Interview “Efficiency in wiring is a big deal”

Roundtable “Which terminal block would you like?”

Wiring made easy: Connecting conductors quickly and easily with Push-in technology
End-to-end wiring using a single connector type

Push-in connection technology – all the way from the field to the controller

With push-in connection technology from Phoenix Contact, you can easily and safely wire your entire application. A complete product range is available for every stage of your project, from field wiring to the wiring of power and control lines. No tools are necessary. Easily connect sensors and actuators, modular terminals, and interface and automation components. Push-in – The new plug-in experience!

For additional information call +49 52 35 3-00 or visit phoenixcontact.com
Dear readers,

Efficient processes are essential for keeping up with the international competition. This applies to every industry – in the automation industry and also for building installation, for control cabinet manufacturing as well as for machine building and systems manufacturing. A few years ago, Phoenix Contact launched Push-in technology on the market for this purpose. This technology makes it possible to connect solid conductors and conductors with ferrules quickly and effortlessly without tools.

This connection technology is now available in a large number of products – from sensor/actuator cabling in the field to terminal blocks, surge protection, relay and optocoupler systems as well as security components and hybrid motor starters up to I/O modules and controllers.

This is the reason for us to present Push-in technology once more in detail in the form of this brochure. You will learn what arguments can be named in practice for using Push-in terminal blocks and the current dissemination of this technology in the industry. We would particularly like you to read the discussion during which two users – one uses spring-cage technology, one uses Push-in technology – talk about connection technology with experts from Phoenix Contact and the Ostwestfalen-Lippe University of Applied Sciences.

This is one conclusion from the conversation: There is not just one connection technology for everyone. Therefore, we don’t consider Push-in technology a one-and-only solution for wiring, but as a – albeit very exciting – component for further rationalizing the wiring process. But take a look yourself – happy reading!
Survey on connection technology in the German industry

Leading article: Wiring made easy

Interview with Klaus Firschke: Efficiency in wiring

Roundtable: Which terminal block would you like?

User report: Making the wiring process more efficient

User report: Barrier system wired safely and quickly

FAQ, Contact & Legal Information
Push-in Technology Becomes Established

Survey on Connection Technology in the German Industry

Around 62 percent of the industrial companies in Germany use Push-in technology at the moment. This was the result of a survey carried out by Vogel Business Media for Phoenix Contact. Over 1,400 experts from a great variety of industries participated in the survey.

According to the results, nearly 70 percent of the companies surveyed primarily use spring-cage connections, followed by screw connections (54 percent) and connectors (47 percent). However, the majority of the surveyed companies also uses Push-in technology for selected applications, and the main area of application is control cabinet wiring.

Fourteen percent of the companies surveyed also plan to use Push-in technology in the future.

Above all the fast wiring, easy handling, and reduced process costs during installation are named in the survey as the benefits of Push-in technology.

The detailed results are summarized in a white paper. The white paper provides information on the dissemination of the different connection technologies at the surveyed companies. In addition, the areas of application of Push-in technology are named – and which arguments are in favor of and which arguments are not in favor of this connection technology in the opinion of the experts consulted.

The white paper can be requested from Phoenix Contact
Contact: Sabrina Sauer,
sabrina.sauer@phoenixcontact.de
The degree of automation in the industry is still constantly increasing. A growing number of sensors, actuators and controllers provide for more efficient processes in systems and machines. Despite the overwhelming success of bus systems and increasingly centralized automation, the amount of wiring remains high: often hundreds of cables still have to be connected in large machines and systems and also in building technology.

Wiring takes up a considerable amount of time in machine building and systems manufacturing, but also in building technology. This is why Phoenix Contact offers with the Push-in technology a wiring system in the control cabinet and also in the field that simplifies handling even with limited space and significantly reduces wiring times. As a current study shows, the system is already established at many companies, whereby even applications critical to security as in the chemical or railway industry rely on Push-in technology.

The wiring process can be rationalized significantly with Push-in technology.

—Olaf Meier—
SIXTY-TWO PERCENT OF THE COMPANIES USE PUSH-IN TECHNOLOGY

Phoenix Contact launched Push-in technology on the market a few years ago to reduce the time required for this and to thus lower the overall process costs – with this system, solid conductors or conductors with ferrules can be directly inserted into the conductor connection without any tools. Thanks to the simple and fast wiring that this makes possible, this connection technology now has established itself at the companies across industries: A current study shows that around 62 percent of the surveyed companies already use Push-in technology. The survey was carried out by Vogel Business Media for Phoenix Contact with 1,428 experts in the spring of 2014. The most important argument in favor of Push-in technology according to the survey is the reduced wiring time – 89 percent of respondents see this as the greatest advantage of this connection technology, closely followed by easy handling, which is a benefit of Push-in technology for 87.6 percent of respondents. Together with lower process costs during installation and reduced maintenance effort, it can be seen that primarily arguments that favor rationalization of wiring are named.

