

UPDATE

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Switching perspectives

Analog, digital, and safety: Phoenix Contact gives you options to make those connections with confidence





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Switching perspectives

We've all heard the saying, "The more things change, the more they stay the same." And as this industrial market continues its most recent evolution, these words begin to strike a stronger chord. While it's absolutely true today's industrial control cabinet looks radically different than its predecessor 20 years ago, the foundations upon which these cabinets are built remain intact: Control cabinets still need some type of power source to activate. Whether manual or automated, some type of logic is present to send and receive signals from the field. And amid all those signals, designers and builders still need cabinets to be easy to build and even easier to maintain.

Phoenix Contact is immersed in this evolution ourselves, and while learning from our nearly 100-year history, we are helping to drive the evolution of the industrial control cabinet. Some of those evolutions are represented in the following pages. For example, relay technology is still required in nearly every control cabinet, but yesterday's oversized and hard-to-wire "ice cube" relays have evolved into narrow, 6-mm wide relays, utilizing push-in termination points and programming adapters. Going one step further, there are now relay versions with hazardous location certifications, making application of these relays nearly universal.

Evolution isn't confined to standard relays; it shines through in other switching devices, such as new multifunctional safety relays and our hybrid motor starters. And what about after these signals are switched? Well, Phoenix Contact is there as well – helping transform the world of modular power and sensor cable connections.

So it is true: The industrial control cabinet is changing, but like the opening words, some things stay the same. Among them, Phoenix Contact remains your trusted partner to not just survive these changes but benefit from them. With that, I ask you to explore the following pages, but remember the founding principles that everything within has remained constant, while the execution has evolved. And know, as this evolution continues, Phoenix Contact will be there with you.

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Find out more with the web code

For detailed information, use the web codes provided in this magazine. Simply enter # and the four-digit number in the search field on our website.

 Web code: #1234 (example)

Relay Confidence

Twenty years ago, Phoenix Contact invented the slim relay, and we've spent the past two decades making it even better.



476
number
of PLC Relay
versions
available

28 PLC Relay versions approved for use in hazardous locations

22,500
relays
manufactured
daily

6.2
width in
millimeters for
SPDT versions

1997
year PLC
Relay was
introduced to
the market

58
authorized
distributors for
PLC Relay

Switching with confidence

Phoenix Contact offers relays for all applications

Relays are a fundamental component of virtually all automation systems. They convert one signal to another, isolate field wiring from the controller, act as an amplifier between I/O in the cabinet and large

loads in the field, and protect humans and equipment from unsafe conditions. By combining exacting quality with unique features and functions, Phoenix Contact gives you the confidence to reliably interface your controllers with your field devices.



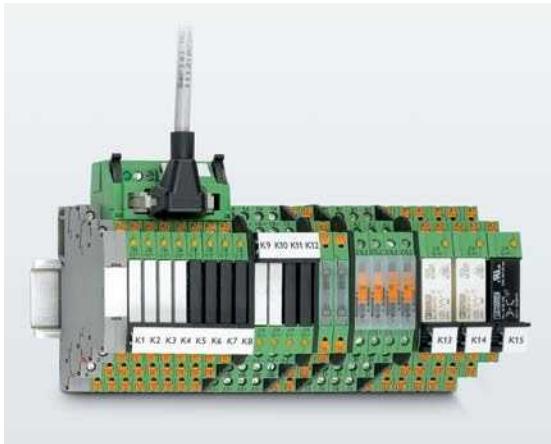
Many people give little thought to the common relay, but they significantly influence the function and reliability of an overall system. As a whole, the wide range of relays, contactors, and motor starters from Phoenix Contact offer advantages that set them apart from the competitors. Innovative designs translate into easy wiring, reduced labor costs, control cabinet space savings, and high system reliability.

In addition to the conventional screw connection, devices are also available with easy and efficient Push-in connection technology. Basic features such as robust bridging options, as well as unique device marking and wire connection technology options, are integral to virtually all of Phoenix Contact switching devices. They all combine to provide real benefits to the user, from installation to daily operation.

Interfacing between the controller and the field: PLC-Interface

Slim interface relays serve as isolators, amplifiers, converters, and contact multipliers between the controller and the field. Its compact, modular structure ensures the PLC-Interface relay system saves a lot of space in the control cabinet. A wide range of accessories accelerate and simplify assembly and wiring. This includes plug-in bridges for potential distribution, several marking options, and system cabling adapters for quick, error-free connections with controllers. Special sensor and actuator versions use a busbar to bridge the power supply to the connected field devices, eliminating the need for additional terminal blocks to distribute sensor-source voltage or the common return lines of actuators.

PLC relays add value to an application because they are always equipped with protective circuitry integrated in the housing, such as reverse polarity protection and kickback circuits to safely dissipate inductive kickback voltages. Inputs and outputs are safely isolated, preventing danger to humans and equipment. Many of these replaceable relays and opto-couplers feature sealed relay designs and bases constructed of corrosion-resistance copper alloys to protect against environmental conditions in virtually all applications. Whether it is moisture, dust, or chemically aggressive settings, the sealed relays and corrosion-resistant bases ensure maximum system reliability and uptime. (p. 14).



PLC-Interface for field wiring with convenient device connection and low space requirements.

PLC relays have a long life cycle, but they can be replaced easily if they reach end of life. This allows quick restoration of machines without the need to unwire anything, resulting in fewer errors and less downtime. With more than 600 unique part numbers and a full offering of accessories, Phoenix Contact offers the right relay solution for every application.

Give your relays a brain: PLC Logic

The programmable PLC Logic module plugs into a block of eight PLC relays, converting them into a compact, small-scale, and flexible controller. The device is only 50 mm wide and features a total of 16 I/O points within that footprint. There are eight dedicated digital inputs and eight configurable channels that can be used for input or output of analog and digital signals. The basic module (BM) version can be extended with up to two devices so that a total of 48 I/O signals can be integrated.

Unlike smart relays from competitors, if an individual relay has reached the end of its service life, the user can replace it within seconds without having to replace the entire control unit. Because the entire system is built around PLC-Interface relays, users can take advantage of their choice of screw or PT push-in connection, marking options, and bridging. They can also take advantage of the many voltages and contact types/configurations offered within the PLC relay family.



PLC Logic for modular, flexible, and compact controlling of up to 48 I/O signals.

The free Logic+ software makes programming PLC Logic quick and easy. Even users with little or no programming experience can quickly learn how to program following our examples and how-to videos. Programs are built up using function block programming, ladder logic, or a mix of both. Drag & drop selection of function blocks and their connections saves time and simplifies the overall experience. The entire program can be simulated and tested both offline and online. Featuring an onboard real-time clock, integrated Modbus RTU communications, and optional Bluetooth monitoring capabilities, the easy-to-use logic module allows for local control of simple processes and applications at an economical price point.

Ice cube relays reimaged: RIFLINE Complete

Rifline complete is a versatile solution for all industrial relay applications. From the low-profile 6-mm open contact, the 4PDT relay, replaceable force-guided options, and the robust three-pole 16 A contactor — all with pluggable and bridgeable designs — the RIFLINE Complete relay family spans virtually all applications. Users of our Clipline Complete terminal blocks will be pleased to know they can use the same bridging and marking accessories with RIFLINE. To round out a robust feature set, Phoenix Contact also offers system cabling adapters for easy connections to the controller.

