

# Automation NOTEBOOK

Your guide to practical products, technologies and applications

From  AUTOMATIONDIRECT.com

Low-code tools such as  
Node-RED are reshaping the industry  
and fulfilling the promise of IIoT.

Student Spotlight: Cultivating Curiosity with Automated Edu-tainment PG. 4

Feature Story: Six Tips to Help You Build a Better, Safer Machine PG. 8

Tech Brief: Industrial Strength Identification is Essential for Manufacturing PG. 20

New Products: The Latest In Industrial Control PG. 30

February 2025

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## Easy, Educational, and Entertaining Automation



*Stephanie Neil*

**Stephanie Neil**  
VP, Editorial Director  
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**A**t AutomationDirect, the goal is to educate customers on the best industrial products for their applications. The mission is also about making industrial control easy — and sometimes even entertaining. In this issue of **NOTEBOOK**, we demonstrate how AutomationDirect delivers on these important objectives.

Here, we focus on modern PLC programming methods. Specifically, the transformative power of no code/low code and open-source platforms that are enabling more integration and innovation. Using visual interfaces and drag-and-drop programming to reduce coding requirements, these platforms can extend the reach of the controller to integrate Internet of Things (IoT) and other application programming interfaces (APIs). The simplicity of the interface enables non-programmers to participate without having to learn an advanced programming language.

AutomationDirect is supporting the low-code and no-code programming movement with its CLICK PLUS PLC and the C2-NRED intelligent option module enabled. Flip to page 17 to learn more.

Another benefit of modern PLCs is the accessibility to industrial data. As more manufacturers depend on data to improve quality control, equipment uptime, and operational responsiveness, they are finding ways to extract, aggregate, and analyze data. Find out how to mine this digital gold in the tech brief Unshackling Industrial Data Access on page 24.

And do you know how manufacturers get all that digital data?

Sensors. These little collection points are constantly capturing information on position, speed, proximity, etc. Choosing the right sensor for the job, however, can be overwhelming. We're making it easy for you. Turn to page 12 for a light lesson on how to select the right sensor for your environment.

Now for the entertainment! We all know it's hard to get young people interested in engineering when we are competing with social media content creators. But add some animatronics and special effects into the mix and the dynamic changes.

The team at Heemer Crafted is rooted in the "edu-tainment" industry by applying industrial automation to create interactive attractions that can be used across a variety of industries. In the article on page 4, Heemer Crafted founder Justin Hiemstra explains how AutomationDirect delivered the technologies needed to create interactive attractions in an agri-tourism environment. This is an interesting success story that is sure to make you smile!

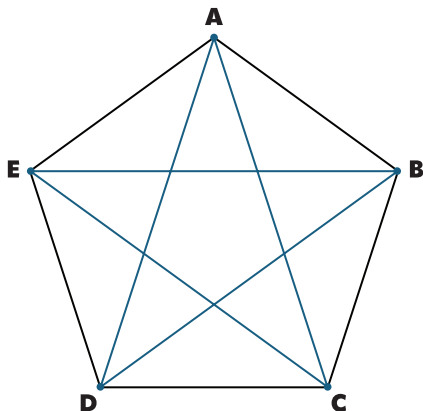
Speaking of success stories, Mel-O-Cream Donuts International is incorporating automation into its operations to ensure product consistency and improve process efficiency. Find out how this 90-year-old company is baking in HMI, sensors, stack lights, and more to perfect the art of donut making.

Of course, there's so much more to explore in the pages of **NOTEBOOK**. Take a read and then pass the issue onto your colleagues to share the education and entertainment! ▼

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# AutomationDirect BRAINTEASERS

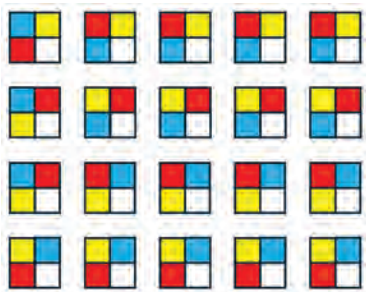


## Coupling Shuffling

The puzzle factory engineer has labeled 10 couplings with numbers from 0-9 and arranged the couplings in a pyramid such that the totals of the numbers on each side of the pyramid add up to 16. What is the smallest sum (on all sides) that can be achieved by rearranging the couplings? You might note that the coupling in the center is not used in any of the sums.

## Application Complication

The programmer for the gasket applicator robot at the puzzle factory noticed that there were a number of different tool paths that could be used to program the gasket path required for a new mechanical puzzle. The complete pattern is shown above. He must apply the gasket in a continuous bead along all the lines shown, but he can only change direction at the outer points (labeled A-E) with no interior turns. And all tool paths must begin (and end) at the point labeled A. How many possible paths are there?



## Tile Style

Can you arrange any 16 of the following tiles into a square such that like colors (of all the tiles) are touching on all sides? You can choose any of the 16, and you may rotate the tiles as needed.

Find these answers and more @  
[library.automationdirect.com/  
brain-teasers-answers](http://library.automationdirect.com/brain-teasers-answers)

*Did you know... that AutomationDirect sells a wide range of shaft couplings, and bore reducers? With coupling styles such as jaw (hub and spider), Oldham, double loop, servo beam, and servo high gain varieties, we have the coupling you need for reliable power transmission (with little or no backlash) and to compensate for shaft misalignment. <https://go2adc.com/couplings>*

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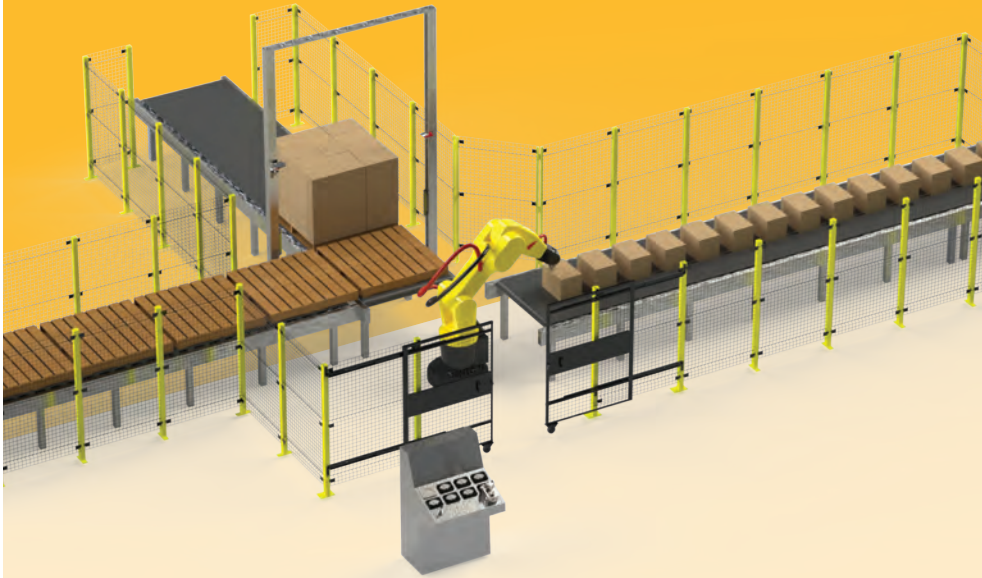
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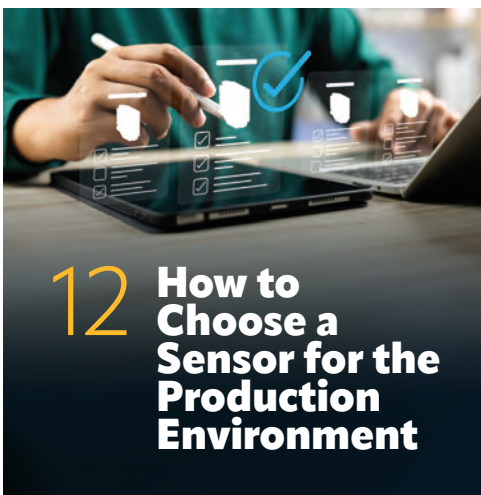
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**The Aeroballs game** makes physics fun, as guests experiment with how foam balls react in air streams.



## Cultivating Curiosity with Automated Edu-tainment

Crafting agricultural education experiences that are also fun is a specialty requiring a mix of creativity and technology.

**BY JUSTIN HIEMSTRA,  
HEEMER CRAFTED**

**C**apturing the interest of a young person today can be a tough task, especially considering the proliferation of mobile devices and the obsession with screen time. However, there are still important opportunities available to engage the next generation in topics as widespread as science, technology, art, and even agriculture.

The team at Heemer Crafted, located about two hours drive west of Toronto, has succeeded in this arena by applying a variety of industrial automation technologies to create tactile and interactive attractions and props. Farm owners are using these technology platforms to educate people in an entertaining way, while withstanding the rigors of enthusiastic interactions from attendees.

With a background in mechanical engineering technology, my early work experiences were at an industrial systems integrator (SI) firm creating automation solutions for a variety of industries, including mining, food & beverage, pharmaceutical, batch processing, and more. With a solid basis in designing, developing, and commissioning programmable logic controller (PLC)





and human-machine interface (HMI) automation systems, I was ready when a new opportunity presented itself.

### Encouraging agri-tourism

My great-grandfather was a beekeeper, and to this day other family and friends are also in the farming and agriculture business. Although these operations are fundamentally about what is grown and produced, an important aspect for many organizations in this space is to entice guests to visit their physical sites. This agricultural tourism (agri-tourism) is a great way to connect with the community, provide some insight into the agriculture business, and increase revenue.

To make this successful, agriculture organizations need an attraction with kid-friendly exhibitions to turn their site into an adventure farm with tactile and interactive educational entertainment (edu-tainment) activities that encourage exploring. Anyone who has visited a contemporary museum will be familiar

with what these displays look like, and how they encourage engagement and learning in an entertaining manner.

While farmers are generally known as resourceful and hands-on in many ways, their need to develop interactive attractions provided an ideal business opportunity, so I founded Heemer Crafted and got to work!

### Technology for planting the seeds of learning

The products and design principles essential for industrial automation are also very effective when applied to showmanship. One key to success at Heemer is the ability to select and implement the right technologies to pull off an entertaining user experience. We develop the attraction concept, pursue the best fabrication approach (which can include machining, welding, and other mechanical aspects), and then integrate the required electrical and controls technologies.

One of our earliest attractions is much like a large size see-and-sound board. It is called “Farm Sounds” (Figure 1), and guests can push a button to select one of three play modes. The first mode lets the guests press a button near the picture of an animal to hear the sound it makes. The second mode is a trivia game where guests are given some facts about a particular farm animal, and they match the animal to the facts. The third mode is like the game “Simon”, where the board creates a series of farm animal sounds and guests try to repeat the sequence. If the guest succeeds, then the series gets progressively longer and more complex.

This functionality required implementing several technologies, and based on our familiarity and past success with the wide range of AutomationDirect products, our first stop is always to their website to find almost everything we need. In this case, the guest-facing elements are Captron capacitive pushbutton switches, which have no moving parts, so they are exceptionally durable—which is a great feature when countless kids are excitedly operating them. Each button features an LED light which operates when it is pushed, or when a controller operates it. This provides many options to improve user interactions and guide activity.

