



Machine SAFETY

A LOOK INTO THE PRODUCTS, TECHNOLOGIES
AND SOLUTIONS SHAPING THE MARKET

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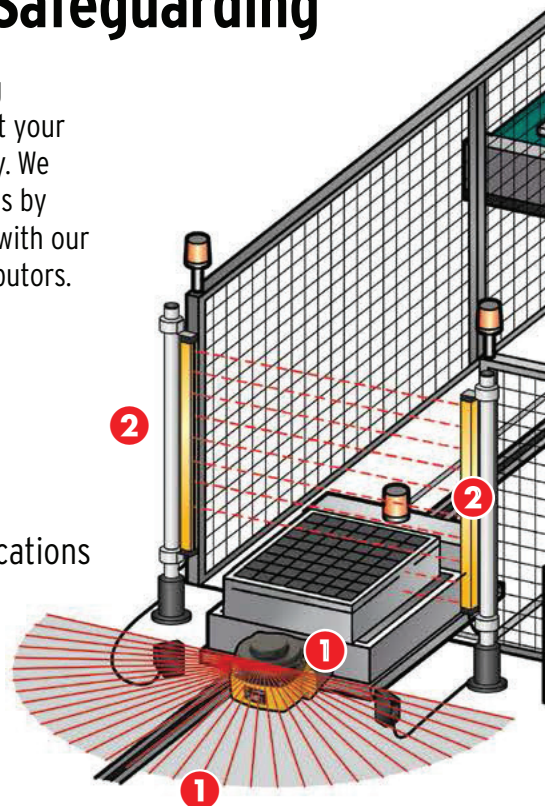
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3 Safety Interlock Switches

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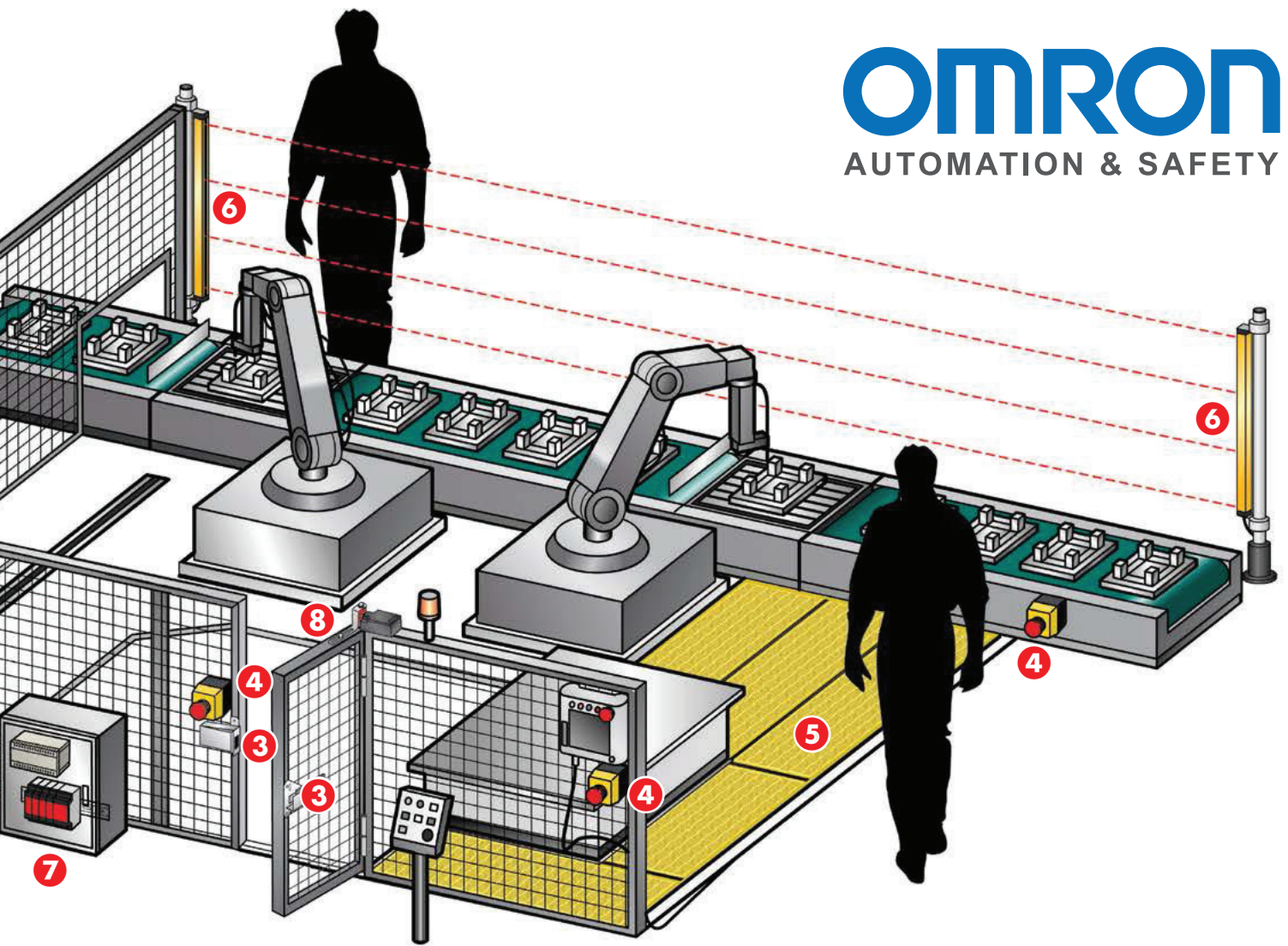
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- Non-contact switches
- Limit switches
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- Explosion-proof versions



