

UPDATE

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Connecting intelligent devices

Versatile solutions for PCB
connections and enclosures





Steve Barber
Director of Product Marketing
Device Connections

IIoT – A new world, yet with old-world needs

Dear Readers,

As we continue to hear more and more about the Industrial Internet of Things (IIoT) and its huge impact on how industry will function, it is important to look at both the new as well as existing elements of connector designs that will be affected by this new paradigm. Connection points within systems will have some new requirements directly related to the increase in “intelligence” expected of such devices. These include greater combinations of data, power, and signal within the same connector, active circuit indication, shielding for faster data rates, and even self-diagnostics.

Yet at the same time, some connector features that have been used for years will continue to be integral parts of a design. Effective latching mechanisms, keying, marking, and other attributes will continue to be needed as interconnection points become an even more critical pathway for the additional throughput needed for today’s and tomorrow’s systems.

Functional density on a PCB is also an ever-growing requirement. Innovations related to enabling such density, balanced with maintaining ease of field wiring and protection of the PCBs through creative enclosure systems, are also a big part of Device Connections’ focus moving into the future.

In this edition, we present a range of connectors and enclosure systems aimed at serving the growing needs of system designs. Phoenix Contact has always been a leader in innovative and reliable products, and with today’s growing needs for such items, we are well positioned to continue to strive toward being the market’s most trusted brand for interconnection products.

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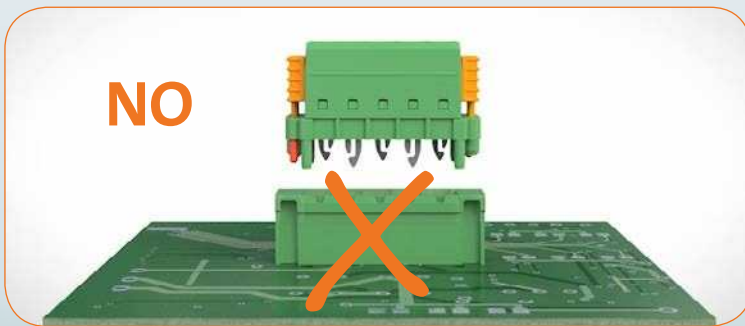
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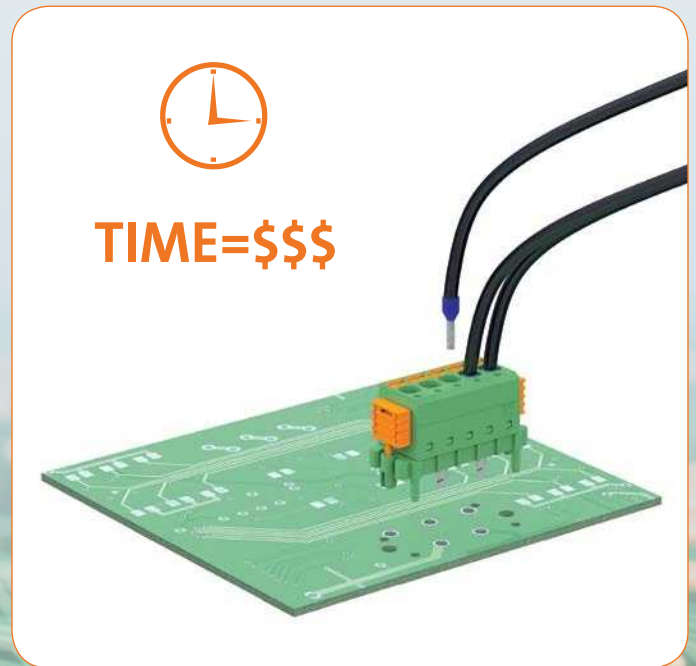
Direct plug-in technology for PCBs

The new SCDC 2.5 and SDDC 1.5 feature “SKEDD” technology.
Connect and disconnect directly to and from the PCB without soldering.

No header needed =
Reduce component costs by **30%**



Push-in spring technology =
Reduce installation time by **60%**



The advantages are on the PCB

M8 and M12 device connectors for THR and SMT soldering

The intelligent production of tomorrow needs easily scalable and adaptable automation components. Manufacturers of device connections also have to follow the trend toward decentralized intelligence and provide suitable solutions for new installation processes and application areas. Circular connectors from Phoenix Contact enable maximum flexibility in the production process.

Originally, circular connectors were designed for the field cabling of sensors and actuators. Since then, they have developed into a versatile industrial standard for signal, data, and power transmission. Device connectors used as an interface between field cabling and device connections drive the trend toward expandable, decentralized modules.

Automated installation processes

Most market solutions for M8 and M12 still require manual installation into the device. Connectors designed with litz wires or round cables cannot be integrated into automated PCB soldering processes. Each device undergoes an automated soldering process for surface-mounted components on the PCB and a manual installation process for connections in the housing panel. Using new device connectors for direct PCB assembly, Phoenix Contact reduces the required effort and makes device design more flexible.

The two-piece pin-and-socket contact supports are produced from temperature-resistant plastic, making them ideal for the increased thermal loads of reflow soldering processes. The advantage: The M8 and M12 circular connectors can be positioned on the PCB using an automated pick-and-place procedure and then soldered on using the THR or

SMT process. This allows electronics and device connection technology to be installed on the PCB in a single process step. It eliminates costs for additional PCB connection technology or manual installation processes. The device connectors also have uniform design-in types and can optionally be routed directly through a threaded hole in the housing or integrated into the device panel using a screw connection.

Tolerance-compensating housing screw connection

The Varioport housing screw connections compensate for production tolerances of up to 1 mm between the PCB and housing feed-through. These deviations can lead to mechanical tension between the device port and PCB connection, putting strain on the solder joints. In the past, assembly jigs were used in the soldering process, or the front plates were produced using a precise, yet complex CNC process. This effort was intended to eliminate resulting malfunctions.





Device connectors for THR and SMT soldering offer flexible solutions for connecting decentralized devices.

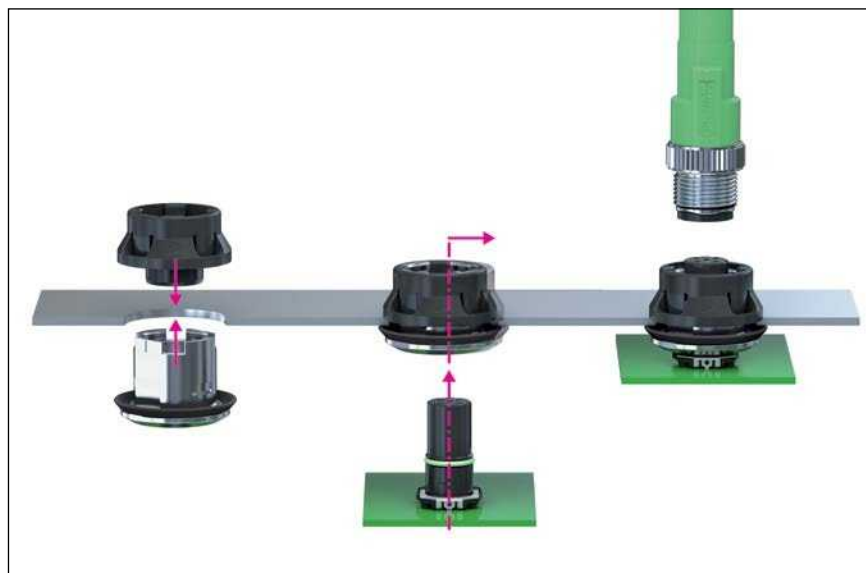
The tolerance-compensating M12 screw connections offer an efficient and reliable alternative.

The housing screw connections are easy to install, are self-adjusting, and lock reliably as soon as the cable connector is screwed onto the device port from the outside. The screw connection prevents water and dirt from getting into the device, even when it is not plugged in. The shock and vibration-resistant screw connections are also shielded completely against electromagnetic influences, making them well-suited for use in harsh industrial conditions such as decentralized fieldbus distributors.

Circular connectors for all situations

The Phoenix Contact product range offers connection solutions for numerous application areas. For example, contact inserts with a complete shield connection to the PCB meet increased requirements for electromagnetic compatibility (EMC), in areas

with welding robots. The shield spring integrated directly into the PCB connector makes additional measures such as soldering lugs unnecessary. The user benefits from low component costs and shorter installation processes. Straight or angled versions, signal connectors with up to 17 positions, and M12 compact hybrid connectors for transmitting signals and power complete the portfolio.



