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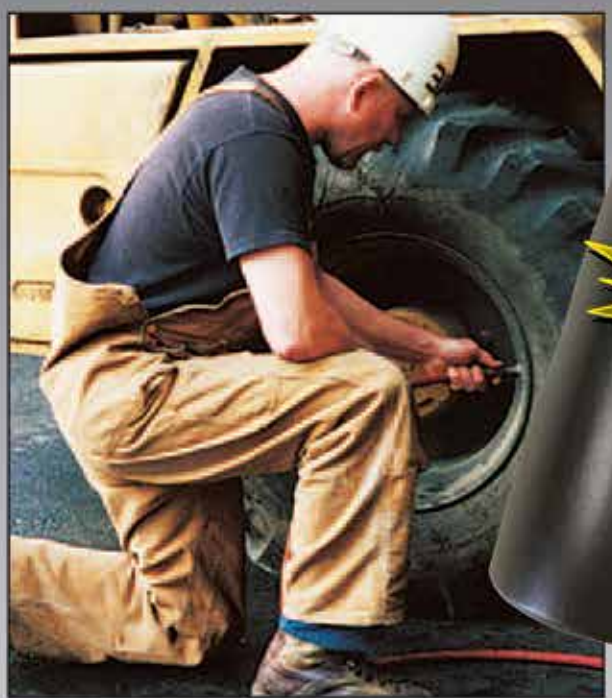

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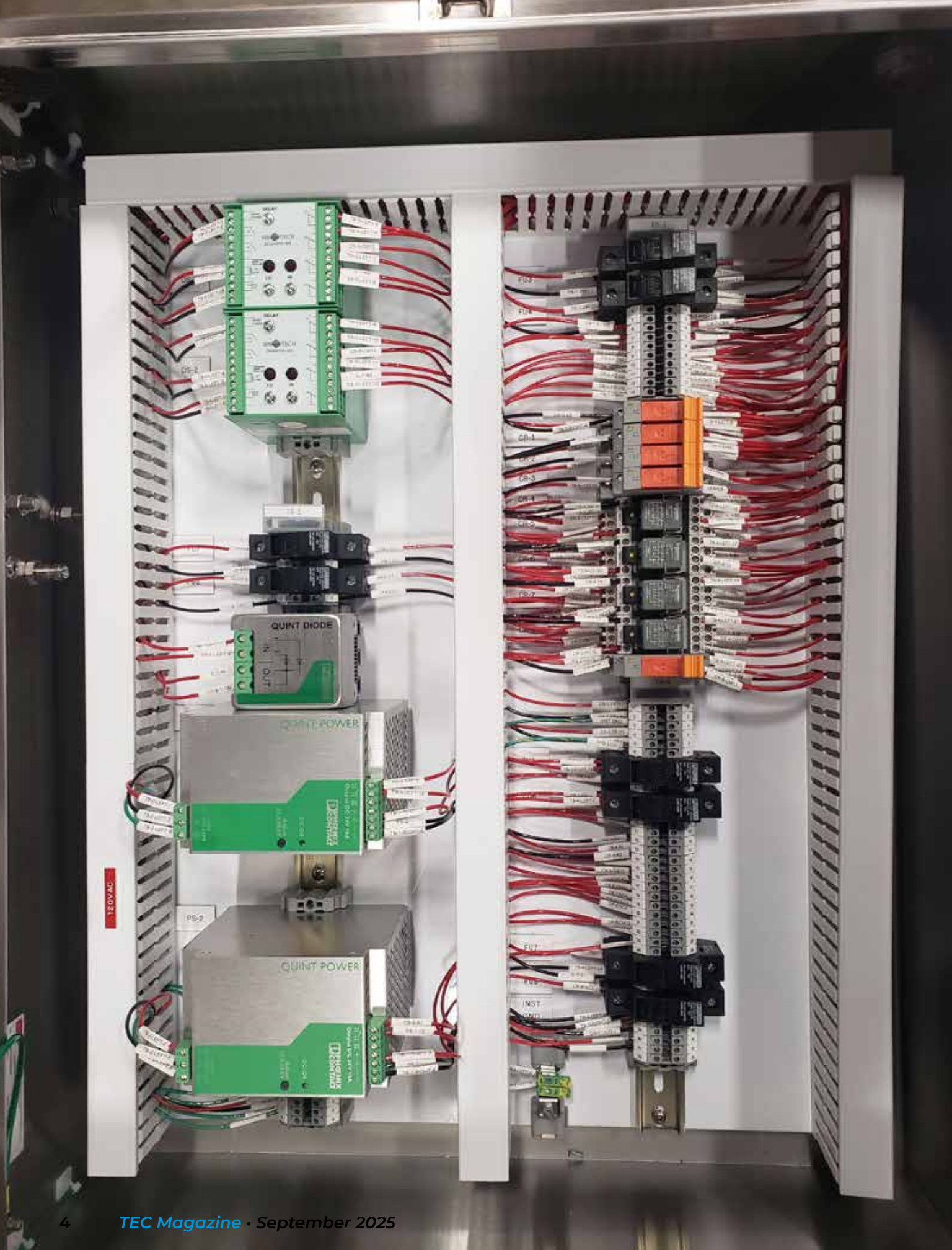
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When Less Is More: Why Refineries Are Rethinking PLCs for Safety Systems