CONNECT CONDUCTORS MORE EASILY

Solid conductors or conductors with ferrules from 0.34 square millimeters can be easily inserted manually into the terminal point with Push-in technology without any tools. The conductor itself opens the contact spring. Direct insertion into the conductor is performed with low conductor insertion force, which is significantly lower compared to other direct insertion connection technologies. At the same time, the spring made from high-quality spring steel provides for high contact and con-

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Solid conductors or conductors with a ferrule can be inserted quickly and directly with Push-in technology.
A conductor pull-out forces. Handling the Push-in technology is significantly easier than for other connection technologies, particularly in tight spaces or for difficult-to-reach terminal points – you only need one hand to insert the conductor into the contact area.

But it is also possible to connect stranded conductors without ferrules from 0.14 square millimeters: This is done by way of the push button – it is pushed down using any common screwdriver and this opens the contact spring. The actuating path of only 3 millimeters makes it possible to work quickly. The conductors can also be removed effortlessly using the push button.

**SIGNIFICANT TIME SAVING IN WIRING**

However, in many cases it is recommended to fit stranded conductors with ferru-
Phoenix Contact has developed the Crimphandy for this purpose – with this tool the conductors are stripped, fitted with a ferrule, and crimped in just one step. **All of this takes place in just three seconds. Combined with Push-in technology, this significantly reduces the time required for a connection:** While about 17 seconds are required for cutting to length, stripping, manually applying and crimping the ferrule and connecting the conductor to the Push-in terminal block, the same work is completed in a mere 10 seconds using Crimphandy.

**SOLUTION FOR HIGH CONTACT DENSITY**

Another trend that is gaining in importance today is miniaturization. And it also does not spare automation – control cabinets and distributor boxes are shrinking, and the space for connection terminal blocks is becoming increasingly smaller.

**Phoenix Contact therefore also offers Push-in terminal blocks with a pitch of just 3.5 millimeters. This allows for a high contact density for wiring small cross sections:** Assuming only 50 connections on a terminal strip, this saves a total of 85 millimeters compared to a 5.2 millimeter pitch.

But Push-in technology terminal blocks are not just available for small cross sections: Phoenix Contact also offers corresponding terminal blocks for conductor connections with conductor cross sections of up to 95 square millimeters. The conductors can also be inserted directly into the terminal blocks without opening them beforehand. The conductor is released again by using a simple screwdriver.

**RELIABLE CONTACTING AND ASSEMBLY**

However, for efficient, inexpensive wiring, it is not enough to connect the conductor quickly – the wiring also has to be reliable.

**For Push-in technology from Phoenix Contact, this already starts with the design of the terminal block:** The push button is orange and can thus be clearly distinguished from the conductor entry funnel, which effectively prevents incorrect insertion of the conductor. When the push button is activated with a screwdriver, there is no direct contact with live parts at any time. The plastic push button guarantees full...
touch proofness and furthermore prevents damage to the terminal block or the conductor due to the use of the wrong tools.

Once inserted, the conductor is held in place reliably by the contact spring, which is manufactured from high-quality spring steel. The conductor pull-out force is far above the standard. Therefore, a 2.5 square millimeter terminal achieves over 270 Newtons for a required 50 Newtons for the conductor pull-out test – this offers a high degree of mechanical reliability. In addition, the contacting is

*Push-in technology meets high requirements in terms of vibration and shock loads up to 350 g.*
Vibration-resistant and gas-proof – it is also not impacted even by aggressive media. At the same time, high-quality copper cables provide for low contact resistances and thus allow for current transfer with low loss.

Numerous tests and certifications prove the high reliability of Push-in technology. It is subjected to tests which go beyond the basic standard, enabling them to be used in all sectors of industry, such as supplying power, transportation technology, process engineering and the chemical, petrochemical and shipbuilding industries in particular.

**CONSISTENT FROM THE FIELD TO THE CONTROLLER**

From sensor/actuator cabling in the field to terminal blocks, surge protection, relay and optocoupler systems as well as security components and hybrid motor starters up to I/O modules and controllers, a great number of wiring tasks can already be implemented without any tools. With Phoenix Contact, the users benefit from a consistent product range equipped with Push-in technology.