Behind the scenes, our go-to controller for monitoring signals and commanding outputs and animatronics is an AutomationDirect CLICK PLUS stackable micro modular PLC. This platform offers a multitude of useful capabilities, including easy programming using free software. Depending on the options selected, nearly any kind of input/output (I/O) signal can be accommodated, while built-in wired Ethernet and available Wi-Fi provide convenient connectivity. Wi-Fi is especially important for farm locations because they usually don't have wired infrastructure, and they often cover large areas. Serial communications are available for specialty applications, such as communicating with some sound amplifier boards. >>



**Figure 1:** AutomationDirect Captron capacitive pushbutton switches are tough enough to withstand the farm environment, and also kids.



**(LEFT) Figure 2:** With a wide range of I/O, wired Ethernet and Wi-Fi, and compact form factors, AutomationDirect PLCs are ideal for use in space-constrained and challenging applications.



**(RIGHT) Figure 3:** The AutomationDirect ProductivityOpen Arduino-compatible controller made it possible for Heemer to create an application using both proven I/O modules, and a custom-developed MIDI sound interface.

The “Farm Sounds” attraction is fairly straightforward, and the compact form factor of AutomationDirect products allowed us to design and build a small control panel (Figure 2). By monitoring discrete inputs to detect button pushes by guests, the PLC logic operates discrete outputs to command an MP3 sound player to create the appropriate sound.

Although there are many types of audio and show controllers used throughout the entertainment industry, most only perform very specific and specialized tasks. AutomationDirect PLCs are much more capable and flexible, providing the connectivity and programming needed to interface with these dedicated controllers so that the right effects can be created and integrated into the overall functionality.

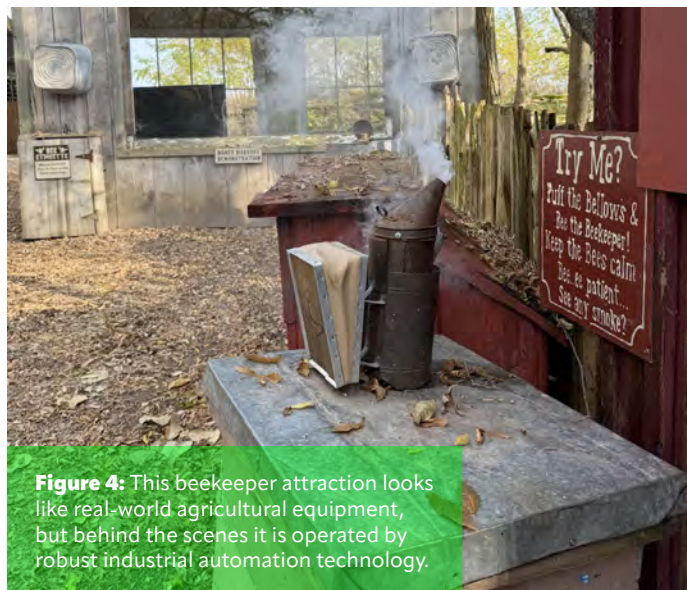
### Cultivating more entertainment possibilities

As Heemer has worked on more of these projects, the level of complexity and sophistication continues to increase. For one attraction, we needed to play multiple sound effect noises concurrently. To achieve this, we were an early adopter of the AutomationDirect ProductivityOpen, which is an industrialized Arduino-compatible controller able to work with industrial-grade PLC modules. Of special note, this controller can also work with Arduino “shield” modules for providing other advanced functionality.

In our case, this capability was essential because we used the ProductivityOpen PIAM-PROTO prototyping shield, which allowed us to create a two-port musical instrument digital interface (MIDI) connection for operating a synthesizer as needed. MIDI allows multiple sounds to be played concurrently (polyphony), which is not possible with many other interface types.

In another activity, guests operate a bellows to create smoke—generated by a fog machine—similar to what beekeepers use to keep the bees calm (Figure 4).

Behind the scenes, a CLICK PLUS PLC monitors the bellows movement and triggers operation of a commercial fog machine. The PLC even controls a stepper motor damper valve which helps to create the realistic puffs of smoke. The PLC also commands a pump as needed to refill a small local day tank from a larger remote supply tank. An AutomationDirect float switch monitors the tank level, so the PLC can email a message to the farm staff when more of the fog-making solution is needed, or send an alarm if the pump runs unexpectedly long which indicates a failure.



**Figure 4:** This beekeeper attraction looks like real-world agricultural equipment, but behind the scenes it is operated by robust industrial automation technology.





**Figure 6a and 6b:** The Amazing Roundup game challenges guests to race each other through a maze and find the designated animals, and it provides split times. You can imagine how hard kids probably punch the “Roundup Pig” button!

*All photos courtesy of Heemer Crafted*

The “Aeroballs” game encourages guests to experiment with how different sizes of foam balls can rise, fall, or float on varying air streams coming from pipes, demonstrating Bernoulli’s principle (Figure 5: Lead Feature Image). Two Captron buttons, and other AutomationDirect-sourced components—such as an enclosure, timing relay, terminal blocks, and M8 connection cables—are used to control a single blower directing air to all eight pipe nozzles concurrently.

AutomationDirect products have played a crucial role in realizing our ever-more-complicated attractions. The Amazing Round-up game features a main display board which prompts two competitors to find a designated animal out in a maze (Figure 6a, 6b). They push the button when they find the animal, and their split times are displayed on an overhead ViewMarq message display.

#### Happy as a pig in slop

Because our clients do not typically have the means to troubleshoot these systems, they appreciate the proven-in-operation reliability of the automation platforms and components. We also take advantage of remote connectivity—built into the

controllers—so we can support our client if needed, usually without having to travel to the site.

AutomationDirect’s website provides a truly one-stop-shopping experience. We can evaluate pricing and availability at a glance, which helps inform us of the best ways to proceed. There have been just a few instances where we needed some live technical support, either via chat or a conversation, and both types of interactions were responsive and top-notch.

Creating these engaging agri-tourism and edu-tainment props has required a careful combination of creativity, showmanship, craftsmanship, and technology. Throughout the process, AutomationDirect products and personnel have proven to be dependable partners in helping Heemer develop innovative attractions. ▼

*Justin Hiemstra, founder and dedicated employee of Heemer Crafted, combines his expertise in engineering and design to create innovative, engaging, and entertaining attractions in the agritourism sector. Leveraging an educational background in mechanical engineering technology, with a specialized focus in robotics and automation, Justin has built his career focused on blending industrial technology with creative problem-solving. Justin left his previous role at a systems integration firm to further pursue his passion for creating designs supporting the creativity, learning, and exploration of the next generation.*

# 6 TIPS TO HELP YOU BUILD A BETTER SAFER MACHINE



At its most basic, a safety system consists of:

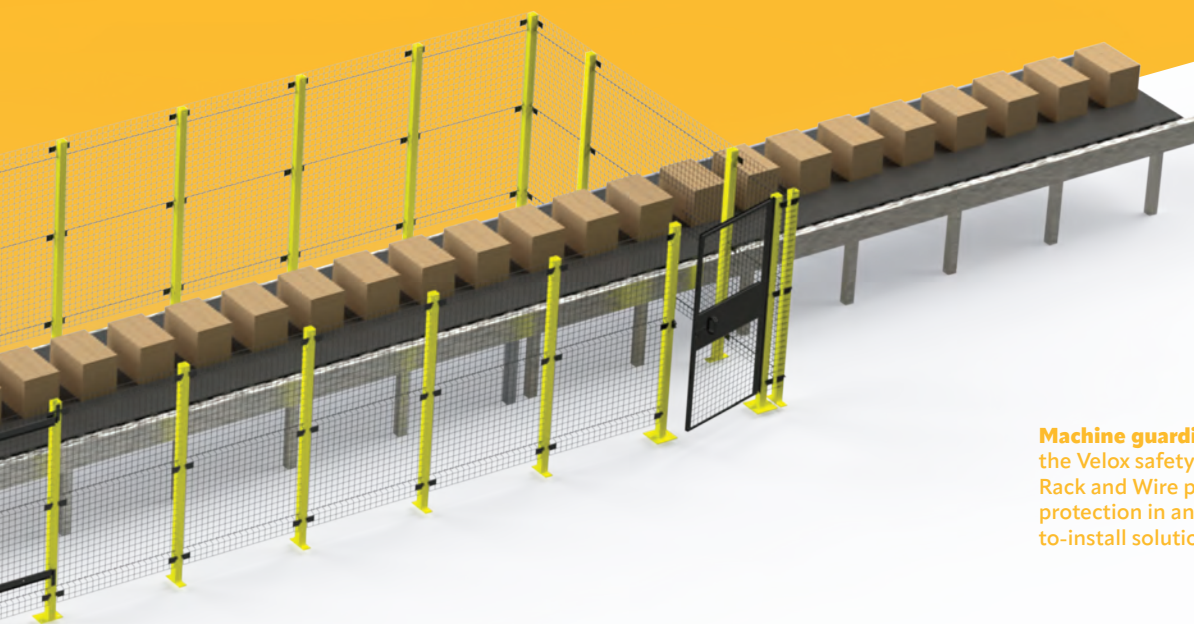
1. Input – sensors that detect hazardous conditions, such as personnel entering restricted zones (e.g., safety switches, light curtains, mats, edges, etc., as well as E-stop buttons or cable pulls)
2. Logic – devices that monitor safety input and control safety outputs (e.g., safety relays, safety PLCs, etc.)
3. Output – devices to bring the machine to a known safe state by controlling hazardous motion (e.g., safety contactors, variable-frequency drives (VFDs) with safe torque off, etc.)

**S**afety is an essential aspect of machine design and operation, protecting personnel, guarding against equipment damage, and maximizing productivity. The purpose of a safety system is to bring a machine to a known safe state as quickly as possible after a safety sensor detects a hazardous condition or a member of staff presses the emergency stop.



# TER,

BY JOSHUA DRAA AND  
LARRY REYNOLDS,  
AUTOMATIONDIRECT



**Machine guarding systems** like the Velox safety system by Husky Rack and Wire provide effective protection in an economical, easy-to-install solution.

A wide variety of machine safety technologies exists, from simple barriers to highly sophisticated zone safety implementations (see image above). More expensive or complex isn't necessarily better, however. The ideal safety system is one that addresses the needs of the machine and the application to ensure safety without adding unnecessary complexity and cost. Here, we review our top tips for building a safe system.

#### **Tip #1: Start with a risk assessment**

Safety should not be considered a separate subsystem layered on top of the machine design as an afterthought. Instead, it should be integrated from the very beginning of design, starting with a risk assessment. The key steps to a risk assessment are:

1. Assembling a cross disciplinary team – design/engineering, equipment function, operations, maintenance, etc. This ensures that no one silo can dominate the conversation.
2. Identifying risks, the frequency/duration of worker exposure to those risks, and the possible negative outcomes. Operators are not the only individuals to consider. The risk assessment should take into account any interaction with the machine, whether for cleaning, maintenance, monitoring, or simply passing by.

The primary standards for safety design and risk assessment include ANSI B11.0, ANSI B11:19, and ANSI/RIA R15.06, or ISO 12100, and ISO 13849. Don't forget to

consider application-specific standards and location-specific requirements.