For the first time, the entire infrastructure (from the control level to decentralized devices, sensors, and actuators) can be fully implemented using one standard. This does more than just reduce storage and maintenance costs. Thanks to the standardized interfaces, system planners and operators can also ensure easy integration of additional decentralized modules and that the existing infrastructure continues to operate without errors. ■

M12 Varioport: The self-adjusting housing screw connection compensates for production tolerances up to 1 mm.

Marco Stapelmann

www.phoenixcontact.com/M8-M12SMD

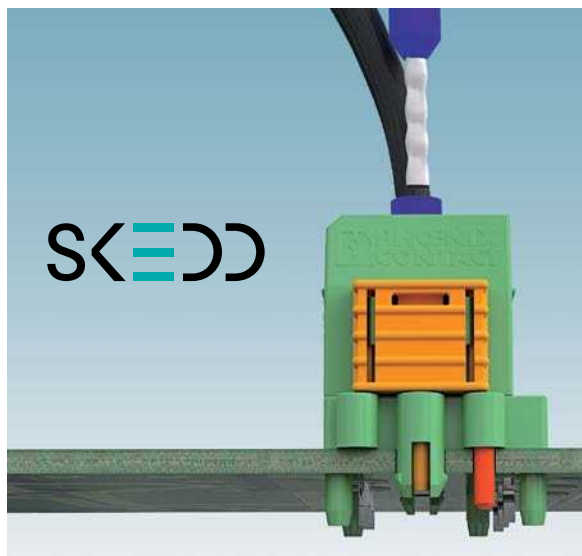
Direct connection adaptivity

SKEDD direct connection technology makes device design more flexible

Intelligent automation structures, such as HVAC systems in building technology or compact controllers in industrial applications, require functionally embedded systems. This poses a challenge to device manufacturers to develop universally operational solutions for specific tasks and ambient conditions. SKEDD direct connection technology is the next innovation in PCB connection technology.

Increased device flexibility means that fewer versions need to be produced and made available, and overall unit costs are lower. PCBs and connection components are the central nervous system of electronics and have a large impact on the performance and flexibility of electrical devices.

The lateral body-bound rivets establish a vibration-proof mechanical connection between the connector and PCB.



More flexibility thanks to SKEDD technology

The innovative direct connection technology SKEDD – Swedish for “it is done” – makes direct pluggable and detachable PCB connections at any position on the PCB possible for the first time. The new SDC 2.5 and SDDC 1.5 PCB connectors from Phoenix Contact, featuring SKEDD technology, eliminate the need for headers. They can be plugged directly onto the PCB by hand, via tin-plated through-holes.

The advantage: In the past, the electronics manufacturer needed to combine application-specific connection technology such as PCB terminal blocks or headers with the PCB using a permanent soldering process. This largely dictated functionality of the PCB and the overall device. SKEDD direct connection technology makes this process unnecessary; only the corresponding plated through-holes need to be provided in the PCB manufacturing process. In this way, the PCB does not become thermally loaded again.

Currently, many PCBs are processed first in an SMD reflow solder method, and PCB terminal blocks or headers are soldered on as the second step in a wave soldering process. Eliminating the second soldering process will reduce process and component costs. This also makes all logistics and materials planning for the headers unnecessary. It also reduces equipment costs and feeder space requirements when using the SMD soldering process. When the header is eliminated from the board, there is more space for additional components. In an ideal case, additional modules can even be produced on a single system without conversion.

Reliable mechanical connection

Both PCB and device manufacturers benefit from this technology. In addition to saving costs, they can now use a single PCB layout for different device designs – and still implement flexible application-specific connections for signal, data, or power transmission.

SKEDD contacts are an improvement on press-in technology, and they place no special requirements on the PCB. The contact zone consists of two flexible contact members that are easy to bend outward and that are adapted optimally to the PCB plated-through holes. When inserting the contact into the plated through-hole, the contact members are pressed together, ensuring a secure mechanical and electrical connection. Lateral body-bound rivets on the connector increase the mechanical stability as well.

The interlock is designed for standard PCBs with a thickness of 0.063 inch and allows for up to 25 mating/unmating cycles.

A wide range of solutions

Phoenix Contact's SKEDD connectors have been subjected to numerous standardized tests, attesting to how reliable the direct connection technology functions, even under demanding ambient conditions and high safety requirements. SKEDD direct connectors are suited for classic industrial applications as well as for applications in building automation and railway technology.

SKEDD PCB connectors offer solutions for countless applications such as climate control in rail vehicles, smoke and fire alarms, or large household appliances. Both series feature tool-free Push-in spring connection: This means that both solid and stranded conductors with ferrules can be connected without opening the spring interface. The integrated test points enable convenient function checks when loaded. Designed for conductor cross sections up to 12 AWG, the SDC 2.5 single-row direct connectors are suited for currents up to 320 V. The double-row connectors offer an efficient connection solution specifically for signal densities that are often high in measuring, control, and regulation technology.

For Whether an application has high-vibration requirements or needs special fire protection, Phoenix Contact's direct connectors with SKEDD technology are an interesting new solution. ■

Pia Horstman

James Dunbar

www.phoenixcontact.com/skedd



SKEDD

The new connectors with SKEDD direct plug-in technology can be plugged into the plated-through bore holes of the PCB directly and without the use of tools.



Three components connected to one cable

Save space and time with hybrid connectors

Providing machines, systems, and automation devices with separate cables for signals, data, and power is time-consuming and cost-intensive. The more complex the regulation and control task, the greater the cabling complexity and, therefore, the effect on the availability of the entire system. Hybrid connectors from Phoenix Contact are a smart solution.

The hybrid connectors provide flexibility when transmitting signals, data, and power in automated systems. Along with the established application for cabling servo motors, hybrid connectors are well-suited for a variety of sophisticated tasks. Phoenix Contact offers robust M23 and M40 hybrid connectors specially designed for serial cabling between field devices.

Hybrid connectors for serial cabling

In frequency-controlled drive solutions, the circuit connecting the control cabinet to the engine still commonly uses a star distribution. Previously, almost all serial cabling solutions were bus systems. Using the new M40 hybrid connector and hybrid servo cables, serial supply and control of consumers with signals, data, and power is achieved. To do this, each device in the supply chain is equipped with two

device connectors. One of these is equipped with pin contacts and the other with socket contacts. The connectors are based on the design for servo motors and combine the contacts for transmitting signals, data, and power in one housing. This makes the M40 hybrid connector suitable for high voltages up to 630/850 V AC/DC and currents up to 70 A.

Higher system availability, less space, lower costs

Hybrid connection technology does more than just reduce the space requirements on the device or in the control cabinet. Machine and system cabling is also more clearly arranged, because only a single cable has to be routed. The narrower cable routes that result also reduce the costs for the cable run and cable duct. An additional advantage of hybrid system cabling: Because up to two-thirds fewer connections have to be installed, devices, machines, and system parts can be commissioned and serviced more easily.

Manufacturers and users in particular benefit from the SPEEDCON fast locking system. This is used to lock the cable connector with its counter piece by turning it a half-turn. Thus, devices can be connected quickly and reliably with two hand movements.



Transmission in the most confined space: Featuring contacts for signals (top left and right), data (center), and power (bottom) and +PE (top) in sets of four for each transmission type, the M40 hybrid connector allows for versatile use.

Same function in a smaller size

The new M40 hybrid connector has a wide application area. Users can implement simple three-phase supply with L1-L3, N, PE, signals, and data at 630 V AC as well as alternating current supply with up to 850 V DC as it is required for decentralized servo drives. Mismatching is prevented mechanically using four different codings and visually using housing markings with color rings.

The standardized size M40 offers great, space-saving advantages compared to rectangular connectors. Circular connectors are much more compact without reducing performance.



Space advantage: Round hybrid connectors are compact and save space.

Regardless of the size, four-position CAT5 elements are used for data transmission in the robust hybrid connectors from Phoenix Contact. These can be used to cable nearly all common bus systems and custom data interfaces. The integrated data connector is designed with 0.8 mm contacts. Compared to 0.6 mm contacts, they are significantly more robust and enable easy, reliable assembly.