**CONCLUSION**

Entire applications can therefore be built more simply and cost effectively. This creates opportunities for new, more economical machine and system installations.
Phoenix Contact has been offering Push-in technology on the market for a few years. This technology can be used to connect solid conductors or conductors with ferrules quickly and effortlessly without tools. Klaus Firschke, Head of the Product Marketing Department for Industrial Cabinet Connectivity at Phoenix Contact, talked about trends in connection technology in general, about the specifics of Push-in technology and about why his company again started a big marketing campaign for it.

Mr. Firschke, what are the prospects for connection technology?

Good! The amount of wiring will continue to increase in the industry in the future. Take a look at the area of power transfer alone – this area still requires very many wiring points since power today still cannot be transferred wirelessly – at least across long distances.

Are there current developments that have a particular impact on connection technology?

In the European area in particular, companies are thinking about how to further automate control cabinet wiring in the future. This of course also has a direct impact on connection technology.

You know, Push-in technology is nothing new; Phoenix has been offe-
ring it for a few years now. Why is Phoenix Contact promoting this technol-
ogy so intensively once again?

We are currently observing that the number of preassembled cables and
preassembled cable harnesses is increasing in industrial use. This is a major re-
quirement for Push-in technology, which helps the acceptance of the technology to
increase since efficiency in wiring today is a very big deal.

Where do you see the strengths of this technology in general?

The strength of Push-in technology is in the intuitive operation and the speed of
wiring.

Compared to the Push-in systems of other suppliers: What are the advanta-
gees that the solution from Phoenix Contact offers?

The major advantage of our system is the fact that insertion forces are very low,
which significantly simplifies wiring, while the extraction forces are high, which
leads to very high wiring reliability. An additional bonus of our Push-in system
is the push button.

It offers two major advantages: Its orange color sets it apart clearly from the
conductor entry funnel – which prevents incorrect insertion of the con-
ductor. And it serves as an insulator so that no live parts can be touched by a
screwdriver or any other tool.

You often hear as an argument against Push-in technology that it’s too
expensive. What’s your answer to that?

In general, the terminal blocks with Push-in connection are the most inex-
ensive in our portfolio. In addition, another cost benefit is created when you
consider the entire wiring process chain – from engineering to preparing the
 cables up to the actual connecting. This is because you can wire much faster
with preassembled cables.

Most users use Push-in technology in control cabinets. But rarely in the
field. Is this justified?
It's not justified. But this is probably also due to the fact that crimp connection technology is used heavily in the field for historical reasons. There also still aren’t too many solutions in Push-in technology that can also be used in the field.

**Push-in technology is at its best for solid conductors and for conductors with ferrules ... Is this statement correct?**

If you also include ultrasound-compacted and resistance-welded conductors, then yes.

**Does Push-in technology also offer advantages for stranded conductors without ferrules?**

When you want to use Push-in technology for stranded conductors, you still have an advantage over traditional spring-cage connection technology, thanks to the short actuating path of the pusher with respect to the overall time for the wiring.

**Will Push-in technology allow for a further development towards automatic wiring, for example with robots?**

A resounding yes. But a very important prerequisite has to be created: The data flow has to be consistent from the E-CAD system to all machines that you use for wiring. You need a database that covers everything and a consistent data flow through all systems.

**Where do you see further development potential for Push-in technology from the perspective of Phoenix Contact?**

Push-in technology is already being used in many industries in our components and solutions today. We will further expand this offer in the future. This means that Push-in technology will increasingly be used in all areas of the control cabinet. In part of course for Phoenix Contact, but also for the manufacturers of components that we do not supply. These companies are also increasingly focusing on Push-in technology and designing it into their products.
WHICH TERMINAL BLOCK WOULD YOU LIKE?

A ROUNDTABLE DISCUSSION ON TRENDS AND REQUIREMENTS FOR CONNECTION TECHNOLOGY

Two users – one uses spring-cage technology, one uses Push-in technology – have a discussion with experts from Phoenix Contact and from the Ostwestfalen-Lippe University of Applied Sciences. Miniaturization, more efficient processes and safe wiring are major aspects according to which practitioners select their terminal blocks.

"Sales in the field of connection technology are growing worldwide and the need for terminal blocks will increase", says Professor Jian Song from the Precision Engineering Laboratory of the Ostwestfalen-Lippe University of Applied Sciences, with conviction. "Due to automation, a growing number of systems is fitted with sensors and actuators that must be connected. However, wiring is shifting outside into the field; therefore, the number of connections can decrease from the perspective of control cabinet manufacturers". But this does not mean that control cabinet manufacturers have more space: "Electricians always get the smallest spaces for their systems", says Olaf Meier.
Volker Krebs-Rahmlow, shrugging his shoulders. He is the Head of the Systems Manufacturing and EMSR division at Krefeld-based Hell GmbH & Co. KG.