#### **Tip #2: Reduce risk through a multilayered safety approach**

Once you identify risks, create a strategy for reducing them. Start by eliminating hazards where possible. If this can't be done, try to modify the design to reduce the level of risk. If a moving part needs to be inspected regularly but accessed only infrequently, for example, change from a door to a transparent window that can only be removed with tools. Note that risk elimination/substitution is easier and less disruptive when performed at the start of a design. This is another benefit of performing risk assessment and mitigation early on. >>



**A cable pull interlock**, like the GLHL-141035 IDEM safety switch from AutomationDirect, is a simple and fast user-operated emergency stop.

If a risk can't be eliminated or substituted, reduce risk using a combination of safety solutions. Safety light curtains or safety laser scanners (see image below), for example, are useful for detecting when personnel have moved into a restricted area, but they can't protect them from objects flying out of the machine. A safety door can prevent objects from exiting the machine, but it needs a sensor to invoke it. A safety mat can detect personnel in an unsafe position. A safety controller can put the machine in a known safe state by sending the command to close the safety door, but what if an operator's hand is in the way? A safety edge can detect a pinch hazard and provide the sensory input into the system to safely stop the motion.

This is the type of layered safety system that a risk assessment makes possible.



**A safety laser scanner** like this one from Datalogic enables users to establish different zones of safety to detect when personnel are entering hazardous areas.

### Tip #3: Don't assume removing energy sources guarantees a known safe state

A common technique for reducing risk presented by a moving actuator, motor, or similar device is to remove energy from it. Although this is a useful technique, it's not necessarily sufficient to achieve our goal of driving the system to a known safe state. A de-energized motor freewheeling to a stop can still present a hazard – active braking may be necessary. Removing compressed air from a pneumatic cylinder could cause an elevated load or tooling to fall, potentially injuring personnel or damaging equipment. Certain types of equipment require more sophisticated approaches.

IEC 60204-1 or NFPA 70 define three stop categories that can be used to better manage risk:

- Category 0: An uncontrolled stop initiated by immediately removing power to the device.
- Category 1: A controlled stop accomplished by active braking using available power, then removing power once the device is at rest.
- Category 2: A controlled stop, after which the actuator remains energized but stationary.

Bringing a moving piece of equipment to a safe state may require a Category 1 or Category 2 stop.

During the mitigation process, be sure to perform the crucial step of comparing your mitigation plan to the risk assessment, and ask yourself these questions: Is the risk level now at an acceptable level, and did we create a new hazard by mitigating the previous hazard?

### Tip #4: Safety doesn't have to be complicated or expensive

It's an engineering truism that there is no one perfect solution, only the best choice for the project at hand. In the risk reduction

phase of your risk assessment, consider the simplest, most robust solution that will ensure the level of protection required.

Your safety system can be as simple as a non-contact door switch, wired in series with an E-stop to a safety relay that controls a safety contactor. Or, you can use a zone safety approach, in which specific safety devices are assigned to one or more zones, with each output device functioning as an independent zone. Zone safety improves both risk reduction and productivity with a more granular application of safety principles. The trade-off is cost and complexity.

### Tip #5: Choose a solution designed to resist defeat

For as long as safety equipment has existed, personnel have developed tricks for defeating it. The rationale is that defeating safety measures is harmless, that it will only be in place "for a minute." The reality is that defeating safety measures can lead to downtime, injury, or worse. Unsuspecting personnel can be exposed to hazards when the duct tape or zip tie or coin used to defeat the system is accidentally left in place.

Look for non-defeatable solutions like RFID safety switches that prevent restart of equipment until the barrier keeping personnel out of the hazardous area has been closed. Even mechanical housings can be used to prevent tampering. The key is to think in terms of preventing defeat.

### Tip #6: Repeat the risk assessment once the machine is on site

Risk assessment responsibility doesn't end once the machine is built. New risks may emerge after it is installed at the facility. The machine may be placed in proximity to another piece of equipment. Operating procedures may change. The risk assessment should always be repeated before start of operations, and revisited throughout the lifespan of the machine to make sure all hazards are documented.

Please note that after all the mitigation steps are implemented the task of validation must be exercised. This is done by following an appropriate standard such as ISO 13849-2 or similar standard. ▼

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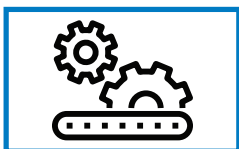
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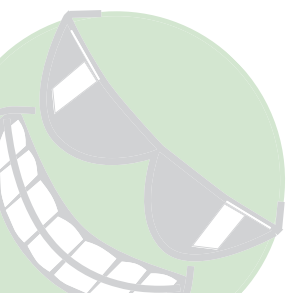
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# how to CHOOSE A SENSOR

## for the production environment

BY ANDREW WAUGH, AUTOMATIONDIRECT

**S**ensors play essential roles in the modern production environment, capturing data on position, speed, proximity, pressure, temperature, level, flow, current, voltage, and more. There is such a wide variety of sensors on the market that finding the right device for your application can seem overwhelming. It doesn't have to be. The goal is to find the least expensive, most reliable sensor that will deliver the data you need without breaking the bank.

Here, we illustrate the steps of selecting the optimal position, proximity, and distance sensors for the production environment.

### Sensor technology basics

It's important to remember that the role of the sensor is to capture data or output a signal. It's the control system that converts that sensor output into presence/absence detection, a proximity reading, or more sophisticated interpretation such as

the water level in a cooling tank.

Choosing the optimal sensor starts with understanding sensing technology.

### Touch (e.g., limit switches)

- Mechanism: physical contact with object being sensed
- Pros: simple, compact, cost-effective, insensitive to environmental conditions, good repeatability, economical, unpowered – just breaks a circuit



- Cons: requires physical contact, potentially damaging product; mechanical operation, which brings inherent lifetime limitations

#### Inductive

- Mechanism: detects magnetic field perturbations caused by ferrous and nonferrous metals
- Pros: noncontact, solid-state, potentially very high resolution, moderately high switching frequency
- Cons: relatively short sensing distances

#### Magnetic

- Mechanism: detects magnetic field perturbations caused by specific magnetic targets
- Pros: can detect magnetic target even when blocked by metal, very high switching frequency, eliminates false positives and interference from other materials in the sensing path
- Cons: requires placement of magnetic target

#### Capacitive

- Mechanism: detects changes in capacitance caused by the presence of other materials, typically dielectrics
- Pros: detects solids, liquids; able to detect objects of interest even through nonmetallic barriers
- Cons: low switching frequency, 100 Hz or less; susceptible to false trips by any ambient materials

#### Ultrasonic

- Mechanism: detecting a reflected or transmitted ultrasonic signal
- Pros: no requirements for physical characteristics of the material (e.g., ferrous, dielectric, etc.); insensitive to material characteristics such as reflectivity, optical transparency, irregular surfaces; working distance on the order of meters
- Cons: low spatial resolution, expensive

#### Photoelectric

- Mechanism: detecting a reflected or transmitted optical signal, from IR to blue light, typically LEDs
- Pros: optical wavelength can be selected to optimize performance and safety, working distance on the order of meters, high accuracy and repeatability

- Cons: susceptible to false reflections or other ambient lights, material surface can alter state

#### Laser

- Mechanism: distance measurements through time-of-flight or triangulation
- Pros: long distance (meters) for TOF systems, micron-scale accuracy and repeatability; working distances of less than a meter for triangulation systems
- Cons: greater cost and complexity, sensitive to vibration and environmental contamination

And now, we can proceed to the process of specifying a sensor.

#### Step #1: What material are you trying to sense?

Different sensing technologies respond to different materials (see Table 1). The first step is to identify the material you're trying to sense and select the technology best suited to it. >>

TABLE 1

| If you're trying to sense...                                                                                            | These sensors will work best                                             |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Ferrous metals                                                                                                          | Inductive sensors                                                        |
| Nonferrous metals                                                                                                       | Inductive sensor or capacitive sensors                                   |
| Dielectric materials (e.g., wood, glass, plastic, cloth)                                                                | Capacitive, ultrasonic, photoelectric, or laser sensors                  |
| A variety of material types (e.g., metals, glass, plastic)                                                              | Capacitive, touch, or ultrasonic sensors                                 |
| Liquids                                                                                                                 | Capacitive or ultrasonic sensors                                         |
| A target that can be touched                                                                                            | Touch sensors                                                            |
| An uneven surface                                                                                                       | Ultrasonic sensors                                                       |
| Glass surfaces                                                                                                          | Ultrasonic or photoelectric sensors                                      |
| Objects hidden behind barriers (e.g. the position of the piston in a pneumatic cylinder, the level of liquid in a tank) | Capacitive (nonmetallic barriers only) or magnetic sensors (any barrier) |
| Dark or shiny objects                                                                                                   | Photoelectric sensor with blue light                                     |



**OPT2151 Wenglor photoelectric sensor** from AutomationDirect uses blue light to reduce false detection duplicate readings of dark or shiny objects.

TABLE 2: SUMMARY OF SENSOR CHARACTERISTICS

| Sensor type   | Working distance | Switching frequency | Cost     | Reliability | Accuracy | Repeat-ability | Resolution     |
|---------------|------------------|---------------------|----------|-------------|----------|----------------|----------------|
| Limit switch  | Zero             | Slowest             | \$\$     | Medium      | High     | Low to High    | Medium         |
| Inductive     | 0-50 mm          | Fast (~2 kHz)       | \$       | High        | High     | High           | Medium to High |
| Magnetic      | 60 mm            | Very fast (~5 kHz)  | \$\$     | High        | Medium   | High           | Medium         |
| Capacitive    | 0-45 mm          | Slow (<100 Hz)      | \$\$\$   | Medium      | Low      | Medium         | Low            |
| Ultrasonic    | 0-10 m           | Very slow           | \$\$\$\$ | Medium      | Low      | Medium         | Low            |
| Photoelectric | 0-50 m           | Fast                | \$\$     | Medium      | Medium   | Medium         | Medium         |
| Laser         | 0-100 m          | Very fast           | \$\$\$\$ | Medium      | High     | High           | High           |

Step #2: What is your working distance?

Once you’ve identified candidate sensors that can work with your materials, the next step is to identify which devices can gather the data you need over the working distances of your application. Notably, touch sensors have the tightest working distance (zero), while laser sensors offer the longest working distances (up to 100 m; see Table 2).

Steps #1 and #2 will get you to the first approximation of the best sensor for your application, but Table 2 shows where the real fun begins.

Step #3: What are your other priorities?

Engineering is always about trade-offs. Now that you have a starting point, consider additional parameters important to your application. The sensor needs to have a fast enough switching frequency to handle the operating parameters of your system. If you need to do presence/absence sensing for a high-speed conveyor or are trying to monitor the teeth in a pair of meshing gears, you need to either find a sensor that’s fast enough to capture the necessary data, or slow the process down.