A growing number of plants are replacing PLCs with cyber-proof, cost-effective, hardware alternatives.

For decades, Programmable Logic Controllers (PLCs) have been the go-to solution for safety systems across refineries, chemical plants, and power facilities. Reliable, flexible, and widely understood, PLCs became the default choice for monitoring, controlling, and responding to critical process conditions. Yet, default doesn't always mean optimal.

As operating budgets tighten and cybersecurity threats intensify, more facilities are reevaluating whether software-based PLCs are the best fit for safety alarms, interlocks, and Safety Instrumented Systems (SIS). This is particularly true in applications with lower input/output (I/O) requirements. Increasingly, many are turning to simpler, hardware-based alternatives, such as dedicated trip amplifiers and relay-based safety systems, which can offer equivalent protection with fewer drawbacks.

"There's a perception that PLCs are the only option," says Tom Crumlish, an instrumentation systems expert at SOR Controls Group. "But in many cases, they're overkill."

SOR designs and manufactures a broad range of industrial process instrumentation, much of which has traditionally been integrated with PLCs. Lately, however, the company has observed a growing shift as facilities explore alternatives to software-based control.

"When you're designing safety systems, you want as few variables as possible," explains Crumlish. "Every layer of software introduces a new set of unknowns."

Hardwired for safety

With hardware-based systems, you eliminate many of the variables introduced by programmable logic. Since these systems operate without software, they are inherently immune to cyber threats. They also require less infrastructure, can be mounted directly in the field, and continue to function reliably under extreme environmental conditions.

"These systems are designed to be simple," adds Crumlish. "In safety, simplicity is a strength. Every time you remove a layer of complexity, you reduce the chance of failure."

While PLCs excel in managing complex logic and multi-variable conditions, they come with several notable drawbacks:

- High Cost: PLC systems require a substantial upfront investment. Beyond the controllers themselves, costs include I/O modules, Human-Machine Interfaces (HMIs), and ongoing software licensing fees.
- Environmental Constraints: PLCs must be installed in climate-controlled environments, which can increase capital and maintenance costs.
- Complex Infrastructure: PLC-based systems typically require extensive cabling and integration, leading to longer project timelines and higher installation costs.

- Remote Limitations: PLCs are not ideal for remote or standalone locations due to their power requirements and network dependencies.

By contrast, hardware-based systems are "right-sized" for the majority of safety applications, delivering equivalent functionality at a fraction of the cost, often up to 85% less than a traditional PLC. Most hardware systems are field-mountable, allowing installation directly adjacent to the equipment they protect. This eliminates many environmental constraints and reduces infrastructure complexity.

These systems are well-suited for both new construction and retrofit projects (brownfield sites) and can also be configured to supplement existing non-certified PLC-based architectures. Common applications include interlocks, permissives, automated overfill prevention, burner management, high-integrity pressure protection systems (HIPPS), and protection for pumps or wellheads.

Rethinking safety and reliability

With constant pressure to maintain uptime, protect assets, and ensure worker safety, reliability is a non-negotiable factor in these industrial environments. Hardware-based safety systems, built on discrete components like relays and trip amplifiers, have been field-proven over decades of real-world use.

