

Automation NOTEBOOK

Your guide to practical products, technologies and applications

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Engineering a manufacturing safety net



Stephanie Neil

Stephanie Neil
VP, Editorial Director
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In the world of manufacturing, efficiency and productivity often take center stage. However, there's one element that must always be prioritized above all else: employee safety.

Recognizing that June is National Safety Month, AutomationDirect is dedicating much of this issue of **NOTEBOOK** to addressing the issues that impact safety in the manufacturing workplace — from culture to the tools and techniques that ensure machine operators don't get injured on the job.

Our two feature articles tackle these issues head on. In our cover story, "Building a Safety Component Fortress Around Equipment," Larry Reynolds, the product manager for safety and identification products at AutomationDirect, explores the technology used to detect hazardous conditions and bring equipment to a known safe state. That starts with a risk assessment to understand the safety needs and culminates in the deployment of specific safety controls and components. Turn to page 8 to learn more.

Our second feature article, on page 14, was written by Travis Morris, AutomationDirect's safety administrator, and takes a deep dive into the safety culture. Tapping into personal experience, Morris explains why safety is the foundation of a productive environment and a successful business.

"At AutomationDirect, we understand that establishing a safety-aware workforce requires more than just hanging 'safety-first' motivational posters on factory walls and breakrooms. A true safety culture must go much further than slogans. Leadership, supervisory management, and factory floor workers must own their respective responsibilities for safe operations — and performance metrics and rewards must reinforce their accountabilities," Morris writes.

In addition, cybersecurity is an area that can have an impact on safety. If there's a security breach on a control system, it could lead to an abrupt shutdown which, depending on the environment, could create a catastrophic event. Tim Wheeler, cybersecurity manager for industrial products at AutomationDirect, covers

cybersecurity basics in his Technical Brief on page 20, outlining standards and regulations, physical security, network management, etc. Because establishing a cybersecure foundation does impact the safety of the workforce.

But wait, there's more...

While safety is a focus in this May 2025 issue, there is more to explore in the following pages. From another technical brief on control panel fabrication to a customer case study on updating the human machine interface (HMI) on the pump controls at a wastewater treatment facility.

And then there is a student spotlight on engineering the blue economy (otherwise known as the marine environment).

To develop young talent to support this field, Monterey Peninsula College—via a grant from the U.S. National Science Foundation—has established a program called the Marine Advanced Technology Education (MATE) Center. MATE promotes marine engineering by inspiring and challenging students to learn and creatively apply STEM skills for solving real-world problems.

This student team, called the WhaleTech team, needed to develop a well-controlled ROV with an extensible gripper and turned to AutomationDirect in the development of this underwater ROV project. Turn to page 4 to learn more on this interesting STEM educational program — and find out if the WhaleTech team won the competition!

We hope you enjoy the latest issue of **NOTEBOOK** while learning about the technologies that make a difference in all aspects of manufacturing. As always, we welcome your feedback and thoughts on what you'd like us to cover in the next issue.

Stay safe. ▼

Stephanie Neil

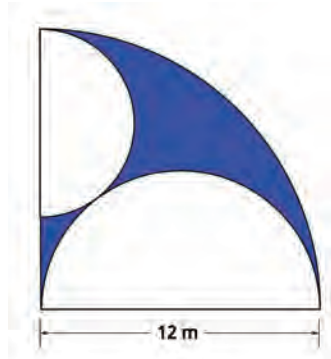




AutomationDirect BRAINTEASERS

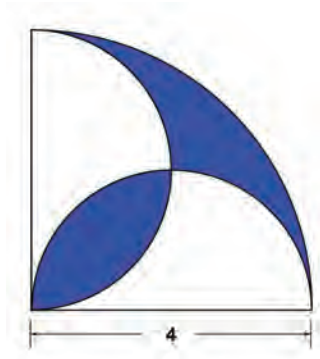
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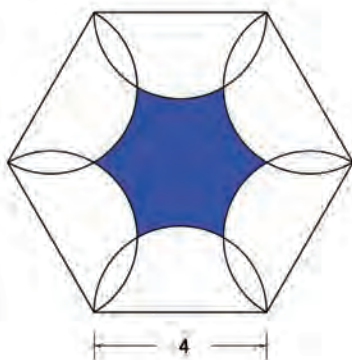
Under My Umbrella

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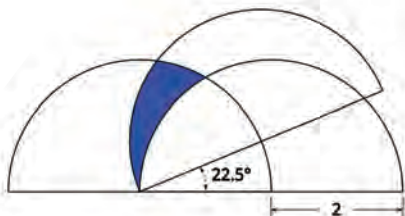
Hexagonal Detangle

Find the area of the blue shaded portion of this figure:



Fang Tango

Find the area of the blue-shaded portion of the figure shown below (the three half-circles are the same size):



Area Sensors

Speaking of Area – did you know that AutomationDirect offers many types of area sensors? Also known as measuring light grids, these sensors can detect the presence of an object within the grid, AND measure that object's height. These sensors can provide a proportional analog output or communication signal to a controller and are ideal for:

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Figure 1: Underwater ROVs operate in challenging environments, so many industrial-grade automation products are a natural fit to support these designs.

Diving Deep into STEM Education

This student team gained valuable STEM experience by developing an underwater remote operated vehicle, and they accelerated their efforts by using commercially available industrial-grade components.

**BY GEOFF GARDENER,
NORTH PAULDING
HIGH SCHOOL**

Exploration of both the deep sea and of outer space share a lot in common. Both are extremely unforgiving environments where it is very expensive to create manned vehicles to carry out missions. As automation has become more capable, robotics and unmanned remote operated vehicles (ROVs) are used to execute much of this work (Figure 1).

Blue economy is a broad term given to any activities associated with developing and preserving the marine environment, covering activities as varied as fishing, aquaculture, renewable energy generation, mining, and more. Research organizations, salvage operators, the military, and commercial

companies need ROVs to perform a variety of tasks in marine environments, and sending ROVs in place of human divers is safer. ROVs can be controlled remotely by human operators, and most will have some degree of on-board automation. Designing and building these ROVs is a specialized endeavor, combining mechanical, automation, and other skill sets.

To develop young talent to support this field, Monterey Peninsula College—via a grant from the U.S. National Science Foundation—has established a program called the Marine Advanced Technology Education (MATE) Center. MATE promotes marine engineering by

inspiring and challenging students to learn and creatively apply STEM skills for solving real-world problems. This story relates how our team of students compete annually in MATE by applying industrial-grade technologies from AutomationDirect to develop their critical thinking, collaboration, entrepreneurship, and innovation skills so they can become part of the Blue Economy and other similar technology-based endeavors.

Whale of a project

Part of the program is the MATE ROV Competition, which offers five different contest classes, each based primarily on skill and not strictly by age group. At

North Paulding High School in Dallas, GA, a number of students make up the "WhaleTech" team. Some of them have participated for up to seven consecutive years, starting in middle school.

Each year, the competition organizer publishes challenges and mock mission profiles simulating real-life conditions, with various restrictions. For example: dive to a pipeline simulation at a given depth, strategically remove a "bad" pipe segment, replace it with a new section, and bring the bad portion to the surface. The team builds a ROV to meet those challenges, and along the way, they must act and present themselves as a professional company. They develop technical documentation, conduct research, select products, learn and follow safe practices, assemble and test the ROV and subcomponents, and even do a bit of marketing.

With a new mission each year, the team generally disassembles and uses part of the prior year's robot. They build on previous successes, adapt to new requirements, and create new assemblies and mechanisms. Some assemblies are prototyped and custom-made using 3D printing, machining, and other techniques. However, just as the overall design is based on proven concepts to a great extent, the team also relies on commercial off-the-shelf (COTS) components where possible to avoid time consuming and technically risky experimentation. In fact, industrial-grade COTS components work very well in this service.

Immersed in the details

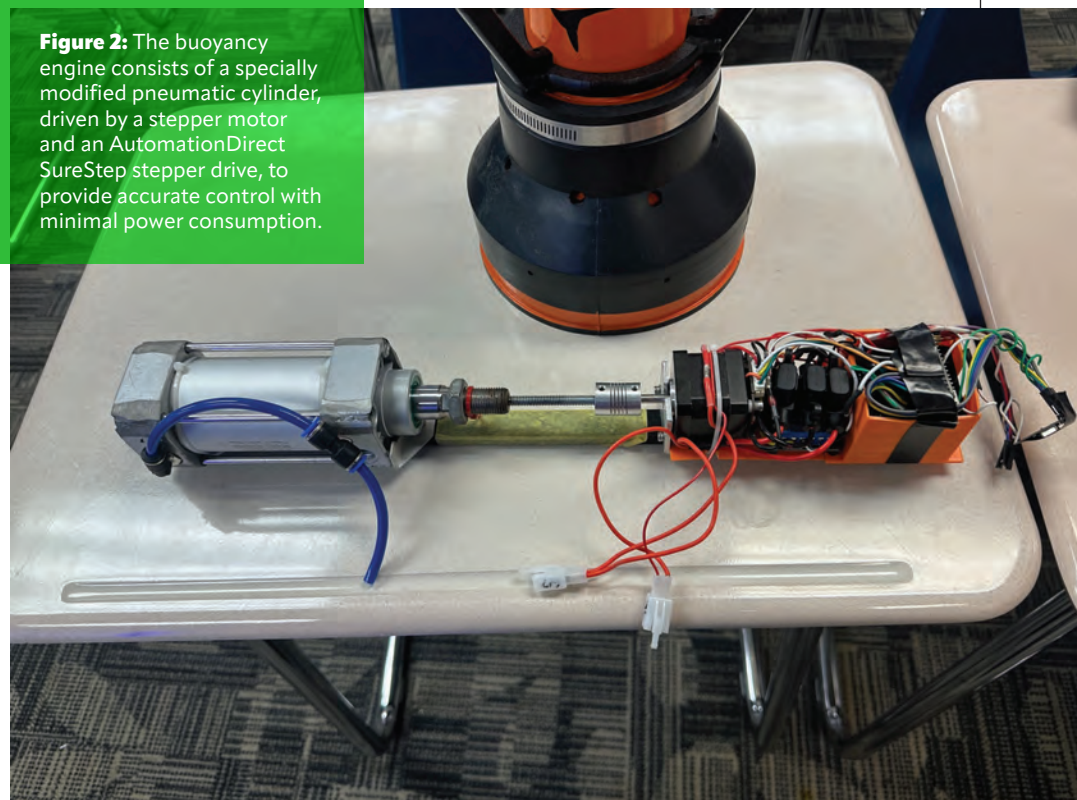
Many ROVs look a lot like aerial drones, with propellers arranged to provide thrust in various directions. Just as aerial drones use propellers to provide constant lift and control motion, an underwater ROV does the same, but it can also use an additional mechanism to adjust its buoyancy. Cameras and lights are common on ROVs, and many also have robotic arms and manipulators to perform tasks. Many of the monitoring and control needs mirror the types of functionalities needed by industrial automation control systems.