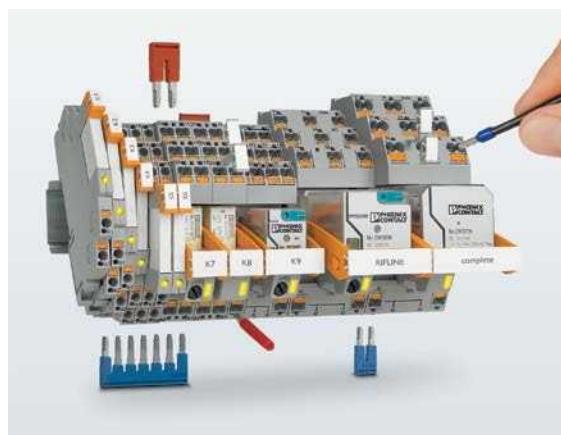
Ice-cube-style relays within the RIFLINE family offer a wide range of customizable function plugs to

comply with the specific application. Different modules connected to the relay coils provide several functions; they protect from inductive kickback, provide a visual indication of the signal state with an LED, or turn it into a timer relay with many functions. From three time functions, the user can select a time range from 0.5 seconds to 100 minutes.

Motor control and three-phase load switching: CONTACTRON

Motors are found in virtually all machines and applications. Control of those motors requires switching devices that provide a long service life and safe operation. The installed devices should require little space, provide high performance, and function reliably. Phoenix Contact's CONTACTRON motor starters show what can be achieved by paralleling electro-mechanical contacts and semiconductor switches (see pages 8-9).

The advantages of hybrid starters are clear: the 5HP motor starter is only 22.5 mm wide and offers a reversing contactor, overload and motor protection, and safe shutdown up to SIL 3/PL e. CONTACTRON starters save up to 75 percent of the space required by conventional electromechanical starters. Internally integrated overload and interlocking circuits — as well as Push-in connection technology — also decrease wiring effort by about 75 percent. The microprocessor-controlled combination of robust relay technology and wear-free solid-state technology extends the service life of the motor starter to 10 times that offered by standard electro-mechanical contactors.



The Rifline Complete relay system encompasses all relevant designs.



Hybrid motor starters from the CONTACTRON product range switch, reverse, and protect the motor.

Ward off danger: PSR

A large portion of machine safety solutions achieve emergency shutdown with two safety relays: one for the emergency stops (daisy chained) and one for any door interlocks. The PSRmultifunction allows machine builders to save space and cost by using a single safety relay to connect up to three separate safety signal paths. More directly, if the machine's design uses the common two-safety relay system described above, one single PSRmultifunction could connect both sensor chains in a single 22.5-mm housing and at a lower cost than two safety relays.

Though the PSRmultifunction can connect up to three separate safety signals (one overriding shutdown and two independent shutdowns), dialog with our safety engineers has shown that the majority of interest comes from a two-sensor solution. With no software, DIP switches, or configuration required, the PSRmultifunction saves space and cost without major changes or overcomplicating the design.

Uptime and reliability monitoring: EMD and ETD

Uptime and reliability are becoming increasingly important within the industrial automation world. Uptime requires the monitoring of equipment health to spot issues and correct them before they result in failures. While it is true the quality of power delivered by the utility company is generally acceptable, voltage fluctuations can and do occur, and they have the potential to damage induction motors very quickly. Machines or processes in good health should generally draw a consistent current;



PSRmultifunction allows machine builders to save space and cost by using a single safety relay to connect up to three separate safety signal paths.

excessive or undercurrent conditions often indicate a failure is imminent or has occurred already. Some equipment is sensitive to the direction of rotation, thus the three-phase power system must be monitored for proper phase sequence. Temperatures, liquid levels, and load monitoring also provide insights into process or machine health.

EMD monitoring relays quickly and accurately detect and indicate undesirable conditions, protecting your equipment and avoiding unplanned machine or system downtime. The relays replace the need for a controller and sensors, and they are available for a wide range of voltage configurations. Just-in-time maintenance is now easier than ever to implement with EMD monitoring relays.

The timer relays of the ETD product range offer multiple timer functions, time ranges, and wide input and control voltage ranges. ETD relays can replace controllers for specific time sequences and control processes, presenting an economical alternative to a PLC. Featuring both slim 6.2-mm dedicated function relays and multifunctional timer relays with wide voltage ranges, ETD relays offer precise timer functions for many applications. ■

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www.phoenixcontact.com/plc-relay
www.phoenixcontact.com/plclogic
www.phoenixcontact.com/rifline
www.phoenixcontact.com/contactron



Monitoring and timer relays monitor operational parameters or control time sequences.



Ground-mounted photovoltaic systems produce as much as 65% of all solar energy in the United States.

The sun always shines with reliable connections

Solar trackers use hybrid motor starters and PT push-in connections

As the solar market grows, so will the number of single-axis tracking solutions for utility-scale solar PV power plants. By using robust connections and space-saving hybrid starters, tracking systems can operate more reliably, even in harsh environments.

The solar industry continues to grow at an accelerated pace both domestically and globally. While some of the most visible indicators of this growth are solar panels popping up on the rooftops of homes in your neighborhood and at your favorite stores, major growth is also occurring in the utility segment, where ground-mounted photovoltaic systems are producing as much as 65 percent of all solar energy in the United States. Total installed utility-scale generation capacity now stands at over 21.5 gigawatts (GW), with more than half of that brought online in just the past two years.¹

With such significant investment in physical infrastructure, utilities are constantly seeking ways

to improve the utilization of solar assets so that they can lessen the time it takes to recoup their return on investment. In many instances, they have found that solar tracking is one of the most effective ways to do this. More than half of the utility-scale installations of PV systems in the United States utilize some form of tracking. Single-axis trackers can provide up to 20% more output than a fixed-position system.² Solar trackers reposition the solar panels multiple times per day to track the sun's arc in the sky. The more irradiance, or sunshine, that directly hits the panels, the more energy they produce and the quicker they pay for themselves.

A market complicated by cost, demand, and service contracts

Industry insiders will tell you that the cost of solar installations have fallen significantly, from about \$4.46/W in 2009 to \$1.42/W in 2016.³ This has not come without extreme competition that pushes

companies to provide the most reliable and cost-effective solutions to the market. In the fast-paced solar industry, those that fail to innovate are quickly pushed aside. Add to it the need to produce massive quantities of components to fuel this explosive growth and service contracts that demand high reliability of the finished solar PV plants, and it becomes obvious that having a strong partner with a reputation for quality and innovation is a major leg up on the competition.

When simplicity rules

Switching the electric motors used in solar panel tracking is a challenge for solar tracker manufacturers. Traditionally, solar tracker systems use standard electromechanical contactors or variable frequency drives to switch the drive motors on and off. While both have their advantages, the drawbacks in this type of application are also significant. Electromechanical contactors are cost-effective, but they suffer from a short service life. Variable frequency drives give more options for customization but are not as well geared for the heat of a typical desert installation. Both take up considerable space in a control cabinet.