The company manufactures electrical engineering equipment for systems and buildings. Krebs-Rahmlow adds: "This means that we need to build as compact as possible". The same also goes for system and machine building, as Stephan Rabsch confirms. He is the Head of Manufacturing at ATR Industrie-Elektronik GmbH in Krefeld; the company, which is part of the Siempelkamp Group, manufactures about 6,500 meters of control cabinets a year. "In supermarkets, for example, space is planned down to the very last inch. The customer wants to have freezers in this area instead of control cabinets".

"We need to build as compact as possible and integrate a lot of things into the control cabinet".

**CHALLENGE MINIATURIZATION**

The manufacturers of connection technology therefore now also offer their terminal blocks with significantly smaller pitches.

"However, there are also limits to this trend of miniaturization", explains Klaus Firschke, Head of the Product Marketing Industrial Cabinet Connectivity Department at Phoenix Contact. "We could certainly manufacture even slimmer terminal blocks, but even at 3.5 millimeters, the conductor insulation sometimes is thicker than the terminal block. It is also becoming increasingly difficult to place legible marking on the conductors and terminal blocks".

"We can only achieve savings in system manufacturing by way of the work hours".

Stephan Rabsch, Head of Manufacturing ATR Industrie-Elektronik, Krefeld
But these are not the only aspects that prevent further miniaturization since the packing density in the control cabinet increases because of the slimmer pitches and smaller cabinets. Volker Krebs-Rahmlow: "We will be facing the issue of how to get the heat out of the control cabinets". This results in quite strange situations: The current in the control cabinet generates heat that then has to be removed with cooling systems – which uses additional current. On the other hand, larger conductors are suddenly being used again, as Stephan Rabsch explains: "We sometimes connect cross sections that are twice the required size for the current flow – they then serve as heatsinks for the equipment used".

Miniaturization has another disadvantage: While it used to be possible to install a terminal block that covers a whole range of conductor cross sections, specific terminal blocks are used for every cross section today. Rabsch: "We need terminal blocks with different pitches with respectively fitting bridging material and separate end plates. This results in significantly higher over head for the areas of procurement and storage".

His request to the manufacturers therefore is to expand the modularity of their products: "Particular attention should be paid to this for accessories, such as for the marking and bridge material".

MORE EFFICIENCY IN THE ENTIRE WIRING PROCESS

Such modularity would not just simplify warehousing, but also allow for more efficiency for the entire wiring process. This has a high priority to both Stephan Rabsch and Volker Krebs-Rahmlow. Rabsch explains: "The material prices on the market are fairly balanced, which means that
we can only achieve savings by way of the working time. And this is also asked of us continuously in the area of electronics”.

To achieve this objective, companies are increasingly optimizing the entire process chain, as Klaus Firschke reports: "This already starts with the engineering and work preparation". ATR GmbH also has been working with CAD and cable assembly for years, according to Stephan Rabsch: "We get the CAD data from our customers. We unfortunately observe repeatedly that many designers don’t use the database function in their electrical CAD system".

This means that for example a box is drawn for the terminal block in the circuit diagram instead of using the "terminal block" component from the corresponding library. "With this, none of the database functions that they could actually use for process improvement are available", explains Rabsch. As a service provider and consultant for his customers, as Rabsch sees himself, he as the Head of Manufacturing continues to communicate this potential for optimization.

**DIFFERENT USERS, DIFFERENT TERMINAL BLOCKS**

However, efficiency can also be improved at the end of the process chain – namely by selecting the suitable terminal blocks. "Screwless processes have now become established everywhere", says Volker Krebs-Rahmlow. "We just insert everything – it’s much faster and you need fewer tools". Hell uses Push-in technology from Phoenix Contact – unless the customer wishes otherwise. With this system, solid conductors or conductors equipped with ferrules can be inserted directly into the conductor connection without any tools.

This is different for Stephan Rabsch: "Spring-cage technology is widely accepted by our customers from machine building and systems manufacturing. But what I personally liked the best was the displacement equipment: No stripping, no ferrule – insert conductor, flip lever, done".

Especially in regards to the process costs, this technology indeed seems to be convincing. Klaus Firschke has an example
for this: "I recently talked to a head of manufacturing; the wiring times were recorded. With displacement equipment, the employees could perform the wiring 30 percent faster".