For the 2024 competition, the WhaleTech team needed to develop a well-controlled ROV with an extensible gripper. The buoyancy mechanism, gripper, cameras, propellers, and other

components would need to be supported and arranged in a chassis, which meant that some design effort would have to be in parallel and iterative to achieve the functionality and create an integrated form factor. As part of the process, the team used cardboard mockups and 3D printing, and then they created many structural elements cut out from high density polyethylene (HDPE).

stepper motor could do the job admirably. A stepper motor can continuously turn in either direction and be commanded in increments as small as 1.8 degrees per step, driven by an AutomationDirect SureStep stepper drive commanded by an Arduino nano controller. A stepper motor draws no power when idle, it works well within the available power budget, and there is no rebound when

Figure 2: The buoyancy engine consists of a specially modified pneumatic cylinder, driven by a stepper motor and an AutomationDirect SureStep stepper drive, to provide accurate control with minimal power consumption.



The buoyancy engine is used to actively alter the buoyancy of the vehicle so the ROV can rise, descend, or stay at a fixed depth (Figure 2). It does so using a sealed cylinder to compress the fixed air volume, displacing it with water, which results in changing the overall density of the apparatus.

After selecting an industrial-grade cylinder, the team needed a powerful yet controllable way to actuate the piston portion via a linear screw drive mechanism. The initial idea was to spin the drive screw using a servo, which is powerful but can be costly. After some trial and error, and investigation of technologies readily available from AutomationDirect, the team found that a

the target position is achieved. The buoyancy engine is also outfitted with a pressure sensor used to store depth data into the on-board computer, and a wireless transmitter to communicate this information to the surface computer for a graph display when the ROV surfaces.

Similar design considerations applied to the gripper assembly, also known as the claw or manipulator (Figure 3). In this case, an AutomationDirect SureStep rotary stepper motor driving a screw shaft provides the motion to extend or retract a mechanism, which in turn opens or closes the gripper. Because this assembly must articulate, it is connected to the controller using a watertight flexible cable. >>

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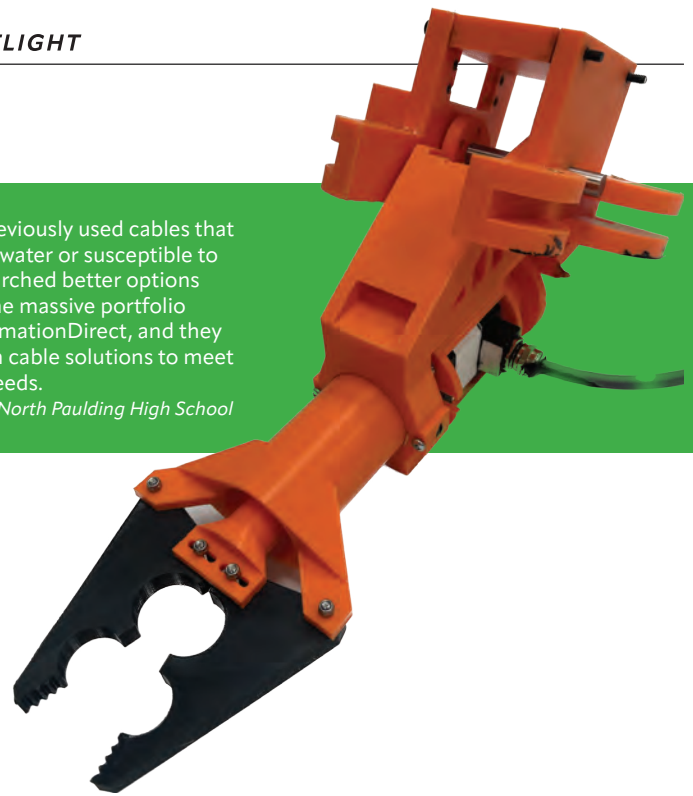
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Figure 3: Having previously used cables that were too stiff underwater or susceptible to EMI, the team researched better options available through the massive portfolio available from AutomationDirect, and they found cut-to-length cable solutions to meet all their technical needs.

All figures courtesy of North Paulding High School



In previous competitions, the team had experienced issues with umbilical cables—running from the ROV to the surface—that were not flexible enough to allow precise movements in the water, or were insufficiently shielded and therefore susceptible to electromagnetic interference (EMI). To solve these issues, the team researched cables on the AutomationDirect website and found products with better flexibility and improved resistance to electrical noise. AutomationDirect offers a wide range of cables, available on spools and/or as cut-to-length.

Throughout the design process, the WhaleTech crew found the AutomationDirect website information and support team to be extremely helpful. They could rapidly browse through a wide variety of products, researching and discovering what would work best for their applications. Technical data sheets were only a click away, and a few times they used phone support to iron out other details.

Industry advances science

AutomationDirect has a long history of supporting student STEM efforts, and this underwater ROV project exemplifies just how important it is for the industry to support education. The AutomationDirect portfolio of high-performance sensors, motors, controllers, visualization devices, installation components, tools, and much more has helped countless individuals, project teams, and companies innovate an incredible variety of solutions while remaining within budget constraints.

As a result of their design and execution efforts, the WhaleTech team won first place in the Ranger class of the 2024 MATE ROV Competition. While some members are graduating and moving on to new work and educational endeavors, a new crew will assemble next year and work to build upon their successes. ▼



Geoff Gardener is a Geometry teacher at North Paulding High School and the head coach and school sponsor of the WhaleTech team. Geoff, with the help of Rocco Leach who is an industrial automation engineer at a local beverage plant, leads the group of students forming the WhaleTech MATE ROV Competition team. In 2024, the team won first place in the Ranger class, <https://materovcompetition.org/awards-0>. After their victory, the team was invited to meet with Georgia Governor Brian Kemp at the State Capitol in Atlanta.

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Building a safety component

FORTRESS

around equipment

Using a risk assessment for guidance, choose the optimal safety inputs, logic, and output to deliver the degree of protection required.

BY LARRY REYNOLDS, AUTOMATIONDIRECT

Safety systems play a crucial role in industrial equipment, protecting personnel, guarding against machine damage, and minimizing unscheduled downtime. To make a machine totally safe, we could build a wall around it, cut the power, send staff home, and lock the doors after them. That approach isn't particularly practical, however. Instead, we use safety technology to detect hazardous conditions and bring equipment to a known safe state as quickly as is practical. Let's look at the tools and techniques we can use to accomplish this goal.

Start with a risk assessment

Understand your safety needs before designing the safety system. It's more efficient, more effective, and more economical than building a machine and adding safety measures afterward. The steps are well defined and detailed in standards like EN/ISO-13850 and IEC 61800-5:

1. Assemble a cross-disciplinary team, including mechanical engineers, electrical engineers, controls engineers, operations, and maintenance.
2. Identify risks, quantifying the frequency/duration of worker exposure. ISO 13849-1, for example, categorizes performance level requirements (PLRs) defined as the probability of dangerous failures per hour. They range from PLa to PLe; the higher the PLr, the more comprehensive the safety system needs to be. Depending on the safety standard used and the authority having jurisdiction, safety integrity level (SIL) rating – a measure of safety system reliability – may also come into play.

Just identifying hazards is not enough. Be specific. What components do you need to bring the equipment to a known safe state? What is the required stopping distance? How quickly does it need to stop? Do you need power on or can it be off? >>

Once you have this information, develop a strategy to eliminate, substitute, or reduce each risk. The details of the safety requirements vary from hazard to hazard, and the solutions must adapt to suit. For example, EN/ISO 13850 defines three stop categories:

- Category 0 – An immediate and uncontrolled stop achieved by removing power from the actuator
- Category 1 – A controlled stop under power, followed by removal of power
- Category 2 – A controlled stop involving removal of torque while keeping drives energized

The PLr determines the stop category and the types of products necessary to mitigate risk.

Perform this exercise for every hazard identified at the beginning and remember, risk elimination/substitution is easier when performed at the start of design.

The basic industrial safety-related control system (SRCS)

In its simplest form, an SRCS consists of three elements:

Input: Safety input encompasses devices that monitor areas of concern for unsafe conditions. Input devices range from safety switches to sensors.

Logic: Logic devices like safety relays and safety PLCs process the input to detect unsafe conditions and generate an output.

Output: Logic output consists of commands or signals to devices that put the machine into a known safe state. These can range from safety contactors or switches that create mechanical blockages, etc. to safety-enabled drives equipped with commands like safe torque off, safe direction, and safely limited speed.

Within this basic structure, a wide variety of implementations can be used to address the different performance levels and hazards identified in the risk assessment.

How do you build a fortress of safety?

As an example, let's consider machine guarding. Surrounding a machine with barriers can protect personnel from hazards but guarding can be expensive and takes up precious floor space. It can also be perceived as interfering with operations and maintenance, creating the temptation for personnel to bypass safety measures (more about that later). The challenge is how to permit entrance while maintaining safety. This is where safety input comes into play.

Safety input

Safety input encompasses a variety of devices, from switches to sensors to operator-managed stops.

Switches

Switches monitor a condition or a part of the machine, providing the safety input to a safety logic device to determine a response (safety output). They can be divided into contact switches and noncontact switches. Contact switches have a physical connection

that needs to be maintained in order for the machine to operate. They provide a strong barrier but require accurate installation and good alignment for proper operation. Noncontact switches are much more flexible and minimize wear and tear by decoupling the switch from the actuator. RFID coding controls operation and prevents tampering.