As an example, the Diamond-SIS is a field-mounted safety system built around a de-energized or fail-safe trip principle which has operated for more than 20 years without a single recorded failure – spurious or dangerous. When predefined process parameters are exceeded, the system initiates an automatic shutdown, ensuring a fail-safe response without requiring human intervention or network connectivity.

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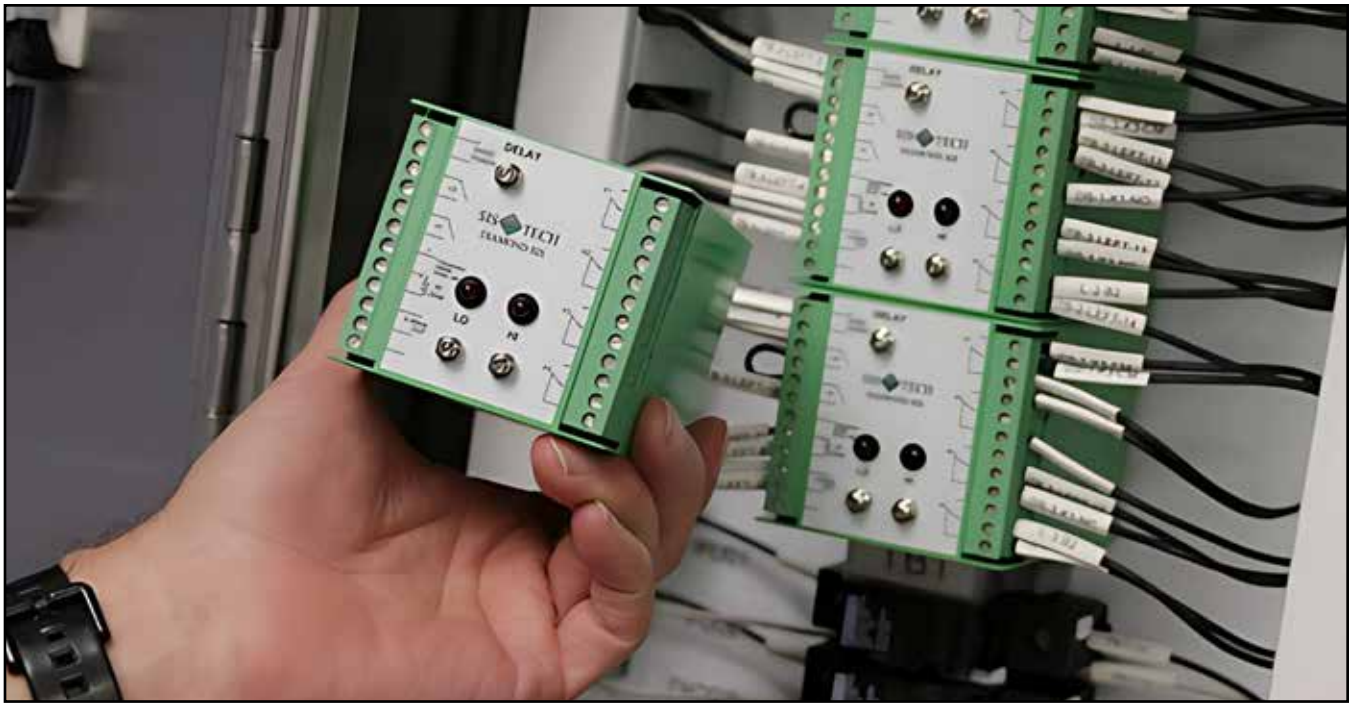

For safety trips, hardware-based systems, such as the Diamond-SIS developed by SIS-TECH, are certified to IEC 61508 Safety Integrity Level (SIL) 3 and can be integrated with plant-wide Distributed Control Systems (DCS). This type of configuration enables real-time monitoring while maintaining the inherent reliability of a hardware-based design.

When integrated with the DCS, the hardware-based system can automatically adjust final control elements – such as placing valves into a safe state – acting as a permissive for a controlled, orderly restart once the abnormal condition is resolved. The key advantage lies in combining the dependability of hardware logic with the visibility and coordination of modern control systems.

Industrial safety rewired

Many hardware-based safety systems also excel in environments where space, power, and communications infrastructure are limited. These systems can be deployed in remote areas or satellite facilities that lack climate control or stable power sources.