But this speed advantage also has drawbacks. Volker Krebs-Rahmlow: "We do not use this connection technology at all since we have different suppliers for our wiring strands. Everyone supplies a different insulation thickness. And for an incorrect insulation thickness, it may happen that the displacement connection equipment does not contact correctly. This does not happen at all with Push-in technology".

Professor Song confirms this issue and adds: "A displacement terminal block does not work for all cables".

This is an important aspect for exporting companies in particular: "A company cannot be familiar with all of the conductors available", says Professor Song. "Therefore it may happen that the contacting is not ensured reliably for large tolerances and a large difference in the conductor structure".

**FASTER WITH PUSH-IN**

Krebs-Rahmlow sees a second disadvantage in displacement technology in that the conductor has to be cut off again for wiring changes.

"For Push-in technology, you just take out the conductor and insert it into the new terminal point", says Krebs-Rahmlow. As a dedicated user of spring-cage connections, which also include Push-in technology, Stephan Rabsch says: "The spring puts constant pressure on the wire. This means that the contact remains reliable even though it sometimes vibrates and shakes".

"The smaller the terminal becomes, the more difficult is it to reliably connect conductors".

Klaus Firschke, Head of the Product Marketing Industrial Cabinet Connectivity Department, Phoenix Contact, Blomberg
Rabsch primarily cites financial reasons for spring-cage technology, since the technology also makes it possible to connect stranded conductors without ferrules:

“This saves us time. However, this also has a disadvantage, since mostly fine-stranded and extra fine-stranded conductors are connected. Especially for the final completion, it is easy for an individual wire to be spliced such that short circuits can occur”.

Nevertheless, Rabsch sees advantages in spring technology compared to Push-in technology: "I would have to use ferrules for fine-stranded conductors for Push-in terminal blocks. So spring-cage terminal blocks are easier to handle and have faster process times". But Jürgen Wegener, Key Account Manager at Phoenix Contact, objects: "You can also use the Push-in terminal block as a normal spring-cage terminal block without ferrules, since the terminal block also has a push button with which you can open the spring. This gives you one terminal block for two applications". And Klaus Firschke adds: "In addition, you are still faster compared to normal spring-cage terminal blocks with our Push-in terminal blocks, even when they are opened using the push button. This is the case since the traverse path of the screwdriver for a spring-cage terminal block is longer than that of the push button for the Push-in terminal block. So you are still faster even without a ferrule".

CONTACT RELIABILITY IS AN IMPORTANT ARGUMENT

Volker Krebs-Rahmlow then also adds a further argument for Push-in technology to the discussion – especially in regards to the shrinking terminal blocks: "Imagine the following situation: At a construction site, the cables are coming from above, the technician does not have a ladder with him and he needs to hit the correct terminal point with a screwdriver in one hand with the conductor to be placed in his other hand. With a Push-in terminal block,
the technician simply inserts the conductor manually – without any tools. When you have multiple strands and you have to connect them in a very tight space – it doesn't get any faster than plugging them in”. Push-in technology also offers advantages in terms of “reliable wiring”, as Klaus Firschke adds: "For Push-in terminal blocks, you only have one opening for the conductor and no additional opening for tools to open the terminal point. This prevents the conductor from being inserted into the wrong opening or that the terminal block is damaged by using an inappropriate tool. In addition, there never is contact to the live parts, thanks to the push button – so if rewiring should be performed under a load, there is no risk". Volker Krebs-Rahmlow adds another advantage from his perspective: "For the Phoenix Contact terminal blocks, there is a special opening that can be used to perform a measurement with a voltage tester, even when no bridge is inserted". Stephan Rabsch attentively listens to this argument: "I do think that the arguments about contact reliability are important". But that does not mean that he wants to switch to Push-in technology. But the requirements for terminal blocks also differ from user to user and from industry to industry. When asked about the developments in connection technology in the future, Professor Song provides a correspondingly diplomatic answer: "There are two users at this table and we've already heard about two different development trends: Standardization and miniaturization. If there were more users at the table, most likely additional points would have been named. There is not just one development tendency for terminal blocks".

"Contact reliability is a very important argument".

Stephan Rabsch, Head of Manufacturing ATR Industrie-Elektronik, Krefeld
The entire wiring process can be implemented much more efficiently with interlocking solutions for the individual steps – from configuration to manufacturing.

Making the Wiring Process More Efficient

Integrated Solutions for Configuration, Marking and Connection

Reduce Costs for Wiring

Fast and at the same time error-free wiring is an important component for optimizing the processes of control cabinet manufacturing in machine building and systems manufacturing. Phoenix Contact offers solutions for this that can significantly reduce the effort for the required steps. The entire wiring process can thus be optimized from the configuration to the connection of the conductor.