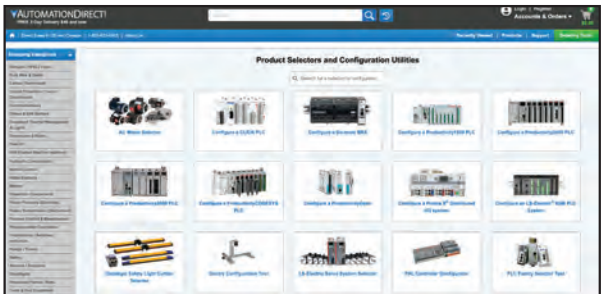
Additional factors to take into account are performance metrics such as accuracy, repeatability, and resolution.

As you work your way through the decision tree, don’t forget that your goal is to find a sensor that meets performance requirements while offering the lowest cost and the longest lifetime. As the table above shows, there are many parameters to play with. Knowing your priorities simplifies making the best selection. ▼

Andrew Waugh is the Product Manager of Sensors & Power Supplies on the Fuel Team at AutomationDirect.

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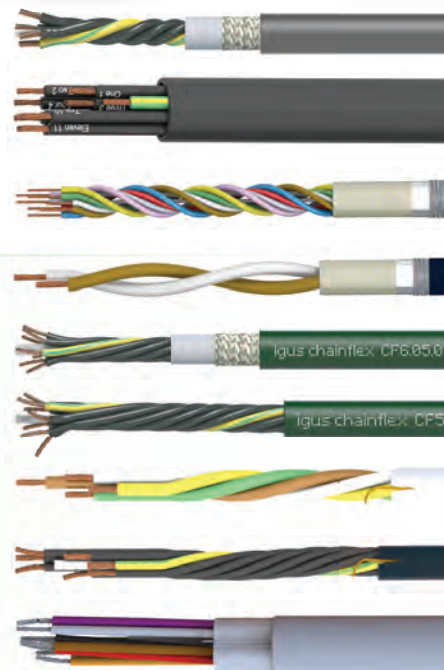


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# ***How Low-Code and No-Code Visual Programming Tools Can Simplify and Accelerate Seamless Industrial IoT Connectivity***

In this article, we explore the transformative impact of low-code/no-code PLC programming in industrial automation with Tim Shippy, a veteran AutomationDirect Product Engineer. With a wealth of experience spanning decades in industrial and enterprise software development, Tim has been at the forefront of integrating industrial systems with enterprise connectivity.

His expertise in both traditional and modern programming methods offers invaluable insights into how low-code/no-code platforms, especially open-source tools like Node-RED, are reshaping the industry. From simplifying complex processes to fostering creativity and innovation, Tim shares his perspectives on the benefits, challenges, and future potential of these cutting-edge tools in today's fast-evolving automation landscape.

## **How would you compare traditional PLC programming languages with low-code/no-code programming techniques?**

Traditional programming languages defined by the IEC 61131, like ladder logic and sequential function block programming, represent an early form of low-code techniques. Over the past 30 years, low-code platforms have evolved significantly, widening their range of capabilities. Modern systems now allow seamless integration with IoT frameworks, internet APIs and a variety of databases, going well beyond the limitations of traditional PLC capabilities. These platforms have transformed industrial programming, enabling greater efficiency and versatility in automation extending the reach of control systems across industrial operations.

## **How widespread is the adoption of low-code/no-code programming for PLCs, and what drives this adoption?**

Adoption varies widely by industry and individual programmers, influenced by factors like training and application needs. A key driver is the increasing demand for advanced system integration. Managers have become accustomed to having access to their systems and data. It is rapidly becoming unacceptable to "hide" data behind the "OT" firewall and blame legacy communications and integration limitations. While challenges like training gaps and security concerns still exist, a new generation of engineers with software expertise is closing these gaps, creating broader opportunities for adoption across diverse industrial sectors. >>

Low-code and no-code PLC programming, like what the AutomationDirect CLICK PLUS PLC and the new C2-NRED Intelligent option module enable, promises to dramatically transform industrial engineering. Benefits include:

### Simplified Programming

**Ease of Use:** Visual interfaces and drag-and-drop elements reduce coding requirements.

**Accessibility:** Non-programmers can contribute, democratizing development.

### More Efficiency

**Faster Development:** Simplified programming accelerates deployment.

**Reduced Errors:** Visual tools minimize coding mistakes.

### Flexibility and Scalability

**Adaptability:** Platforms easily update and scale with changing needs.

**Integration:** Built-in tools connect with IoT and cloud services.

### Cost-Effectiveness

**Lower Costs:** Reduced programming needs and faster development cut costs.

**Resource Optimization:** Frees engineers for higher-level problem solving.

### Future Trends

**Adoption Growth:** Agile, responsive automation drives adoption.

**Advanced Features:** Platforms will evolve with AI and machine learning integration.

### What are the primary benefits and challenges of transitioning to low-code/no-code PLC platforms?

Low-code platforms enable traditional PLC programmers to access capabilities that were previously only available in advanced programming languages like C++. Engineers can now program without having to learn an entirely new language and mastering complex syntax. These platforms can work in conjunction with ladder logic to add capabilities without degrading the performance of production systems. The primary challenge lies in gaining acceptance among experienced maintenance professionals who may resist adapting to these new technologies. However, the industry is shifting as younger, tech-savvy engineers increasingly advocate for these modern solutions, which will help their organizations adapt and modernize.

### Are there any risks involved in adopting low-code/no-code PLC programming?

The risks associated with low-code platforms are similar to those found with traditional IEC techniques, especially around training and compatibility. Organizations familiar with flowchart programming will find the transition easier, but training maintenance teams to adapt remains a significant hurdle. On the upside, the use of JavaScript or Python in these platforms allows for greater IT department support, enabling companies to leverage internal expertise to simplify deployment while mitigating potential complexities.

### How does low-code/no-code programming impact debugging and testing compared to traditional methods?

Debugging becomes much easier with modern low-code platforms, which feature built-in capabilities for real-time monitoring of variable values. Users can drag and drop debugging icons, bypassing the tedious setup required by traditional systems. Unlike ladder logic or C++ methods, debug widgets can remain in final builds without significant performance impact. This simplified approach to troubleshooting reduces errors, shortens development cycles, and enhances overall system reliability in industrial environments.

### Can you share examples of successful implementations of low-code/no-code PLC programming?

One compelling example is an OEM who makes cotton gins. He used low-code programming to connect weather data with his machinery's operations. Their system adjusted processes based on real-time humidity and rain forecasts and even sent text alerts to operators. Another example from a national manufacturer is they used recipes stored in a centralized Azure® database. By leveraging a cloud database, they didn't need additional server infrastructure, and every system was able to use data that was managed from a central location. Although widespread adoption is still in its early stages, examples like this demonstrate the immense creative potential of low- or no-code platforms for solving complex automation challenges and optimizing performance.

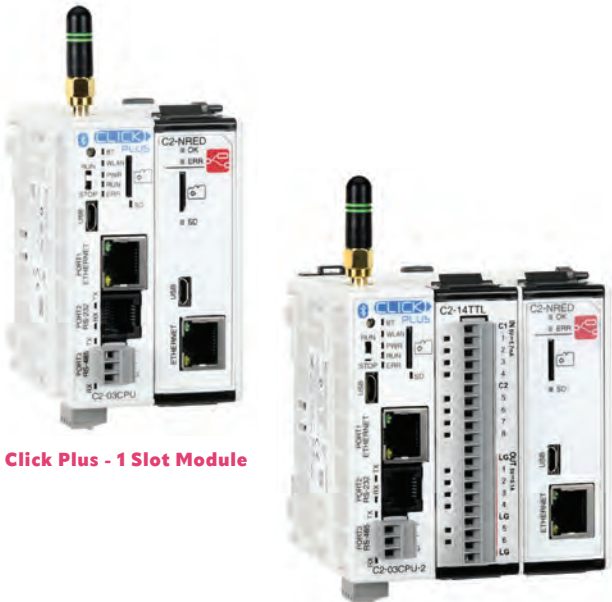
### How well can low-code/no-code solutions scale for complex industrial systems?

These solutions are highly scalable and can operate as add-on processors, ensuring the main system's CPU remains unburdened. This design allows critical processes like PLC scan times to continue functioning efficiently, even as complexity increases. The separation between the add-on tools and the core system enhances scalability while maintaining high performance, making these platforms ideal for large-scale industrial applications where responsiveness and reliability are essential.

### What are the integration challenges of connecting low-code/no-code PLC solutions with legacy systems or advanced technologies like IIoT and AI?

Security remains one of the biggest challenges when integrating legacy systems, which often rely on older protocols like Modbus or serial communications. Modern low-code platforms simplify these integrations by offering pre-built nodes and reducing the need for additional devices. This makes bridging the gap between older systems and new technologies more manageable, ensuring compatibility while addressing key concerns around security, safety, and efficiency.





Click Plus - 1 Slot Module

Click Plus - 2 Slot Modules

### How flexible are low-code/no-code platforms for custom functionality compared to traditional programming?

These platforms are extremely flexible, offering extensive libraries of pre-built nodes for common tasks like SQL integration and OPC UA communications. Users can also write custom JavaScript to meet unique requirements, extending the platform's functionality. This adaptability mirrors the open-source nature of Python, allowing businesses to create tailored solutions that enhance automation and meet specific operational challenges in innovative ways.

### How is AutomationDirect incorporating low- and no-code programming capabilities into its PLC portfolio?

We're quite excited about all the creative possibilities that our CLICK PLUS PLC customers will be able to unleash with our new C2-NRED intelligent option module. It allows open-source Node-RED access to PLC memory, enabling real-time data interaction with databases, cloud services, and external devices. With this combination of proven CLICK PLC logic with Node-RED's tools, our customers can quickly and easily build all kinds of IIoT applications, create custom HMIs, and connect physical devices to advanced IT systems. We expect it to be a game-changer that will really accelerate the development of integrated control systems.

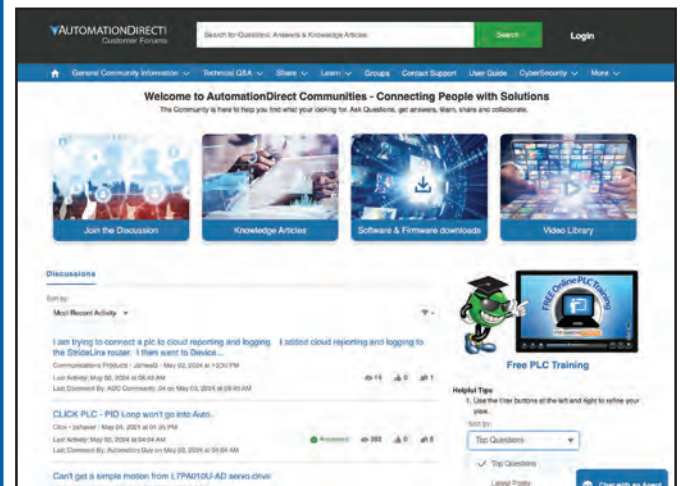
### What future trends do you see shaping low-code/no-code programming in industrial automation?

We see more and more industrial equipment having built-in APIs for easy connectivity that older equipment just didn't have because they didn't need it, being isolated on factory floors. This trend will drive innovation like never before, enabling engineers to achieve greater levels of efficiency, system integration, and operational visibility across the industrial automation landscape, whether that involves a single site or fleets of equipment at diverse sites around the world. ▼

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# Industrial Strength Identification is Essential for Manufacturing

Applying the right barcode, RFID, and vision technologies addresses the increasing demand for data-driven manufacturing, improved quality control, and compliance with track-and-trace requirements.