Enter Phoenix Contact's hybrid motor starters. Combining a solid-state component with a traditional electromechanical contact, Phoenix Contact hybrid starters can reliably switch a motor up to 30 million times – 10 times the life of a traditional contactor. The footprint of our hybrid device is approximately 75 percent smaller than a comparable traditional reversing starter with overload protection and redundant safety contacts. In the case of a variable frequency drive, the footprint savings of a hybrid starter is even greater. The inclusion of internal interlocking and overload circuits further reduces wiring time, making CONTACTRON up to 75% faster to wire than traditional solutions.

Several manufacturers have used Phoenix Contact's reversing hybrid starters in various solar tracking applications since 2010. During this time, the tried-and-true hybrid starters have earned a reputation for reliability and longevity in the very demanding world of solar trackers. After seven years of growth and experience with our partners, there are now over 18,000 units installed on solar tracking systems around the globe – a number that continues to grow every day.

Connectivity and beyond: Bringing confidence to your solution

The inception of the CONTACTRON hybrid starter marked a milestone in electric motor switching, offering a unique solution in a compact package. Originally launched with two core variants, we have since continuously expanded the CONTACTRON product family to dozens of part numbers to further enable our customers' successes.

For instance, CONTACTRON hybrid motor starters originally featured screw connection technology, but like many other Phoenix Contact products, it is now also available with the popular Push-in connection technology. Users appreciate the simplicity, time savings, and assured repeatability of quality connections that come with the popular PT connection.

From hybrid motor starters and market-leading connection technologies to power reliability, networking, safety, control, shop floor productivity, and more, Phoenix Contact offers innovative, high-quality products for all areas of the control cabinet.

Thanks to our strong competency in connectivity and power reliability solutions, engineers can be confident in Phoenix Contact to power solutions across the United States and around the world.



Clinton Hommel
www.phoenixcontact.com/contactron

Phoenix Contact hybrid starters can reliably switch a motor up to 30 million times – 10 times the life of a traditional contactor.

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- [2] <https://www.eia.gov/todayinenergy/detail.php?id=30912>
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Switching and control in hazardous locations with intrinsic safety technology

A universal approach to hazardous area instrumentation

Switching and/or controlling devices in a potentially hazardous location has become commonplace in some geographical regions. The trend or priority is to only purchase and stock electrical devices with the global “big three” hazardous location approvals (UL, ATEX, and IECEx). Because of this trend, a lot of devices you would commonly use in a safe area can be found with approvals that allow them to be used in a potentially dangerous Division 2 or Zone 2 area.

But when engineering for areas that are considered hazardous locations 24/7, devices and design will definitely change. The devices allowed to sit in the hazardous area change (with one exception, and I'll get to that), and the way you get information and energy into the area changes.

The three main technologies used for industrial control in hazardous locations are:

- Containment: Explosion- or flame-proof
- Segregation: Encapsulation and purged (positive pressure) enclosures
- Prevention: Non-incendive and intrinsic safety

All three technologies have advantages and disadvantages. In defining the application to a switching function, it brings up factors that could weigh the decision to one particular technology in a decisive way.

Is the device necessary?

First, let's consider a best practice of not installing any type of mechanical or electrical device that could be an unnecessary

source of potential ignition – especially if there is no reason for that device to be there. Does that high-voltage or high-energy consuming application really need to be there? Could it possibly reside in the safer Div. 2 area, or better yet, the safe area?

So then let's think about what types of devices or applications you cannot remove (or at least it would be physically difficult to remove) from a Div.1 hazardous location. Typically, these applications will be centered around monitoring and controlling the manufacturing process and/or the material handling of a hazardous material.

Monitoring does not involve switching, but controlling could. Depending on the type of device needed, control or switching is usually done for the movement of a mechanism in the process or to control the hazardous material itself. So we are looking to either move something or limit the movement of something. Typical devices used for these applications include motors or mechanical drive systems and actuators. All these devices can be powered via electric or pneumatic energy, and all have their advantages and disadvantages.

Explosion-proof technology

So we now circle back around to the three hazardous location technologies, but in relation to control devices that will move or limit the movement of the hazardous material. Nothing has changed, in that they all have their pros and cons, so let's look at a few.

We'll start with the most common of the three: explosion-proof technology. Electric motors and actuators in explosion-proof housings can be quite heavy and expensive. Depending on size, temperature rating, and hazardous material subgroup, they might require customization and not be readily available. An option could be to go with a purged and pressurized enclosure surrounding a standard safe area

MACX intrinsic safety isolators measures only 12.5 mm wide, including 2-channel versions.



electrical-powered device. The advantage of explosion-proof and purged enclosures is the switching and control devices (e.g., relays) would not change from the design for the Div. 2 or zone 2 area.

If you're designing for a global market, however, you would run into a roadblock trying to use explosion-proof and purged enclosures in the continuously hazardous area. While these technologies are acceptable in North America, the rest of the world uses the zone method of hazardous classification. This system allows only intrinsic safety technology into the hazardous zone 0 area.

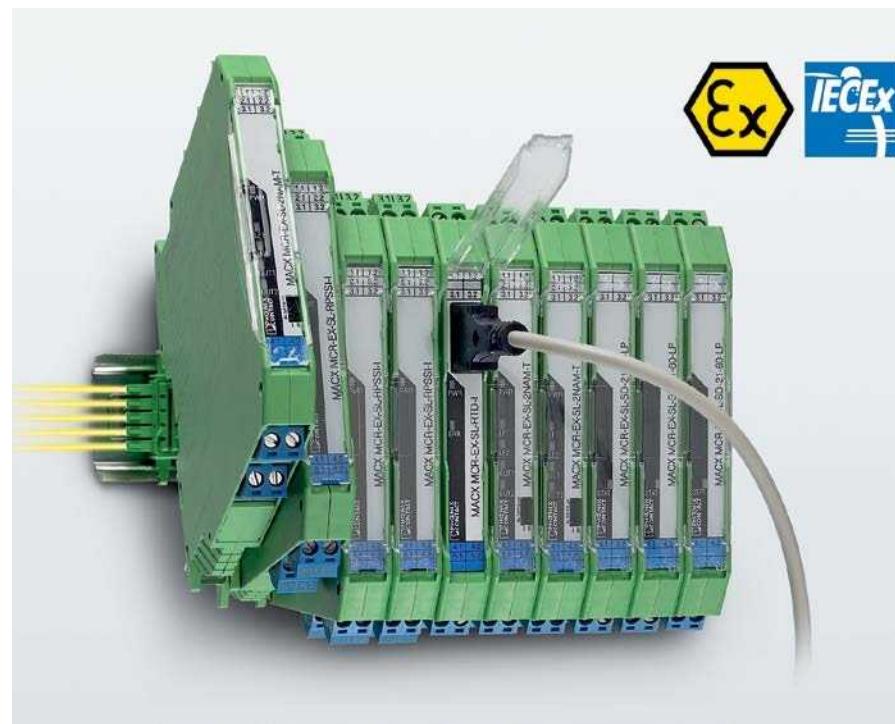
Pneumatic energy

So if designing a control application that involves some type of mechanical movement or motion control for the global market, consider pneumatic energy. This is readily available in most plants, making it a common first choice. Controlling the pneumatic energy locally in the hazardous area can be done via an electrical signal at the solenoid valve. If the valve is in the Div. 1 or zone 0 area, it can be done safely and efficiently with low-level electric energy via intrinsic safety technology.