Various versions for different applications

The CAT5 data element can be replaced by a 4-position unshielded signal element in applications that do not require a shielded data interface. As such, the connector features eight 1 mm signal contacts, while the power contacts have the same performance characteristics in all other respects. Currents up to 8 A per contact and a wire cross-section up to 1.5 mm² make it possible to implement applications for control electronics including hardware shutdowns. Thanks to appropriate air clearances and creepage distances, the signal contacts can even transmit supply voltages of up to 500 V AC. ■

Gerhard Liewer

www.phoenixcontact.com/m23

Power looking for a connection

Versatile technologies for transferring high currents to PCBs

Conductor connection technology for the coming generations of devices has to provide more performance in less space while still allowing for safe, convenient operation, even in installation conditions with limited space. The new connection solutions from Phoenix Contact make those conditions a reality.

Manufacturers of devices such as drive regulators, power supplies, and I/O systems frequently manufacture goods for international use. They have to do more than just follow international standards and safety regulations, such as those from the International Electrotechnical Commission (IEC) or Underwriters Laboratories (UL). They also build their devices with an eye toward different user behavior. While system builders and installers in the United States prefer screw connections, European users have been using fast connection technologies, such as spring-cage and Push-in connections, for decades. This difference stems from the geographical and historical characteristics of the local industries. The importance of properties such as intuitive operation, mechanical design, connection time, material quality, and procurement costs are weighted differently depending on the region. These criteria also affect the functionality of the device.

Connection technology performance center

The design-in of the connection technology early on decides the versatility in use offered by the device later. As a literal performance center, connection technology requires continuous development for this reason. Transmitting large amounts of current and power while still offering convenient operation will continue to be important for future application areas as well.

Not all connection technologies are cut out for demanding high-current applications in devices such as power supplies, frequency inverters, or drive regulators. In addition to the required conductor

size, the PCB layout and the device design are the primary limiting factors in the choice of connection technology.

Specifically for applications with conductor wire gauge of more than 6 AWG, Phoenix Contact offers a solution portfolio that is ideal for numerous industry and infrastructure applications. The selection ranges from a PCB terminal block with an SPT 35 Push-in spring connection, to a detachable PC 35 connector and from MKDSP 50 and MKDSP 95 screw terminal blocks suitable for wave soldering to the TW 50 and TW95 panel feed-through terminal blocks.

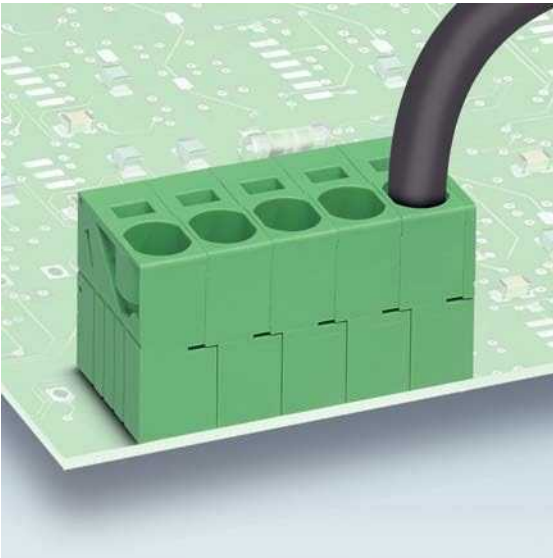
Tested for safety

The power connections from Phoenix Contact are the perfect fit for user requirements with regard to convenience in operation. They also meet the high safety requirements for material and processing quality. The electrical suitability of the components is demonstrated by resistance measurements or rated impulse voltage testing.

In addition, the mechanical contact reliability is tested. This factor plays an important role in the decision-making process for fast connection technologies in particular.

Because the conductor cross sections as well as the potential mechanical forces that may occur increase with the transmitted electrical power, power connections are subjected to high safety requirements. Depending on the conductor cross section, connections properly wired in accordance with DIN EN 60947-1 may have to withstand huge pull-out forces of several hundred Newtons. Standardized flexural tests and conductor pull-out tests give device manufacturers and users the peace of mind that even easy-to-operate terminal blocks and connectors like the TW 95 ensure solid contact over the long term.





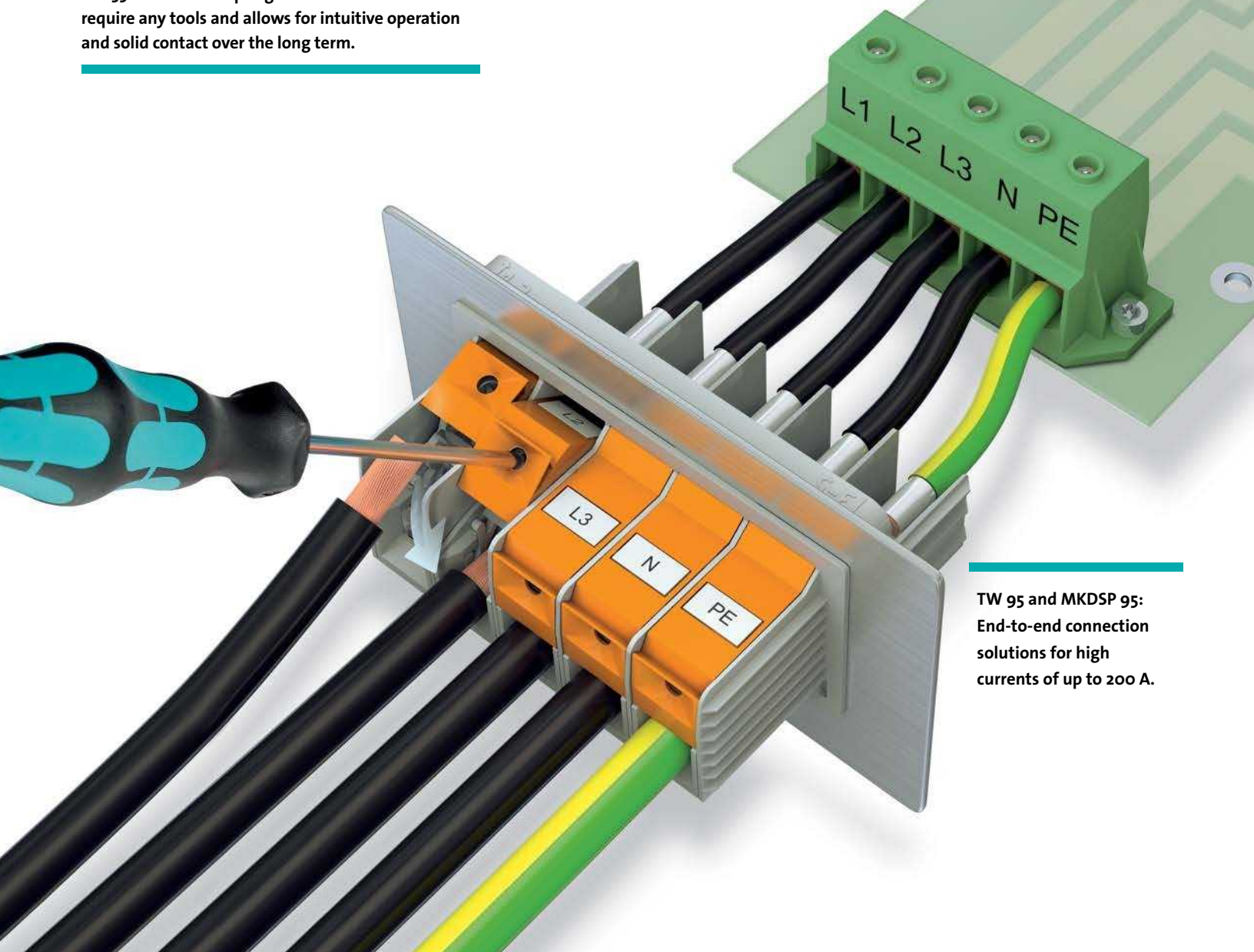
SPT 35: The Push-in spring connection does not require any tools and allows for intuitive operation and solid contact over the long term.