**BY LARRY REYNOLDS,  
AUTOMATIONDIRECT**

**A**utomation systems routinely use a variety of sensors to detect the position, motion, weight, and many other physical characteristics of products and other targets. This type of monitoring is essential for controlling the associated equipment and machinery. But increasingly, it is becoming just as important for tracking and traceability purposes to more thoroughly identify target items and provide supplementary information. This type of sensing requires more specialized detection devices and supporting software.

Extended identification information can be accessed in a variety of ways, including barcodes (both 1D and 2D), radio frequency identification tags (RFID), and vision systems. These technologies are widely available throughout the commercial and manufacturing sectors, but when they are used for industrial applications, it is important for designers to select products adapted for these challenging environments. Another consideration is that in past years there has been significant cost and complexity to implement these technologies, but those barriers are now significantly reduced.

Fortunately, the latest industrial identification technologies for barcode reading, RFID, and vision systems, are now packing advanced capabilities into compact, economical, and easy-to-use

form factors, making it practical to add these functions to more applications.

## Identification essentials

End users, systems integrators (SIs), and original equipment manufacturers (OEMs) are finding an increased need to use identification technologies to identify items they are handling, and to obtain additional quality control information.

Manufactured or transported goods may have barcodes or RFID tags directly on them, or on the equipment moving them, which can be used by the automation system to track, direct, and event-log their motion through a process. Typical barcode and RFID identification systems require tags or markings—which are available in a wide variety of formats—affixed to the target product or component. They also need a device capable of reading the tags, and a way to communicate that information to a supervisory system for processing or association with a database.

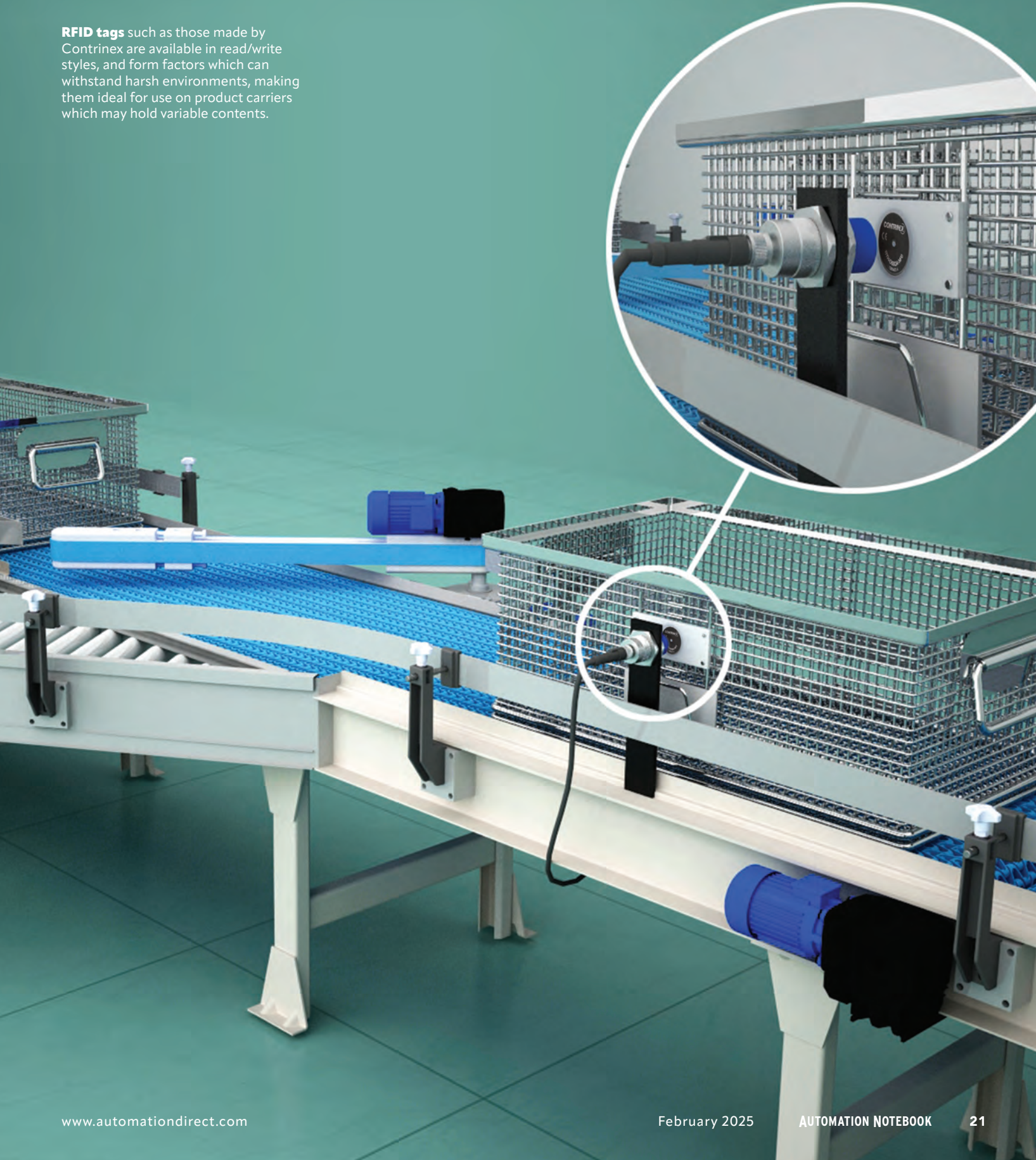
Vision identification systems may be used to read barcodes, but many versions are capable of much more advanced inspection functions for quality control and other purposes. Some vision sensors can perform image processing on-board, while others require more complex external systems.

*(continued on page 22)*





**RFID tags** such as those made by Contrinex are available in read/write styles, and form factors which can withstand harsh environments, making them ideal for use on product carriers which may hold variable contents.



(continued from page 20)

Camera and visual processing capabilities has improved in recent years, and it is now very common to use vision systems for detecting the alignment, size, color/quality, labeling application, and even the orientation of parts of the target, such as a cap or a subcomponent.

Applying identification technologies for industrial applications—whether on a machine or elsewhere on a manufacturing line—requires designers to address several physical installation aspects. The targets must be oriented properly, sensors need to be mounted at the appropriate distance but protected from vibration and mechanical damage, and acceptable lighting is needed. Some devices may be hardwired to associated control systems, but more commonly the sensors will use industrial communications protocols over a network connection because of the type and volume of data which must be transmitted.

For these and other reasons, identification systems have historically been costly, complex, and difficult to integrate, especially for vision-based technologies. The latest generation of technologies has overcome each of these problems, enabling end users, SIs, and OEMs to easily incorporate identification capabilities into any machine or system.

#### Detection details

Several advances in the identification space have made the technology more accessible. Sensing devices have become more compact, with improved on-board processing, and connectivity over common Ethernet using standardized protocols. This makes it far easier to install the sensors, wire them to the host system, and take advantage of PC- and browser-based tools to configure, commission, integrate, and maintain them. The following are some specifics about various technologies.

#### Barcodes

Barcodes and their associated scanners are probably the most typical industrial identification systems (Figure 1). A barcode may be printed on a label or product, or even engraved or embedded on a target. Laser-based scanners were originally the most common, but today optical-based versions—which effectively take a picture of the barcode and then analyze it—are

**Figure 1:** Both 1D and 2D barcodes are ubiquitous throughout commercial and industrial applications, so fixed and handheld laser- or optical-based readers such as those from Code, Datalogic, and ifm Efectar are widely used.



very capable but can be more susceptible to lighting issues and dusty conditions. Handheld scanners can be used by workers for production or spot-checking purposes, but machine-mountable form factors are typically used for industrial manufacturing applications.

Because the barcode formats and communication protocols are largely standardized, designers should look for suppliers offering a range of form factors to meet their needs. Handheld barcode scanners are available in both general- and rugged-duty versions, with selection depending on the environment where they will be primarily used. For machine-mountable versions, designers should consider scanners with:

- Built-in lighting
- An alignment laser and autofocus system to simplify setup
- Various communication protocols
- Free configuration software with wizards and one-touch teach capability
- An onboard logic engine to perform a degree of data pre-processing

#### RFID tags

While barcodes can be used on actual portions of operating equipment, such as product carriers or tooling, an RFID tag offers some additional advantages because it has both fixed and user-accessible memory (Lead Image). Therefore, the tag can carry a static serial number—similar to the license plate of a car—and the user application can also

read/write dynamic data as the tag goes by a scanner. This, for instance, can be useful to record what the equipment is carrying as it is loaded, or to identify when it is unloaded.

Designers need to recognize that RFID read/write transceivers must be located within an appropriate distance to the tags they will interact with. This distance requires thinking about many factors such as the surrounding environment, the technology and frequency of the device being used, antenna sizing, and installation geometry. Read/write modules are available in many different housing styles with various environmental protection ratings. As with barcode readers, an industrial protocol such as EtherNet/IP is now common, and the IO-Link protocol is also a newly popular connectivity option.

#### Vision

Vision is where the greatest identification technology gains have been made in recent years (Figure 2). The earliest systems required expensive and finicky cameras, connected to dedicated PC-based systems. Certainly, these high-end systems continue to be improved and available. But there are newer categories that can fulfill many of the most common manufacturing requirements:

- Vision sensor: An intelligent self-contained device that can be taught to recognize images representing proper target qualities. In normal operation,



the vision sensor acquires a target image and compares it in real-time with the baseline image, providing a pass/fail or good/no-good result, or even making more complex decisions. These types of sensors are ideal for verifying fill level, cap orientation, label presence, and/or color.

- **2D camera:** A device with high-resolution sensor and associated lighting, optimized to capture images which are used to reliably perform inspection—including quality aspects such as contours and “blob analysis”—to determine shape features such as presence, number, size, and location of elements. These capable cameras can do much of the work that previously required much higher-end devices.
- **3D vision sensor:** A device that applies time-of-flight or similar point technology from the sensor to the image to measure the distance of numerous points within the field of view. This type of sensor can be used to determine the volume and surface area of a target.

### Accessible identification is within sight

With the increased demand for data-driven production, product specialization, and improved manufacturing tracking/tracing, industrial identification has become fundamental for machine and processing automation. Barcodes, RFID tags, and vision technologies are all proven ways to carry out a variety of identification tasks, and each offers certain performance benefits depending on the application.

In particular, barcoding and RFID tagging are very mainstream at this point, but vision systems for industrial applications have expanded their reach greatly in recent years. Developments of the past few years mean that a wide range of vision capabilities are now much more accessible for all types of end users, SIs, and OEMs.