Basic pneumatic control typically costs 30 to 50 percent less than an electric motor solution for the same application. The disadvantage with intrinsic safety would be the additional cost of the intrinsic safety isolator.

In a Div. 2 or unclassified area, on the other hand, it would be more common to isolate the digital output from the controller to the solenoid valve with a lower-cost mechanical relay. The advantage is the rest of the system would not have to change along with the cabling and wiring in and out of the hazardous area. This makes it quicker, easier, and less costly to implement.

Intrinsic safety technology is a well-defined, universal approach to hazardous area instrumentation, with virtually identical standards across the world, applicable to all combinations of hazardous locations. It is considered the safest electrical control technology for hazardous locations, which is one of the reasons it is the only allowed electrical control technology in the zone 0 hazardous location zone system used by the rest of the world. This makes it globally acceptable, no matter where you market and sell your product.



Intrinsic safety in narrow package

Phoenix Contact's family of MACX intrinsic safety isolators measures only 12.5 mm wide, including 2-channel versions. This is probably the same width, or possibly even thinner, than your current safe-area signal conditioners, so it does not increase panel space.

As a link between control and field devices, the MACX MCR-EX... isolators serve for safe power limitation in intrinsically safe signal circuits (Ex-i protection type) up to Div. 1 and zone 0 of potentially explosive areas. Moreover, they transmit measured values and control signals electrically isolated and with high accuracy. The MACX MCR-EX modules have the "big three" Ex approvals: UL, ATEX, and IECEx – so they can be used globally. For functional safety applications, the modules are designed to meet SIL 2 or SIL 3 requirements.

This article only highlights a few of the advantages of intrinsic safety. I hope I've given you enough basic information here to create an interest to further research switching to intrinsic safety technology. ■

The MACX MCR-EX modules have the "big three" Ex approvals: UL, ATEX, and IECEx, so they can be used globally.

Derek Sackett

www.phoenixcontact.com/macx

Functional safety life cycle management starts with proper planning and a cross-functional safety team.



Three steps to a safer machine

Asking a few questions at the beginning can reduce liability and improve safety in the long run

For many manufacturers, the safety of machinery can be a frightening concept: too little protection and you may endanger workers, face fines and litigation, or see insurance premiums skyrocket, while spending too much on safety may price you out of the competition. This begs the question, “Where do I even start?” Here are the first three steps anyone should take when designing a new machine to ensure proper functional safety.

Step 1: Define and understand any standards that apply to your design

Identifying the proper standards for your machine starts with a simple question: “Where are you selling your machine?” We start with this question because it will begin to point us in the correct direction. If your answer is inside the USA only, then the first place to start is the Occupational Safety and Health

Administration (OSHA). Laws and regulations for general and specific machinery and machine guarding requirements are laid out under 29 CFR 1910 Subpart O (<https://www.osha.gov/law-reg.html>). All pertinent regulations for your machine must be followed and are enforceable by law.

The United States also has many consensus standards (through ANSI, NFPA, RIA, etc.) that, although not law, can still be cited by OSHA during an assessment. OSHA also holds an “incorporation by reference” clause in 1910.6, which allows for the inclusion of any standard by referencing directly, meaning any existing consensus standard could become a law if OSHA does reference it.

If you are shipping to the European Union, you must follow the Machinery Directive in order to apply a CE marking to your product. The Machinery Directive defines the requirements machinery must meet before

it can be placed on the market and operated in the European Economic Area. The requirements of the safety-related parts of a machine control system are specified in EN ISO 13849 and EN 62061, one of which must be used to achieve a Performance Level (PL) or Safety Integrity Level (SIL) requirement for your machine.

What if you are looking to build both for the U.S. and EU markets? To be dual-compliant, you must still follow all the requirements of both examples.

Step 2: Conduct a risk assessment on your design

Whether building for the United States or the EU, a risk assessment is required when designing a machine. Conducting a risk assessment can be stressful; in fact, manufacturers will often hire outside contractors to carry out risk assessments for them. There are a number of standards covering risk assessments (EN ISO 12100, ANSI B11.19.TR3, RIA R15.06, etc.). While some are application-specific, each takes similar steps to determine risk: Determine the limits of the machine, identify hazards, estimate the risk, and evaluate and reduce the risk. Determining the machine limits means to list all the technical data (dimensions, weight, voltages, pressures, speed, temperatures, material, cycle time, etc.) you know you'll have in your machine. Though this may seem redundant because "I already know my machine inside and out," this step is necessary so that nothing is overlooked and the entire risk assessment team is



Ensure that your machine meets the local safety standards of the country into which you are selling it.

working from the same information. This brings up another good point: if you are running a risk assessment on your own machine, it is important to bring together a multifaceted team from all different job functions to run the risk assessment. Having different points of view working together helps find all the possible hazards that could have been overlooked otherwise.

After hazards are identified, the team will gather to discuss the risk of each hazard and determine if it is a high, medium, or low risk. If a risk cannot be removed, the team will then determine if a mechanism is required to guard against the risk or if a safety control system is required. As a team, you can then reference the standards you've identified in step one and take the necessary actions to protect the machine and reduce the risk.

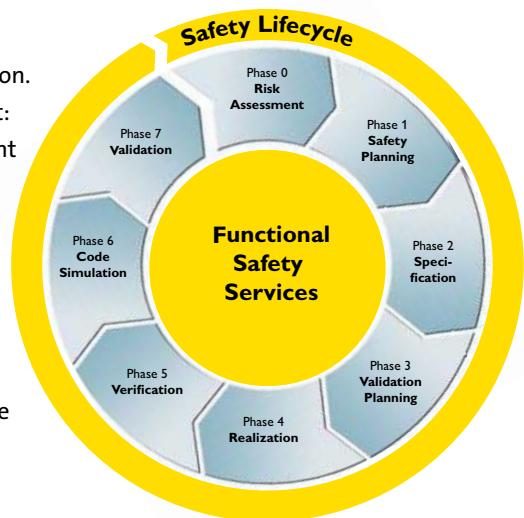
Step 3: Improve the design before adding safety measures

Sometimes it's easy to jump straight from risk identification to applying a safety control system, but you might be overprotecting your machine. The best way to protect your machine is to design out the risks by removing hazards. In many cases, making simple changes to the design (such as removing pinch points or access to hazards) can dramatically decrease the risk of your machine. If you don't consider changing your initial designs, you might end up adding thousands of dollars of unnecessary equipment to reduce risk.

Don't be in a hurry to add safety control to your machine blindly. Missing any of these steps could prove dangerous and costly. If you aren't following the correct laws and regulations, you could be culpable and face legal action. Complete a full risk assessment with a cross-functional team to correctly identify hazards and properly assess your machine's risk. Finally, don't be in a rush to add safety devices to your machine. Sometimes, the easiest and most cost-effective risk-reduction solutions are just minor tweaks of your initial design. ■

Zachary Stank

<https://www.linkedin.com/pulse/first-three-steps-ensure-safe-machine-zachary-stank/>



Complete a full risk assessment with a cross-functional team to identify all hazards.

