

Making Wiring Easier – Push-in Terminal Blocks for Modular Machine Designs

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Executive Summary

More machine builders are implementing Lean product design to meet the needs of individual customers. These modular production cells need to be lean, cost-effective and individually configurable. Careful component selection can help make these systems more economical and flexible. In particular, terminal blocks with push-in technology are an excellent choice for these designs. Push-in terminal blocks not only reduce wiring time and operator fatigue, but also meet the stringent safety requirements of the machine building industry.

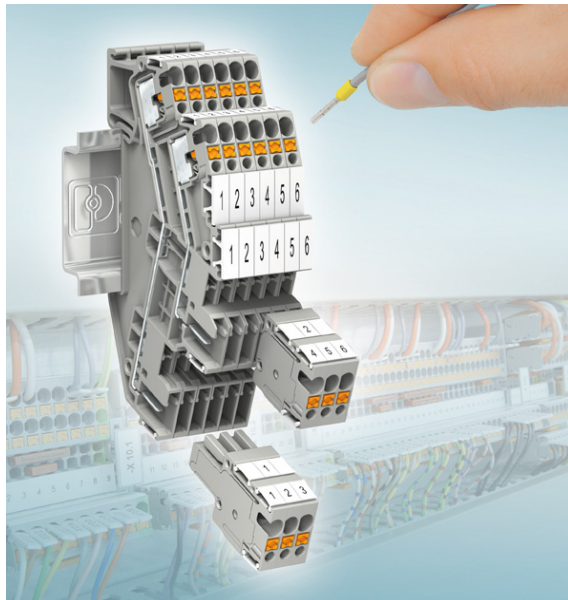
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Making Wiring Easier – Push-in Terminal Blocks for Modular Machine Designs

Key concepts:

- With Lean Product Design, engineers need cost-effective and configurable components to meet the individual needs of a production cell
- Terminal blocks with push-in technology can be particularly useful in such a design, as they simplify wiring and are much easier to use
- Push-in terminal blocks are available in a variety of sizes and pitches for different applications, and to meet the strict safety standards required in machine building



Modular machine design is on the rise. Users are demanding more from products along the entire process chain right up to the last component. Modern terminal blocks with push-in technology make systems more economical and flexible.

Mechanical engineers base their strategic design decisions on their customers' production requirements. This trend is known as "Lean Product Design." The market is moving away from fully automated, complete production systems toward smaller production cells with standardized functional modules.

Lean, Cost-Effective and Individually Configurable

Lean Product Design does not mean poorer quality or reduced availability. It simply describes a way to standardize predefined functional modules to meet customer demands. The production designs stipulate that the systems should be lean, cost-effective and individually configurable. Component manufacturers are also falling in line with this trend. On today's market, you can find a wide variety of traditional terminal block connection systems. Ideally, these terminal blocks are designed for flexibility, economy and ease of use.

Although the tried-and-tested screw connection technology still dominates the global market, spring-connection technologies have started gaining ground. Terminal blocks with push-in technology use compression springs to press the conductor against the live copper rail to form an electrical connection.

Installers find this technology particularly useful. No tools are required for wiring, since a prefabricated or rigid conductor is connected to the contact point directly – without tools. Rigid or single-wire conductors are standard in building engineering, but not in mechanical engineering. Previously, only thick, rigid conductors were standard, but now thin sensor cables are also used.

Push-In Terminal Blocks Make Their Mark Safety Factor

Today's innovative push-in connection technology (Figure 1) is much easier to use. Wiring without tools is particularly useful in cramped, hard-to-access areas. Electricians at the end of the process chain can even work with one hand. Forming a connection is as easy as grasping the conductor and plugging it in. This simpler, ergonomic wiring style reduces wiring time and fatigue.

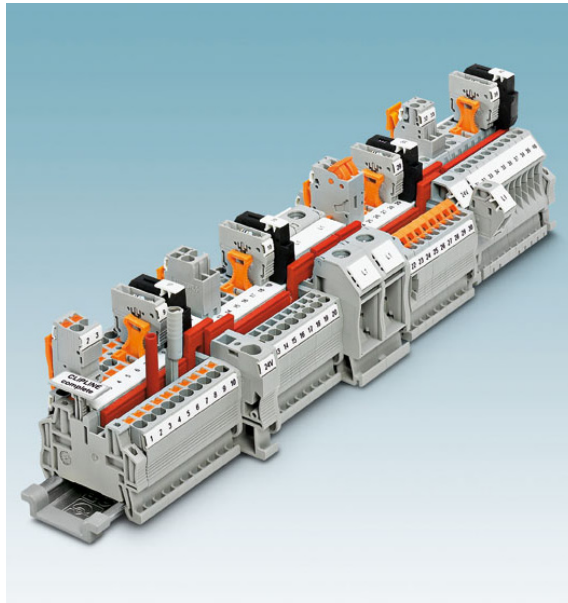


Figure 1 Push-in terminal blocks simplify wiring. When push-in terminals are part of a comprehensive terminal block system, such as Phoenix Contact's Cipline complete, the universal range of accessories increases the system's flexibility.

The wide variety of manufacturer-specific connection technologies used in all kinds of terminals, relays and control units makes installers' daily work more difficult. There is no standard way to position conductors and working tools in the components. This can result in faulty wiring, which in turn may lead to system failures and could even pose safety hazards.