"They draw very little current, so they can run on solar power without the need for a network connection," says Crumlish. "We've seen these systems operate in extreme heat, high vibration, and electrically noisy environments without issue. That kind of dependability is exactly what safety systems need."

Unlike software-based platforms, hardware systems are physically wired to execute specific safety functions. Voting logic, for instance – two-out-of-three (2oo3) sensors – can be implemented using wiring and trip amplifiers, mounted in a rack room or local panel. While this approach may appear less flexible, it delivers a higher level of reliability, particularly in safety applications that don't require frequent reconfiguration.

"Some facilities like to know they can reprogram their systems with a PLC," explains Pete Fuller, an engineer and application manager at SIS-Tech who supports the deployment of hardware-based safety systems. "Our integrated Diamond-SIS is scalable and can be upgraded by simply rewiring or adding components. Modifications to large sys-

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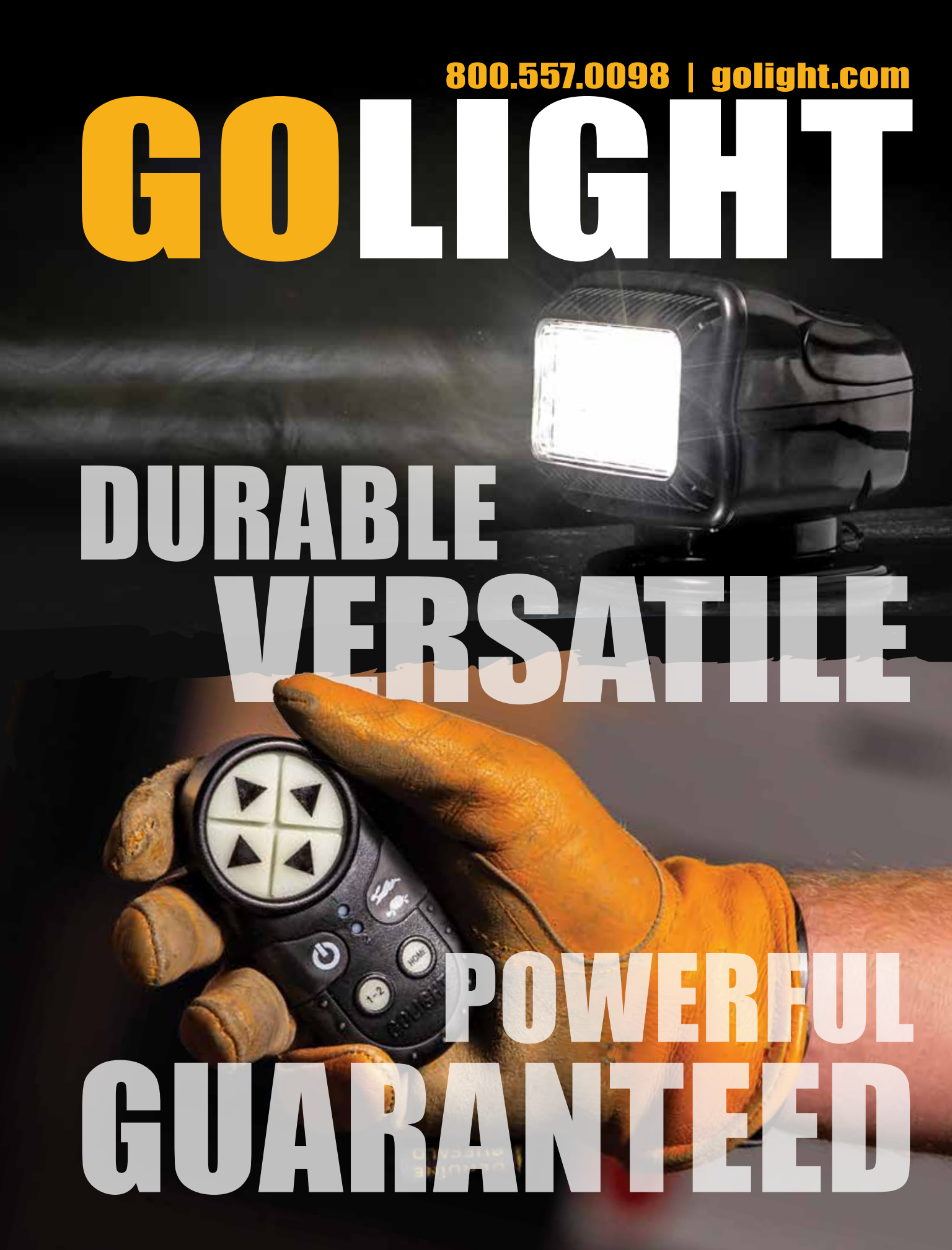

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tems can usually be done in a single day."

