landschau, +43 1 86305 169
petra.landschau@codico.com



Project facilitator Gernot Estermann and students at work

CODICO Supports Technical College



CO₂ Traffic Light of HTL Wien West

Students of Vienna West Technical College develop CO₂ Traffic Light for Classrooms.

A cross-departmental cooperation at the higher technical college (HTL) Wien West in Ottakring resulted in the development of an indoor air quality sensor that can reliably determine the correct ventilation intervals. A regular and consistent ventilation of the classrooms does not only increase the students' performance, it also reduces virus concentration and thus the risk of infection with the coronavirus in schools. An indoor air quality traffic light can help determine the right ventilation intervals. The price for a reliable device, however, starts at 100 euros.

HTL Wien West was therefore asked by the Brüßlgasse primary school nearby to come up with an affordable solution. With the help of the friends' association, the students and teachers at the information technology, electronics, and computer engineering faculties, as well as the workshops worked together and developed a prototype. Jakob Estermann from class 2BHEL designed a suitable device on the basis of a microcontroller and sensors for CO₂ content, temperature, and air humidity. The casing was made using the college's own 3D printer, and the printed circuit board was manufactured on equipment available in the workshops.

The device beeps when CO₂ levels exceed a specific threshold, and the gas concentration is displayed on an LED bar well visible to all those present - similar to a traffic light, in green, yellow and red. The first six prototypes are already in place and operating in the said primary school.

The students of HTL Wien West want to build the traffic light for their classrooms as well. CODICO GmbH provided 30 OLED displays and 40 rocker switches for this purpose. Despite the lockdown, the students can continue working on their project during workshop classes.

»We attach great importance to promoting young talents and to supporting projects in regional schools. It is all the more positive when we can contribute to the health of students and educators in the process.« (Sven Krumpel, CEO CODICO GmbH)

D04

► Verena Schweitzer, +43 0186305 140
verena.schweitzer@codico.com

The CODICO TEAM says hello!



Sophie Kohlberger

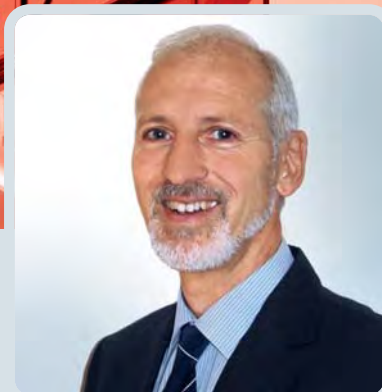
My name is Sophie Kohlberger, and I began my professional career at the world's oldest public limited company, and one of its largest private forest owners. I was already working in order processing at the time, where I had the sole responsibility for the Baltic Region. Around five years ago, I finally joined this diverse CODICO family. I took my first steps in active components order processing for Austrian and German customers. Other regions such as Switzerland, Bulgaria, Romania, the Czech Republic and Poland soon followed.

There was major reshuffling after the order processing departments of all three component groups were merged, and I was initially assigned the German areas with the post codes 3 and 80-85, as well as Bulgaria. In addition, I was given the opportunity to participate in the implementation of an internal project, which made the little »Monk« in me beam with joy. Moreover, the company had enough confidence in me to appoint me as mentor for two new employees. I must honestly say that I faced this responsibility with great respect, as I consider the introduction to our family as well as a good start for the new family member is extremely important, and it matters a great deal to me.

Today, I am in charge of support for the aforementioned areas, plus Great Britain and the Nordic countries. I enjoy being able to use my oral and written skills in both English and German on a daily basis. My tasks in order processing are very wide-ranging and comprehensive, and they require a great degree of precision. I consider myself lucky to be able to work in such an extremely agreeable and motivated team. Moreover, I very much appreciate how CODICO is committed to family, and how it handles the relationship with its family members. For instance, when Easter or Christmas is approaching, I often think myself back into my childhood. Even »big« Sophie (just 156 cm above ground) is elated when a chocolate bunny or an advent calendar awaits her at her workplace. On a more private note, I live in a beautiful flat, decorated in a country house style, and I feel very comfortable there. I often bake, cook, read, and spend time with my loved ones here, and a good film or a difficult sudoku are occasionally part of the deal. Dogs are also welcome here. When the weather allows, you will often find me outdoors. The gardening season is now beginning, and I am always looking forward to the challenge of some planting some exciting vegetables, herbs, or flowers, a task I approach with a lot of sensitivity. The same sensitivity I like to show toward my customers. I look forward to our next call.