Designers will benefit from working with suppliers who offer all these technologies, along with associated accessories, such as brackets, cables, and lighting. With a range of options at hand, it becomes more straightforward to apply the best-fit identification products to meet the price and performance demands of any application. ▼



**Larry Reynolds**, Product Engineer, Safety Components, AutomationDirect

*Larry Reynolds started his career over 30 years ago. He has served in many industry roles such as technical specialist, radiation safety officer, plant safety officer, project manager, control designer, and system integrator, and has also specialized in safety applications for automation systems. Larry holds a Bachelor of Engineering degree, is a certified PMP (Project Management Professional) and holds a Functional Safety Engineer certificate from TÜV Rheinland, #15983/18, Machinery.*

**Figure 2:** Vision sensing technologies have advanced tremendously in recent years. Compact smart vision sensors by Datalogic are self-contained and field configured to detect various physical characteristics, while more advanced vision cameras such as those by ifm Efector can perform 2D and 3D inspections. All figures courtesy of AutomationDirect



# Unshackling Industrial Data Access

Modern PLCs and HMIs make it easy to implement extensive data connectivity and analytics.

**BY DAMON PURVIS,  
AUTOMATIONDIRECT**

**M**odern consumers are increasingly familiar with tailored experiences, abundant information, and generally getting things “their way.” Those working in the industrial manufacturing and automation sectors, on the other hand, have not always enjoyed such flexibility. Fortunately, hardware and software advancements mean that access to valuable industrial sourced data is easier, more secure, and available in many more ways than ever before.

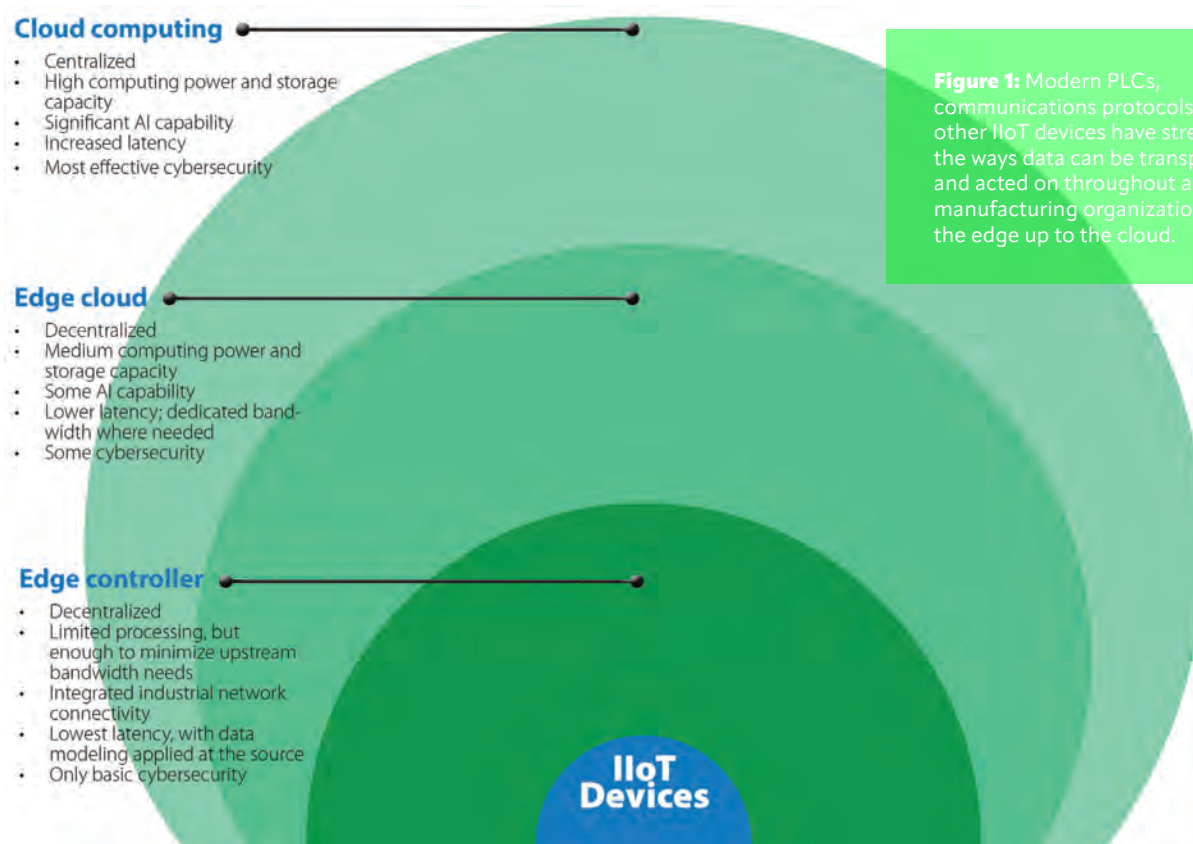
## The explosion of industrial data

Manufacturing systems today generate vast amounts of data, a trend that shows no sign of slowing. According to estimates, global data creation was projected to reach 97 zettabytes in 2022, with manufacturing leading all sectors in data storage. Manufacturing data is digital gold, but only if it can be accessed, contextualized, and transported securely. The challenge lies in connecting distributed data sources, often located at the edge of production systems, to

centralized computing resources or cloud platforms where the data can be processed and analyzed in support of efficient mass production (Figure 1).

In today’s competitive market, manufacturers are adopting data-driven solutions to enhance equipment uptime, product quality, and operational responsiveness. This shift has led to greater integration of operational technology (OT) and information technology (IT) systems. Such integration allows manufacturers to leverage data for continuous improvement, quality control, predictive analytics, and more.

The increasing reliance on data has driven the adoption of new technologies, including the industrial internet of things (IIoT) and edge computing. Programmable logic controllers (PLCs) and human-machine interfaces (HMIs) used in the OT realm have long been staples in industrial automation, providing fundamental real-time control and monitoring functions. Industrial systems were commonly architected in accordance with the Purdue Model, a hierarchy with independent—but connectable—zones, including the



**Figure 1:** Modern PLCs, communications protocols, and other IIoT devices have streamlined the ways data can be transported and acted on throughout a manufacturing organization, from the edge up to the cloud.



**Figure 2:** Modern PLCs—like the AutomationDirect Productivity, CLICK PLUS, and BRX families—incorporate a wide range of connectivity and communications capabilities, providing many practical options for accessing OT data.

*Figures, all courtesy of AutomationDirect*

manufacturing physical process, control center, enterprise, and others.

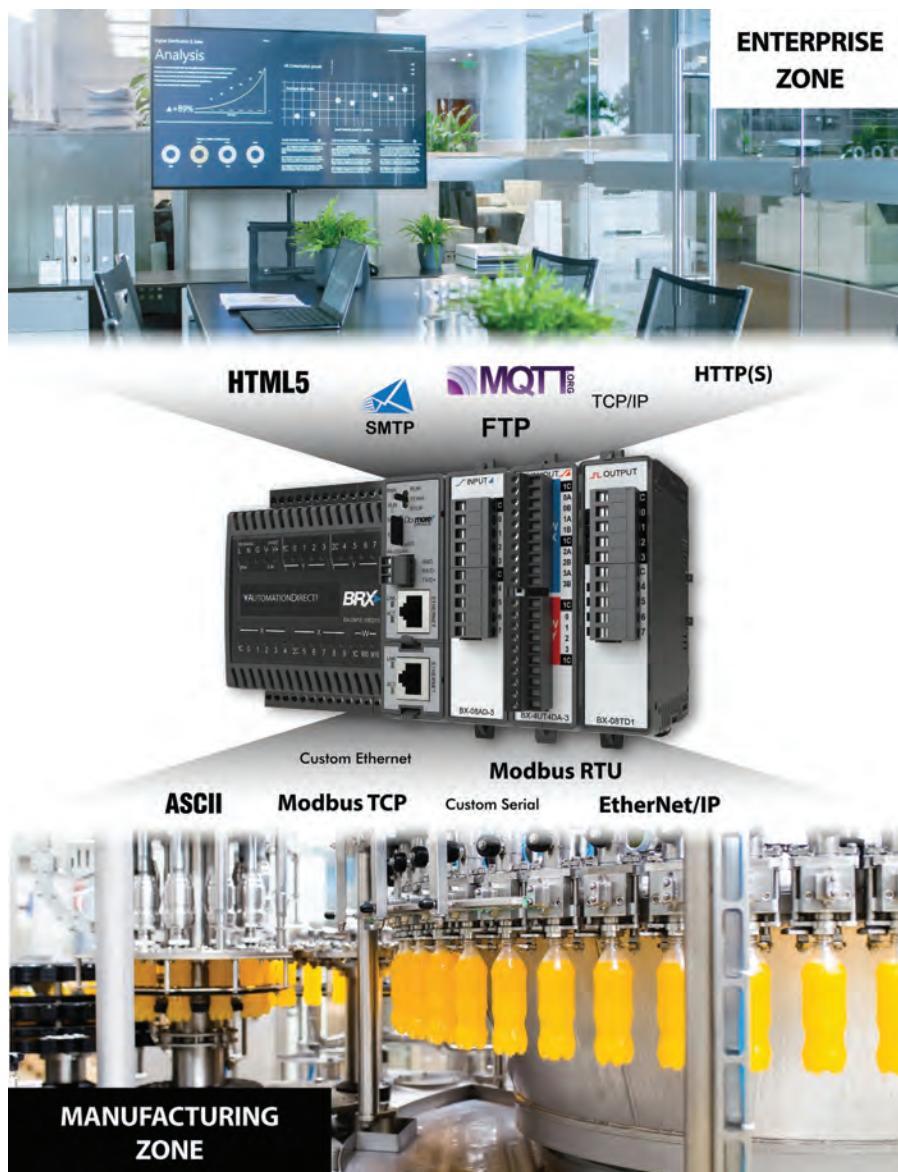
However, the evolving landscape of manufacturing now requires more than just basic control and rigidly segmented zones. As industries move toward more data-driven operations, the role of modern PLCs and HMI is becoming integral not only for automation, but also for facilitating the collection, processing, and sharing of valuable operational data with IT-based enterprise resources. Combined, these technologies enable data collection and analysis, which are critical for optimizing operations, reducing energy consumption, and enhancing overall production agility.

#### Advanced data access

Although data collected from PLCs, HMIs, and other OT systems was historically isolated from enterprise IT networks to a great degree, over time the convergence of OT and IT has made it easier to collect and securely share data, enabling real-time visibility and decision-making. A critical development in this convergence is the introduction of controllers with enhanced connectivity and computing resources to process and communicate data directly at the edge.

For many small to mid-sized operations, the advanced capabilities of modern PLCs and HMIs are ideal for accessing, processing, and transmitting data (Figure 2).

Today's PLCs are far more advanced than their predecessors. They come equipped with enhanced networking, data handling, and processing capabilities, making them well-suited for tasks beyond basic control. These devices now support secure remote connectivity and integration with higher-level IT systems, facilitating seamless data exchange and enabling advanced analytics.



Modern PLCs offer several key capabilities that enhance their utility in data-driven environments:

- **Advanced Networking and Communication:** PLCs today support traditional OT protocols—such as Modbus, EtherNet/IP, and PROFINET—for communication with field devices. They also incorporate a broad array of communication protocols and methods—including OPC UA, secure REST APIs, MQTT, and Microsoft Azure® integration—which allow them to integrate directly with enterprise IT systems. These capabilities provide an efficient
- means of data exchange, while addressing cybersecurity concerns with native encryption and secure communication protocols.
- **Data Contextualization:** Earlier PLCs often stored unstructured data that required significant effort to prepare it for enterprise system consumption. Modern PLCs, however, allow automation designers to define and structure data at the source, ensuring consistency and reducing the need for complex data rework. This capability results in a "single source of truth," which improves data accuracy and accessibility across systems. >>

- Low-Latency Data Processing: Modern PLCs have improved memory and processing power, enabling them to collect and process data locally at the edge. This local aggregation reduces the amount of upstream data traffic and lowers the strain on centralized computing resources, which is particularly useful for applications requiring real-time decision-making.