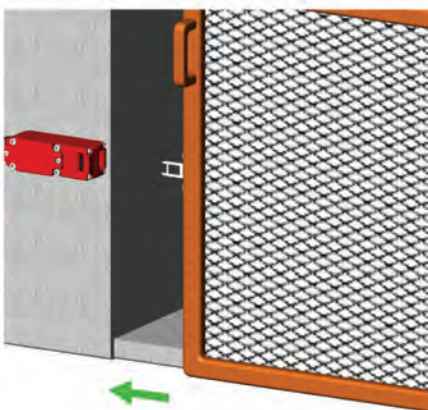
Let's look at two common types of switches:

Interlock safety switches

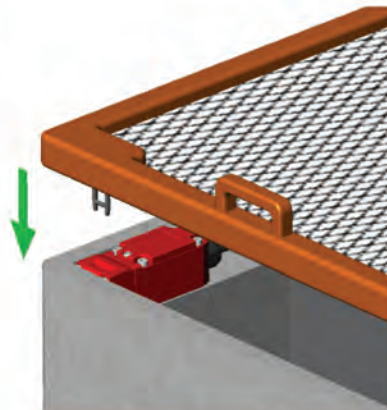
Interlock safety switches are contact switches that use a physical connection such as a tongue or key to monitor the condition of guards, gates, doors, windows, etc. If the physical contact is broken, the safety system causes the machine to move into a safe state.

One of the most common types of interlock safety switches, tongue interlock safety switches, have tongues or keys that must be physically inserted into the switch housing for normal machine operation to take place. The switch element is typically mounted to the static frame, while the actuator (the tongue/key) is attached to the moving part (see Figure 1). If the tongue is removed from the switch, for example when a door is opened or a cover

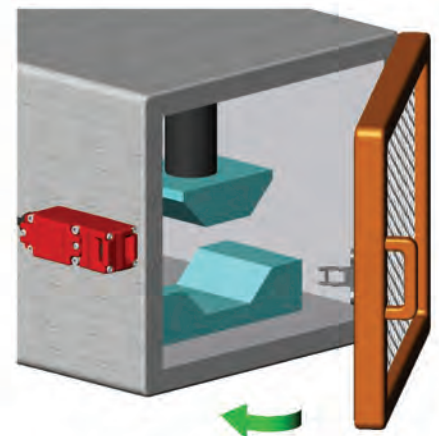
Figure 1: Tongue interlock safety switches detect hazardous conditions when the tongue/key is removed from the body (red). This signals the SRCS to command the equipment into a known safe state.



Sliding Guard



Lift off Guard



Hinged Guard

Figure 2: Safety enabling switches like the ZEUS series from Safety System Products support limited safe motion for certain types of routine operations and maintenance.



removed, the safety circuit is broken. This removes the signal from the logic device, triggering the machine to move into a known safe state by slowing or stopping. Only after the tongue/key is reinserted into the switch will the safety circuit permit normal machine function.

Tongue interlock safety switches are well known, easy to install, and economical. On the downside, they're intolerant to misalignment and can be defeated.

Safety enabling switches

For some applications, routine maintenance tasks like clearing jams or cleaning may require controlled motion while personnel are inside restricted areas. Safety enabling switches are three-position switches (off-on-off) that can signal the SRCS to limit motion or perform other tasks in a controlled manner, only when the switch is held in the central position (see Figure 2). Safety system designers can use safety enabling switches to allow the machine to be jogged or run at slow speed even when doors are open or personnel are within the enclosures using commands like safe direction or safely limited speed. Fully depressing or releasing the switch will result in the machine instantly moving into a safe state.

Sensors

Sensors are valuable tools for increasing safety while reducing the need for guarding. Sensors can be used to detect operator position and send the signal to the logic device, which in turn generates commands to put the machine in a safe state when required.

Safety light curtains

Safety light curtains can be used to protect personnel from hazards in areas where barriers are impractical. A light curtain consists of a linear array of photo emitters and a separate array of photodetectors. When a photodetector receives the optical beam, it generates a signal. Breaking the optical beam cuts the signal sent to the logic device, causing it to put the machine in a safe state.

Safety laser scanners

Safety laser scanners detect objects via backscatter over a wide angle. Using time-of-flight technology, they can monitor distance, making them useful for zone safety.

Safety mats, edges, and bumpers

Safety mats are pressure-sensitive devices that offer a variety of implementations. They can be used to detect the presence of personnel in a hazardous area, slowing, then stopping the machine as risk increases. Conversely, they can provide a way to ensure that personnel are in a safe position by preventing operation of the equipment unless the person is standing in a designated spot, such as at the control panel outside of the barrier.

Other options include safety edges and bumpers, which can protect personnel from moving doors and equipment.

Operator-invoked stops

Traditional operator-controlled safety sensors include E-stop buttons for proximity control and cable-pull safety switches for stoppage along a distance.

Bypass-resistant safety devices

Few people would argue with the value of safety systems to protect personnel from injury or worse. That said, safety measures can be perceived as causing line stoppage and reducing throughput. This gives rise to efforts to defeat safety measures, such as fastening a magnet over a sensor or simulating a tongue/key with a bit of metal so that a door or panel can be opened while the machine continues running. "I'll be quick," or "I'll be careful," a staffer might say but they can't really guarantee that. Also, once a machine is placed in an unsafe state, there is no protection for any other personnel who might not be aware of the actions of their colleagues. Look for non-defeatable devices designed to prevent bypass. Here are a few examples:

Solenoid locking tongue interlock safety switches

These contact safety switches operate similarly to the conventional tongue interlock safety switch – access to the guarded region isn't allowed until the tongue/key is released from the switch body, which then causes the safety system to slow or stop the machine. The critical difference is that the tongue/key is held in place by the solenoid and can't be released until the solenoid is energized.

Energizing the solenoid is typically controlled through the PLC or safety relays. This approach ensures that the door can't just be muscled open and limits access only to qualified personnel. To increase protection levels, it can be equipped with a delay timer to allow machinery to stop before the solenoid is energized to release the switch.

RFID coded safety switches

RFID coding adds a layer of non-defeatability to safety switches. There are different levels of coding dependent on the amount of anti-tampering required. Uniquely coded RFID non-contact switches have some of the best anti-tampering properties.

Two-hand safety controls

One specialty non-defeatable solution is the two-hand safety control. Designed for equipment with hazardous closing motions like hydraulic presses, these controls require actuation with two hands simultaneously to initiate and complete the operation. The goal is to ensure that the operators' hands and arms are out of range of moving equipment during the entire stroke.

As with so much else in safety design, the devil is in the details. The two units need guards and sufficient separation to ensure that an operator can't use the hand and elbow on the same arm to operate the machine (see Figure 3). The logic device, commonly a two hand control relay, should allow only fractional latency between the two signals, to prevent an operator from activating the actuators sequentially with a single hand.

Safety logic devices

Safety logic devices analyze safety inputs to detect hazards. If a hazardous situation is identified, the safety logic will command other devices to bring the machine to a known safe state. >>

Figure 3: Two-hand safety control panels like these from IDEM (top) and Schmersal (bottom) feature guard hoods over the actuators to prevent operators from running the equipment with only one hand or from the back side of the panel.



There are different classes of safety logic devices with increasing levels of functionality, complexity, and, of course, cost: safety relays, configurable safety relays, and safety PLCs. The optimal choice depends on the risk assessment, the requirements of the application, and any project constraints such as budget.

Safety relays

Standard safety relays are simple, robust, easy to install, and cost-effective. Safety relays incorporate monitoring logic, circuit protection, and redundancies to ensure reliable operation. They require two inputs so that if one fails, it is detected, and the machine is put into a safe state. Safety relays are available in many versions capable of monitoring one or more devices.

Configurable safety relays

As machine and safety system complexity rises, standard safety relays become unwieldy. In these cases, safety configurable relays can be an excellent solution. They can be used to monitor a variety of devices (see Figure 4). Some units are programmable, while others can be extended with additional safety contacts and signaling outputs.

Safety controllers

Configurable relays can handle a wide range of applications, but when additional flexibility is needed, safety controllers step in. A safety controller is a dedicated device that monitors safety inputs (such as emergency stops, light curtains, or door switches) and controls safety outputs (like safety

contractors or STO drives to stop motion, or brakes to prevent other hazardous energy). These devices are typically used in minimum to moderately complex systems where safety functions are straightforward but there may be multiple safety functions. Safety controllers usually work with configuration or programming software, allowing users to design a safety circuit and download it directly to the controller.

Safety PLCs

With increased memory and processing power, safety PLCs are ideal for complex machines. They're more expensive and require more expertise but the advantages are flexibility and the ability to expand to meet future needs.

Safety output

Safety output is a critical part of the safety system. In the simplest form, it can take the form of a standard safety relay causing the safety contact to open, cutting power to the machine. In a more complex design, a safety PLC might send a command to a safety-rated drive to invoke functions such as safely limited speed, safe direction, or safe torque off (followed by application of an external brake, if freewheeling does not satisfy requirements).

Conclusion

Safety systems are essential to machine design and operation. Begin with the risk assessment at the very start of machine development. This will streamline the process, optimize safety, and minimize cost. The risk assessment provides an indispensable tool for the process of designing a safety system with the optimal safety inputs, logic devices, and safety outputs. Don't forget to take advantage of configurable safety relays as a cost-effective middle ground between standard safety relays and safety PLCs. Most of all, don't be shy about reaching out to your vendors for guidance. They can help you design the most effective system for your requirements, application, and budget. ▼

Larry Reynolds, PMP, FS Eng (TÜV Rheinland, #15983/18, Machinery), is product manager, Safety and Identification products, at AutomationDirect.

Figure 4: Configurable safety relays in the Schmersal PROTECT SRB-E product line can handle as many as 10 safety inputs and 5 safety outputs, as well as supporting many different applications. Each is compatible with monitoring all conventional safety devices.



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**CULTIVATING A WORKFORCE CULTURE TO
PROTECT PEOPLE AND PRODUCTIVITY**

**BY TRAVIS MORRIS,
SAFETY ADMINISTRATOR, AUTOMATIONDIRECT**



As we recognize National Safety Month this June 2025, it's the perfect time to reflect on how industrial safety has evolved alongside technological advancement. At AutomationDirect, we've seen firsthand how the safety landscape in manufacturing and logistics continues to advance rapidly, creating both new challenges and unprecedented opportunities for protecting our workforce—and supporting our customers in safeguarding theirs.