However, Fuller adds that for most applications, when a hardware-based system is installed to mitigate a particular hazard, it becomes the foundation for the process's safe operation and will remain in place, unchanged, for decades.

The manual configuration process for hardware safety systems also eliminates the risk of accidental code changes or remote cyber intrusions. By removing the software layer, hardware-based safety systems reduce exposure to two of the most common failure modes: human error and digital attack.

Cyber-proof systems

Cybersecurity concerns are becoming a central factor in the move away from PLC-based safety systems. As critical infrastructure faces increasingly sophisticated cyber threats, many operators are reassessing just how much connectivity is truly necessary for safety applications.

"Hardware doesn't need a firewall," says Fuller. "There's no login, no remote access, no software patch updates. It just works. That's incredibly valuable in safety applications."

By contrast, even well-secured PLCs are part of a broader network architecture and therefore remain potential targets for intrusion. The 2021 ransomware attack on Colonial Pipeline, which disrupted nearly half of the East Coast's fuel supply, served as a stark reminder: even systems with advanced protections can be compromised if they're connected.

Hardware-based systems may not be ideal for every situation, however. In applications that require hundreds of sensor inputs, complex sequencing, or advanced data analytics, PLCs offer unparalleled flexibility and scalability. But for many refinery and industrial processes, where the safety logic is straightforward and the I/O count is limited, hardware-based systems present a more targeted, cost-effective, and resilient solution.

As industrial operators continue to modernize their safety protocols, some are choosing to upgrade, not by layering on more complexity, but by simplifying. In industries where uptime, safety, and security are non-negotiable, hardware-based safety systems are proving that less complexity can deliver more confidence and greater protection when it matters most.

For more information, contact SIS-TECH, phone: 713-909-2100, email: info@sis-tech.com, or visit ***www.sis-tech.com*** •

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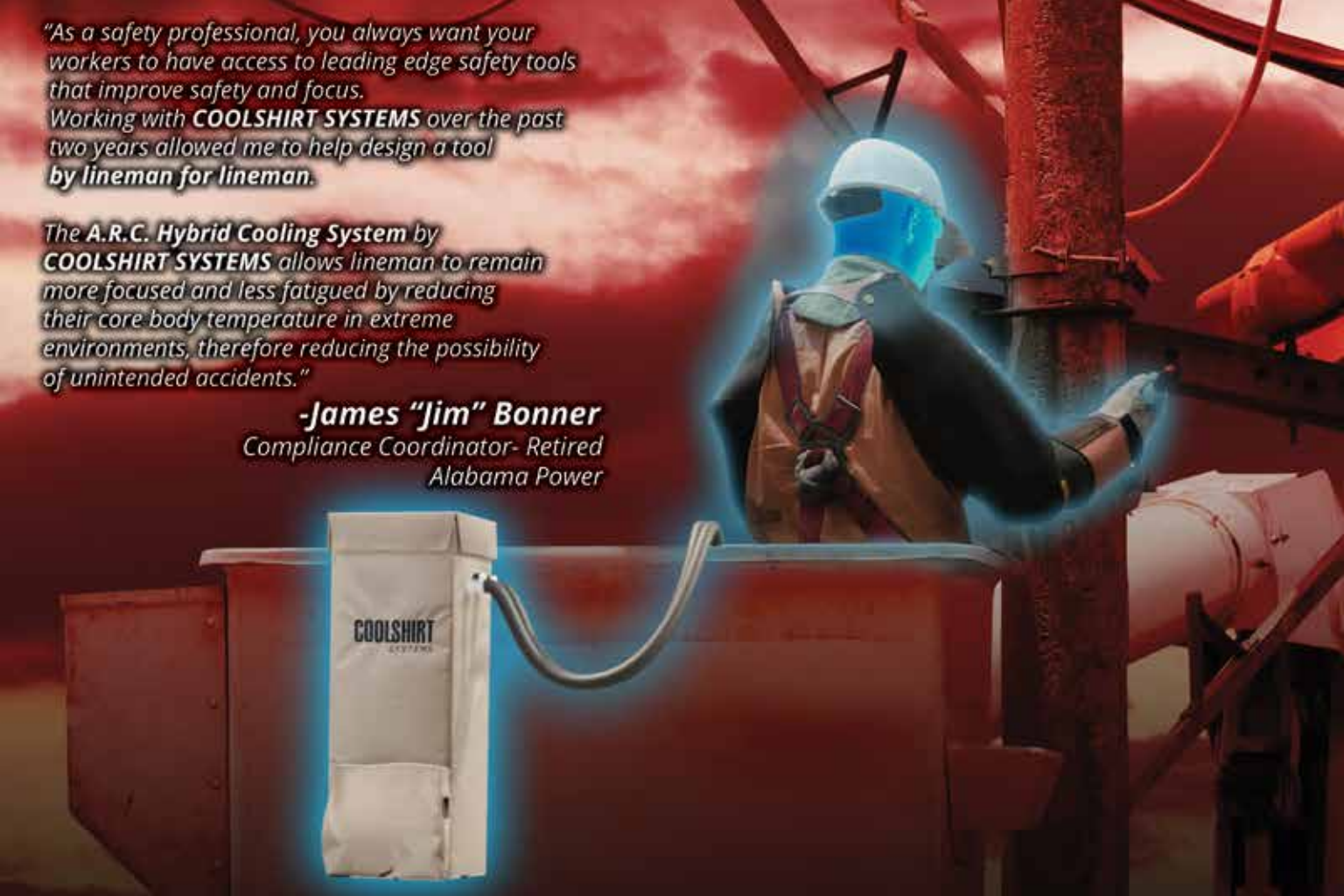