Slim relay modules with hazloc approvals allow you to safely disconnect and switch signals in potentially explosive areas.



Hazardous location relays with triple ratings

Safely switching around the globe with IECEx, ATEX, and CID2 approvals

Hazardous locations can be broadly defined as areas that are at risk of being exposed to flammable or combustible gases, dusts, or vapors. Hazardous locations exist virtually everywhere across a wide spread of industries – from oil and gas applications to wastewater treatment plants, in pharmaceutical production and grain handling, and more.

Potentially explosive areas in such industries are subject to stringent requirements that ensure the reliability and safety of electrical equipment installed within them. Generally speaking, equipment installed in a hazardous location (flammable or combustible atmosphere) must be approved for installation in these areas by a certified testing agency. This includes switching components such as relays.

For companies that do business globally, meeting approval requirements of local authorities can be complicated. Different regions around the world implement their standards and regulations independently of one another. Ultimately, the goal is to install reliable switching components that minimize inventory counts, while having the preferred approval of

the local authority. Multiple approvals on one part is key when it comes to finding a single relay design that meets local requirements and can be used across the globe.

Approval systems in North America

In the United States and Canada, hazardous locations are classified with the class/division system, similar to Europe's zone system. Classes (I, II, or III) define the general nature or properties of the hazardous material in the surrounding atmosphere.

- Class I: flammable gases or vapors are present
- Class II: combustible or conductive dusts are present
- Class III: ignitable fibers are present

The division defines the probability of the material being present in an ignitable concentration. Division 1 refers to a high probability, while Division 2 presents a lower probability. Equipment approved for use in Division 1 locations can also be used in Division 2 locations, provided it is the same class and group.

Relays that have multiple ratings simplify approval and document management. This also minimizes inventory counts, as fewer variations of the product are needed.

For example, a relay may be rated as Class I, Div. 2 (UL). This means that it is equipped for a potentially explosive premises in North America in which flammable gases or vapors may be present and that an ignition or explosion is only expected to occur under abnormal conditions.

The group (A through G) defines the type of hazardous material in the atmosphere:

- Group A: contains acetylene
- Group B: contains either a MESG (Maximum Experimental Safe Gap) value less than or equal to 0.45 mm or a MIC (Minimum Igniting Current) ratio less than or equal to 0.40
- Group C: contains either a MESG greater than 0.75 mm or MIC ratio between 0.40 and 0.80
- Group D: contains either a MESG greater than 0.75 mm or a MIC ratio greater than 0.80
- Group E: contains combustible metal dusts
- Group F: contains carbonaceous dusts such as carbon black, coal black, charcoal, coal, or coke dusts
- Group G: contains combustible dust not included in Group E or F (flour, grain, starch, sugar, wood, plastics, chemicals, etc.)

Global approval systems

For use in Europe, products must meet the requirements set by the European Committee for Standardization. ATEX is the directive requiring certification for hazardous locations to European standards.

With ATEX ratings, which reference EN 60097, the zones define the frequency or probability of occurrence. Zone 0 classifies areas with a constant or frequent risk of explosion, while Zone 1 operates with an occasional risk. Zone 2 includes locations where danger does not usually occur or is very brief.

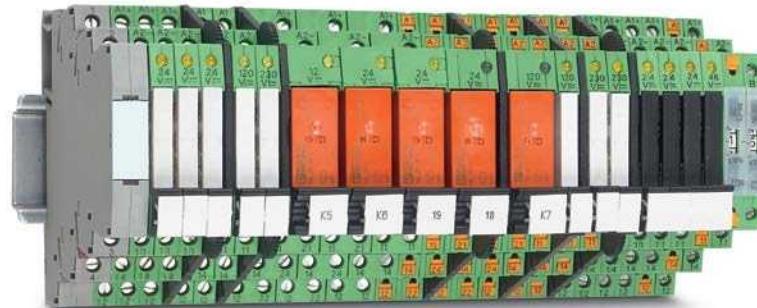
To help facilitate the international trade of electrical equipment, the IECEx regulates standards for applications used around the world. If the product features IECEx approval, no further international approvals must be obtained for the purpose of conformity with standards, making trade quicker and more cost-effective.

Conclusion

Hazardous locations require stringent approval systems to ensure the reliability and safety of the equipment, including relays, used within them. The UL class/division system, ATEX, and IECEx approval systems have nuances that prevent them from being completely interchangeable, which can complicate matters for global businesses. To eliminate costs and inventory by producing region-specific design variations, a simple solution is to install products with multiple approval ratings.

Phoenix Contact's PLC...EX line offers the only triple-rated hazardous location, slimline relays on the market today. The PLC...EX range of products features control from 12 V to 230 V, single-pole,

With just 24 part numbers, PLC...EX can cover thousands of hazardous location applications here in the United States and around the globe.



double-throw (SPDT) and double-pole, double-throw options (DPDT), a unique 10 A SPDT relay, and screw or PT push-in connection technology. Because these relays are part of the robust and comprehensive PLC-Interface relay portfolio, they are compatible with all PLC relay accessories, such as bridging, markers, and system cabling adapters. ■

Florian Sawitzki, Product Marketing Manager
Interface Digital, Phoenix Contact Germany

Clinton Hommel, Product Marketing Specialist
Interface, Phoenix Contact USA

www.phoenixcontact.com/HazLocRelays

A current trend:
Building with precast
concrete parts.



Set in concrete with Bluetooth

Wireless signal transmission in a concrete factory

Wireless solutions from Phoenix Contact ensure error-free communication at the So-Con concrete factories in a harsh industrial environment. So-Con's experience with the solutions has been so good that the wireless multiplexers are implemented as standard in many production areas. In so doing, numerous Bluetooth systems can operate in parallel in a single industrial building without interfering with one another.

So-Con Leit- und Steuerungstechnik GmbH, located in Asperg, Germany, specializes in automation for these kinds of concrete factories. Since 1987, the company has focused on assembly systems and control technology for the automotive and concrete industries. Fifteen employees plan every project individually in accordance with each customer's specific requirements, as well as according to the newest technical perspectives. So-Con's range of services spans from consultation about project planning, programming, and visualization to the assembly and installation of the corresponding hardware.

The So-Con concrete factories are designed so that fresh concrete is transported from the mixing station to the concrete spreaders via bucket conveyors up to 200 meters long. Depending on the concrete element,

the buckets may weigh as much as 3.8 tons when they reach the concrete spreaders. Bucket conveyors generally travel through the halls lengthways, while the concrete spreaders are arranged crossways. The concrete spreaders fill various formwork types quickly and precisely with all kinds of concrete. The filling and spreading processes are fully automatic.

The entire circulation system process is controlled by a central PLC. "If we were using traditional trailing cables, communication between the controller and the moving buckets and concrete spreaders would prove to be expensive, prone to failure and require a high degree of maintenance," says Johann Klotz, executive vice president of So-Con.

The production becomes more efficient thanks to modern automation technology. The work processes can be planned better. This results in higher delivery reliability of the precast concrete parts in conveyor belt production.