Industrial safety standards have undergone a significant transformation in recent years, primarily driven by the integration of automation and robotics into manufacturing environments. Traditional lockout and tagout procedures have evolved into sophisticated safety systems that incorporate real-time monitoring, predictive analytics, and zone-based safety protocols.

Standards like ISO 13849 and IEC 62061 have been updated to address safety-related control systems, while ANSI/RIA R15.06 has expanded to accommodate collaborative robot applications where humans and machines share workspaces. These modernized standards now emphasize risk assessment methodologies that consider the entire lifecycle of automated systems rather than just physical guarding.

Operator complacency, a critical risk factor

While automation enhances safety overall, it introduces distinct risks that require careful management. The most common challenges include complacency among operators who develop false confidence in automated safety systems, creating vulnerability during maintenance or unexpected malfunctions.

Complex human-machine interfaces can lead to confusion during critical decision points, while cybersecurity vulnerabilities in networked safety systems represent an emerging threat vector. Additionally, the skills gap means we often have workers interacting with technology they don't fully understand, raising the risk of improper operation or bypassing safety features.

Consider a typical food processing operation that implements a robotic palletizing system. Such automation could replace manual stacking operations that frequently cause back injuries and repetitive strain issues. A well-designed system would incorporate advanced sensors to detect human presence and automatically adjust the system's operation to prevent collisions. >>

In such scenarios, companies can expect to see significant reductions in recordable incidents while also increasing productivity — demonstrating how automation can enhance both safety and efficiency when properly implemented with a strong safety mindset.

Building a safety-aware workforce

At AutomationDirect, we understand that establishing a safety-aware workforce requires more than just hanging “safety-first” motivational posters on factory walls and breakrooms. A true safety culture must go much further than slogans. Leadership, supervisory management, and factory floor workers must own their respective responsibilities for safe operations — and performance metrics and rewards must reinforce their accountabilities.

The reality is that safety isn’t separate from productivity; it’s the foundation that makes consistent productivity possible. While serving customers often drives the operational tempo of a manufacturing or logistics operation, safety’s prioritization is fundamental to sustained productivity, quality, and output. When companies cut corners on safety, the consequences can ripple throughout the entire value chain: reputations suffer; stakeholders lose confidence; customer relationships deteriorate; and most critically, people get hurt.

Balancing efficiency with safety during automation implementation requires careful planning. The principle that “slow is smooth, smooth is fast”

applies perfectly here. Rushing high-risk tasks might meet immediate deadlines but creates vulnerability to accidents, injuries, and quality defects — all of which can ultimately slow production more than doing work safely the first time.

Effective implementation starts with comprehensive risk assessments that identify potential hazards early, bringing together cross-functional expertise from maintenance, automation specialists, and operations during planning phases. Mitigating risks through the hierarchy of controls — eliminating hazards where possible, engineering them out, or implementing protective measures — creates systems that are both safer and more efficient.

Training plays a huge role in reducing accidents, but it has to evolve beyond compliance-focused checkbox exercises. Generic presentations rarely engage frontline workers or prevent accidents. Instead, training should be hands-on, site-specific, and directly applicable to real workplace scenarios. Taking workers to their actual workspaces, demonstrating practical skills, and allowing them to troubleshoot realistic situations creates meaningful engagement. With automated systems, this approach becomes even more important — workers need to physically interact with the technology they’ll use daily, building instincts that help them identify and address safety concerns before incidents occur.

Cultivating a strong safety culture

Cultivating a safety culture in manufacturing and logistics means going beyond buzzwords to establish safety as a fundamental operating principle. At AutomationDirect, we’re fortunate to have genuine buy-in from senior leadership and executives who demonstrate healthy respect for workplace safety. This is evident in how we manage our automated logistics warehouse — pushing operational tempo to meet customer demand while simultaneously maintaining a serious commitment to managing and mitigating risks.

Leadership reinforcement happens daily through visible engagement. Employees and visitors will see our executives, managers, and safety professionals walking the floor, connecting with team members, and asking meaningful questions related to “How can we make your job safer, more efficient, or both?”

After all, safety should never involve intimidation or policing the workplace. Instead, it should be open for discussion and collaboration. In environments where line-level employees often fear speaking up, we’ve cultivated an authentic open-door policy where everyone has a voice in safety matters.

Encouraging employee ownership of safety requires recognizing the right behaviors. Rather than focusing solely on minimizing lagging indicators like Total Case Rate (TCR) or the Days Away, Restricted, or Transferred (DART) metrics developed by the Occupational Safety and Health Administration (OSHA), proactive actions are needed: hazard reports; safety suggestions; and near-miss callouts.

One idea is putting in place a straightforward QR code reporting system that can make it simple for anyone to flag potential issues, even anonymously. This approach can help every team member become a company’s eyes and ears on the floor, identifying leading indicators before incidents occur.

When implementing new safety protocols or automation-driven measures, resistance to change is natural. The most effective strategy is collaborative problem-solving rather than top-down directives.

When facing a necessary safety issue that needs resolution, companies should start by thoroughly investigating the issue [\(continued on page 18\)](#)



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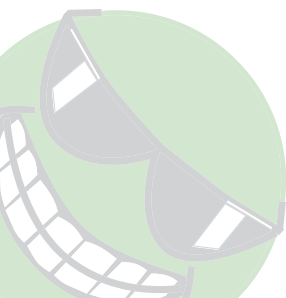
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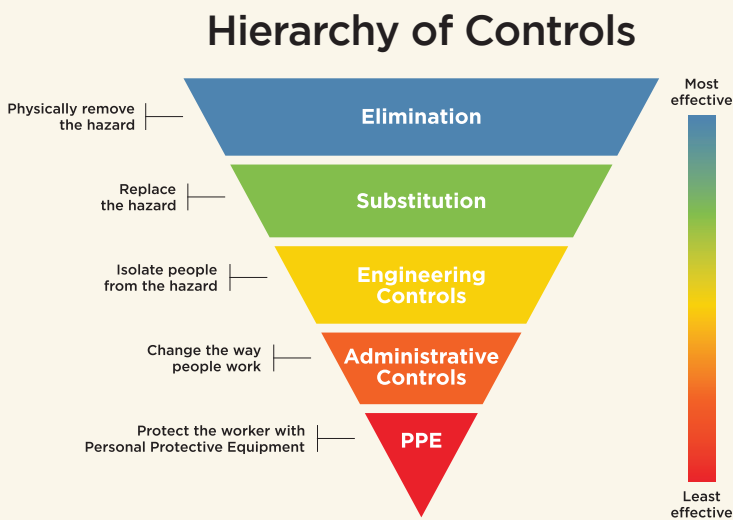


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THE HIERARCHY OF CONTROLS: A PRACTICAL FRAMEWORK FOR HAZARD MANAGEMENT

As defined by OSHA, the Hierarchy of Controls is a structured approach to identifying and prioritizing safety measures to protect workers from hazards. As the diagram shows, these controls are ranked from most to least effective and include elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE).

In many cases, a combination of these methods is necessary for optimal worker protection. Additionally, the practicality of implementing these measures must be considered. When implementing safety measures in manufacturing environments, not all controls offer equal protection. The Hierarchy of Controls provides a structured approach to selecting the most effective safeguards, arranged from most to least effective. See this OSHA link for more details.



Source: NIOSH.

SAFETY

(continued from page 16)

with affected team members, explaining the underlying drivers — whether regulatory requirements or identified risks — and then asking for their input: “What would you do?” This approach guides people toward solutions while giving them meaningful influence in shaping the implementation of those solutions.

It's a basic tenet of change management: people are far more likely to follow and enforce protocols they helped create. By inviting those affected to participate in developing solutions that balance efficiency, compliance, and practicality, potential resistance can yield solution ownership. Once new measures are implemented, feedback loops should be in place to check effectiveness and make adjustments as needed. This collaborative approach turns what could be seen as impositions into shared commitments that team members actively uphold and advance.

The future of safety and automation

Emerging technologies are fundamentally transforming the industrial safety landscape, creating both new opportunities and challenges that manufacturers must navigate. Industrial robots, AI, machine vision systems, and collaborative robots (cobots) are reshaping how we approach workplace safety, particularly in automated environments like our logistics warehouse at AutomationDirect.

One significant benefit these technologies offer is addressing ergonomic concerns — the repetitive motions and awkward positioning that can lead to cumulative trauma disorders over time. By assigning physically demanding or repetitive tasks to automated systems, companies can substantially reduce strain on workers and prevent long-term injuries that have traditionally plagued manufacturing and logistics operations.

However, implementing these technologies requires careful planning rather than hasty integration. A comprehensive risk assessment process is essential at multiple stages: during initial planning, throughout system integration, and after commissioning. Without this diligence, companies risk solving one safety challenge only to inadvertently create others, such as introducing unpredictable machine movements or creating new pinch points.

These advanced systems bring unique safety considerations. How do workers safely interact with cobots? What protocols ensure safe maintenance procedures? Training becomes even more crucial in these environments, requiring thoroughness for maintenance technicians, operators, and anyone working in proximity to automated systems. Workers need a clear understanding of operational modes, expected movement patterns, and how to interpret system indicators, lights, and sounds that communicate machine status.

When implemented with proper planning and training, automation technologies significantly enhance workplace safety. When deployed without adequate assessment and preparation, they can introduce new hazards. As we look toward the future of industrial safety, the distinction between success and failure will increasingly depend on how thoughtfully we integrate these powerful tools into our operations.

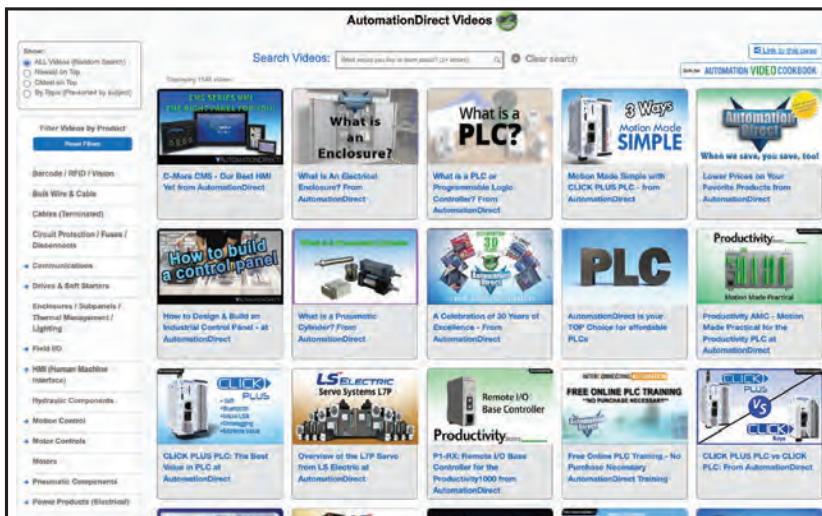
Future safety trends

Looking ahead, manufacturers should prepare for several emerging industrial safety trends. We'll see increased integration of wearable technologies that monitor worker biometrics and environmental conditions in real time. Digital twins will enable virtual safety testing before physical implementation. AI-powered predictive analytics will identify potential safety issues before incidents occur.