4 Emergency Stop Devices

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5 Safety Edges & Bumpers

5 Safety Mats & Area Guarding

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6 Perimeter Guarding

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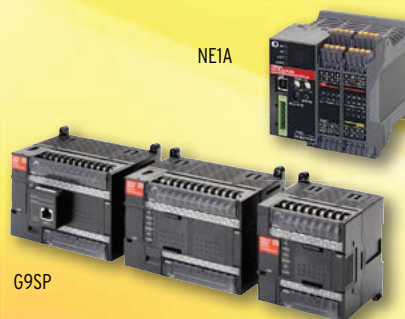


PA4600

7 Safety Programmable Controllers

7 Safety Monitoring Relays

The G9SP stand-alone programmable safety controller for mid-sized applications supports direct connection to safety mats and non-contact switches. The NE1A DeviceNet safety network controller is well-suited for large complex applications, while safety monitoring relays are ideal for ensuring control reliability in smaller applications.



G9SP

8 Enabling Switches

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- Has distinct clicks for three easily discernible positions



A4EG



G9SX

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5 machine safety guarding tips you must know

Machine operation and maintenance causes approximately 1800 injuries and over 80 deaths in Canada each year. Treating them as random accidents outside our control contributes to even more preventable injuries and fatalities. As a leader in machine safety-guarding, we have established five machine safety-guarding tips to help keep employees safe:

1. Become current with all government machine-guarding safety standards and regulations.

Educating yourself on machine safety and remaining current on the most recent government codes and regulations is the first step toward effective machine safety-guarding. In particular, you must strictly adhere to codes pertaining to the protection of personnel from the hazards arising from the use of mobile or stationary machinery. (In Canada: CAN/CSA code Z432. In the U.S.: ANSI B11 8.1 and 8.4-2008 / OSHA 1910.147, 1910.23, and 1910.132)

2. Identify your 'pinch-points.'

Always identify a machine for its 'pinch-points'—a machine's moving parts or places where body parts can become caught, like chain-drives and feed-rolls, or other moving parts adjacent to fixed objects. Also determine if plant personnel can be in a machine's operating zone while a machine is operating. Once these are discovered, then they can be appropriately safety-guarded.

3. Determine the precise safety equipment.

Precisely matching machine-guarding safety equipment to a specific machine and work environment ensures that your personnel remain safe and efficient workers. Customizing your safety equipment to the machine's pinch-points integrally contributes to personnel safety.