Simple forwarding of signals

"We became aware of the wireless technology from Phoenix Contact while searching for an alternative transmission solution," says Klotz. This is why So-Con now uses wireless multiplexers as replacements for

cables. Using the Bluetooth technology-based devices, signals from the buckets and the concrete spreaders are sent to the central machine control system. This allows data to be forwarded simply and economically, even in this harsh industrial environment.

The centrally installed PLC ensures that the concrete spreader moves independently under the bucket in order to take the concrete. Information about the current position, the container weight, interlocks, error messages, and signals for the slider width adjustment is transmitted over the wireless system to adjust the flow of concrete. Due to the good experiences it has had with wireless solutions from Phoenix Contact, So-Con is implementing wireless multiplexers as standard in many production areas of its concrete factories.

Parallel operation of Bluetooth and WLAN networks

The wireless multiplexer functions wherever a few digital or analog input and output signals need to



The Wireless MUX transmits 16 digital and two analog signals bidirectionally .

be communicated wirelessly to a distant or moving station. The device has the IP20 degree of protection and exchanges 16 digital and two analog signals bidirectionally – that is, in both directions. This means that it replaces a 40-wire signal cable.

The international Bluetooth standard in accordance with IEEE 802.15.1 is used as wireless technology,



which functions in the license-free 2.4 GHz frequency band. Due to the integrated, fast frequency hopping method, communication is robust and reliable. In addition, it will not interrupt possible WLAN systems installed on-site in accordance with IEEE 802.11b/g, since Bluetooth detects the corresponding occupied channels automatically and removes them from its own hopping table. This means that both wireless systems can operate without interrupting each other, even in immediate proximity. Efficient frequency usage also allows for parallel operation of numerous Bluetooth systems in a single industrial building.

Furthermore, the system offers a high degree of robustness and reliability due to its wide ambient temperature range from -25° to 60° C in operation and vibration load up to 5g and shock load up to 25g. In addition, the wireless multiplexer is safe from accesses since the security mechanisms are already implemented in its chip. Additionally, the devices are configured so that they cannot be found by other Bluetooth devices.

Benjamin Fiene

Web code: #1504

Production area in prefabricated concrete factory (Image source: So-Con Leith- und Steuerungstechnik GmbH).

Switching cabling selection

Efficiency from the cabinet to the field

In any automated system, field devices must connect and relay their information back to the controller. On most industrial machines, the majority of these signals are digital inputs and outputs. Due to changes in installation and safety guidelines, most wires don't need to be pulled through hard conduit anymore; rather, they can be connected via multiconductor jacketed cables with quick disconnects like M8 or M12.

Figure 1 shows a typical application with a sensor box that provides common voltage to each field device (in this case proximity sensors) on pins 1 and 3 and collects back individual I/O on pins 4 and 2 back into the controller.

More signal types = higher complexity

The real connectivity challenge begins when you move from handling just digital signals and begin adding sensitive analog signals, networking protocols, and power cabling to the topology. Each of these signal types introduces a new level of complexity and requires engineering teams to appropriately select and size the

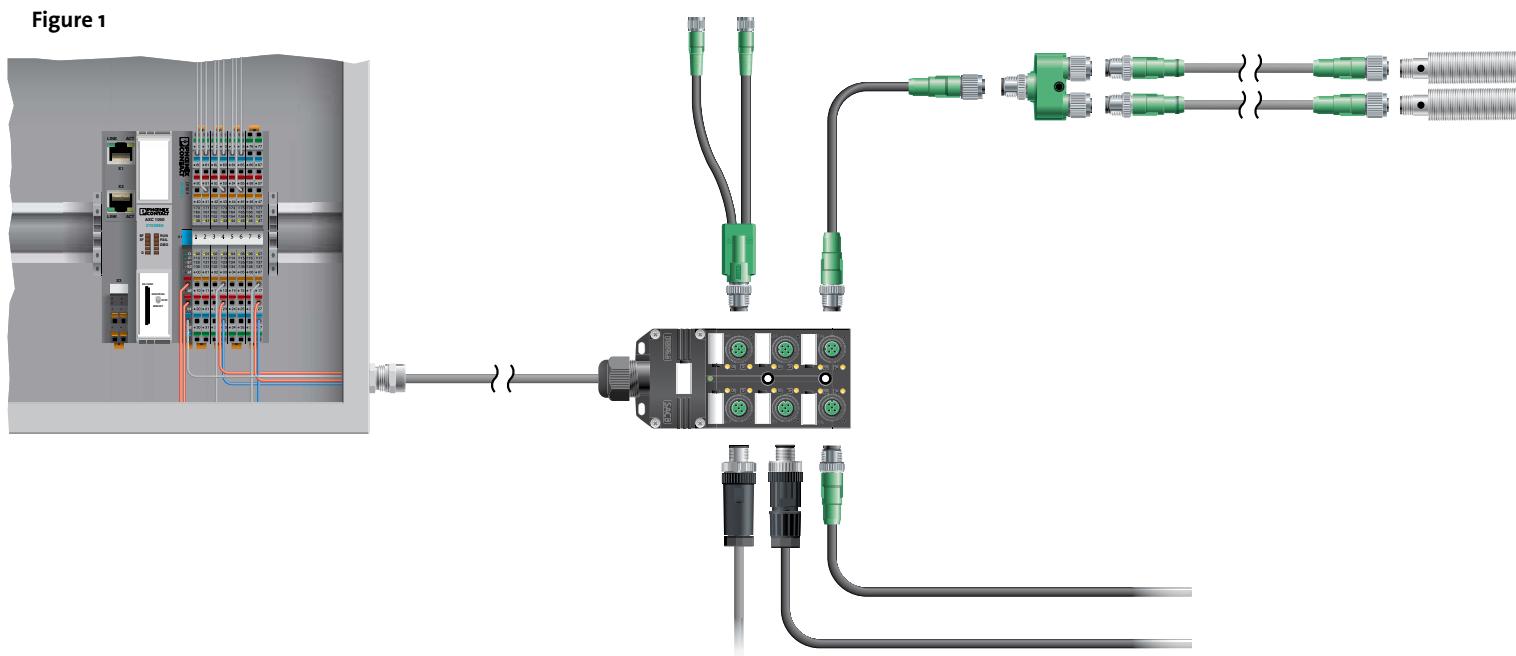
connector, contacts, wire size, EMI shielding, and length requirements for each device. Partnering with a supplier that has connectivity solutions for each of these signal types is a good start.

Phoenix Contact offers products for all three of the crucial areas in a system: field cabling, cabinet feed-through, and in-cabinet on a DIN rail. This ability to design and connect an end-to-end solution optimizes system layout and allows better integration of new technology.