Outlook

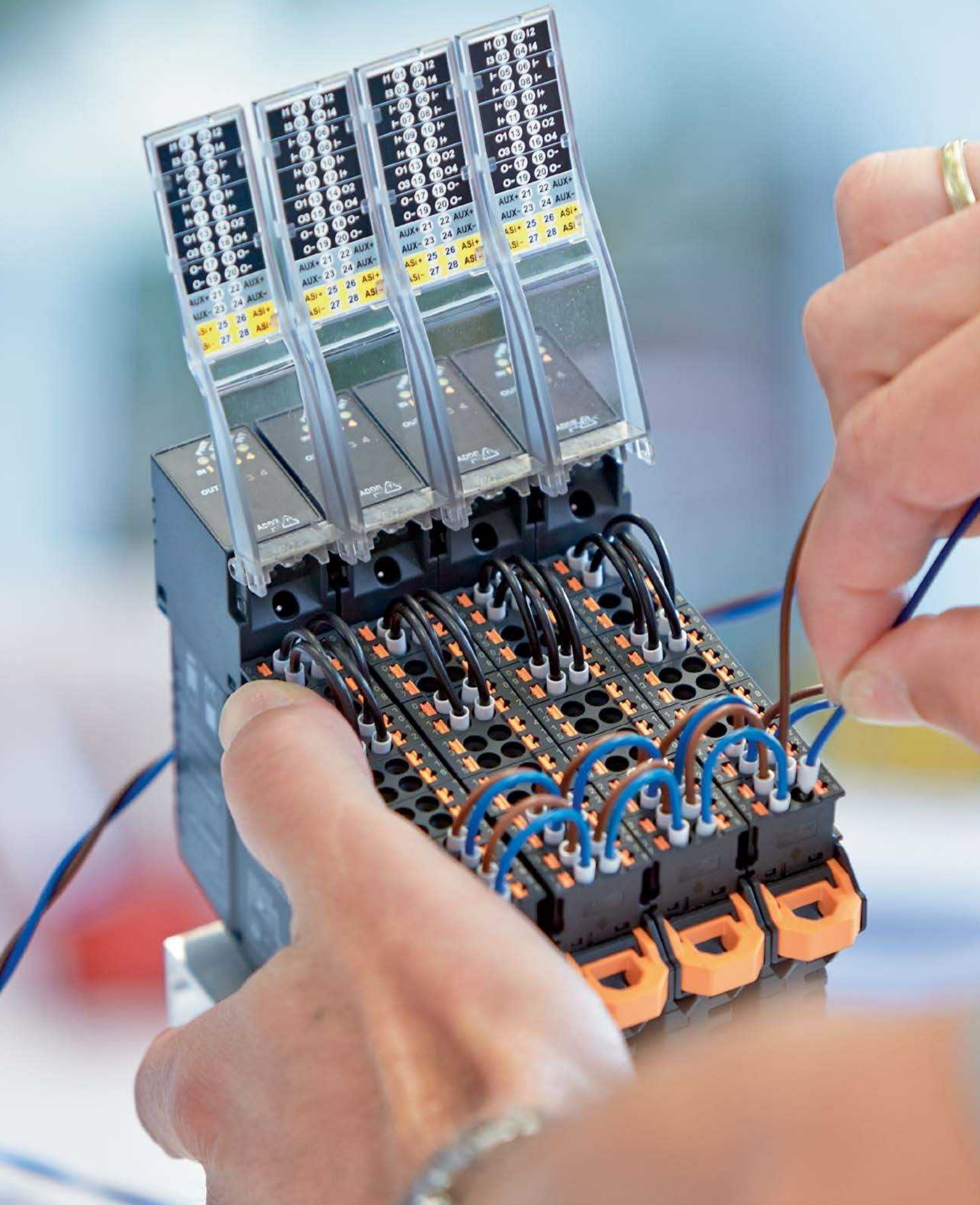
The trend toward miniaturization in components for power electronics means less installation space is available for frequency inverters, drive regulators, and similar devices. Conductor connections become smaller and more difficult to access as devices become smaller. While numerous connection technologies offer flexible solutions for smaller conductor cross sections today, fast connections for large conductor wire gauges of 6 AWG or greater are becoming increasingly important. Phoenix Contact offers ideal solutions for this area, covering a wide range of applications. ■

Marco Stapelmann

www.phoenixcontact.com/powerconnectors



TW 95 and MKDSP 95:
End-to-end connection
solutions for high
currents of up to 200 A.



Form follows function

Pepperl+Fuchs is developing a highly integrated control cabinet module for AS-Interface with Phoenix Contact

Compact modules with a large number of terminal points are still a rare sight in systems manufacturing at the lower field level. Pepperl+Fuchs has developed an installation-friendly, cost-effective control cabinet module for AS-Interface in cooperation with Phoenix Contact.

Generally, there is a long path from development of a new device to real-world deployment. Taking the detailed requirements of the end user into account during development of the components is a rather special approach for this reason. This is the approach taken by Pepperl+Fuchs, a company based in Mannheim, Germany, that specializes in plant and process automation. The company brought Phoenix Contact on board as a partner in the new development of an I/O module for a beverage filling system.

“With Phoenix Contact as a specialist for PCB connection technology and electronic housings, we were able to break down the requirements from beverage industry systems manufacturing into specific components,” recalls Dr. Konrad Kern, who serves as the Product Manager for Factory Automation at Pepperl+Fuchs. He works at the main headquarters of the family-owned company in Mannheim, which also houses the company’s Development and Marketing departments.

In developing the KE5 module, those involved in the project at Pepperl+Fuchs and Phoenix Contact exchanged a wealth of ideas and were able to implement and test them in Mannheim. This led to the EMC tests for radio frequency emissions and interference radiation in the EMC measuring chamber at Pepperl+Fuchs. In addition, the EMC laboratory tested the noise immunity in a GTEM (gigahertz transverse electromagnetic) cell.

The new KE5 AS-i control cabinet module for sensors and actuators was created at Pepperl+Fuchs in close cooperation with Phoenix Contact.

Compact and efficient with AS-Interface

AS-Interface, or AS-i for short, plays an important role for manufacturers of filling systems. It has been developed as the standard for fieldbus communication for connecting actuators and sensors and offers an excellent price/performance ratio. Due to its simplicity and flexibility, the decentralized interface system is also beloved by design engineers.

Energy, digital data, analog data, and safety signals are transmitted over a two-core ribbon cable. This reduces installation time and significantly increases productivity.

As the leading provider of AS-i solutions, Pepperl+Fuchs has succeeded in developing an efficient system in a compact design with its KE5 device series. In an overall width of less than 19 mm, the front area provides convenient access to 28 terminal points. “We were able to increase the packing density by 50% compared to other solutions,” Kern says, explaining the benefits. This can save customers money, especially in terms of high-cost control cabinet space. Since typical solutions have terminal points on both sides, they require a cable duct on the top and bottom. Thanks to the front-side connection, now only the lower cable harness is required. This creates a wiring design that is easy to follow. The shallow design enables installation in class 100 control boxes without any problems.

In addition to the wiring design, the assignment of terminal points has been changed. Additional colored terminal markers are stored in the transparent hinged cover. They are visible immediately after opening the cover for wiring. A centralized, back-lit numerical display provides good visibility even in harsh ambient conditions. In the event of an output overload, the number for the affected duct lights up red, enabling duct-specific diagnostics for the fault. This makes the use of AS-i in a control cabinet even more efficient.

It all comes down to the connector

The innovative connection technology is especially efficient for housings. The Push-in spring-force connector provides convenient wiring without any tools, which is simply not possible for conventional screw or spring-cage connections. The spring contact provides high contact and conductor pull-out forces as well as vibration-resistant and gas-tight connection. The encodable connectors can be detached quickly and conveniently using a locking system, supporting error-free device replacement. This saves time in the field and results in less stress for installers.

