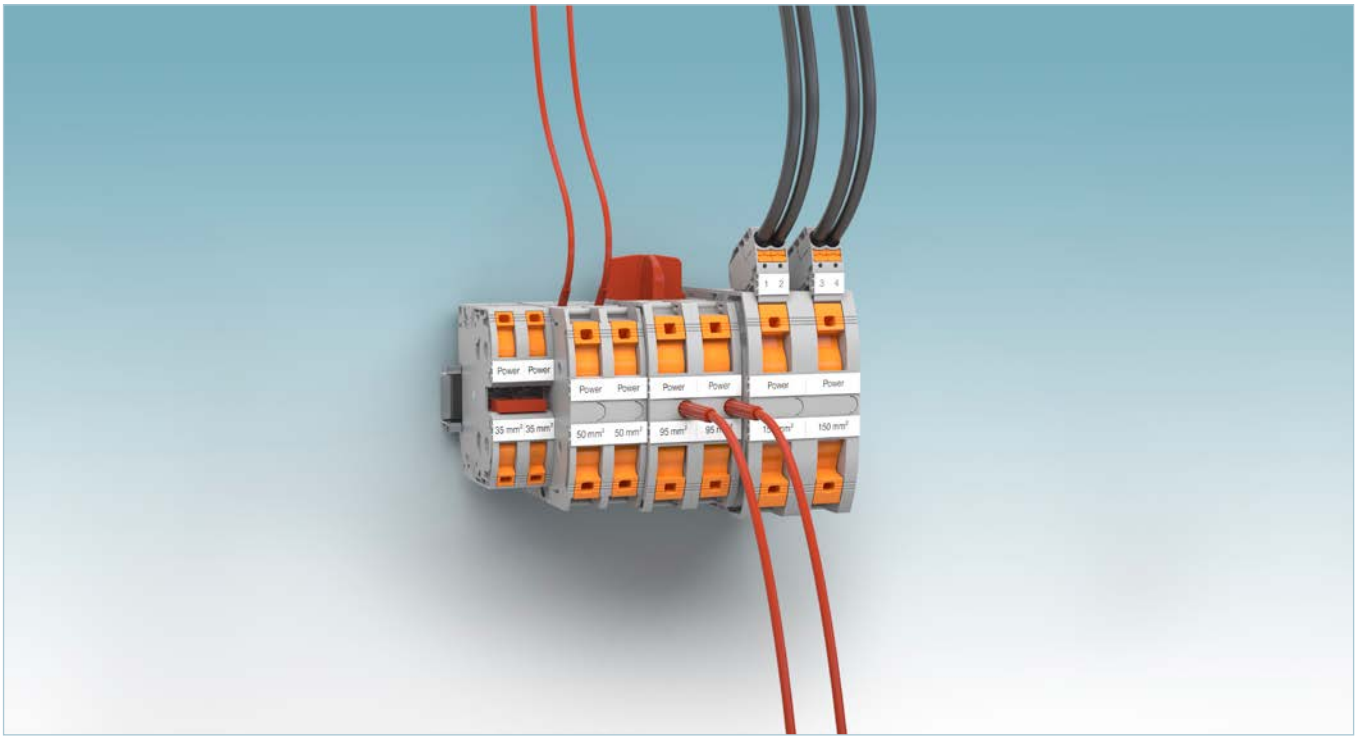


Figure 1: The new high-current terminals in the PT Power product line from Phoenix Contact allow for easy, fast and safe connections with large cable cross-sections.

Power wiring made easy

Push-in Connection Technology for large wires

Dipl.-Ing.(FH) Stephan Pollmann, Product Marketing Terminal Blocks, Phoenix Contact GmbH & Co. KG, Blomberg, Germany; Cory Myer, Product Marketing Specialist Terminal Blocks, Phoenix Contact USA, Harrisburg, PA

Electrical connections in the control cabinet have undergone a remarkable evolution in the past few decades. Highly sophisticated connection technologies and specific functions bear witness to the significance of connection technology for innovative manufacturers and users. Today's market offers quick and user-friendly connection options for the wiring of large conductors of up to 300 kcmil or 185 mm² with high-current spring-cage terminals (Figure 1, lead image).

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There are a large number of terminal block solutions ranging from 26 to 4 AWG or 0.14 to 25 mm² today: Whether connected via screw or spring-cage connection, tool-free, or even wired entirely without cable preparation, the options are numerous. Today, terminal blocks are not only used to connect electrical cables, but also for application-specific functions like isolation or fuse protection, universal pluggability, or seating for discrete components.