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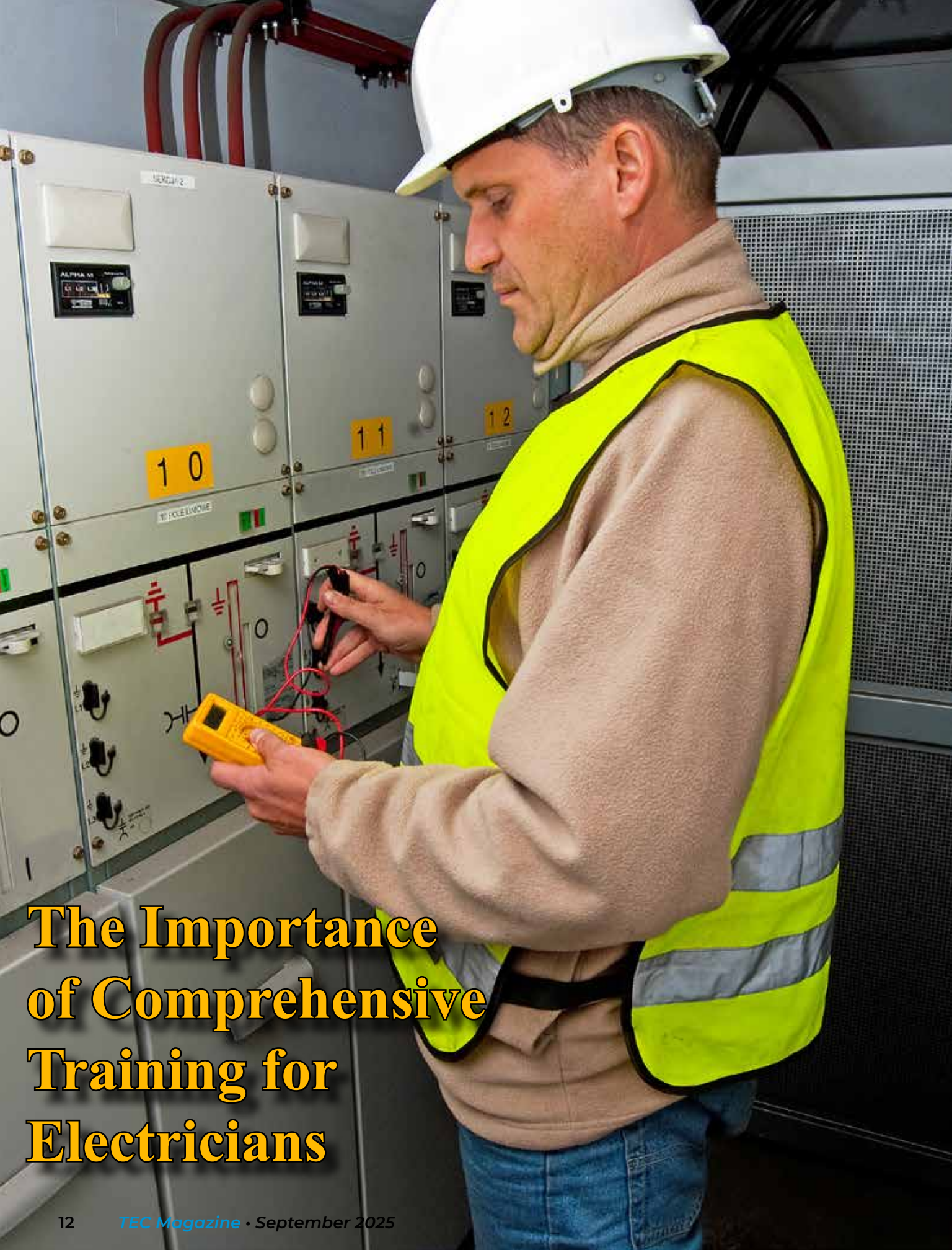