4. Know your stop-times.

The stop-time is the measurement of how long a machine takes to completely shut-down after cutting its power supply. This measurement is necessary to obtain the correct safety-guarding equipment. For example, when considering light-curtains, or other presence-detection devices, you must know the distance from the hazard, the stop-time, and how large the opening space is. The protection area can range from the size of an operator's finger to the entire body's size.

5. Know your safety-guarding material.

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Machine Safety Solutions

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SAFETY on the PLANT FLOOR



HOW LEADING MANUFACTURERS KEEP THEIR EMPLOYEES SAFE ON THE JOB

BY MARY DEL CIANCIO

Today's safest manufacturers are those that make safety an integral part of what they do every day; those that engage employees in their safety goals, get leadership commitment, and manage and measure their risks regularly.

Together, these factors are the keys to a successful safety strategy, according to the health and safety professionals that *Manufacturing AUTOMATION* interviewed for our annual focus on machine safety. This year, we spoke to four safety professionals from two leading manufacturers in Canada — PepsiCo and Molson Coors — about their strategies for keeping their employees safe on the plant floor. The safety experts also shared their tips on improving safety within an organization.

The plant floor at Pepsi

The safety, health and well-being of its employees is a core value for global food and beverage giant PepsiCo.

“At PepsiCo Canada, we believe that all accidents are pre-

ventable, and we strive to eliminate all such occurrences,” says Cassandra Coldwell, the director of Health and Safety at PepsiCo Foods Canada. “We believe that health and safety improvement starts by having the highest concern for employee health and safety, and that it is both an individual and a corporate responsibility, with full alignment and ownership across the organization. We strive to create a world-class safety culture to achieve an accident-free, incident-free, and a regulatory-compliant work environment.”

And while the team at PepsiCo knows they can't fix everything at once, they focus on continuous improvement, and target a five to 10 per cent improvement each year.

To achieve these commitments, the company has a global environmental health and safety management system, which focuses on five key pillars: lead and commit; manage risk; build capability; perform and measure; and engage.

PepsiCo has Global EHS Standards — including Machine Equipment Safety Standards (MESS) — which the company fol-

lows to ensure that they are consistent within all of their sites.

“At PepsiCo Canada, we use a risk management approach for all our key management system elements, including machine safety,” explains Bryan Farley, regional HSE senior manager with PepsiCo Beverages Canada. “This cyclical process of risk identification, risk evaluation/prioritization and risk control is designed to reduce the risk of this potential hazard for our workers.”

The keys to this risk management technique are leadership, competence and proper documentation, says Farley.

“Program leadership defines the resources, roles and responsibilities and formal support needed for our locations that have equipment and processes that require machine safety. Once the machine safety program element leader and team have been identified, we ensure that they have the right support and capabilities to execute machine safety risk assessments for all their equipment. This support is a combination of internal HSE resources or external technical experts so that we complete the assessments, identify controls and develop a corrective action plan to close any gaps,” Farley explains.

He adds that the risk assessment methodology used at PepsiCo Canada takes into consideration ANSI, ISO and CSA standards for machine safety. It also looks at the tasks, hazards and affected persons, and determines risk using a scoring system that factors in the potential severity of harm and probability of occurrence of that harm.

“To control the risk in new, existing and transferred equipment, a hierarchy of controls is considered to determine the most appropriate risk reduction measure,” says Farley.

Typical solutions or controls that the manufacturer uses to reduce risk and close any identified gaps include the installation of fixed or movable guarding, emergency stops, and presence sensing devices (such as light curtains and safety interlocking and control systems). The company also employs a lock-out, tag-out (LOTO) process as the primary method of control to protect employees from potential hazards when access to the machine is required and where an alternate method to LOTO (i.e., safety-related control systems) is not in place.

“To continuously improve, we require periodic review of our risk assessment to ensure we’re reducing risk and identifying any additions or modifications that may require additional controls,” says Farley. “We also react quickly when a risk is identified. Rapid response serves to quickly eliminate the risk, while demonstrating our overall commitment to employee safety.”

Coldwell says that the key to OHS success at PepsiCo Canada is leadership commitment and employee engagement.