Recent years have seen a push for the development of a high connection density. This has resulted in small design widths, multi-level geometries, and high-density contacts, such as switching connectors.

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Figure 2: With solar parks being built all over the world, the connection technology must be particularly easy and safe – PT Power can be seen in the center connection box (upper middle).

Limited solutions for large cross-sections

The focus tends to be on simple connections when it comes to large conductors of 4 AWG or 16 mm² or more. Given the universality in the cross-section spectrum, the screw terminal continues to be the dominant form, followed by the bolt terminal, which is particularly well suited for large cross-sections. The main advantage of the bolt connection is that the cable with a ring cable lug can be "hung" frontally on the bolt, making it convenient to tighten the hex nut. On the downside, the assembly of the cable prior to the connection is difficult, and the cable lug has additional costs.

The installer must observe the torque specified by the manufacturer to ensure the proper installation of screw and bolt connection terminals. Due to the modular structure of modern electrical systems, control cabinets and plant parts are often prefabricated and then sold around the world, resulting in decentralized manufacturing. This makes it difficult to guarantee that the end user will observe the torques.

For example, take the installation of combiner boxes in photovoltaics. The engineering, procurement, and construction (EPC) general contractors who install combiner boxes on-site are often spread out all over the globe. Now, more and more PV plants are being set up in Central and South America or Asia. It is not always clear whether qualified specialists are assigned to the construction of plants, or whether lesser-skilled staff may be used due to the price pressure in the industry. However, failure to observe the proper torque represents a potential risk (Figure 2).

Advantages thanks to innovative spring connection

Spring-cage connections for cable cross-sections of up to 4 AWG or 35 mm² have been around for many years. Tension-spring technology was the top technology used in terminal blocks for a long time. Even today, it is still common around the world.

In recent years, push-in connections have been added to spring-cage technology. This technology offers a level of wiring convenience not known before – a plastic push button (pusher) provides additional safety with respect to protection against contact and incorrect wiring. This has led to significantly faster installation times. High-density wiring can be realized with a design width of 3.5 mm and a connection cross-section of 26 AWG or 1.5 mm². However, spring-cage connections for cross-sections over 4 AWG or 35 mm² were not on the horizon for a long time.

High-voltage terminals featuring PowerTurn connection technology

A newly developed spring-cage connection technology, known as "PowerTurn," entered the market in 2013 – and comes with many advantages. Designed for contacting large cables, PowerTurn was initially available with a nominal cross-section of 95 mm². Today, PowerTurn comes in cross-sections of 35, 50, 95, and 185 mm².

The PowerTurn connection is easy, fast, and safe – any specialist in the world can work with it. The new terminals come with an open clamping area. The cable is placed in the terminal block directly. To close the clamping area, simply move the orange actuator lever. What used to take a lot of effort before is now easy with user-friendly, powerful connection technology.

Massive cables and cables with wire-end ferrules can be plugged in directly without any tools when using the push-in connection terminal with its orange pushbutton. The PowerTurn high-current terminal allows for similar direct connection. When the actuator lever is closed, cables of up to 300 kcmil or 185 mm² can be placed inside the clamping area without any tools. This is particularly useful in small spaces, because Class 1 and Class 2 cables according to DIN EN 60228 (VDE 0295) are used in the larger cross-section segment – round, single-core cables as well as round or sector-shaped multi-core cables.

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Flexible marking, bridging, and installation

Insertion bridges are available for a nominal cross-section of 50 mm² or larger. This conveniently allows for the establishment of two- and three-position connections of adjacent terminal blocks on both sides. Placed in the clamping area before the cable is inserted, the bridges snap into the terminal housing. This prevents them from falling out, and the user has both hands free for wiring. The bridges have a plastic fin, making it easy to identify them visually. When the terminals are connected, the red fin sticks out between the cables.

The smallest terminal block with PowerTurn technology has a nominal cross-section of 35 mm². This makes it compatible with universal plug-in bridges from the Clipline Complete accessories program. The bridges can be plugged into the central area of the terminal, as usual, in two rows. Special reducer bridges have proven particularly useful, as this small power-in terminal block uses them to distribute potential on terminal blocks with nominal cross-sections of 2.5, 4, and 16 mm² (Figure 3).