D05

➤ *Sophie Kohlberger*, +43 1 86305 304
sophie.kohlberger@codico.com



Christian Forthuber

I am actually considered one of young members of the CODICO family. Maybe not in terms of age, but certainly when it comes to my time of arrival at the company. My personal connection to CODICO, however, began decades ago. I was working as product manager for an FPGA supplier at an electronics distributor at the time, and I was invited to a job interview with Dr. Hawlik. As far as I can recall, it was a very interesting and pleasant conversation. Nonetheless, I did not accept the job offer. Years later, I received another invitation to a job interview. In the meantime, CODICO had become much bigger and had moved to a new building. Once again, I rejected the offer – something I fail to understand from today's point of view. A few years later, I believe it was seven, another job interview. This time we finally got together. Now I have been a member of the CODICO family for four and a half years. I felt welcome in this new family from the very first day, and I still do.

As product manager, I am responsible for optoelectronic components; these are essentially displays. I enjoy supporting my colleagues in sales and providing advice to our customers on new projects. A display does not "disappear" in the innards of a device, like other electronic components do. Instead, it is the device's showcase, and gives a face to the application. What I find most enjoyable is when a product is finished and makes its way into the public sphere. It is then offered for sale, and usually also appears on the customer's website so that buyers can see it. The relationship with my suppliers is another important factor. I regularly travel to Asia to visit our business partners and take a look at the local manufacturing facilities. It is interesting to get to know different cultures and lifestyles. Learning how they work and think there creates a mutual understanding and makes cooperation much easier. What do I do in my free time? Anyone who has a garden knows that work there is never over. There is always something to do.

Mowing the lawn, breaking up the soil, cutting the hedge, or planting trees (and taking them out again): I am usually in charge of the heavy-duty jobs in our garden. I am also the family's pool boy, making sure that the installation functions and the water stays clean. Moreover, there is always something to take care of or repair on and inside the house. Unfortunately, very few things last for ever. Nevertheless, I find this diversion quite satisfying. A few years ago, I discovered qigong. Working with qi, the so-called energy cultivation, helps me switch off completely, and contributes to my mental relaxation. Qigong strengthens your immune system, prevents disease, and even alleviates pain. Those who don't believe me should simply try it out. Nordic walking is my second sports mainstay. To my great disappointment, there are no competitions taking place at the moment. Each year, the Vienna Night Run around the Ringstrasse is a true highlight. Any other interests? Of course! My (maybe no longer) secret passion is the railway. I can get very enthusiastic about steam locomotives, the engines of industrialisation and mobility in the 19th and 20th century. They were the high-tech machines of their time. Most interesting are extraordinary locomotives such as Shay, Heisler, or Climax. But that's a different story. I am very happy to answer any questions about displays, but I equally enjoy a good chat about rolling stock.

D06

➤ *Christian Forthuber*, +43 1 86305 158
christian.forthuber@codico.com



Ezio De Chirico

I'm happy to introduce myself. My name is Ezio De Chirico, I'm 60 years old, and I've been working for CODICO for 5 years now. My »adventure« in CODICO started in April 2016 as Field Sales Engineer Interconnect and Assemblies for the entire territory of Italy, and it has proven stimulating and thrilling since the very beginning. Before that, where the main focus was on design than on plain and simple distribution. As I felt the need for change and professional advancement, CODICO presented me with the opportunity I was looking for.

CODICO's high-tech standards allowed me to use the professional experience and skills I had developed through the years in the world of Telecom, Automotive and Industrial Automation etc..., allowing me to focus more on the customer's specific needs, and to always target innovative solutions.

Today I can say that this new experience has made my work more committed and satisfying through constant achievement, and I am now more determined than ever when it comes to tackling difficult and stimulating new challenges.

I was already firmly convinced that the mixing of different cultures and personal experiences represents an added value on both the business and the human relationship side, and the welcoming and friendly environment that I found here at CODICO helped me meeting very interesting people, as colleagues and as friends. In the past, I used to commute from home to work, and I would frequently get stuck in the traffic jam. Thanks to CODICO's »smart working« philosophy I installed my own office at home, thus optimizing the time I can dedicate to my office job than wasting it on less productive travelling. This working approach has made me more efficient and focused on my tasks.

I live in Italy, in a small town called Cornaredo, 5km from Milan. I'm married to Paola, and we have two wonderful boys, Tommaso, 16 years old, and Filippo, 14. We also have a dog, a sweet little 8 years old West-Highland, named Ciro (our 3 child....). Music has always been my first and biggest passion. I sing and play the guitar in a "band" we set up with a few friends. We enjoy playing mostly Rock and Blues. In the past we performed at special events quite successfully!