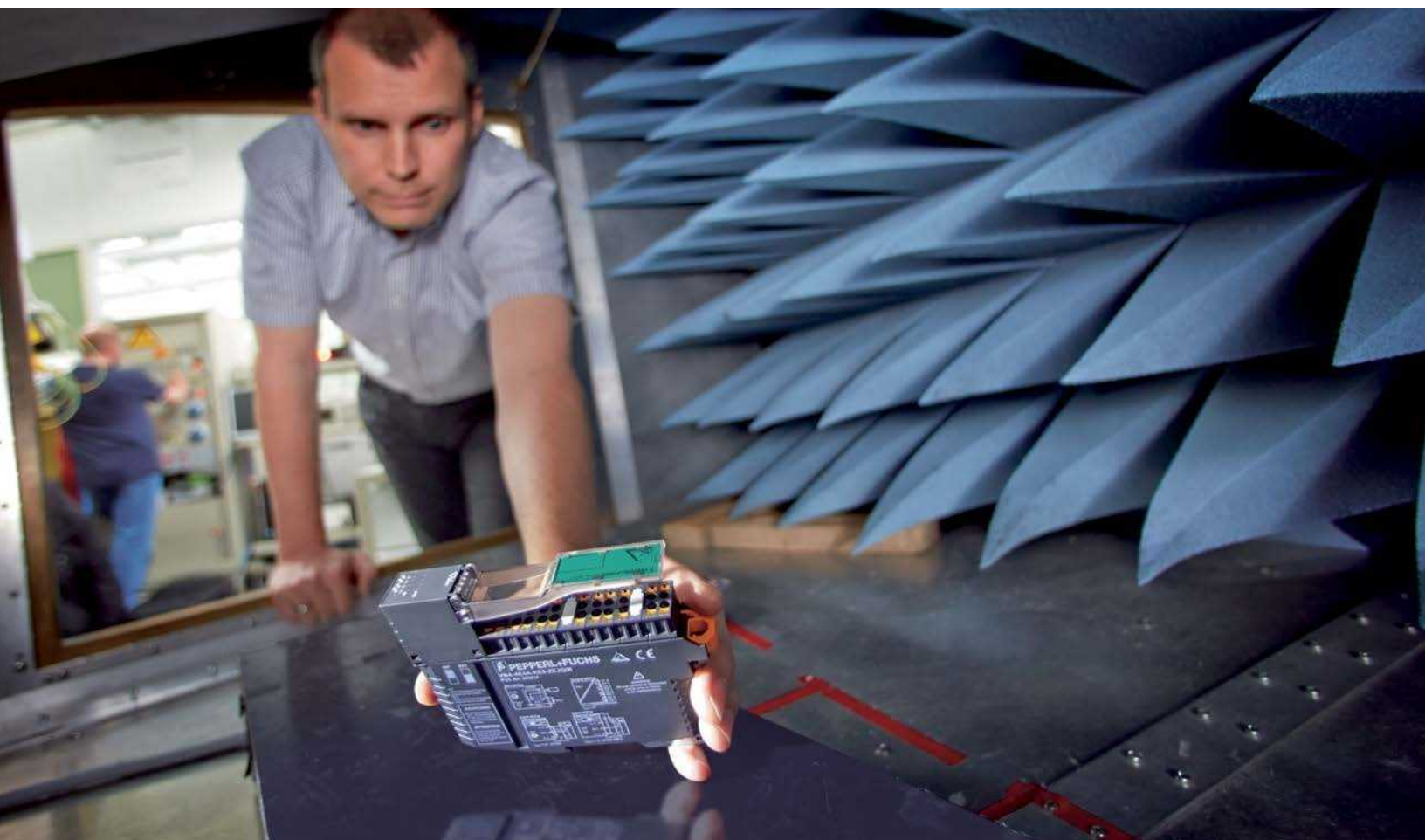
To date, both the AS-i and the AUX interface have required complex looping through double-wire ferrules. Internal bridging in the connector has now eliminated that installation task.

“Our KE5 module uses a bridged connector so that AS-i and AUX can now be looped through four additional terminal points,” explains Frank Ebert, the Head of Development in charge of the KE5 project. “And it does this under a full current load of 8 A.”

For electrical isolation of the switching outputs, relay modules have been developed that enable connections of third-party systems with different potential levels. In addition, the relay modules enable switching with a higher load at 230 V AC. There is a two-position version specifically for this as a complement to the four-position standard connector. Two contact points on opposite sides are eliminated, replaced by a blind cap. This increases the air clearances and creepage distances; the connector is ideal for the requested application area. “The electronic modules have an innovative PCB design, allowing safe separation of AS-i and AUX,” says Kern. “This functional safety is particularly important because it also allows KE5 modules to be used in safety applications as an output multiplier.”

This enables straightforward, cost-effective implementation of safety concepts for machines. One example of such use is the safe shut-off over AUX with decentralized multipliers using the AUX outputs on the KE5 module. “All of the sensor signals continue to remain available through the inputs on the module,” adds Kern. “And end users receive all the relevant

The noise immunity of the KE5 module is tested in accordance with the IEC 61000-4-20 standard in a GTEM cell at the Pepperl+Fuchs facility.



information about the system status even with auxiliary energy turned off.”

Advantages for both cooperation partners

Phoenix Contact now offers the new ME-IO series with its integrated connection technology to device manufacturers in other industries as well. In this housing family, up to 54 pluggable connection positions can be implemented on the front in an overall width of just 18.8 mm. The housing system was devised based on a modular design principle. Various cover length versions can be combined with a multitude of connection positions. Design engineers often rely on DIN rail connectors to provide simple communication between several modules. This is a T-shaped connector that snaps onto the DIN rail. The modules are then slid in and snap onto each other immediately.

Compact ME-IO housing system with front connection

The ME-IO housing system is ideal for applications with minimal installation space. The Push-in front connection technology and compact housing design lends itself to the implementation of small devices with up to 54 positions. This simplifies the use of input and output signals in automation.

The benefits at a glance:

- Tool-free Push-in wiring on the front
- Up to 54 positions with a module width of 18.8 mm
- TWIN connection available
- Error-free connection of connectors and headers, thanks to coding
- Safe connector locking and unlocking, thanks to the Lock and Release system



As a product manager at Pepperl+Fuchs, Dr. Konrad Kern (left) knows the requirements of his customers. The KE5 module was created in close coordination with the project team headed by developer Frank Ebert.

Conclusion

Close collaboration between participating partners at an early stage leads to user-friendly solutions. The KE5 housing serves as an apt demonstration of this potential. An innovative control cabinet module for filling systems in the beverage industry was developed using experience relating to the requirements from systems manufacturing. Krones AG in Neutraubling plans, develops, and manufactures machines to complete systems for process, filling, and packaging technology. The module is currently in testing at its facilities. ■

Marta Ciesielski

www.phoenixcontact.com/meiokit

RPI-BC gives the Raspberry Pi professional packaging for industrial applications.



The perfect packaging for raspberries

Industry-ready housing solution for Raspberry Pi microcomputers

The Raspberry Pi has seen great success among hobbyists and amateurs. If the microcomputer hopes to replicate this success in professional applications in control cabinets, it needs a functional, secure housing with easy-to-use connection technology. Phoenix Contact has the perfect solution with its Raspberry Pi enclosures (RPI-BC).

The Raspberry Pi microcomputer has earned an almost legendary status among hobbyist developers and educational institutions. More and more companies and institutions are also finding uses for the Raspberry Pi platform in their applications in commercial building automation and industrial applications.

These ideas range from use in development environments to prototyping to cost-effective small-scale controllers, simple servers, and data loggers.

Device solutions for professional use

Professional use of the Raspberry Pi requires functional, high-quality enclosure and connection technology. Installing and operating the devices in control cabinets with reliability and in line with standards is especially important for applications in building and industrial automation.

Many standard enclosures on the market only incorporate the actual Raspberry Pi board. They are often used as table-top housings and have the option of being mounted on the wall. These standard solutions are not intended for DIN rail mounting in control boxes. The housings are available in many colors and designs and can be made of plastic, metal, or even wood. A ribbon cable provides access to the connections for the Raspberry Pi programmable interface, called GPIO (general purpose input/output).

In contrast, the RPI-BC DIN rail enclosure for the Raspberry Pi offers secure, standardized installation of the module in control cabinets.

Additional boards can also be integrated into the housing, and the GPIOs can be easily accessed using field-wirable connectors common in industrial applications. The RPI-BC enclosure solution provides practical, reliable HDMI, USB, RJ45, and Micro USB power supply connections, and even makes it possible to set up a device system using bus connectors.

The housing is compatible with the Raspberry Pi series A+, B+, B2, and B3. The USB connection for version A+ uses an adapter.

DIN rail connectors for easy wiring

Bus connectors offer an advantage for device development. Among other functions, this lets the Raspberry Pi act as the CPU while additional I/O modules can be built using the BC enclosure family. By simply aligning the devices together on the DIN rail, the bus connector allows different device types to communicate.