These features make modern PLCs highly versatile, capable of supporting both real-time control and advanced data handling. As a result, they serve as a cost-effective and scalable solution for a variety of industrial automation needs, from basic control tasks to more complex, data-driven applications.

#### Practical connectivity

For original equipment manufacturers (OEMs) and automation designers, the

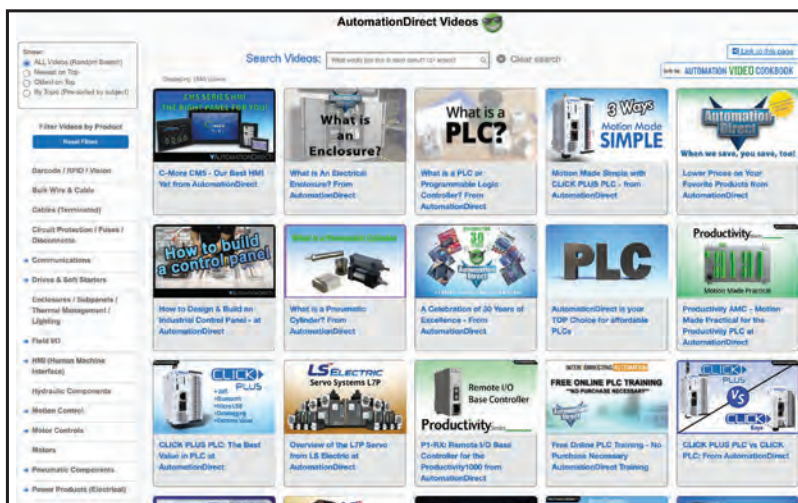
primary goal is to develop reliable, standardized systems that can be easily deployed and maintained. However, these users may worry that standard solutions could limit innovation as their needs evolve. Modern PLCs and HMIs address this issue by providing a balance between standardized control and flexibility for future needs.

By leveraging the advanced features of modern PLCs, designers can create right-sized systems that are ready to integrate with enterprise IT systems now, and to support more sophisticated applications in the future. These devices provide a robust platform for current automation needs, while also enabling easy upgrades to incorporate more advanced technologies, such as cloud computing, machine learning, and IIoT analytics. ▼



*Damon Purvis is the PLC Product Manager at AutomationDirect.com. He has over 22 years of industrial automation experience. Previous roles have included designing and deploying automated solutions in a variety of industries, and managing product development of manufacturing data management and business intelligence applications.*

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## Recipe for Success: Automation Proves to Be a Key Ingredient

BY ROGER DYER, MEL-O-CREAM DONUTS INTERNATIONAL

The right mix of automation elements is crucial for creating a consistent process yielding high-quality donuts and baked goods.

**M**el-O-Cream, a commercial bakery in Springfield, IL, has been baking and perfecting donuts since 1932. From measuring precise ingredient amounts and maintaining a consistent mixing process, to ensuring uniform dough shaping and controlling product flow, technology plays an important role in producing premium baked goods. The company has found automation essential to compensate for environmental factors, achieve consistent baking times, and maintain ingredient and lot traceability. Over the years, Mel-O-Cream has invested in automation to enhance both product consistency and process efficiency (Figure 1).

With operations spanning more than 90 years, Mel-O-Cream relies on a variety of equipment with varied automation features and controls that are as diverse

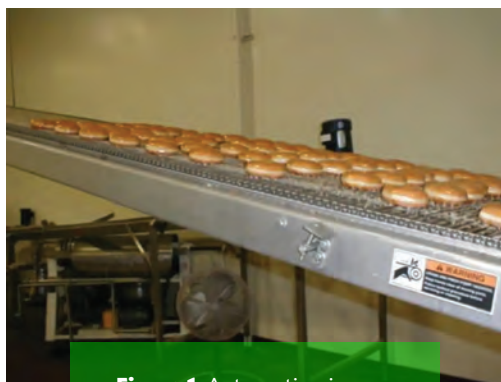
as the baked goods and frozen dough that they produce. Specialized baking equipment and machines are often delivered with on-board controls from various suppliers. Despite best efforts to standardize controls throughout the facility, they found themselves with several PLCs from one major automation supplier, most HMIs from a second supplier, and their print management software for applying labeling and barcodes from a third, not to mention the various sensors and controls on specialty equipment.

Although integrating machines and parts from multiple vendors can sometimes create challenges, it is also an opportunity to approach old problems in new ways. Like many companies of this size, Mel-O-Cream has far more production personnel compared to technical staff. As the sole

control engineer on staff, Roger Dyer relishes each time a unique challenge comes along. With a major automation investment underway at Mel-O-Cream, it was the perfect time to seek out and investigate new ways to monitor and visualize crucial elements of the baking process.

### Perfecting the proofing process

The baking process is sensitive to environmental factors—even slight variations in temperature and humidity can significantly impact the final product. Traditional donut recipes made with yeasted dough require time to proof, or rise, before they are transferred to the fryer for cooking. To ensure the dough rises uniformly from batch to batch, bakeries commonly utilize proofing boxes. >>



**Figure 1:** Automation is one of the keys to success in modern commercial bakeries. From product flow to controlling environmental factors, maintaining a consistent process is vital for producing high-yield, quality baked goods.

A proofing box is a heated enclosure designed to hold multiple trays of dough. Proofing boxes are equipped with sensors that continuously monitor humidity and temperature levels. If conditions deviate from the ideal range, the settings can be adjusted to maintain optimal proofing conditions for yeast fermentation.

Because the conditions inside the proofing box can affect rise—and overall process—time, the production team was eager to use automation to achieve better consistency. In addition, it was critical to be notified if conditions inside the proofing box begin to drift, so corrective action could be taken. With this in mind, the production managers and bakery leadership requested greater visibility to conditions inside the proofing box and they turned to Roger for solutions.

#### Stacking up solutions

Traditionally, stack lights have been used in industrial settings—including commercial bakeries—as the default way to provide visual status indications at a glance. Positioned so they could be seen throughout the bakery, a three-color stack light could be used to indicate acceptable, warning, and alarm conditions for a specific sensor. Therefore, bakery management thought a stack light solution would be the answer.

However, this particular proof box had two zones with temperature and humidity sensors in each zone. A stack light solution would require four individual towers. Operators would need to remember not only what each tower represented, but also the significance of the three colors in each tower.

After getting input from the production staff, Roger discovered that both operators and maintenance could work more

efficiently with additional information—specifically the actual temperature and humidity values at a given time, rather than just a range. Given the cost and complexity of the stack light option, it was decided that a different approach would better serve the needs of monitoring the proofing box.

#### Raising the bar...and saving the dough

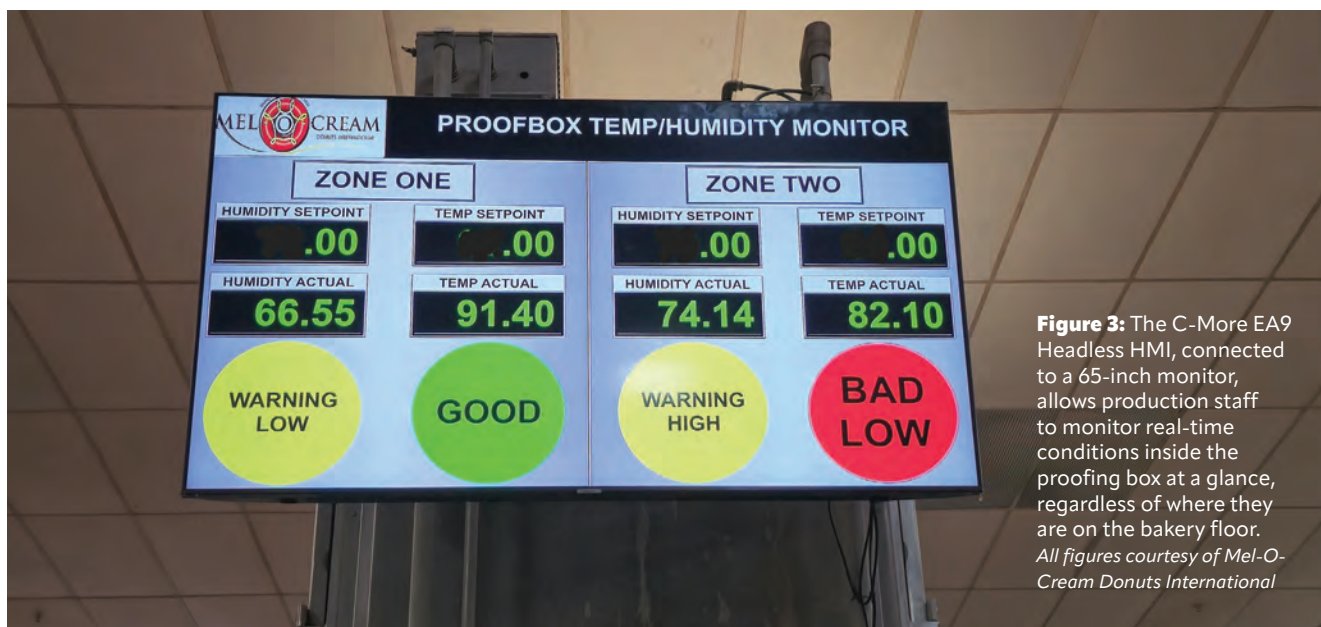
It was clear that the proofing box would benefit from the additional detail available via a human-machine interface (HMI) screen. However, a small local display would provide neither the visibility nor the convenience desired. To better address the application requirements, Roger proposed a headless HMI solution. A headless HMI provides the same functionality as traditional HMIs with integrated displays, but it operates without a local display or interface. Instead, the headless HMI can drive an external monitor of any size, and communicate securely with other remote PCs or mobile devices, allowing for greater flexibility in placement without any display size restrictions.

With more than a decade of experience configuring industrial HMIs, Roger immediately turned to AutomationDirect. The C-more EA9 Headless HMI (Figure 2) proved to be the ideal choice, easily integrating with the existing proofing box controls from another automation manufacturer. The EA9 features Ethernet, serial, and USB ports, making it compatible with many control systems. It also offers remote access, and data logging capability with an SD card slot for additional memory, which is helpful for capturing process data. In this case, the EA9 visual output was connected to a 65" television via an HDMI cable to provide clear visibility even from a great distance.

**Figure 2:** The AutomationDirect C-more EA9 Headless HMI does not have a local display, but rather features an audio/video output and networking, allowing easy connection to any HDMI-compatible display and access via a remote web browser or mobile device app.







**Figure 3:** The C-More EA9 Headless HMI, connected to a 65-inch monitor, allows production staff to monitor real-time conditions inside the proofing box at a glance, regardless of where they are on the bakery floor. All figures courtesy of Mel-O-Cream Donuts International

The large, color display is intuitive and visible throughout the bakery floor (Figure 3). Real-time operation data is obtained from the sensors via an Ethernet connection with the existing PLC, so the HMI can display information including each temperature and humidity setpoint as well as actual values. A color-coded graphic status is also visible so production staff can quickly determine when to investigate and take action.