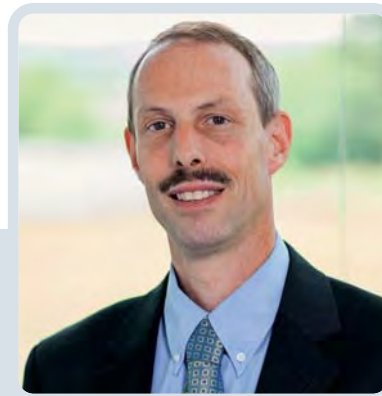
Soccer is another great passion. As a young boy I played in the second division of the INTER junior team, the team that I still keep in my heart.

Being a sports cars enthusiast, I'm also a great fan of the FERRARI team. As part of my professional duties, I had to opportunity to visit the Ferrari plant and all its departments. It was an incredible experience, and strengthened my conviction that it is the number 1 car brand in the world!

In my little free time I like to relax reading a book or riding my bicycle to keep fit. I wish to conclude by saying that even though my job is very demanding, it always gives me the motivation and the satisfaction to look forward to many future challenges with this fantastic group.

D07

▶ Ezio De Chirico, +39 0246514448
ezio.dechirico@codico.com



Markus Schmid

You have reached the last page of this issue, where CODICO staff members introduce themselves. And there's a Swiss lurking on you here! I was born in March 1965, that is, I turned 56 when this issue was being prepared, or in other words, I am less than a decade away from my retirement. Time literally flies, which doesn't mean that I actually feel that old already! I currently live near Lake Zurich, hardly a 20-minute motorway drive away from the city of Zurich. When I need some recreation, I usually drive up the mountains to Graubünden, where our parked caravan always awaits me. Back to the very beginning, though: After completing my nine-year school education – typical for Switzerland – and an apprenticeship as radio and television electrician, I was drawn toward in-service training in the areas of electronics and business. Moreover, since 1991 I have been appointed by the vocational training authorities of Zurich as expert for the final apprenticeship exams for multimedia electronics engineers, helping to ensure that the examination procedures run smoothly. Eventually, I landed in the electronics distribution industry in the year 2000. The establishment of the Internet and mobile telephony, and the development of handheld computers led to an atmosphere of optimism in the field of digital technologies and, as a result, to an allocation situation in the component market. I was working as product manager with warehousing duties in a small local Swiss company at the time. Later, I was able to expand my experience as product manager at a globally operating distributor, before my career path led me to CODICO in 2016. My position here is that of a technical engineer with salesperson duties, i.e. sales rep, though my colleagues are not particularly fond of the latter term. I achieve my work-life balance mostly with the help of my two children, though at the age of 17 and 20 years, one can hardly describe them as such. From childhood on, I have always spent my free time doing sports. I discovered my passion for sports at around eleven, with a particular preference for whitewater canoeing, and I even made it to the national C squad in this discipline. Since I was canoeing on a competitive level, I regularly had to undergo extensive running training as well. This habit has stayed with me to this day, so I still run two to three times a week and take part in a half marathon once a year, just to test my state of fitness. Later in my youth, at around 16, a canoeing colleague and I began taking part in unicycle races. We were able to contribute to the drafting of the regulations, so we became creative and constantly tried out something new. For instance, we shortened the axles at the pedals to reach higher speeds, or we wrapped Velcro tape around the pedals to prevent us from slipping. This only worked until the first accidents happened: then the regulations were rewritten, and these performance-enhancing measures were forbidden. A littler later, in 1987, I took up paragliding as a hobby, and a year later I already obtained the hang-glider certification. At the time, paragliding was just beginning to really take off, the regulations of the Federal Office of Civil Aviation were not so stringent, and the examination standards were not comparable at all to the current requirements. Another passion I have is skiing. What I enjoy most about it is the fresh mountain air, and where else can you get more of it than by blasting down a ski slope, surrounded by a snow-blanketed landscape? Besides, being able to ski is almost self-evident when you live in a mountainous country like Switzerland. When I am not busy doing sports after work, I still find joy in making small electronic circuits, which will occasionally cause brief blackouts in our house on Sundays. In such a case, there is a standard procedure to follow: Grab the torch, head to the safety fuse box in the basement, flip the RCD switch back on, and reset all the clocks that don't have battery backup.

D08

▶ Markus Schmid, +41 44 9221113
markus.schmid@codico.com



CODICO GmbH | Zwingenstrasse 6-8 | 2380 Perchtoldsdorf | Austria

Phone: +43 1 86 305-0 | Fax: +43 1 86 305-5000

office@codico.com | www.codico.com