The regulatory landscape will likely evolve to address new technologies, requiring more sophisticated compliance approaches. Remote operations capabilities will expand, necessitating cybersecurity measures that protect both data and physical safety. Finally, environmental sustainability and worker safety will become increasingly interconnected, with greater emphasis on solutions that address both priorities simultaneously. ▼

Travis Morris has a B.S. degree in Aerospace Maintenance & Safety, is a former member of the U.S. Army 82nd Airborne Division, and was an Aviation Maintenance Leader and non-commissioned officer in the U.S. Army 160th Special Operations Aviation Regiment. He has years of additional safety consulting and supervisory experience. And he currently is a board member of the Association for Advancing Automation (A3) Robotics Committee.

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Cybersecurity: Pursuing Basics First

Many industrial automation end users are not staffed to deploy cutting-edge cybersecurity provisions, but they all will benefit from performing attainable and practical basic steps.

**BY TIM WHEELER,
AUTOMATIONDIRECT**

Albert Einstein said, “Genius is making complex ideas simple, not making simple ideas complex.” Modern cybersecurity is an example of an extremely complex subject, where a lot of people are seeking some genius-inspired simple steps to start them on the right path toward being cybersecure. Most people—whether they explicitly realize it or not—already rely on carefully conceived personal/commercial cybersecurity provisions in their everyday lives for activities such as web browsing, mobile access, and banking. However, how can anyone really understand all the details?

For industrial automation users, the cybersecurity struggle is compounded by the variety and vintages of devices and technologies present in their operations, and often in service for many years before cybersecurity was a serious consideration. The volume of cyberattacks continues to increase and the threats become more sophisticated, and both offensive and defensive technologies evolve. Furthermore, standards and regulations continue to be updated.

In the face of this relatively grim news, it is encouraging to remember that there are many back-to-basics steps that any industrial organization can perform

to clarify and enhance their cybersecurity posture, and to set the foundation for future improvements. Also, industrial users should familiarize themselves with a few topics commonly discussed by industry, regulators, and standards organizations regarding cybersecurity.

Standards and regulations

There are several cybersecurity standards, but two of the most relevant for industrial operational technology (OT) users are ISA/IEC 62443 “Security for industrial automation and control systems,” and ISO/IEC 27001 “Information security, cybersecurity, and privacy protection — Information security management systems — Requirements.” The United States Cybersecurity & Infrastructure Security Agency (CISA) develops services, tools, and programs aimed at improving the cyber resilience of technology. More recently, at the end of 2024, the European Union Cyber Resilience Act (CRA) regulation has come into force and will impact industrial automation and control products and systems going to or from Europe, but it is too early to say exactly how.

New threats and even projected threats are constantly identified. As just one example, have you heard of “Q-Day,” which is a term describing—perhaps mere years away—when quantum computing will make some current security standards obsolete? New information technology

(IT) strategies are rolling out to address this, and they will need to be expanded past consumer and commercial uses and into the industrial domain.

Many end users and designers may not be staffed to understand the intricacies of cybersecurity standards, and the full impact of merging OT and IT systems, but they can look for suppliers and products certified as compliant with these standards (Figure 1). Regarding the EU CRA, this is a new regulation with a lot of potential to improve products with digital elements (PDEs), and it will introduce obligations and the potential for noncompliance fines.

However, there are some concerns with regards to general definitions in the regulation, such as “secure by design,” and on the impact of EU CRA on PDE used throughout industrial installations, especially around automatic update requirements, which is generally considered undesirable for validated production OT systems.

Cybersecurity basics for today

Eventually, there will be no way industrial automation implementers can avoid the need to pursue a deeper understanding of cybersecurity details. Despite this outlook, there is some good news, because all cybersecurity provisions are built upon some basic foundations which can be instantiated today.

Performing an audit

Management consultant Peter Drucker is often quoted as saying “You can’t manage what you can’t measure.” Adapting this thought to cybersecurity leads to the idea that you can’t cybersecure what you can’t identify. Accordingly, the first step for any industrial cybersecurity effort is to perform a comprehensive audit of automation assets.

This includes obtaining the make, model, serial/license number, and firmware or software version status for any network-capable device or application. Identifying the product source and country of origin is also becoming important. Performing a comprehensive audit task requires lots of legwork and investigation to dig through control cabinets and explore network connections.

Target tangible devices can include intelligent field instruments, programmable logic controllers (PLCs), human-machine interfaces (HMIs), edge controllers or PCs running Linux- or Windows-based applications, and more. Network connectivity for less significant assets is more intangible and can require additional software tools to discover unexpected wired and wireless connectivity onsite, and even spanning to remote locations or the cloud.

Physical security

Physical security is probably the easiest understood-cybersecurity topic. Once all new and existing industrial automation assets are identified by an audit, they should simply be physically locked up to the greatest extent possible, using a controlled method with access defined and logged for personnel with the appropriate privilege (Figure 2).

Control panels, electrical cabinets, and entire electrical rooms are some of the most likely locations for physical lockdown. Control rooms or any form of active HMI should be in a secured space. End users should ensure that all Ethernet switches or other potential entry points to the industrial automation network are locked up, which leads to the next item.

Network management

Cyberattacks can be perpetrated via in-person access to USB ports and other network connections, but some of the most insidious assaults happen remotely from internet or wireless network connections. Decades ago, most OT automation existed as individual air-gapped systems with no convenient external connectivity. Today, with the wide adoption of IT technologies for industrial use, almost any automation element may be networked.



Figure 2: Simply locking up automation assets—whether in control panels, network cabinets, electrical rooms, or elsewhere—is a straightforward yet important first step toward cybersecurity.



Figure 1: As OT systems become more fully merged with IT, standards and regulations are developing to manage the cybersecurity threat.

End users supporting existing automation or designing new systems can follow some ever-useful guidelines. For example, for OT systems it remains useful to preserve a degree of network hierarchy and segmentation, much like the classic Purdue Model (Figure 3). Although modern systems can be architected into many flatter and converged arrangements, a more segmented design restricts unexpected access by enabling just associated devices to interact. For example, field devices connect with their associated PLC, the PLCs connect with related HMIs, and PLC/HMIs connect with higher-level enterprise computing assets.

Of course, modern Internet of Things (IoT) protocols, internet cloud connectivity, and mobile devices make it possible for a smart field instrument to connect up through a PLC or directly to the cloud, and then interact with a user’s mobile device. This type of connectivity can be beneficial, but it must be properly secured and managed. OT Implementers should enforce strict user management and authentication controls, usually enacted by and in conjunction with IT personnel, and based on solutions certified according to ISO 27001. >>

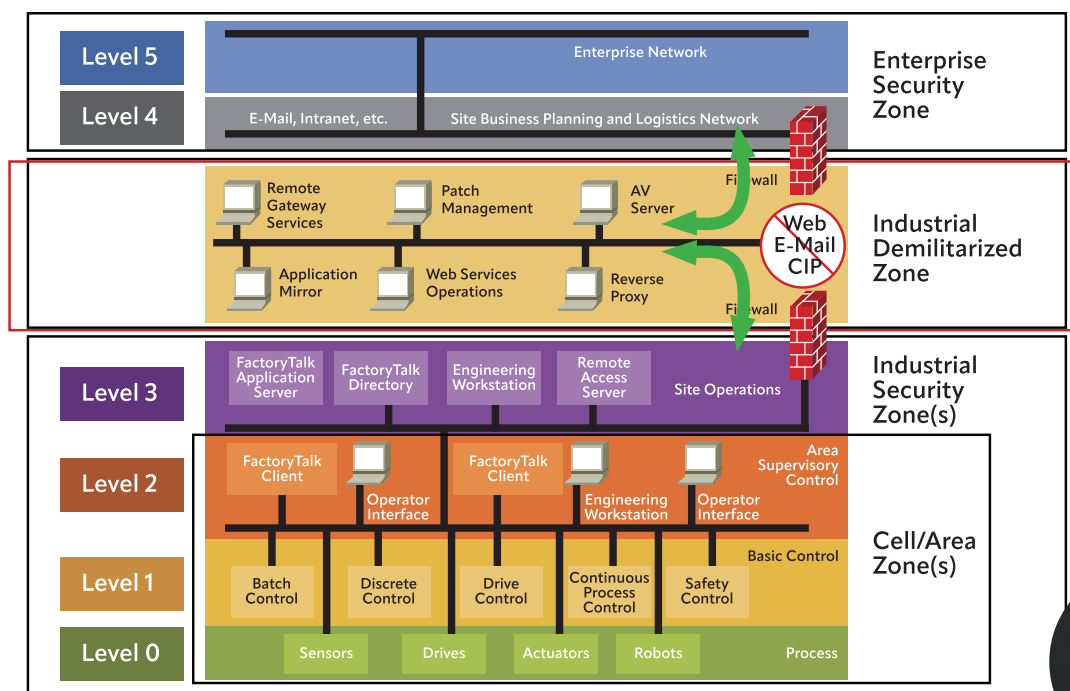


Figure 3: Although modern networking media and protocols enable OT devices and systems to communicate amongst each other on significantly “flattened” networks, there are cybersecurity benefits associated with maintaining a segmented networking hierarchy as indicated by the classic Purdue Model.



Researching vulnerabilities

There is another important cybersecurity basic, typically much more confusing to users than the preceding steps, and that is to actively research vulnerabilities. This requires searching through information published by hardware and software vendors relating to known issues with their products. Responsible reporting of these security advisories is a sign of a quality vendor (Figure 4).