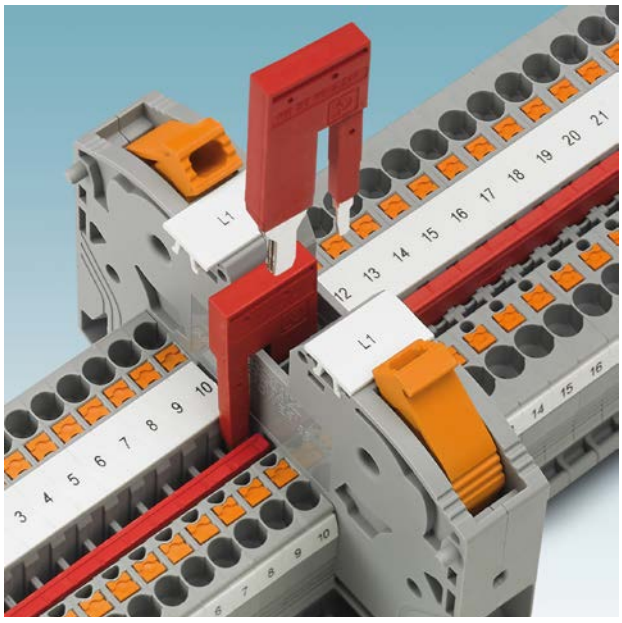


Figure 3: The PT Power 35 power-in terminal block can distribute potential to smaller cross-sections (2.5 mm², 4 mm², and 16 mm²) thanks to new reducer bridges.

PowerTurn – the new connection technology



The PowerTurn connection technology works with an innovative spring mechanism that consists of a bundle of up to three spring-steel elements that are positioned on top of each other. These press the cable against the current bar with great force at different positions. The current bar has a conic profile, which creates a high-contact surface and a low-contact resistance. The arrangement of the spring elements allows for the direct insertion of the cable when the clamping area is closed (push-in).

The PowerTurn connection has by far the greatest cable withdrawal forces in its market segment. Terminal blocks with a spring-cage connection are tested and approved, like screw terminals, according to DIN EN 60947-7-1/2, but because they do not have screws, the terminal blocks are also subjected to an additional aging test.

With 50 mm² or larger, PowerTurn offers three different testing options. The standard variant has openings for test probes with a diameter of 2.3 mm on both sides, near the conductor connection. A pick-off terminal can be snapped into place on both sides to connect permanent test and measurement devices, but also to attach surge voltage-protection devices. The tap terminal has two additional, full-fledged push-in connections. Cables of up to 16 mm² can be connected here, and there is also space for two separate 2.3-mm test sockets. If these testing options are not sufficient, then another variant can be used, one that comes with an additional socket in the center of the terminal, for example, for touch-safe measuring lines according to IEC 61010 with a 4-mm lamella-spring contact. As a result, the voltage can be measured conveniently at the front of the terminal.

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Figure 4: Preassembled terminal blocks reduce assembly and storage costs – the right terminal block is available for every function, for mounting-rail or direct assembly.

Conclusion

Phoenix Contact offers high-current terminals for assembly on the TH 35-15 mounting rail according to DIN EN 60715. There are also additional variants for surface mounting by means of flange mounting. This uses less space in terms of depth and also fixes the terminal optimally in place.

Terminal block variants from the PT Power product family are recommended if a group of up to five single terminals is required on a regular basis (Figure 4). Firmly interconnected, they are not only practical to use, but also offer the advantages of a single article when it comes to ordering or storage. These multi-pole terminal blocks are also available in mounting-rail and flange-mounting versions. As a universal terminal, PT Power has all customary approvals – including for shipbuilding and IECEx.

A fabrication facility in Southern California designs electrical distribution and control equipment. They specialize in fast, effective solutions to complex electrical problems, and offer services including: repair and reconditioning services, design and engineering, on-site UL recertification, in-place modifications, corrections, and total rebuild.



This system integrator was asked to construct panels for the stadium lighting at a new professional football stadium. The stadium lighting required 1000 V UL Recognized terminal blocks. The integrator was pleased to find PT Power blocks had the required voltage rating and easy installation. The blocks were arranged to handle power for both standard lighting situations and emergency lighting for the stadium.

ABOUT PHOENIX CONTACT

Phoenix Contact develops and manufactures industrial electrical and electronic technology products that power, protect, connect, and automate systems and equipment for a wide range of industries. Phoenix Contact GmbH & Co. KG, Blomberg, Germany, operates 50 international subsidiaries, including Phoenix Contact USA in Middletown, Pennsylvania.

For more information about Phoenix Contact or its products, visit **www.phoenixcontact.com**, call technical service at **800-322-3225**, or e-mail **info@phoenixcon.com**.

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