The Importance of Comprehensive Training for Electricians

In today's rapidly evolving technological landscape, the role of electricians has never been more crucial. As we increasingly rely on advanced electrical systems, renewable energy sources, and smart technologies, the demand for skilled electricians continues to grow. However, this demand brings to light the importance of comprehensive training programs that not only equip aspiring electricians with the necessary technical skills but also ensure their safety and adaptability in a changing industry.

Electricity is a powerful force that, when handled improperly, can lead to serious accidents, injuries, or even fatalities. Therefore, electrician training must prioritize safety as its cornerstone. A robust training program should encompass not only the basics of electrical theory and practical skills but also an in-depth understanding of safety protocols, regulations, and best practices. This includes training in the use of personal protective equipment (PPE), hazard recognition, and emergency response procedures. By instilling a strong safety culture from the outset, we can significantly reduce workplace accidents and promote a safer working environment for all.

Moreover, as the electrical industry embraces new technologies, training programs must evolve to include education on emerging fields such as solar energy, electric vehicle infrastructure, and smart home systems. Electricians are no longer just responsible for installing and repairing wiring; they must also understand complex systems and how to integrate new technologies into existing infrastructures. Training that emphasizes adaptability and continuous learning will prepare electricians for the challenges of tomorrow, ensuring they remain relevant and competitive in the job market.

Hands-on experience is another critical component of effective electrician training. While theoretical knowledge is essential, practical application is where true learning occurs. Apprenticeships and on-the-job training provide invaluable opportunities for aspiring electricians to work alongside experienced professionals, allowing them to apply their knowledge in real-world settings. This mentorship not only enhances technical skills but also fosters a sense of professionalism and ethical responsibility.

In addition to technical training, soft skills such as communication, problem-solving, and customer service should not be overlooked. Electricians often work directly with clients, and the ability to communicate effectively, understand customer needs, and provide solutions is essential for building trust and ensuring customer satisfaction. Training programs that incorporate these soft skills will produce well-rounded professionals who can navigate the complexities of the modern electrical landscape.

Finally, as we look to the future, it is vital that training programs remain accessible and inclusive. The electrical industry has historically faced challenges related to diversity and representation. By actively promoting training opportunities for underrepresented groups and providing scholarships, mentorship, and support, we can cultivate a more diverse workforce that reflects the communities we serve.

In conclusion, comprehensive training for electricians is essential not only for individual success but also for the advancement of the industry as a whole. By prioritizing safety, embracing new technologies, providing hands-on experience, developing soft skills, and promoting inclusivity, we can ensure that the next generation of electricians is well-equipped to meet the demands of an ever-changing world. As we invest in their training today, we are paving the way for a safer, more innovative, and more sustainable future. •

Durable, Long-Lasting Cable Markers Speed Underground Fault Response

In underground electrical systems, accurate and visible tags and markers are essential for locating faults quickly and safely.