An extremely useful tool for users is the CISA known exploited vulnerabilities catalog, available at the www.cisa.gov website. Researching vulnerabilities is an essential activity that must be initiated procedurally for risk mitigation. However, it can be a challenge for smaller and leaner organizations to perform, especially those operating under an “if it isn’t broke don’t fix it” approach.

Establishing cybersecure foundations

The consequences of cybersecurity failures in an OT context are many: downtime, waste, equipment damage, environmental incidents, and even compromised personnel safety. Industry does not have all the answers, and many end users are not staffed to implement esoteric new technologies.

However, foundational activities—such as auditing assets, establishing physical security, performing responsible network management, and researching vulnerabilities—are within the reach of almost any organization. Together, these activities will provide a basic level of defense and a foundation for additional cybersecurity provisions to be applied when possible. ▼

Tim Wheeler is the Cybersecurity Manager for Industrial Products at AutomationDirect. Tim is a veteran, with over 25 years of experience in the military and industrial sectors, specializing in automation, communication, and process optimization. He is skilled in developing and implementing streamlined solutions for complex systems.

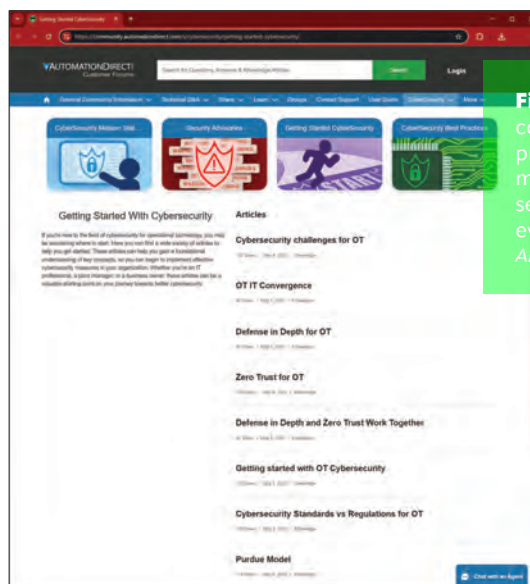


Figure 4: As part of a thorough commitment to providing cybersecure products, AutomationDirect maintains a website identifying known security advisories to help end users evaluate their installed systems. All figures courtesy of AutomationDirect

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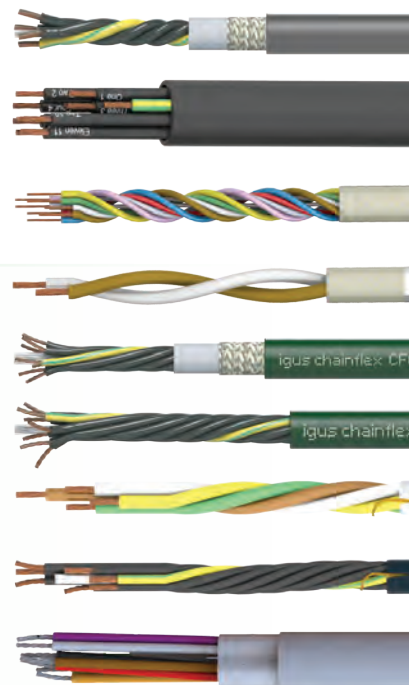


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Outfitting Your Panel Shop to be Safe and Efficient

BY ZACH GANSTER,
AUTOMATIONDIRECT

AutomationDirect has created an extensive portfolio of professional-grade control panel products, tools, and test equipment, all readily available at reasonable cost so that shops can equip their technicians to deliver high-quality results.

The “good/better/best” concept is familiar to most people. When it comes to obtaining anything we use in our daily lives, we need to make choices between necessity, performance, price, and even safety. For example, an inexpensive pair of shoes is good enough for walking around the block, but someone tackling a significant mountain hike is more focused on their boot’s grip, comfort, and support than they are on price. Similarly, a shade-tree mechanic may get by with a cheap good-enough tool for a one-off job, but a master auto technician will pay for durable high-

quality specialty tools they use all the time.

For companies operating an electrical and control panel fabrication and/or assembly shop, superior tools, test equipment, and supplies are essential for ensuring the work is performed correctly. These items are also critical for preserving the safety of those initially building the panels and those who will work in and around them in the future.

Begin with the basics

When a company first gets their panel-building capabilities off the ground, they may just have one or two techs fulfilling a variety of roles. Eventually, these shops may grow their staff to encompass several skill levels, similar to other trades. Beginners start off as apprentices, and as each grows in skill they will become a journeyman. Once they gain experience in most aspects of the work, they will become a master. While all levels will use basic hand tools, those with greater experience will use more advanced products and test equipment.

Simple hand tools

All worker levels will rely on basic hand tools like slotted, Phillips, and Torx screwdrivers, and nut drivers. Simple consumer-grade options will provide inferior results. Professional versions of these tools feature precision-ground and machined designs and heat-treating, which closely fit standard fasteners to reduce the chance of slipping out or stripping the fastener head (camout), or marring nearby hardware. Likewise, handles will provide a good ergonomic grip for comfort, even after extended periods of use, and safe torque transfer.

Figure 1: Electrical and control panel fabrication technicians use standard tools, but they also sometimes require specialized insulated versions.



More advanced workers will add insulated versions of these tools to their kit. The handles and shanks of these tools should feature a 1,000V insulation rating, necessary for those trained to work on live equipment, yet they should be slim enough to fit into recessed areas (Figure 1).

Depending on the work task, other specialty screwdriver versions—such as multi-bit, small precision, and heavy-duty chisel screwdrivers—may be needed. One other tool crucial for any control panel shop worker is a calibrated torque screwdriver, which is a much more advanced version of a simple screwdriver. It is required so that technicians can properly tighten wiring terminations in accordance with specifications to provide optimal connection integrity and electrical continuity.

There are many other types of basic hand tools (Figure 2a/b/c). Some examples are:

- Pliers: Long nose, tongue-and-groove, linesman, and many other configurations
- Terminal tools
- Bit drivers, standard bits, impact bits, and adapters
- Wrenches: adjustable, combination, ratcheting
- Ratchets and socket sets
- Hex keys: fold-out, L-type, T-handle, each in standard- and ball-end
- Hole cutting, knockouts, drill bits, and step drill bits

It can be tempting to pick up low-cost tools, but quality versions exist because of professional needs and demands for performance, durability, and safety.

Electrician tools

While some control panels may contain mechanical-only components, like hydraulics or pneumatics, most will have some kind of wiring. Wire cutters, wire strippers, and sheathing strippers are used many thousands of times by control panel workers to cut wire to length and then strip back the insulation and prepare the conductor for termination. Consumer-grade tools will simply not last in this service.

Expert wire tools will have hardened and sharpened cutting edges, with long-lasting profiles. Wire strippers will be carefully gauged to remove just the insulation without damaging any of the conductors. Workers will appreciate a range of models, with professional-grade options such as:



Figure 2a/b/c: Professional electrical and control panel fabrication staff require high-performance tools to safely perform top-quality work.

All figures courtesy of AutomationDirect and Agape Collaborations, Inc., a Georgia-based industrial automation control systems manufacturing and engineering company with a UL508A control panel shop, <https://www.agape-inc.com/manufacturing>



- Soft-touch, ergonomic designs requiring lower hand force
- Hardened and tempered steel
- Replaceable blades
- Sizes for common solid and stranded conductors, and multi-conductor cable jackets

As shop throughput increases, workers will appreciate more advanced automatic cutting/stripping tools, with an adjustable strip length (Figure 3a/b). This minimizes the time to prepare conductors and maximizes consistency.

Many wiring operations require fork, ring, spade, or ferrule connectors to be crimped onto the end of the bare conductor to provide a better mechanical connection with the receiving end. Basic crimping tools are a form of pliers, but most professionals will opt for ratcheting and self-adjusting wire crimping tools to ensure the proper force is applied to the crimp, with inherent leverage to minimize their effort.



One other installation product used heavily throughout control panels is the humble cable tie, available in a wide range of sizes and configurations. While a casual user may simply install these by hand, a professional will prefer a specific cable tie tool to perform this work. This tool will pull the tie to a proper tension and then cut it off cleanly to prevent leaving a sharp exposed edge. >>

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TECHNICAL BRIEFS

Almost every panel worker likely knows the pain of cutting themselves on a poorly trimmed cable tie, and the right tool will eliminate this hazard.

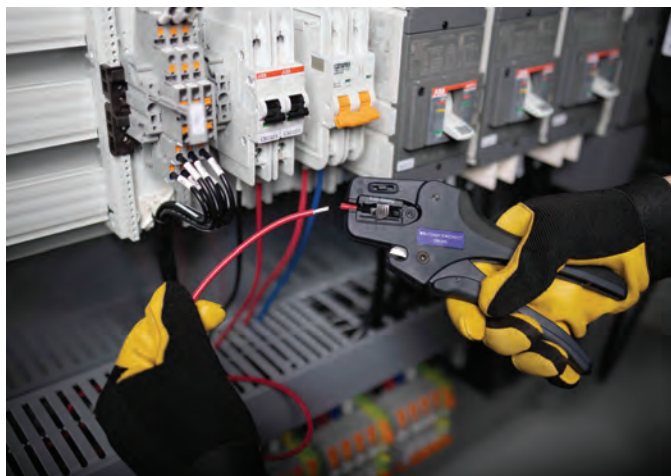
Quality tools are fundamental for a safe and efficient shop

The list goes on and on, but the theme repeats. Quality tools cost more but are designed for a hardworking lifetime of safe and effective use. Workers can accumulate these tools one at a time from trusted suppliers, or save by obtaining sets.

AutomationDirect's website and catalog contain an extensive range of professional-grade control panel tools and test equipment, so users can quickly obtain the high-quality items they need at a superior price/performance ratio than is possible from other sources. The AutomationDirect portfolio provides a head start for control panel shops, whether they are just entering the discipline, or if they are growing and better equipping their operation. ▼



Figure 3a/b: Specialty electrical tools such as wire strippers, sheathing strippers, crimpers, cable tie tensioners/cutters, and more help technicians speed up task execution, improve consistency, and lead to overall efficiency improvements.



Zach Ganster is the Product Engineer for Hand Tools Products at AutomationDirect. He has over 12 years of experience with control panel products, electrical safety products, and hand tools. He previously worked at a large industrial manufacturing company as a business development manager of electrical safety products. Zach holds a Mechanical Engineering degree from Southern Polytechnic State University and a Masters in Business Administration from Kennesaw State University.