Converting IO-Link

One of the biggest new trends in connectivity is the introduction of IO-Link. This peer-to-peer standard provides bidirectional communication between controllers and devices regardless of manufacturer or protocol. A great deployment of IO-Link is when a machine has a couple of analog signals among an otherwise heavy digital signal network. In the past, the cables used to connect these sensitive analog signals would need to be shielded and perhaps twisted to maintain the

Figure 1



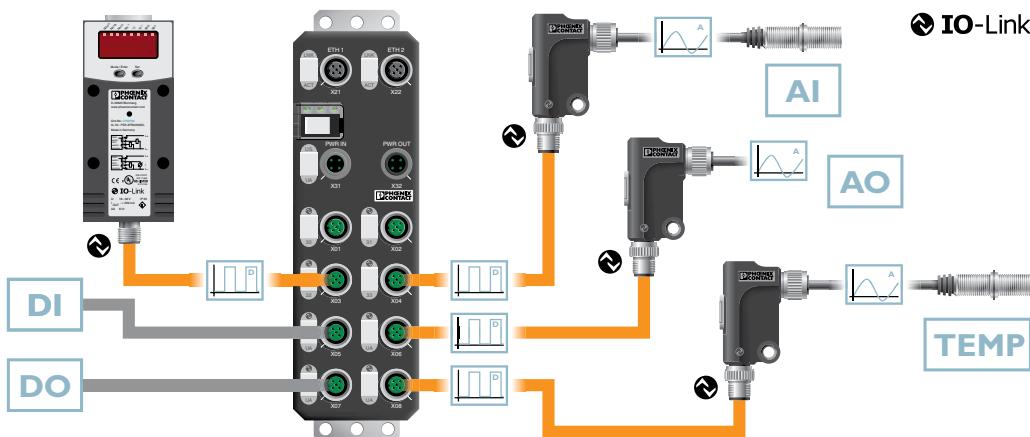


Figure 2

integrity of the voltage readings. This meant that temperature sensors, flow meters, or level monitoring typically did not get to take advantage of local collection via sensor boxes and were instead wired individually back to the controller via higher-cost shielded cables. To upgrade these analog devices, Phoenix Contact now offers an IO-Link converter that essentially converts your 0 to 10 V or 4 to 20 mA signal into a digital signal (Figure 2).

This means installers no longer need to run a shielded four-wire cable along the machine but can wire a basic non-shielded three-wire cable directly into the IO-Link master. This greatly simplifies cable planning, as all points can now be connected via standard three-wire cables to this I/O block and then placed on a preferred network like EtherNet/IP, Profinet, etc. When it comes to procuring sensor and network cables, a great place to start is the North American cordset program. These M8 and M12 cables are made in the USA with short lead times and competitive pricing and are UL listed.

Furthermore, if the analog device doesn't already have an integrated M12 to plug the IO-Link converter into directly, it can easily be upgraded with a four-position, shielded, field-wired connector. Phoenix Contact's QUICKON connector is the easiest for on-site wiring via IDC termination with no special tools.

It can be placed on a short cable whip to provide the M12 interface off the device (figure 3).

While there are many different connectivity solutions, only one choice will be the most efficient and cost-effective from the cabinet to the field. Partnering with a company that can offer you that advice at every junction in a system will lead to easier deployment, maintenance, and inventory savings — ultimately providing you with better access to your machine data. ■

Nathan Owens

www.phoenixcontact.com/iolink

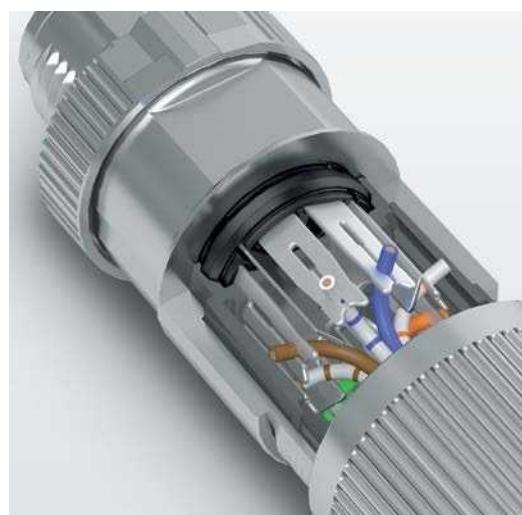
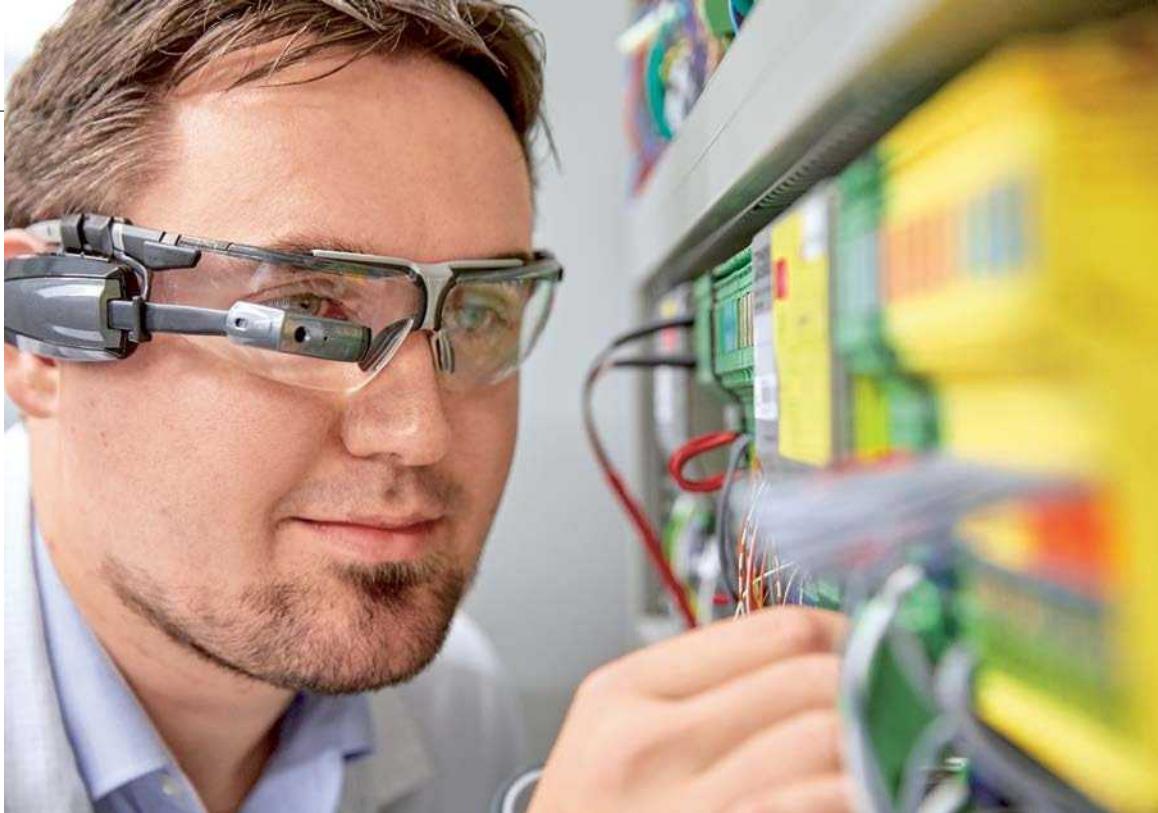


Figure 3

Innovation Ventures GmbH focuses on future technologies, such as the application of augmented reality for maintenance.



Strategic growth

Phoenix Contact reinforces its expertise for the future

Phoenix Contact has solidified its strategic position in future markets by acquiring technology network technology and energy-automation companies. In addition to expanding the company portfolio, Phoenix Contact is also investing in technology start-ups that will give access to new markets.