For electric utilities, even brief power outages can disrupt homes, businesses, and critical infrastructure. These interruptions can also impact public safety and diminish customer trust, so quickly identifying and resolving electrical line faults is essential.

The challenges can be even greater with underground systems that distribute electricity through cables buried below ground. Unlike overhead lines, underground cables are not easily accessible. When a fault occurs, locating and repairing the problem often requires specialized tools and possibly excavation. Even minor failures can turn into extended outages.

To identify the probable location of the fault, linemen rely on data such as feeder loads, breaker activity, and SCADA information before going out into the field to make repairs. However, this is where the work becomes more challenging. Physical signage at the site is a critical tool for directing utility crews to the precise location of underground cables, access points, and other infrastructure so the work can begin.

Therefore, when cable markers are missing, mislabeled, or damaged, the entire fault-response effort is delayed. Dispatchers often require more time to narrow down the field location. Technicians must wait for updated locations. Electromagnetic detection, ground-penetrating radar, and vacuum excavation may be required.

This underscores the importance of signage that is accurate, visible, and legible over many years, despite the harsh underground environment.

“Cable tags and markers play a critical role in warning utility personnel about potential hazards, but also can help utilities minimize any downtime by facilitating the location of cables and other equipment underground faster,” explains Daniel O’Connor, General Manager of Tech Products, Inc., a New York-

based manufacturer of industrial identification solutions with over 75 years of experience. O'Connor emphasizes that markers that are "good enough" for a few years may be slightly less expensive but are ultimately poor choices in the long run.

"The graphics should remain highly visible and legible for thirty to forty years after installation, even in harsh environments above and below ground," says O'Connor.

Signs Everywhere

In underground electrical distribution systems, signage must be installed in several critical locations. The rules for signage are largely derived from OSHA regulations, the National Electrical Safety Code (NESC), the National Electrical Code (NEC), and ANSI standards for safety signage. Utilities also maintain their own detailed signage and labeling standards that often exceed the general codes

Above ground, labels are posted on transformer enclosures, switchgear, cable risers, junction boxes, and utility access points. Common warning signs include "DANGER: High Voltage," "Underground Electric," and "Authorized Personnel Only." Pad-mounted transformers and sectionalizing cabinets must include an equipment ID number, voltage and phase information, kVA rating, and manufacturer information.

Below ground, buried cable marker tape is often placed 12–18 inches above URD cables or conduit with warning text such as "Caution: Buried Electric Line Below" to alert excavation crews that electrical lines are present.

In underground vaults, manholes, and handholes, it is standard to label ducts, phases, and splices,

using durable cable tags that include circuit and feeder IDs. These tags serve as essential safety warnings and help identify cable racks, grounding systems, junctions, and protective devices.

Unfortunately, the same underground environmental conditions that affect cable systems can also have an impact on any installed signage. For example, moisture can cause painted and laminated signs to fade or delaminate. Temperature extremes can cause plastic signs to become brittle or warp. Exposure to chemicals can also degrade plastics and coatings.

All these factors make it essential for utility signage to be made from materials designed for long-term outdoor or underground use.

One of the most common options are write-on tags, which allow users to add information using

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Despite their simplicity and convenience, write-on tags have notable limitations. Handwritten information is often illegible and can smudge and fade over time. In addition, only some write-on tags are designed specifically for harsh environments.

A better solution is high impact polyolefin plastic products like the EVERLAST® brand from Tech Products. The company offers a range of identification products for electric and gas utilities, telecommunication and cable companies, OEMs and pipeline companies.

EVERLAST cable tags and markers display text or pictograms that are permanently embedded through the entire thickness of the substrate. UV stabilizers and antioxidants are added to provide complete protection and weather resistance in all climates. The polyolefin plastic is impervious to sun, wind, rain, humidity, salt water, fumes, and acid/alkali solutions.

The tags and markers are not painted or screened but instead designed with solid black polypropylene characters permanently embedded into the substrate. Custom wording, logos, and a range of color options are available.

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Given the increasing adoption of underground systems and with the stakes so high to quickly restore power, utilities need to effectively utilize industry best practice signage, tags, and markers to help technicians quickly and safely identify and resolve any faults.

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