Push-in terminal blocks with distinctive color-coded push buttons can solve this problem. Clearly identified push buttons will separate the operation and conductor insertion both optically and physically. This rules out any possibility of positioning the conductor incorrectly.

Full insulation also increases operational safety. Most workers know that working on live systems is dangerous and violates safety regulations, but it still occurs in real life. Despite the dangers, many operators still perform measurement and test procedures or rewire during live operation. The push-in technology actuation button provides secure contact protection with insulation to separate the internal contact elements reliably. This makes it impossible to come in contact with live parts.

The signal and control wiring in the lower power range plays a key role in the system wiring. As machine functions become ever more complex, there is less space for the increasing signal density. Push-in terminal blocks are available with a 3.5 mm pitch, developed specifically for these applications to supplement products on the market. These terminal blocks are particularly suited for control circuits, sensors and actuators.

In practice, wiring in the lower power range typically uses conductors with cross sections between 0.14 and 1.5 mm². Off-the-shelf terminal blocks with a standard pitch of 5 mm or even 6 mm are often too large for these applications in terms of their performance characteristics. The slim shape frees space in the control cabinet.

Compliance with Machine Standards

As described above, the configuration of lean production systems using standardized functional components requires a modular assembly design. In electrical installations, pluggable electrical solutions offer clear advantages when commissioning, servicing and transporting individual system modules. This makes it possible to combine individual terminal blocks and connectors. Choosing a comprehensive terminal block system, such as Phoenix Contact's CLIPLINE complete, makes this even easier. The number of contacts required can be customized to the application, and coded contacts can prevent misidentification.

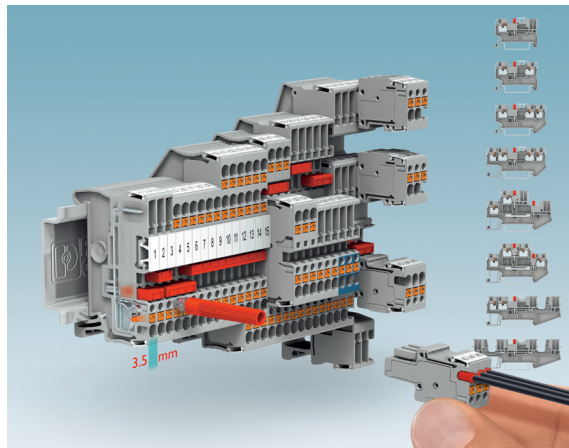


Figure 2 Push-in terminal blocks with 3.5 mm pitch leave lots of free space when wiring modular production systems.

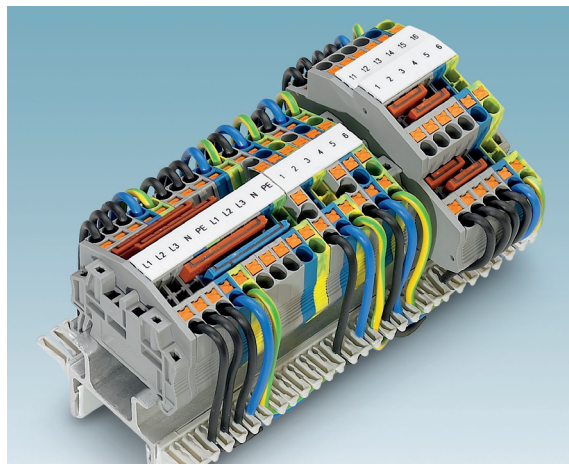


Figure 3 Push-in terminal blocks are also available in angled models. Bridges allow flexible cross connections, and both horizontal and vertical bridges are possible in multilevel terminal blocks.

Selecting connectors that comply with the stringent safety regulations per IEC 60204-1 and UL 508 will ensure safety. When connecting, the protective conductor makes the first contact. Connectors and basic terminal blocks are protected against finger contact in compliance with BGV A2 (Figure 2).

Push-in terminal blocks are available for cross sections from 0.14 to 16 mm². There are various housing types to match the application. These types differ in their terminal operating angles. Depending on the application, users can choose either a horizontal or an inclined wiring angle, which makes it easier to guide and handle the conductor. The technology is the same for all models, which are all compatible (Figure 3).

Sidebar: Easy Electrical Design

Software packages are helpful for designing the best electrical solution. For example, Phoenix Contact's "Clip Project" project planning software facilitates quick product selection, and complete terminal blocks can be ordered with the click of a mouse. The selection is made automatically on the basis of technical requirements such as connection type, current-carrying capacity, functionality or approval of the components for certain markets.



Figure 4 Clip Project supports the entire engineering process, from component selection to automated data exchange with CAD systems.

Clip Project has easy-to-use interfaces to the most popular electrical engineering tools like Eplan P8, all current CAD programs and Microsoft® Office applications. In addition, Clip Project supplies the printing systems associated with the processes. A graphics viewer documents the project planning status in 3D. The auto-correction feature checks for completeness and adds the accessories required for the terminal block (Figure 4).

Conclusion

While there are a variety of push-in terminal blocks on the market today, Phoenix Contact's Push-In terminal blocks can reduce the required insertion force by up to 50 percent compared with similar products. Conductors with cross sections beginning at 0.25 mm² can be wired without tools. The Push-In terminal blocks form a component of the CLIPLINE complete terminal block product line, so they are compatible with Phoenix Contact's comprehensive line of terminal blocks.

To learn more about Phoenix Contact's Push-In terminal blocks and the entire Clipline complete product range, visit:

www.phoenixcontact.com/push-in

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