These acquisitions help Phoenix Contact strengthen its network division, which is a key technology for digitization. In September 2016, Phoenix Contact acquired Perle Systems Limited, a Canadian company specializing in industrial network technology. This was followed by the acquisition of Etherwan System Inc., a Taiwanese manufacturer of Ethernet communications technology, in April 2017.

In addition, Phoenix Contact fully acquired German-based Mauell Netzeleittechnik GmbH in early April. The company now trades as Phoenix Contact Energy Automation GmbH. With the integration of the automation specialist for energy networks into the Group, Phoenix Contact is driving forward its sustainable growth strategy in the energy market.

In 2015, Phoenix Contact created a separate company for promoting and investing in promising high-tech

manufacturers: Phoenix Contact Innovation Ventures GmbH.

Start-up help for start-ups

Phoenix Contact Innovation Ventures has provided assistance to a number of start-ups. One of those is Windesco, a Boston-based company that offers Internet of Things (IoT) solutions for the wind industry.

SecurityMatters B.V. from the Netherlands, another company supported by Phoenix Contact Innovation Ventures, focuses on cybersecurity solutions for industrial control systems.



The Austrian company, eologix, focuses on detecting ice on rotor blades of wind turbines. Most recently, Phoenix Contact Innovation Ventures bought a share in the Berlin start-up smartB Energy Management, which focuses on the energy management in commercial buildings. ■

www.phoenixcontact-innovationventures.com

TERMITRAB Complete

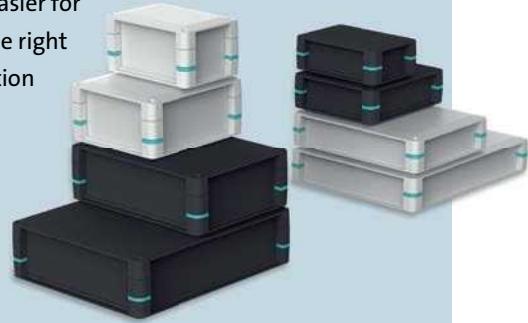
With the TERMITRAB Complete product range, Phoenix Contact now offers the narrowest surge protective devices on the market. They are suitable for measurement and control applications and start from an overall width of just 3.5 mm. This means that the protective devices can protect up to 572 signals against surge voltages on just 1 meter of DIN rail.

www.phoenixcontact.com/TTC



UCS

The Universal Case System (UCS) is a new enclosure that gives design flexibility for all kinds of printed circuit boards (PCBs). The enclosure was designed for embedded systems but can accommodate other PCB form factors. The modular configuration of the UCS makes it easier for users to find the right enclosure solution for their electronics. UCS also has a wide range of accessories for further customization.



www.phoenixcontact.com/ucs

Axioline F with SafetyBridge Technology

Phoenix Contact's SafetyBridge Technology (SBT) is now available on the Axioline F I/O system. The new SafetyBridge I/O modules (logic, 8-point input, and 8-point solid-state output) record and output safety-related signals for easier and more flexible safety applications.

www.phoenixcontact.com/safetybridge



PTFIX distribution blocks

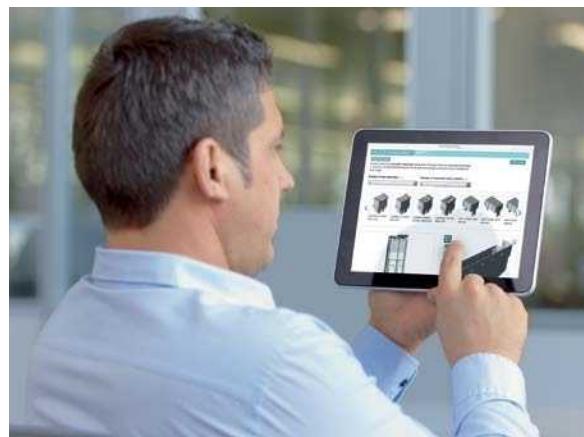
PTFIX power distribution blocks reduce installation time and save significant cabinet space. PTFIX blocks come ready to connect right out of the box, saving time and labor costs. With numerous different mounting and connection configurations, PTFIX has the ability to satisfy many applications.

www.phoenixcontact.com/PTFIX



Configure the right product

Caption: Housings are just one of many easy-to-configure products.



With so many products to choose from, selecting the right one to meet your application can be difficult. Phoenix Contact's online configurators solve this problem.

Often, there are too many technical aspects to decide the right product with a quick glance. Our configurators support your needs by walking you through the specific application requirements, so you can find the right product or solution for the job.

www.phoenixcontact.com/configurator

New issue available for Innovations app

The latest issue of Innovations is now available on the Phoenix Contact USA app for your iPad. If you have not used the app recently, please visit it and download the latest issue, featuring:

- Serial device servers and gateways
- FL WLAN 1101
- Axioline and Axioccontrol
- HEAVYCON push-in connectors
- Environmental Case Systems (ECS)

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

To see all of the apps that Phoenix Contact offers, please visit: www.phoenixcontact.com/apps_usa.

Features and benefits of the ECS

Environmental Case System (ECS)

PHOENIX CONTACT | INNOVATIONS – FALL 2017

Phoenix Contact welcomes Wolf Administration official

Pennsylvania Department of Labor & Industry (L&I) Deputy Secretary for Workforce Development Eileen Cipriani recently visited Phoenix Contact USA to highlight science, technology, engineering, and mathematics (STEM) jobs and apprenticeship opportunities in Pennsylvania. The visit was part of the Wolf Administration's "Jobs that Pay" tour.

Cipriani met with company officials to discuss Phoenix Contact's workforce development programs, STEM outreach, and environmental initiatives. Cipriani also toured the company's worksite, including the manufacturing and logistics facilities and the engineering and design facility.

"We've found apprenticeships to be a win-win solution to help us address the skills gap," said Jack Nehlig, president of Phoenix Contact USA. "The program gives our apprentices the knowledge, skills, and confidence they need to pursue

a technical career, while Phoenix Contact gets a competitive edge in attracting the best employees." ■

Jack Nehlig shows Deputy Secretary Cipriani Phoenix Contact's manufacturing facility.



1 million views

Phoenix Contact USA recently reached a milestone when we surpassed 1 million views on our YouTube channel.

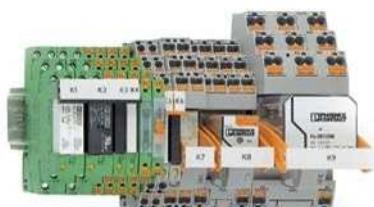
Thanks to all who helped us reach this milestone. We'd love to hear what types of videos would be helpful to you. Let us know and subscribe at: www.youtube.com/phoenixcontactusa. ■





Matt Anater
President
Genesys Controls Corporation

“Unmatched, field-proven reliability”



Genesys Controls relies on relays from Phoenix Contact

“For more than 10 years, Genesys has been integrating Phoenix Contact’s relays into our control systems and panels. Our technicians like the design, the ease of assembly, and the clearly defined termination points. And Push-in Technology is a huge time saver.”

Relays from Phoenix Contact provide field-proven reliability for unmatched confidence in your application.

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