Olaf Meier
In a survey conducted by Vogel Business Media in cooperation with Phoenix Contact in the spring of 2014, the respondents mostly agreed: lowering costs is considered a major challenge for the future almost everywhere. This is closely tied with the aim to further promote growth and to increase productivity.

To achieve these objectives, many individual components and measures along a company’s value added chain are necessary. Connection technology is also a component of this: This is the case since the increase in automation, growth in distributed intelligence systems, and modular machine concepts are increasing the costs for wiring in nearly every industry.

**Digital Component Data Increases Efficiency in Planning**

Today, powerful electrical CAD systems are used for creating circuit diagrams. The systems have comprehensive database functions in which detailed data of the individual components can be stored. They are the basis for cross-process planning and can be included throughout the entire value added chain – up into manufacturing.

Phoenix Contact provides the corresponding article master data and function macros for many components in the formats of the most important E-CAD systems. The macros for controllers and I/O modules, for example, contain the conductor system, the bus connection, the power connector as well as the quantity and addresses of the inputs and outputs. The circuit diagram macro describes connection assignments, cables, and plugs in detail. The master data also includes commercial information, such as order designations and numbers, packaging units and possibly price indications that can be used directly for the project parts list. Additional components are technical specifications like dimensions and the number of inputs and outputs with the
corresponding voltage levels. For terminal blocks, the master data e.g. contains the connection cross section, the number of connections and the function. Three-dimensional mechanical data is also part of the product data of every component – formats like STEP, IGES, DXF, and DWG are common. So, for example, for a three-dimensional configuration of a control cabinet, it can be checked whether components collide.

AUTOMATICALLY GENERATE TERMINAL STRIPS

Especially for planning complete terminal strips, Phoenix Contact offers a sensible addition for E-CAD systems with the Clip Project planning and marking software: The software lets you automate most of the assembly of the terminal strips. For the EPLAN Electric P8 system, for example, the terminal blocks no longer have to be selected as an item from the material database, but instead only symbols for terminal block points are inserted into the circuit diagram and the cross sections of the connected conductors are defined. The Clip Project software automatically generates the terminal strip with suitable terminal blocks and accessories based on this information. This information is then imported back into EPLAN Electric P8 – this way, the user created an article including accessories from a terminal block point within seconds. Furthermore, Clip Project has interfaces to other leading E-CAD systems such as Aucotec, Zuken, WSCAD, IGE XAO, and PC-Schematic. In addition, the suitable accessories such as covers and end brackets can automatically be added by the Clip Project autocorrect function for already configured terminal blocks. Also, the terminal strip undergoes a logical test with the autocorrect function – errors in the later setup are therefore already prevented in the planning phase. Thus, using Clip Project reduces the configuration costs by up to 30 percent. Errors due to the manual entry of data are also avoided.

STRESS-FREE COMPONENT MARKING

In the next step – marking all components in the control cabinet – Clip Project increases the efficiency of the process since the software automatically imports the marking data from the circuit diagram generated in the E-CAD system.
Time-consuming manual entry of the information is no longer necessary and the marking information is applied quickly and without any errors. In addition, Clip Project automatically suggests the right marking materials. This prevents a loss of information, and the drawing size is automatically adjusted to the marking area, if needed. Phoenix Contact also offers a broad range of marking materials – for terminal block, cable, and conductor marking as well as for equipment marking or plant marking. The different printing systems from Phoenix Contact can be controlled directly from within Clip Project – from the Blue-mark CLED high-speed printer to the Thermomark printer for printing labels from a roll or markings in card and mat format to the Topmark Laser marking system. The system allows for fast and effective marking on stainless steel, aluminum, and plastic, thanks to automatic material recognition.

**FASTER AND MORE RELIABLE CONNECTING**

The requirements for an error-free and fast assembly were created with the

Wired in 10 seconds: The conductor cut to length is automatically stripped with the Crimphandy, fitted with a ferrule, and then simply inserted into the Push-in terminal block.
error-free import of component data, the automatic generation of terminal strips as well as the marking solution integrated in the configuration systems. But in this last step, the wiring process can also be streamlined significantly through the selection of the terminal block system.

Phoenix Contact launched Push-in connection technology on the market for this purpose: with this system, solid conductors or conductors with ferrules can be directly inserted into the conductor connection without any tools. From sensor/actuator cabling in the field to terminal blocks, surge protection, relay and optocoupler systems as well as security components and hybrid motor starters up to I/O modules and controllers, a great number of wiring tasks can already be implemented with Push-in connections. Entire applications are thus set up more simply and cost effectively. Of course all item data and, if required, function macros for the integration into E-CAD systems and Clip Project are available for this consistent Push-in program.