“Safety is not something that can be effective if only owned by a safety manager,” says Coldwell. “Everyone needs to believe in it and own it every day. Having a vision that has OHS as a core value, and ensuring that everyone is aligned to that is a critical part to this success. Another key to success is the development and implementation of a health and safety management system, which addresses all areas of safety and is applicable across the total business, is verified through both internal and external audits, and embedded within the organization.”

Safety the Molson Coors Way

Molson Coors, North America’s oldest brewer, takes its responsibility to its employees very seriously.



The above images show safeguarded equipment in PepsiCo Beverages Canada’s Mississauga Falbourn Plant. PHOTOS COURTESY OF PEPSICO CANADA.

“At Molson Coors, we value every human life, and we believe in the journey to zero harm,” says Paul Lay, director of Environment, Health and Safety for Molson Coors Canada.

The company has a comprehensive health and safety and environmental program, and Lay is responsible for the execution of the program across Canada — including six breweries, 20 distribution centres and all of the sales offices across the country.

How does he accomplish such a massive undertaking? Each brewery has a technical governance team, and then there is a centralized team that Lay manages, all with the responsibility of ensuring safe behaviours and working conditions.

This year, the company rolled out what it calls “Safety the Molson Coors Way” — an approach designed to simplify safety, and ensure safe working conditions and behaviours. This approach has been utilized in the company’s U.K. operations for the last two and a half years, where they have seen a 60 per cent reduction in lost time. And now Molson Coors wants to mirror the results they’ve seen in the U.K. in their other operations globally.

The program has four elements: STEP, SPEAK, CARE and SEARCH.

STEP focuses on ensuring safe working conditions and behaviours. To ensure safe working conditions, all levels of management — from the GM to the supervisor — complete



To ensure safe working conditions, all levels of management at Molson Coors complete regular workplace inspections. PHOTO COURTESY OF MOLSON COORS.

regular workplace inspections. To ensure safe working behaviours, employees are asked to volunteer and are trained using a simplified behavioural safety model to conduct peer observations. What is unique about this element is that 90 per cent of those employee observations are positive — acknowledging when employees are doing something right.

“This drives a positive safety culture,” explains Lay. “If an employee observation identifies an improvement opportunity, the employee is provided with feedback to correct the behaviour and an agreement to change is made. Safety observations are not tied to discipline, as this would not support the behavioural and cultural change aspects.”

The next element of the program, SPEAK, focuses on professional, two-way communication. It is about speaking to employees on a regular basis about relevant topics and getting feedback, as well. Sessions are conducted in front of a professionally designed SPEAK board and can incorporate learnings from STEP observations and incidents, says Lay.

The third component, CARE, is about ensuring the correct incident response for early and safe return to work following an injury.

The final piece of the program, SEARCH, focuses on conducting effective

root cause investigations into loss events to ensure that they understand the underlying direct and root cause of an event.

The program has already been launched at the company’s breweries in Moncton, N.B., St. John’s, Nfld., and Creemore Springs, Ont. It will be launched in Montreal, Que., by the end of November, with Toronto and Vancouver launches to follow in 2014, and then rolled out at the company’s sales offices and distribution centres across the country.

Part of Molson Coors’ approach to safety is an annual audit program to review things like equipment and machinery to make sure that they meet the company’s world-class global standards. This includes conducting GAP assessments, risk assessments and job hazard analysis. Following the annual audit, the safety team develops a three-year plan, and guarding is something that would be included in this plan to ensure that the machines are in the right category and can be operated safely.

The idea is to simplify safety, make it easy to understand, engage employees, and build a critical mass to ensure that managers and employees alike are being safe every day.

“Everyone has a role to play,” says Lay. “Safety is not just the safety team’s job. It’s the whole facility.”

“Safety isn’t a one-person show,” agrees

Jeremy Shorthouse, the member of Lay’s central team who is leading the roll out of “Safety the Molson Coors Way” in Canada. “It’s a team buying into the program and ultimately wanting to be better.”

Shorthouse says that employee engagement is the key to any safety program’s success. And he knows a little bit about success. With his previous employers, Shorthouse has been able to reduce lost-time accidents by 90 per cent, and decrease the number of total incidents by 50 to 60 per cent.