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- 1-1/2" NPT process connection
- IP68 protection rating



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- **NEW!** Endress+Hauser hygienic pressure transmitters



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Efficiently Updating Pump Stations

BY RANDY AMES, AMES ELECTRICAL CONSULTING, INC.

Because industrial automation systems often remain in service for decades, selecting a hardware/software supplier and integration specialist familiar with performing incremental updates as needed is important.

Repair or replace: a conundrum familiar to owners of appliances, consumer electronics, cars, homes, and also industrial processing facilities. For a typical car owner, replacing a vehicle instead of repairing it is more a question of cost than risk. But for entities using industrial automation, the equation includes both cost and risk because existing equipment must be ripped out and superseded by something else, which involves downtime and the possibility that the new system won't work as well, or at all.

At Ames Electrical Consulting, Inc. in Greenfield MA, the team is familiar with designing and installing brand new automation systems, ripping and replacing legacy systems that are end-of-life, and updating existing systems that just need a few improvements. Depending on the situation, Ames brings this experience to help their clients in industries as varied as water/wastewater, nuclear power generation, food & beverage manufacturing, and also heavier manufacturing—such as rubber, steel, paper, and plastics.

When a smaller wastewater treatment facility realized that the pump controls for lift stations throughout their service area were using an older human-machine interface (HMI) product that was now obsolete and unavailable, Ames was engaged to help perform an update that preserved as much of the existing installations as possible, yet provided useful new functionality.

Staying afloat

Pump station controls are a common form of automation used throughout the industry. While there are some standardized and dedicated automation

controllers for this service, a great number of installations are operated using more flexible programmable logic controllers (PLCs), programmed as needed for each application to provide monitoring, control, and data communication. This is because there are countless variations for the mechanical equipment with regard to the number of pumps, speed controls, level sensing, wet well geometry, control strategy, and other factors, and many agencies prefer to standardize certain makes and models of products to address these needs.

Another reality is that these installations must typically remain dutifully in service for decades, and there is usually no call to upgrade unless there is a failure, additional capabilities (often in the form of improved data connectivity or

remote monitoring/control) are called for, or if the parts become obsolete.

The latter case represented the situation of a wastewater treatment facility in Connecticut. They had numerous pump station control panels using AutomationDirect DirectLOGIC DL205 series PLCs, with HMI capability delivered using AutomationDirect OptiMate OP-1500 operator panels (Figure 1). The PLC product family was first introduced over 30 years ago and sold by AutomationDirect (formerly PLCDirect) and is a little long in the tooth today, but these controllers still perform just as well as they had on day one and replacement parts remain readily available, so there has been no reason to touch this part of the automation system.



Figure 1: While this 2-line display/keypad provided just the right functionality when the pump station control panel was first installed, the technology had been superseded by modern touchscreen HMIs and was therefore due for a refresh.

For the HMIs, the original operator panels used a 2-line by 20-character monochrome display, a few LED indicators, and some basic number and entry buttons. While basic, this was just the right amount of functionality for the application when it was originally developed. However, these models were eventually retired with no direct replacement, as the industry transitioned to display-based touchscreens. Because the PLC controls were well-liked and remained supportable, the facility needed to find the best path forward to replace just the HMIs, while keeping the pumping operations afloat.

Keeping it simple

The Ames team was engaged to evaluate the situation, beginning with a survey of the typical physical installations and how the PLC and HMI code worked. Because Ames has been in business for over three decades and regularly performs this type of retrofit work, they maintain older laptops and software so they can work with any vintage of devices. In this case, a laptop with serial ports, running Windows 2000, facilitated looking into the older HMI.

It was quickly confirmed that there was a minimal-impact upgrade path to preserve existing functionality—and provide some additional capabilities—with low risk and quick implementation times by procuring and installing current-generation AutomationDirect C-more touchscreens. Physically, this would be an easy swap, just requiring a larger hole cutout and an adapter plate (Figure 2).

From a software standpoint, all the text messages were stored in the older HMI and displayed when they were triggered by the PLC. For the initial migration, messages would need to be replicated in the new touchscreen using a multi-state indicator (Figure 3). In addition, it was now easy to add other functionality, such as live water level readouts, and moving forward the facility has a platform that will support other enhancements.

Although Ames was already familiar with many AutomationDirect projects, this was their first project converting these specific older style HMIs to the current generation platform. Having the Optimate programming software available on their older laptop, Ames was able to install the customer's program and begin to reverse engineer the project. As expected, the AutomationDirect website and technical support provided an abundance of helpful information and made it easy to



Figure 2: A current-generation AutomationDirect C-more touchscreen HMI was readily retrofitted into the existing control panels, and it was easily configured to replicate the existing functionality and provide new capabilities.

select and order the new HMIs platform, the C-more touch panel.

Since the team had previously used the C-More HMI in many different applications, and the free development software had an intuitive interface, they were able to start the HMI configuration immediately. Along the way, they also used online help resources and videos to help them find and implement any needed functionality. The HMI was easily adaptable to this project to provide a similar look and feel to the original obsolete HMI, including maintaining the exact wording for the alarms and notifications, as well as the same locations for the original buttons and indicators. This resulted in minimal training needed for the facility operators, allowing them to quickly gain comfort with the new HMI.

The team was able to pre-test the configuration in their office, and then deploy it to the first pump station in coordination with the wastewater facility, to avoid outages. With the first migration installed and operational with a flawless cutover record, the facility is expecting to upgrade the remaining 18 pump stations as soon as possible.

Trusted support makes the difference

Just as Ames provides reliable support services to their clients, the design team has found over the years that AutomationDirect is a trusted and reliable hardware and software supplier. Some of Ames's clients specify what products must be used for projects, but in cases where AutomationDirect is not specified and there is flexibility, the team relies on AutomationDirect as a key supplier, in part because they know that support is available, free, and helpful, which is not true with some other product lines. ▼

Randy Ames is the founder and president of Ames Electrical Consulting, Inc. in Greenfield, MA. Mr. Ames has an Electrical Engineering degree from Wentworth Institute of Technology and is a Licensed Master and Journeyman Electrician in MA, VT, and NH. Ames Electrical has assisted large and small customers around the globe and continues to solve problems with all sorts of machinery and equipment, by servicing, designing, and building custom electrical industrial control systems. You can find them on the web at www.ameselectrical.com

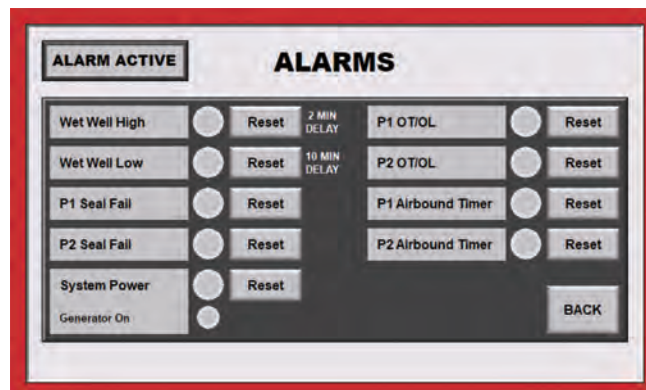


Figure 3: Using a modern HMI platform, the wastewater facility is positioned to keep their systems in operation for many more years, and they now have the flexibility to add expanded capabilities when the time is right. All photos courtesy of Ames Electrical Consulting, Inc.



Block Open Core Control Transformers

AutomationDirect has added BLOCK CT and USTE series open core control transformers to provide a flexible solution for stepping down a wide range of voltages from 208 to 600 VAC.

The BLOCK CT series is made in the USA and offers a rugged design specifically engineered for isolation, lighting, or signaling systems. It is available with a 240/480 or 600 VAC primary and a 24 or 120 VAC secondary. Ratings range from 50 to 2500 VA, providing a cost-effective solution to guarantee uninterrupted power delivery in various applications. Fused versions are available.

The BLOCK USTE series provides a versatile solution for a wide range of input voltages, allowing OEMs and system integrators to save time and reduce costs by standardizing on a single model. Available in ratings from 40 to 3200 VA, they feature low inrush current, tool-free push-in wire terminals, and thirteen jumper selectable primary inputs from 208 to 600 VAC. In addition, the 12/24 VAC models comply with safety standards to ensure a safe power supply for SELV (Safety Extra Low Voltage) circuits.

The new BLOCK open core control transformers are RoHS compliant, CE marked, and come with a 3-year warranty. The CT series is UL Recognized and starts at \$53.00, while the USTE series is UL Listed and starts at \$64.00.

Learn more by visiting:

<https://www.automationdirect.com/open-core-transformer>



Captron Caneo Series Capacitive Pushbuttons

AutomationDirect has added more Captron capacitive pushbuttons that utilize touch control and are activated without pressure when a hand or body part nears the device's surface. They feature a robust IP69K design, wear-free operation, resistance to water, oil, and harsh environments, and are available in various mounting/operator sizes.

Caneo Series10 additions include more standard and stainless-steel hygienic models with static or dynamic switch types and blank, power symbol, or RESET legends. They are available in automatic or semi-automatic LED control modes and provide a convenient 7.87in. (200mm) pigtail connection for quick installation.

New Caneo Series41 solid display capacitive switches combine a flange-mount capacitive switch with a sturdy aluminum terminal base that can withstand the harshest of environments. These switches feature an ergonomic design for ease of use and a robust construction for long-lasting, reliable performance. They combine status, control signal, and 7-segment display into one compact device.

New Caneo Series40 puck-style standard and display type capacitive switches offer the same reliable performance as the Series41 in a compact, encapsulated polycarbonate housing. Their standard 22mm mounting provides a low-cost solution to quickly and easily retrofit and modernize aging installations.

The new Captron Caneo series capacitive pushbuttons start at \$59.00, are CSA approved, CE marked, RoHS compliant, and come with a 5-year warranty.

Learn more by visiting:

<https://www.automationdirect.com/capacitive-switches>



Dold VARIMETER Series Voltage and Phase Monitoring Relays

AutomationDirect has added Dold VARIMETER series voltage and phase monitoring relays to safeguard electrical equipment and prevent costly downtime by evaluating voltage levels and phase sequences. These relays provide early detection and response to abnormalities such as undervoltage, overvoltage, phase loss, phase reversal, and phase imbalance. The VARIMETER series monitoring relays feature wide voltage measuring ranges, compact frame sizes, and integrated terminal bases.