Connection technology for professional applications

Simple, reliable wiring for items such as sensors to the GPIOs is essential if the Raspberry Pi is to be used in a serial production application. In particular, it should be possible to connect to the GPIOs without complex work steps.

The RPI-BC housing uses PTSM (print terminal, spring connection, miniature in size) connectors to make these connections. The Push-in connection allows for tool-free wiring. Additional boards can also be snapped into the housing without any tools and offer space for additional custom circuit ideas. Phoenix Contact has the perfect bread boards for creating simple circuits. The additional boards are connected to the Raspberry Pi and to the bus system automatically during device assembly. This is made possible by the corresponding

PTSD terminals soldered onto the additional boards that also form a mating connection with the GPIOs from the Raspberry Pi and the bus slot.

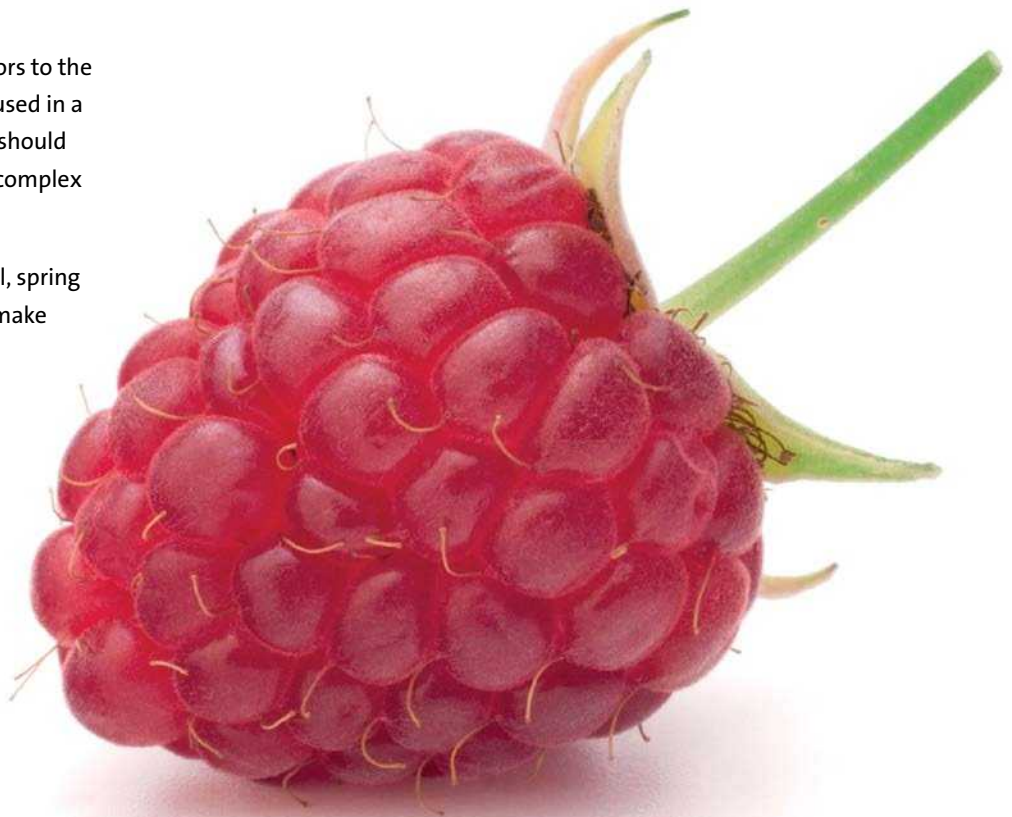
The Micro SD card acts as a hard drive for the computer and is a key component for the Raspberry Pi. To prevent computer failure or tampering with the device, the RPI-BC housing can be secured with a seal sticker. The seal is placed over the slot after the card is inserted. This sticker leaves a mark on the housing surface if the card has been removed. This makes any tampering evident and prevents any unintended removal of the card.

Conclusion

All in all, the Raspberry Pi BC enclosure from Phoenix Contact offers significant upgrades over existing enclosures for the Raspberry Pi, especially when an application calls for serial production and in a control cabinet environment. ■

Anke Beck

www.phoenixcontact.com/raspberrypi





Plug-in approach for the battery compartment: 200 kWh of storage capacity from eight racks of 13 modules each.

Batteries with the best connections

Hybrid connectors in the Energy Neighbor storage system

Decentralized stationary battery storage systems that efficiently utilize renewable energies and stabilize the power grid in the process are key to shaping the energy revolution. The Energy Neighbor battery storage systems got their start in Moosham in Upper Bavaria. They feature a modular design and are connected using square hybrid connectors from Phoenix Contact.

VARTA Storage GmbH, headquartered in the Bavarian town of Nördlingen, is a leading specialist in temporary energy storage. The company is part of the VARTA Microbattery/VARTA Storage group of companies and specializes in innovative lithium-ion battery storage for private homes and industrial applications.

VARTA Storage is contributing to the energy revolution through an assortment of research and development projects. This led to stationary storage for

renewable energy developed in collaboration with the Technical University of Munich (TUM), Kraftwerke Haag GmbH, and the Bavarian Center for Applied Energy Research (ZAE). This storage system was put into operation as the Energy Neighbor.

In today's typical battery storage systems, the individual battery modules are connected together in a complex process, almost always using lithium-ion batteries. "If connection lines are used for the series connection, the cables are screwed to the positive and negative terminals on the battery blocks," explains design engineer Eugen Budjugin from VARTA Storage GmbH. "This leads to a lot of time and effort spent on cabling when putting large-scale storage systems into operation." The risk of installation errors also increases with the number of battery modules with this approach.

Connectors as a flexible interface

Instead of wiring the storage modules, they should be connected via connectors. Battery storage systems are generally built with one or more battery modules. Each battery module contains battery cells and a battery management system responsible for monitoring the cell parameters. Thus, a battery module is a mechanical and an electrical unit. Budjugin: "Our battery modules are equipped with a connection system from Phoenix Contact, so that when the modules are inserted, contact is automatically made with communication and power connections." Up to 100 amperes can flow through this flexible interface at several hundred volts. As a result, making contact with the modules is not only more reliable, but also simpler and faster.

A hybrid connector that meets these special requirements has been developed by Phoenix Contact in cooperation with VARTA Storage. The connector is based on the Variocon product range. This compact rectangular connector system based on IP67 is ideal for use in devices, as well as junction boxes and control cabinets in harsh industrial environments.

Five power contacts and eight signal contacts

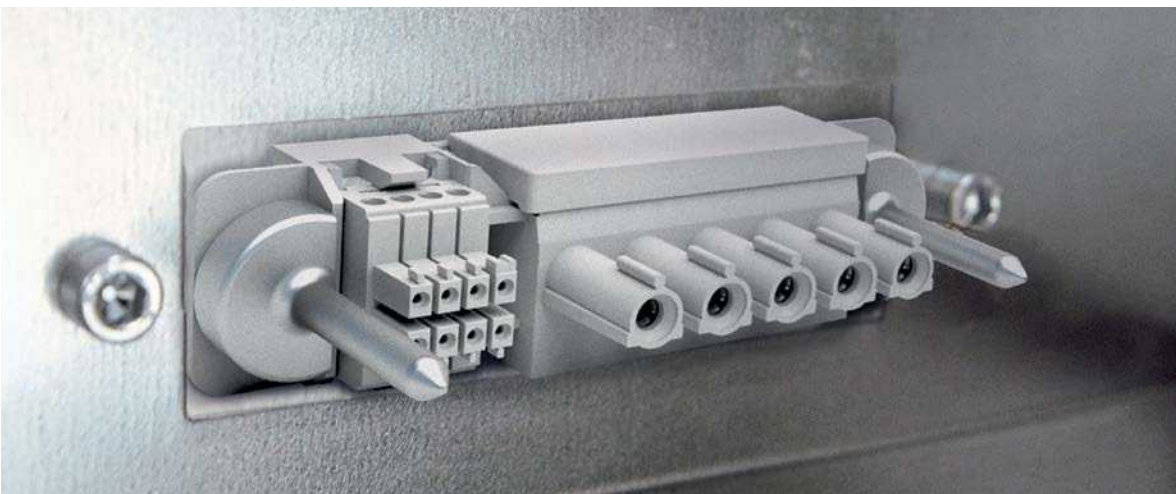
The decision to produce a modular storage system was made during the design phase for the Energy Neighbor. During development of the connector system, we relied on other connectors from other battery

storage projects that had already been tested. Electrical energy storage units are not only becoming more important in stabilization of the power grid, but also in portable tools and machines as well as E-Mobility.