Because the headless HMI is located securely in a control panel, and the monitor is mounted up high, they are both effectively protected from washdown activities. Not only does this make routine sanitation easier, but it also results in equipment and installation cost savings since watertight displays and fittings are not required.

With the combination of the headless HMI and the large color display, production staff is able to easily monitor the proofing box. When a yellow or red warning indication appears on the monitor, operators quickly check the proofing box settings or, if necessary, call maintenance. Since implementing the headless HMI solution, the bakery has realized significant reductions in both product loss and defects, because any materializing issues are quickly discovered and resolved.

#### Timely answers and streamlined procurement

When integrating equipment and controls from multiple vendors, it's not uncommon for issues to arise. Coordinating between multiple companies can sometimes lead to delays in identifying components or gathering information. However, the support provided by AutomationDirect for this project was phenomenal with all questions quickly and adequately addressed by their support staff.

In addition, the AutomationDirect website helped to make sure the project could be completed in a timely manner. With transparent stocking levels and price visibility, there was no time lost waiting for quotes on products with undesirable lead times.

#### The icing on top

As Mel-O-Cream continues to incorporate automation into their operations, they are doing so thoughtfully to protect existing capital investments. By partnering with suppliers committed to providing not only quality products but also exceptional support and integration assistance, they have effectively mitigated risks while boosting productivity. Leveraging new approaches like the headless HMI solution has increased efficiency, giving them proof that their bakery can meet rising consumer demands and expand production capabilities, ensuring their delicious donuts remain unmatched for years to come. ▼

*Roger Dyer is a Controls Engineer at Mel-O-Cream Donuts International. With nearly 30 years of experience in automation and controls, he tackles diverse projects—from basic machines to complex robotics—driven by a passion for problem-solving and innovation. With the Ohm's Law wheel tattooed on his arm as a testament to his dedication, Roger remains committed to the ultimate pursuit of excellence in his field.*



## IronHorse ACG Drives

**AutomationDirect** has added general-purpose AC drives to the IronHorse brand. These new VFDs support three control modes, including V/Hz, slip compensation, and sensorless vector, and come in various voltage and horsepower ratings at a very affordable price.

The 230 VAC models can support AC motors up to 20hp with 230 VAC three-phase power and up to 10hp with 230 VAC single-phase power. The 460 VAC models support motor sizes up to 30hp with 460 VAC three-phase power and up to 15hp with 460 VAC single-phase power.

These drives include ample built-in I/O and embedded Modbus RTU support, dynamic braking, torque limit capability, NEMA 1 conduit boxes, zero-stack installation, and a robust construction that meets military standards. Ethernet communication is supported with an optional card that allows the drive to be controlled and monitored over Modbus TCP or EtherNet/IP. VFD Suite is a free, user-friendly software package that allows configuration of the ACG drive and other advanced features, such as trending.

The new IronHorse ACG drives start at \$164.00 and all ACG drives and accessories come with a 2-year warranty.

Learn more by visiting:

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



## Murrelektronik EtherCAT® IO-Link Master Modules and additional IO-Link Hubs

**AutomationDirect** has added Murrelektronik Premium EtherCAT IO-Link master modules to their IO-Link product lineup. IO-Link masters provide standardized, point-to-point connections between smart devices and controllers. IO-Link functions similarly to traditional field I/O but adds the capability to collect diagnostic and operational data from IO-Link capable devices, helping pinpoint potential problems or improvements. Typical IO-Link systems consist of one IO-Link master (the interface between IO-Link and higher-level systems) and at least one IO-Link device.

The new Murrelektronik master module adds EtherCAT capability for systems that utilize this powerful protocol. Premium master modules also include MQTT and OPC UA communication for high-level data collection and cloud/IIoT networking.

Murrelektronik IO-Link hubs allow several sensors and actuators to connect easily to an IO-Link master via a standard sensor cable. These hubs transmit standard field I/O signals, and several new models have been added, including more discrete I/O modules and modules that support analog/temperature inputs.

The Murrelektronik Premium EtherCAT IO-Link master module is priced at \$399 and the new IO-Link hubs start at \$215.

Learn more by visiting:

<https://www.automationdirect.com/io-link>



## Lika Electronic Medium Duty Encoders and Encoder Linear Measuring Wheel Systems

**AutomationDirect** has added four new series of Lika Electronic rotary encoders. 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 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.

Learn more by visiting:

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





### AchieVe FDM Series 12mm Tubular Photoelectric Sensors

**AutomationDirect** has added AchieVe FDM series 12mm tubular photoelectric sensors that offer a rugged metal construction, high IP67 protection ratings, and sensing distances up to 4 meters. These photoelectric sensors feature selectable light-on/dark-on operation, a 10 to 30 VDC operating voltage range, potentiometer or teach-in button sensitivity adjustment, and a fast 1kHz switching frequency. Highly visible red LED models are offered with the polarized reflective sensing style, while infrared models are available in diffuse and through-beam styles.

The new AchieVe FDM series photoelectric sensors are UL Listed, CE and UKCA marked, and RoHS compliant. They offer a 3-year warranty and start at \$35.00.

Learn more by visiting:

<https://www.automationdirect.com/general-photoelectric>



### Advantech Gateways & Ziplink Connector

**AutomationDirect** has added Advantech serial-to-Ethernet Modbus gateways allowing connections of isolated serial



### More Nidec U.S. Motors ACCU-Torq Motors

**AutomationDirect** has added more AC-CU-Torq motors from Nidec U.S. Motors. The ACCU-Torq motors are high-performance inverter duty motors and are an excellent cost-effective solution for applications that require 100% torque down to zero speed. They are available in 230/460 VAC and are now offered in sizes up to 20 hp at 1800rpm and from ¼ to 10 hp at 1200rpm.

Additionally, models with a pre-installed encoder are available in sizes from ¼ to 20 hp at 1800rpm. A separately purchased encoder retrofit kit, which includes an Avtron HS35A full-quadrature encoder, is also part of this addition.

The new ACCU-Torq motors with a 143 frame or larger come with a 3-year warranty and start at \$578.00. Smaller framed motors and the encoder retrofit kit come with a 1-year warranty.

Learn more by visiting:

<https://www.automationdirect.com/inverter-duty-motors>



### Endress+Hauser Soliphant® FTM20 Vibration Rod Level Switches

**AutomationDirect** has added Endress+Hauser Soliphant vibration rod level switches to detect fine- or coarse-grained, non-fluidized bulk solids in silos, hoppers, and bins. They can even detect solids underwater, such as sediment buildup in a tank. These robust switches are insensitive to buildup, providing maintenance-free operation and easy setup with no calibration required.

They feature rugged plastic or aluminum housings, 316L stainless steel sensing elements, and come with solid state or relay outputs. Select models offer hazardous location ratings. These cost-effective sensors have a wide range of applications and can be installed in any orientation to indicate full, demand, or empty status.

The new Endress+Hauser Soliphant vibration rod level switches are UL Listed, CSA approved, CE marked, and RoHS compliant. They offer a 1-year warranty and start at \$673.00.

Learn more by visiting:

<https://www.automationdirect.com/vibration-rod-level-switch>

devices to the Internet for centralized machine communication management. Advantech Modbus gateways provide easy integration of Modbus TCP and Modbus RTU/ASCII networks and offer two 10/100 Mbps Ethernet ports for LAN redundancy.

These gateways can be set up and troubleshot with an easy-to-use web interface and provide up to four software selectable RS-232/422/485 ports. Configurations allow up to 16 peer connections under Modbus Client mode and 32 peer connections under Modbus Server mode on each serial port.

Another addition to this launch is the ZIPLink ZL-CMA9 9-position terminal block to 9-pin D-sub female port adapter communication module. This type of adapter provides fast and convenient screw terminal connections for D-sub ports on Advantech Modbus gateways or any other compatible device.

The Advantech Modbus gateways start at \$278.00 (EKI-1221-CE). The ZIPLink ZL-CMA9 adapter is \$24.00.

Learn more by visiting: <https://www.automationdirect.com/protocol-gateways>



## 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>



## Schneider Electric Easy TeSys Series IEC Motor Controls

**AutomationDirect** has added Schneider Electric Easy TeSys series manual motor protectors, contactors, thermal overload relays, and accessories to their lineup of motor control products. Easy TeSys series IEC manual motor protectors are compact, easy to use, and cover the functions of disconnect, controller, thermal overload relay, and branch circuit protection in a single device. They are pushbutton operated and available in ratings up to 32A.

Easy TeSys series IEC magnetic contactors offer a compact design for easy installation, a 45mm frame width, and a long life expectancy of up to one million electrical operations. They have a built-in N.O. auxiliary contact and are available in a variety of coil voltages, with ratings from 3 to 20 hp (38A) at 480 VAC.

Easy TeSys series IEC thermal overload relays offer an adjustable current range and are designed for direct connection to the Easy TeSys contactors. They protect against overloads, phase failures, and long starting times and are available in ratings up to 32A.

The new Schneider Electric motor controls have a 1-year warranty and are UL listed, CSA approved, CE marked, and RoHS compliant. The Easy TeSys series IEC manual motor protectors start at \$69.00, contactors start at \$29.50, and thermal overload relays start at \$29.50.

Learn more by visiting: <https://www.automationdirect.com/motor-controls>



## 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.

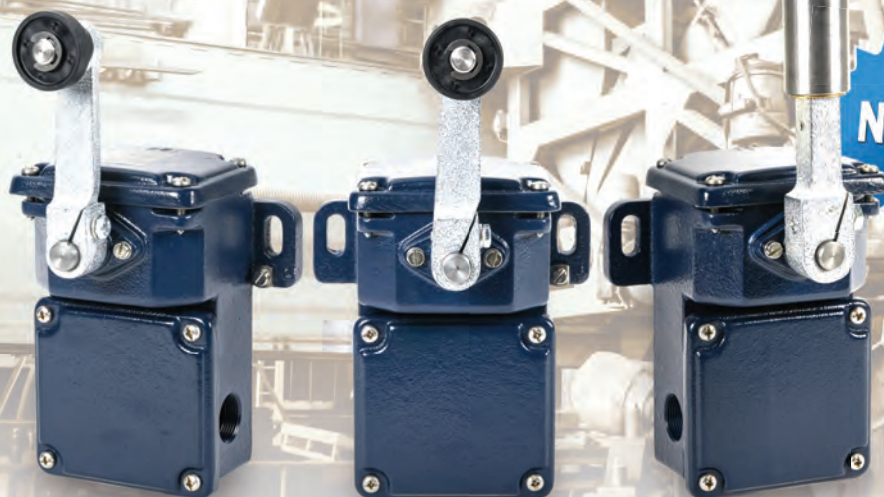
New Caneo Series40 puck-style standard and display type capacitive switches offer the same reliable performance as the Series41 in a compact, encapsulated polycarbonate housing. Their standard 22mm mounting provides a low-cost solution to quickly and easily retrofit and modernize aging installations.

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>



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