Push-in technology offers significantly easier handling in tight spaces in particular or for terminal points that are difficult to reach – you only need one hand to plug the conductor into the contact area. In addition, the terminal blocks with Push-in technology offer high wiring reliability: Unlike many terminal blocks on the market, they only have an opening for the conductor, and thus do not have a second opening for tools to open the terminal point. This prevents the conductor from being inserted into the wrong opening or the terminal block from being damaged by using an inappropriate tool. The terminal blocks can also be used for stranded conductors without ferrules: This is done by way of the push button – it is pushed down with any common
screwdriver and opens the contact spring. The actuating path of only 3 millimeters makes it possible to work quickly. However, the Push-in connections achieve their full potential when the stranded conductors are already fitted with ferrules. To reduce the time required for this, Phoenix Contact has developed the Crimphandy: with this tool, conductors are stripped, fitted with a ferrule, and crimped in just one step.

All of this takes place in just three seconds. Combined with Push-in technology, this significantly reduces the time required for a connection: While about 17 seconds are required for cutting to length, stripping, manually applying and crimping the ferrule and connecting the conductor to the Push-in terminal block, the same work is completed in a mere 10 seconds using the Crimphandy.

With this, the last step in the wiring process chain has been reached. Phoenix Contact offers solutions for every step in this chain that can reduce the overhead and number of errors.

**CONCLUSION**

The interlocking of individual solutions makes the entire wiring process much more efficient.
BARRIER SYSTEM WIRED RELIABLY AND QUICKLY

WALTER RELIES ON TERMINAL BLOCKS WITH PUSH-IN TECHNOLOGY

Thanks to the Push-in terminal blocks, even the conductors close to the ground and in tight control cabinets could be connected quickly and reliably.
Nearly 25 years of use of the Ems Tunnel by the A31 highway close to Leer, Germany made a comprehensive structural overhaul and operational retrofitting a necessity. The Federal Republic of Germany invested around 13 million euros in modernizing the tunnel. In so doing, a variety of measures for improving tunnel safety were taken, which also included the fast opening barriers on the median strip at both entrances to the tunnel: This is a type of barrier in the middle guard rail that can be opened hydraulically in the event of an emergency. This allows fire trucks and ambulances to quickly change to the other side of the road in an emergency and to get to the scene of the incident faster.

Walter Elektro- und Anlagentechnik GmbH, headquartered in Bochum, was responsible for both the electrical engineering and for the implementation of the controller of this system. "The fast opening barriers are controlled with electrical hydraulics and are monitored by way of mechanical limit switches and sensors", explains Matthias Walter. "The controller also assesses and controls the traffic lights and additional safety and monitoring facilities". The central control room gives commands remotely during normal operation of the programmable logic controller of the
The barrier system is a so-called fast opening barrier that fire trucks and ambulances can use to quickly change to the other side of the road in the event of an emergency.

Each barrier on site can only be controlled individually with a control cabinet for a revision or in the case of an emergency.

All cables required for operating the system come together in two control cabinets – one on each side of the tunnel. The dimension and complexity of the system is illustrated by a number that Nicolas Blötz, Project Engineer at Walter, cites: "We installed roughly 100 terminal blocks per control cabinet to connect the different cables". The company exclusively uses terminal blocks from Phoenix Contact: "In transportation technology, the demands on the installed components are very high", emphasizes Matthias Walter. "We have a suitable partner in Phoenix Contact since their products fulfill all relevant norms". In addition to the terminal blocks, additional products from Phoenix Contact are used: Trabtech surge protection, the Rifline industrial relay system, Trio Power power supplies as well as EMD monitoring relays.

The majority of the terminal blocks is designed in Push-in technology, with which solid conductors or conductors fitted with ferrules can be connected without any tools. Conductors from 0.34 square millimeters can be inserted into the terminal point manually. The conductor itself opens the contact spring. At the same time, the spring provides for high contact and conductor pull-out forces. In close quarters in particular or for terminal points that are difficult to reach, handling Push-in technology is significantly easier than for other connection technologies – you only need one hand to insert the conductor into the contact area. "The control cabinet of the barrier system is relatively small – you thus have to
manage the space. In addition, the cables are fed in from the bottom", Walter describes the situation on site. "So it is important that the technician can connect the conductors quickly and without any tools". Nicolas Blötz adds: "The advantage of the Push-in technology for us definitely is the aspect of time – the conductor is simply inserted into the terminal point and you are done. You don't have to insert the screwdriver – as for a normal spring-cage terminal block. In addition, our customer generally requires the use of ferrules for these systems, so Push-in technology is also suitable in that regard".