The version developed for the Energy Neighbor has a total of 13 contacts: five power contacts and eight signal contacts. High contact density places special requirements on tolerance compensation during the connection process. This is where the special design of the battery-swapping connector comes into play. The 13 contacts are arranged in a contact insert with a floating design and additional guide pins. The guide pins protrude beyond the contacts and ensure that the battery module plug is correctly aligned during the connection process.

Stringent requirements for connectors

With a storage capacity of 200 kilowatt hours and output of 250 kilowatts, the storage system can absorb power peaks from solar and wind power plants and compensate for consumption peaks in households that are connected locally. Energy Neighbor also provides reserve power and other power grid services. The battery storage system is integrated into a container and consists of eight racks, each with 13 battery modules. These are supplemented by the power electronics as well as energy and battery management systems. The complete system has a total weight of eight metric tons. "If necessary, we can add additional racks to our



Installation errors are prevented by the special contact geometry of the battery connectors.

storage system in 25-kilowatt-hour increments,” Budjugin reports. “With an additional transformer, it could even be used as an isolated solution or UPS system disconnected from the power grid.”

Stringent requirements are also placed on the performance and connection reliability to ensure easy installation and fast replacement of battery storage modules. When manually connecting the socket and pin of a connector, the installer intuitively compensates for the offset between the two components, centers these parts with each other, and manually inserts one part into the other.

The user receives direct tactile feedback indicating whether the pin and socket have been connected correctly and securely. This feedback is not possible for Energy Neighbor battery-swapping systems. The installer always inserts an entire battery module into the rack and, therefore, cannot sense whether the pin and socket contacts are in the correct position just by touch. For this reason, all components involved must interact with a high degree of precision.

Conclusion

The compact, modular rectangular connector from Phoenix Contact acts as the interface for energy and data in the battery storage system from VARTA Storage GmbH.

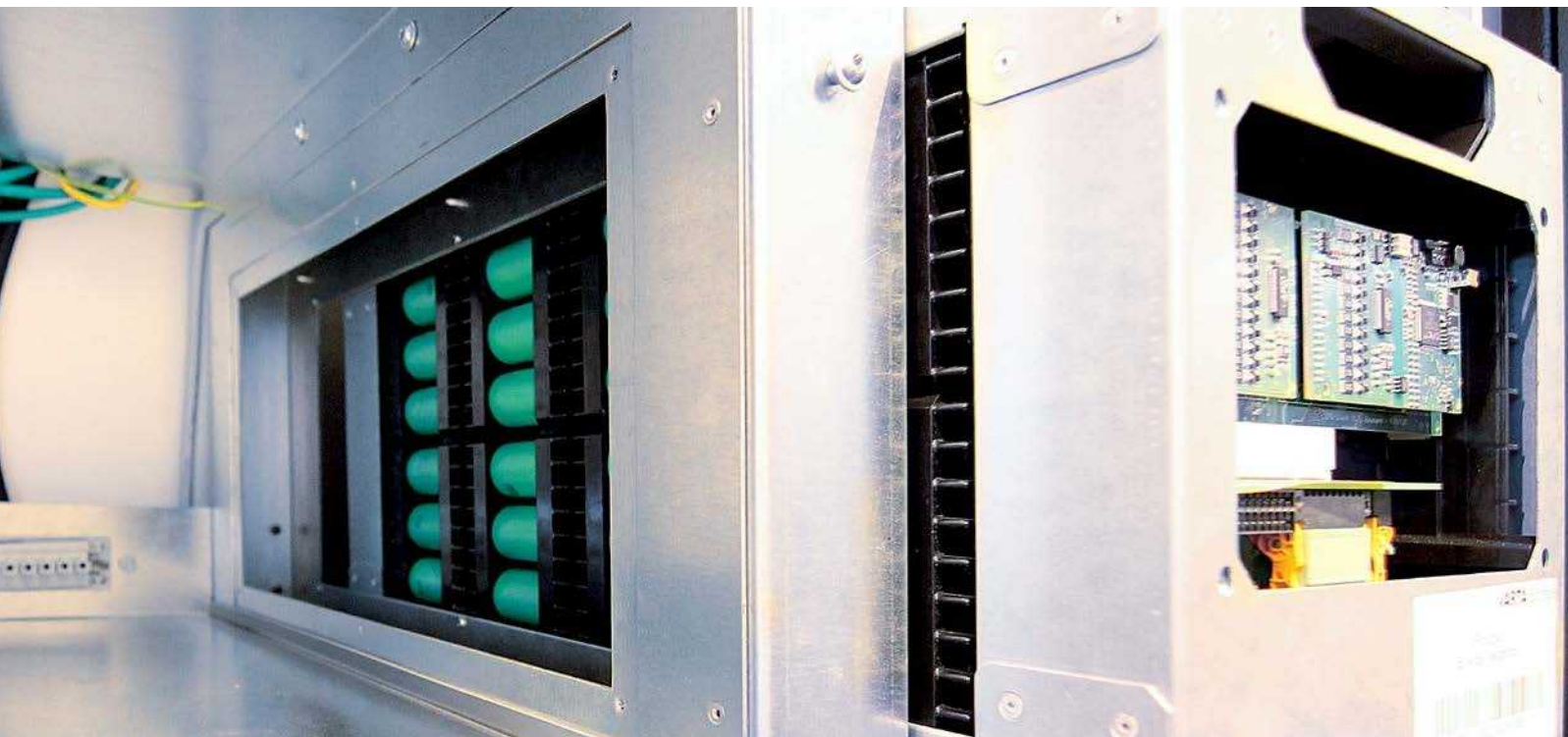
The interaction between connection technology and battery modules considerably reduces the commissioning and replacement time for the large accumulator because the individual modules do not have to be wired manually. This makes it possible to design turnkey, energy storage solutions of different capacities that are disconnected from the power grid and provide an environmentally friendly and future-proof alternative to existing diesel generators.

The prototype of the Energy Neighbor battery storage system from VARTA Storage has been demonstrating its capabilities in the field since late 2015. The integration of the container-sized battery into the grid at the Haag power station on the outskirts of Moosham is providing important insights for shaping the energy revolution. Pioneering work for the energy supply of tomorrow is being provided in the field test in Moosham. “We are gaining insights from daily use that we are utilizing to continue development of our storage systems,” explains Budjugin in closing. “Existing solar systems are already pushing many local transformers to their load limits. We expect to gain important insights into the effects of this kind of storage on the stability of the low-voltage network.” The innovative connection technology from Phoenix Contact will be there every step of the way with its Variocon product range. ■

Peter Richter

www.phoenixcontact.com

Battery module in the rack receiving bay.



Compact and configurable circuit breaker

The new CBMC circuit breaker from Phoenix Contact combines a compact design with custom configurability. It is also Phoenix Contact's first circuit breaker to receive NEC Class 2 approval.

The CBMC measures just 36 mm wide and has four channels to protect against overload and short-circuit current in electrical applications. Each channel is electronic and adjustable from

1 A to 4 A, giving the overall component the ideal protection level for NEC Class 2. When installed in a 24 V DC application, the CBMC limits the total output power to less than 100 W per channel.

www.phoenixcontact.com/cbmc



Portable card printer for industrial use



Phoenix Contact introduces Thermomark Prime, a portable card printer ideal for both on-site and stationary identification, in and around the industrial control

cabinet. The Thermomark Prime features integrated marking software for direct input of data, drop-in ink cartridge for easy loading, and automatic material detection to quickly start a new project.

Thermomark Prime can be connected to an external PC and controlled via Clip Project marking software. The printer can be used for several hours at a time thanks to a rechargeable, powerful nickel-metal hydride (NiMH) battery.

www.phoenixcontact.com/prime

Low-profile PCB terminal blocks

The new SPTAF 1 connector family from Phoenix Contact features a low-profile body and three user-friendly spring-lever options (IL, EL, LL series). The terminal blocks measure between 8 and 11 mm high and have spring-wire termination, making it easy for the user to insert solid or ferruled wires into any of the connectors without opening the spring connection.