The new Dold voltage monitoring relays are available in measuring ranges up to 250 VDC or 300 VAC. They continuously monitor voltage levels and respond when the voltages exceed or fall below a predetermined threshold. Four single-turn switches offer quick and easy configuration for a broad range of applications.

VARIMETER series phase monitoring relays detect phase unbalance, phase reversal, phase loss, and missing or broken neutrals in three-phase AC systems up to 525 VAC. Select models offer advanced phase loss protection, while others provide overvoltage, undervoltage, voltage range, and missing neutral monitoring options for single- or three-phase applications. Simple single-turn switches allow quick and easy configuration without a complex menu structure.

The new Dold VARIMETER series phase and voltage monitoring relays are UL listed, CE marked, and RoHS compliant. They offer a 1-year warranty and start at \$110.

Learn more by visiting:

<https://www.automationdirect.com/relays>



New Option Slot and Stackable I/O Modules for the CLICK PLC Family

AutomationDirect has added new specialty modules for the CLICK PLC family. CLICK PLUS CPUs offer the utmost versatility with up to two option slots for custom I/O configurations. These option slots also allow for specialty modules, including the C2-DCM serial communication module and the new C2-NRED and C2-OPCUA modules.

The C2-NRED module provides an industrial interface to the most popular open-source software tool for developing IIoT applications, Node-RED®. With low-code Node-RED programming, you can easily facilitate interactions between the CLICK PLUS CPU and upper-level IT/business systems. This intelligent module utilizes its own processor, ensuring the main CPU remains unburdened but has direct access to the memory of the PLC and all the data needed. The C2-NRED also supports custom JavaScript programming, extending the CLICK PLUS platform's functionality even further.

OPC UA® (Open Platform Communications Unified Architecture) is a long-standing communication protocol used throughout industry and provides a standardized way for industrial systems, regardless of manufacturer, to communicate and share data. The C2-OPCUA module, when added to a CLICK PLUS CPU, allows the simplicity and reliability of CLICK PLCs to be deployed in many more applications that support this protocol.

Also now available is the C2-14TTL option slot module, which supports up to 14 low-voltage (~5VDC) high-speed motion control signals. TTL I/O has a much faster response time than standard I/O and provides a long service life due to solid-state switching.

For both the CLICK PLUS and standard CLICK PLCs, a new 4-channel 12-bit analog simulator (CO-04POT) is available. This



Schmersal Configurable Safety Relays

AutomationDirect has added configurable and programmable safety relays from Schmersal. Many safety systems require more than one specialty safety relay but do not justify the need for a safety controller. Schmersal PROTECT SRB-E configurable relays are easy to set up and reduce the number of safety relays required for a machine or system. These relays include up to 10 safety inputs and up to 5 safety outputs, support up to 16 different applications, and can monitor all conventional safety devices.

Schmersal PROTECT SELECT programmable relays can replace up to 8 safety relays, have a simple multilingual menu on a color display, and report error and status messages. Programmable relays require no prior programming experience and offer up to 4 pre-configured safety monitoring programs to choose from.

The new Schmersal configurable safety relays provide a safety level up to PL e/SIL 3, offer a 1-year warranty, and start at \$171.00.

Learn more by visiting: <https://www.automationdirect.com/safety-configurable-relays>

stackable I/O module connects to the side of the CPU and provides four potentiometers that can be used to simulate an analog device for testing or manual control.

The new CLICK PLUS option slot modules start at \$65.00 for the C2-14TTL output module, \$195.00 for the C2-OPCUA module, and \$235.00 for the C2-NRED module. The stackable analog simulator for CLICK and CLICK PLUS is only \$68.00. All modules come with a 2-year warranty and a 45-day money-back guarantee.

Learn more by visiting: <https://www.automationdirect.com/programmable-controllers>



Ever Motion Solutions Titanio Series Stepper Drives

AutomationDirect has added the new Titanio series of stepper drives from Ever Motion Solutions®. These drives offer peak performance, a rich feature set, and work seamlessly with AutomationDirect SureStep® stepper motors. Three new drives are available with two open-loop (no encoder feedback) models and one open/closed-loop version (a motor-mounted encoder provides position feedback to the drive). Unlike typical stepper drives, Titanio steppers can detect stalls in open-loop control mode by monitoring the motor's back EMF. This allows system designers to take advantage of stall detection without the hassle and expense of a closed-loop system.

Among other advanced features, the Titanio drives use sinusoidal current control to provide extremely smooth motor movement, with reduced audible noise, significant dampening of vibration and resonances, higher system efficiency (less heat) and increased and more consistent torque output at all speeds.

The LW3A model is a high-bus-voltage unit that accepts 100-240 VAC power input and is compatible with all STP-MTRACx series high-bus-voltage stepper motors.

While basic DIP-switch setup is possible for all models, the optional Ever Studio configuration software (a free download) allows advanced configuration of the LW3A and LW4D stepper drives, including the setup of additional microstepping resolutions. It even allows jogging/indexing and a built-in oscilloscope for tuning and debugging the LW4D.

The new Ever Motion Solutions stepper drives start at \$105.00.

Learn more by visiting: <https://www.automationdirect.com/step-per-drives>

NEW PRODUCTS



WEG CFW320 AC VFDs and SSW900 Soft Starters

AutomationDirect has added general-purpose WEG CFW320 AC drives and full-featured SSW900 soft starters. The CFW320 series VFDs offer all the features of the existing CFW300, including a compact size, a built-in operator interface (HMI), and an embedded SoftPLC, but provide support for 460 VAC and Ethernet communications. These drives support 230 VAC 3-phase motors up to 5hp and 460 VAC motors up to 10hp. Dynamic braking is built in on many models, so no external braking chopper is required. The optional Ethernet module communicates over EtherNet/IP and Modbus TCP.

The new SSW900 soft starters offer motor support up to 950A and a voltage range of 220-575 VAC. These soft starters feature an advanced setup with parameter help and event history on the included HMI. Software setup is optional using free WPS software and the same software is used for all WEG drives and soft starters. Ethernet communication is optional on the SSW900.

All WEG AC drives, soft starters, and accessories come with a 1-year warranty. WEG CFW320 drives start at \$165.00 and the SSW900 soft starters start at \$860.00.

Learn more by visiting:

<https://www.automationdirect.com/drives>



Lika Electronic Medium Duty Encoders and Encoder Linear Measuring Wheel Systems

AutomationDirect has added four new series of Lika Electronic rotary encoders each with unique features or applications. Linear measuring wheel encoders are also now available.

The new A41 series are compact (41mm diameter body) medium duty encoders with hollow or solid shafts and resolutions from 100 to 3600 PPR. A50 series units are medium duty encoders designed to withstand high temperature environments up to 100°C/212°F with ¼ inch or 3/8 inch hollow shafts, in resolutions from 360 up to 2048 PPR. A80 series medium duty encoders are designed to fit large AC motors, with a 30mm hollow shaft and 1024 PPR resolution. The AQ5x series medium duty encoders have a programmable resolution from 1 to 16,384 PPR, a 58 mm or 59 mm body diameter, and either a 3/8 inch solid shaft or a 15mm hollow shaft. Reducer bushings are available with select encoders to accommodate metric or SAE shafts.

All Lika Electronic encoders operate at 5-30VDC and have universal output circuitry that provides push-pull (totem pole), NPN/PNP open collector (HTL), or line driver (TTL) output signals. A selection of M12 and M23 cables are available for connectorized encoders.

Also included is the new AR01 series encoder linear measuring systems are designed to ride directly on a product or a conveyor belt to measure length, distance, or provide speed control feedback. They are often used for cut-to-length and positioning applications.

The A41 series models are priced at \$92 (A41S-0200-HZCP6-AL2). The encoder linear measuring systems are priced at \$299 (AR01-0250-HM12-A). A complete line of accessories, cables, bushings, couplings and replacement parts is also available.



Gladiator GPB1 and GPB2 Enclosed Style Terminal Blocks

AutomationDirect has added Gladiator GPB1 and GPB2 series enclosed-style terminal blocks to provide a safe and reliable way to connect multiple electrical circuits to a single power source.

The GPB1 series terminal blocks are ultra-compact, offering time-saving multiple wire connection options for a variety of control panel applications. Push-in spring connections save installation time by locking the screwdriver into place for virtually hands-free wiring. GPB1 series terminal blocks are offered in ampere ratings up to 130 Amps and voltage ratings up to 1000 VAC / 1500 VDC (suitable for solar applications). They provide an IP20 finger-safe protection rating and a 100kA SCCR with proper fusing.

The GPB2 series terminal blocks feature a space-saving modular design and an innovative interlocking system for easy multi-pole assembly. They offer a 100kA SCCR rating with proper fusing and are available in ampere ratings up to 510 Amps and voltage ratings up to 1000 VAC / 1500 VDC (suitable for solar applications). The blocks can be reversed to group multiple inputs into a single output. Covers can be opened in two directions; pre-printed markers provide fast and easy identification.

The new Gladiator enclosed-style terminal blocks and busbars are UL recognized, CE approved, and RoHS compliant. They come with a 1-year warranty and start at \$11.25.

Learn more by visiting:

<https://www.automationdirect.com/power-blocks>

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Timothy in FORT WORTH, TX

"AutomationDirect is always one of the first suppliers I look to for electronic/automation needs. The prices can't be beat and the selection is incredible. Very glad I discovered them."

Nathan in TWINSBURG, OH

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Teknokol ECO Series HMI Enclosures and Suspension Arm Systems
HMI enclosures starting at \$349.00

Versatile Teknokol ECO HMI enclosures provide supreme protection for HMI panels. Modular HMI enclosure suspension arm systems enhance your HMI installation by allowing operators to easily adjust the HMI enclosure's position.

- Enclosure sides are made from extruded anodized aluminum with cast aluminum and plastic corners
- Removable front panels allow for easy HMI installation and access
- ECO1290 and ECO1590 enclosures open clamshell style via two double bit 1/4-turns for easy access to equipment without removing an exterior panel
- ECO1500 enclosures open from the rear with two double bit 1/4-turns
- HMI enclosure accessories such as handles also available

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