**COMBINATION OF VARIOUS CONNECTION TECHNOLOGIES AND CROSS SECTIONS**

An additional advantage is the fact that terminal blocks are part of a product system from Phoenix Contact. "This makes it possible to mount different series and cross sections together on a top-hat rail and to combine them with the standardized bridges", emphasizes Matthias Walter. The barrier system for the Ems Tunnel uses different conductor cross sections and connection technologies. Thus, Walter uses Push-in technology for cross sections up to a maximum of 6 square millimeters and the company uses screw terminal blocks for larger cross sections. "In our experience, the technicians have a better feeling for thicker conductors when they can tighten a screw with a screwdriver". However, when a large number of installation cables have to be connected, the Push-in terminal block is the standard choice at Walter. Potential distribution in the control cabinet beco-
mes much easier with the help of these systematic options.

PUSH-IN WITHOUT MAINTENANCE OVERHEAD

Thus, Matthias Walter cannot understand the concerns that sometimes are stated by some systems manufacturers regarding the connection reliability of the Push-in technology: "We have been using spring-cage terminal blocks for 15 years and have never experienced that a conductor disengaged on its own". Nicolas Blötz adds another aspect that justifies Push-in technology: "Systems are often implemented in the area of conveyor belts in particular. This means that connections have to be disconnected and later reconnected".

For Push-in terminal blocks, the conductor can easily be disconnected by activating the push button with any sharp item or a screwdriver-like tool – the conductor can then simply be reinserted. This can be repeated any number of times without the terminal block or conductor suffering from it. This makes changing the position of conveyor belts multiple times very uncomplicated in terms of the electrical aspect.

The Push-in terminal blocks from Phoenix Contact also offer high reliability for the connection itself, since the push button is orange and can thus be clearly differentiated from the conductor entry funnel. "The Push-in terminal block thus only has one opening – which clearly indicates the correct terminal point", says Walter. "Especially when systems are in use worldwide, this avoids that an untrained technician attempts to insert the conductor into the wrong hole". It is also impossible to
destroy the terminal block by using the wrong tools, thanks to the push button.

**ERROR-FREE AND FAST MARKING**

"For projects like the barrier system for the Ems Tunnel, it of course is very important to correctly assign the conductors to the terminal blocks", Matthias Walter adds. "We have the requirement here that both the terminal block and the conductor must be marked with a corresponding address". Walter uses the marking systems from Phoenix Contact for this. "We use the Clip Project marking software for marking", says Nicolas Blötz. The software automatically imports the marking data from the circuit diagram generated in the E-CAD system and then assigns it to the correct marking material. This eliminates the need for time-consuming manual and therefore error-prone entry of marking information or the material selection. At Walter, the markings are then output on a Thermomark card (for card materials) and on a Thermomark Roll printer (for roll materials). "With the option of marking
via the software and the matching printers from Phoenix Contact, we save a lot of time and avoid errors when marking the terminal blocks and conductors", emphasizes Matthias Walter. Thus, the solution from Phoenix is convincing overall: "Time is a major factor, especially for a highway construction site such as the Ems Tunnel", says Matthias Walter in conclusion. "The Push-in terminal block just gives us the option to connect conductors quickly and reliably. Today, we generally only use Push-in terminal blocks for control manufacturing."

Walter Elektro- und Anlagentechnik GmbH, headquartered in Bochum, has been serving the European market as a supplier and service provider for industry and trade for over 35 years. Wolfgang Walter founded the business in 1970, which has now been managed in the second generation by his son Matthias Walter since 1993. The focus of the company today is on industrial system equipment: This mainly is control gear and controller manufacturing, electrical installations as well as industrial maintenance and servicing. The company is active for a large variety of industries. Thus also in the area of transportation technology: Walter works closely with the Bochum-based company Heintzmann, which manufactures barrier systems for safety and transportation technology. This is also the company that manufactured the fast opening barriers for the Ems Tunnel.
FAQ ON PUSH-IN TERMINAL BLOCKS

You will receive answers to the most frequently asked questions on our products, technologies, and solutions at www.phoenixcontact.com/faq
The questions and answers are clearly ordered by product categories and topics – which lets you get your answer particularly quickly.

Your question is not listed? Contact us!
We would also be happy to help you on the phone.
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