For applications with the tightest fit, the IL series has an internal lever

that keeps overall connector height to just 8 mm. For stranded wire, a screwdriver quickly and easily opens the connection. The EL series, measuring 10 mm high, does not require any tools. The user depresses an external lever with a finger. The locking lever on the LL series locks the connector into an open position. This enables the installer to use both hands for wiring. The LL series does not require any tools, and it is less than 11 mm high.

www.phoenixcontact.com/newproducts

Entry-level VL2 box and panel PC

The VL2 1000 offers high uptime with an appealing design. Equipped with state-of-the-art Intel® Atom™ "Bay Trail" processors, rich functionality, and appealing design, the Valueline2 1000 product family is a tailor-made IPC solution for simple applications.

The award-winning display appearance has a robust design, where a metal base smoothly embeds the logoless front glass. Displays range from 7 to 18.5 inches, allowing OEMs to always have the same interface on their machines.



www.phoenixcontact.com/vl2

Solutions for the future at Hannover Messe



Each year, more than 250,000 people visit the Hannover Messe to get a first look at the latest trends and technology for worldwide manufacturing. Phoenix Contact, a longtime exhibitor at the world's largest tradeshow, presented "Solutions for the future" and introduced many innovative products and solutions.

Even if you weren't able to make the trip to Germany to see Hannover Messe in person, we bring the show to you. Get all of the highlights and a preview of new Phoenix Contact products by watching our video updates at:

www.youtube.com/phoenixcontactusa

or www.phoenixcontact.com/hannover2017 ■

Awards roundup

Automation professionals continue to recognize Phoenix Contact's outstanding product quality and industry leadership. In early 2017, Phoenix Contact received several awards from leading trade magazines, all voted on by readers. Thanks to all who showed their support for Phoenix Contact!



German Design Award – Valueline panel PCs Control Readers' Choice Awards

- #1 in Power Supply
- #1 in Signal Conditioner
- #1 in Terminal Block
- #5 in Wireless

Control Engineering Engineer's Choice Awards

- QUINT POWER Supply – Winner of the Energy, power protection category
- Managed Switch 7000 – Honorable Mention in the Network Integration – Ethernet switches category

Automation World Leader in Automation – First Team Honoree in the following categories:

- Cables, Connectors & I/O Modules
- Networking – Wired Components
- Power Supplies

TMC Network Security Excellence Award – TC mGuard

LEDs Magazine 2017 Sapphire Awards Honorable Mention: Automated tunnel lighting solution ■

Confidence Infomobile

The newest edition of Phoenix Contact's Infomobile has hit the road. The vehicle features a "Cabinet Confidence" theme, demonstrating how Phoenix Contact products work together to provide cost-effective, flexible solutions to improving automation systems. The vehicle will tour the eastern half of the United States throughout 2017. System integrators, OEMs, and panel builders can participate in a virtual cabinet experience as well as a hands-on product experience. The vehicle highlights seven areas of design:

- Control – The heart of the control cabinet.
- Power reliability – Don't overlook the basics.
- Connectivity – Never take a good connection for granted.
- Safety – Machine safety means more than OSHA regulations.
- Networking and remote connectivity – Proper implementation means increased productivity.
- EtherNet/IP and PROFINET solutions – Make cost-effective and open solutions a reality.
- Shop floor productivity – Time is money.

Customers can contact their local Phoenix Contact sales professional to find out if the Infomobile will be visiting their area and to schedule a visit. ■

www.phoenixcontact.com/confidence



Innovations: Spring 2017 issue

A Spring 2017 issue of the Phoenix Contact USA iPad app is now available. If you have not used the app recently, please visit it and download the latest issue featuring:

- Crimpfox Centrus
- SKEDD
- FL SWITCH 7000-EIP
- Raspberry Pi BC Enclosure
- Ethernet HART multiplexer
- TMC 8 circuit breakers

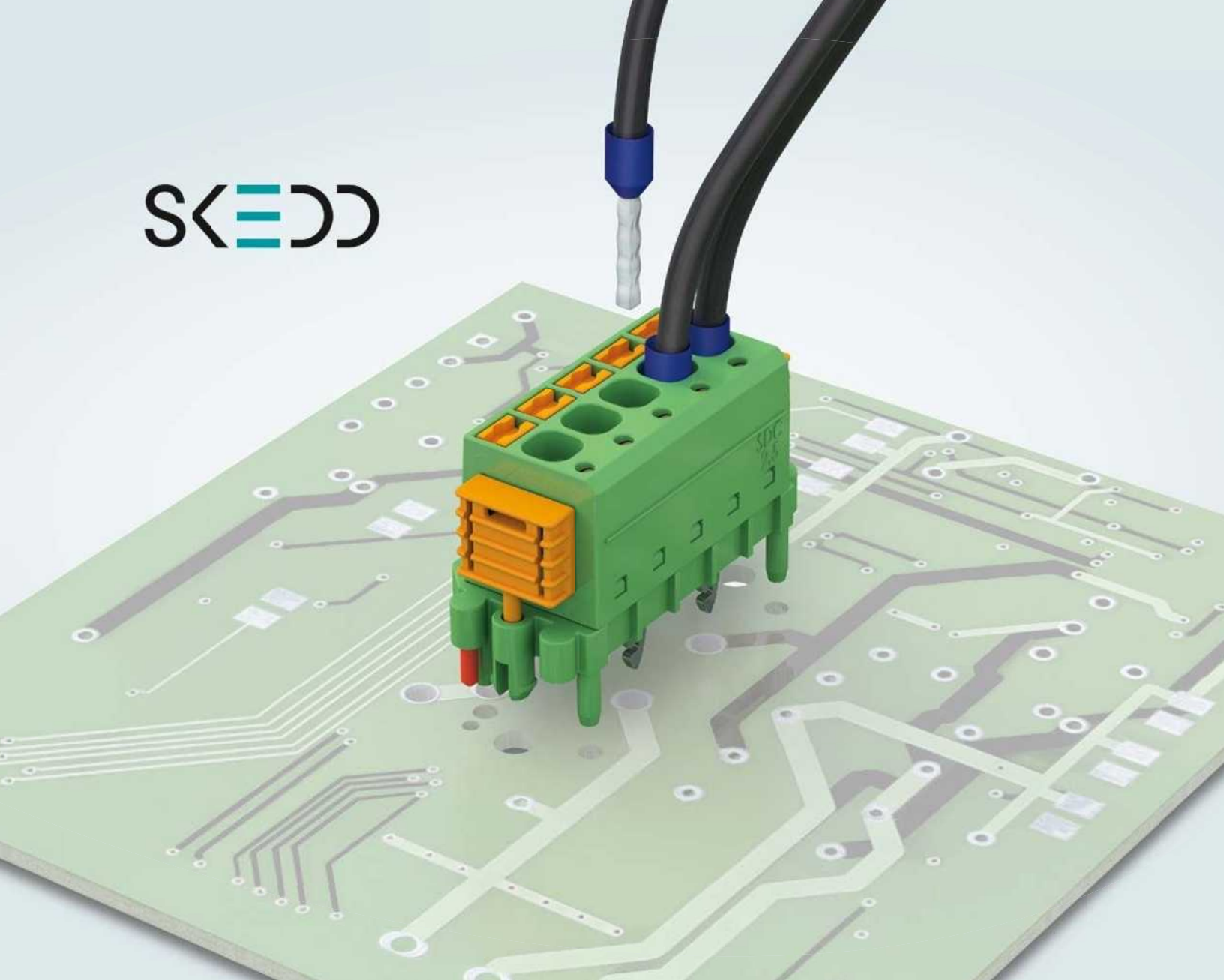
The app is available at:

<https://itunes.apple.com/us/app/id975841240>

or www.phoenixcontact.com/apps_usa ■



SKEDD

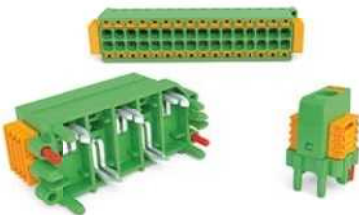


Direct connect

SKEDD technology decreases inventory and cuts cost.

Phoenix Contact presents the world's first direct connector with a Push-in spring connection. SKEDD technology will reduce your parts and processing costs.

Position, insert, and lock. Connecting SDC 2.5 and SDDC 1.5 series connectors to the PCB doesn't get any easier than this.



Call 1-800-322-3225 or visit: www.phoenixcontact.com/skedd