“The employees have to be involved in what we’re doing and help come up with the ideas and the solutions,” he says. “There’s lots of different ways to guard machines... Go to the one that they think is going to best let them operate moving forward.”

Tips from the team

How are these safety leaders able to balance safety and productivity to ensure that employees on the plant floor are both safe and productive? It doesn’t have to be one or the other, the experts say.

“We believe safety improves productivity, and that a world-class safety culture can be a competitive advantage,” says PepsiCo’s Farley. “We focus on developing a safety mindset in our leaders and front-line employees where it’s not about safety first and then we move on with our work, but rather that whatever we do, we do it safely. We also educate all of our employees that the cost of an accident can be much greater than the cost of working safely.”

Molson Coors has a similar philosophy.

“When you do safety, quality and environment really well, it actually is a benefit to your overall organization, and your production will therefore increase as a result of it,” says Lay. “We don’t really see them as competing. We see it as the fabric of what we do — embed strong EH&S principles into your approach of everything that you do every day.”

Shorthouse has seen firsthand that safety can actually improve productivity.

“Ninety-five per cent of the time, productivity has improved in the [companies] I’ve been involved with, and five per cent [it] has stayed the same. So never once have I seen it where we’ve actually slowed the production down,” says Shorthouse.

“Safety just needs to be an integral part of our process, just like quality and everything else,” he adds.

Having a successful health and safety

FOOD FOR THOUGHT

When Scott Ellinor began his career as an industrial mechanic back in the seventies, workplace safety was not what it is today.

“If a guard bothered us, well it disappeared. If we thought it didn’t fit, we cut it to fit,” recalls the retired health and safety manager.

But the rules on guarding have drastically changed since then, and so has the manufacturing industry.

Before his retirement earlier this year, Ellinor was a health and safety manager at a large food manufacturer in Ontario. For the last 11 years of his career, he was responsible for setting the health and safety direction and goals in the plant.

The key to plant floor safety these days, he says, is worker involvement.

“We always got workers involved in any changes we were making, so when we upgraded some of our older equipment...we got them heavily involved because we needed to know how they interacted with the equipment so that we didn’t guard it to the point where they couldn’t do their job,” he says.

Ellinor also worked diligently with the company’s engineering department.

“I had the engineers trained in ergonomic design so that they could engineer hazards out of the machines where possible. I had worker representatives trained in risk assessments and involved in all new machinery installations before the machine was purchased.”

And, he adds, he worked with the engineering manager to purchase CSA guidelines for guarding and worked with the engineering department to put that level of guarding into the spec sheets for purchasing new equipment.

His key to success was communication.

“Many safety professionals and senior managers get confused with what is happening on the plant floor. I made it my responsibility to be on the plant floor in every department every day I was at work and occasionally going into the plant on weekends. My work hours were from 6 am to 6 pm every day. This meant I was on the shop floor on every shift,” Ellinor explains. “The worker on the floor believes and will follow a manager who is there when they are and answers their questions as best as he can...If the worker knows that he can go to the supervisor with a concern and it will be looked at, the workers are happier as a group, and happier workers are more productive.”



The assessment methodology used at PepsiCo Canada takes into consideration ANSI, ISO and CSA standards for machine safety. PHOTO COURTESY OF PEPSICO CANADA.

program is not without its challenges. For PepsiCo Canada, the biggest challenge is competing priorities.

“We run a complex business, and our leaders must balance their focus across a number of different areas, such as people, quality, service and productivity,” says Coldwell. “This is why we focus on safety being a core value versus a priority. We want to instill in all our managers that safety is not prioritized, because priorities change. Instead, it needs to be with us no matter what we do, so that we do it safely.”

For Molson Coors’ Lay, the biggest challenge is shortcuts and complacency.

“If you’re rushing or you’re fatigued, you might take shortcuts. Or if you’ve been doing the same role for a long time you become complacent, you don’t see the hazards. So part of our ‘Safety the Molson Coors Way’ program is to understand exactly what are the assumptions and the norms behind the behaviours, and what are our people thinking, and how do we counteract and understand that.”

What tips do they have for other manufacturers who are trying to improve safety within their organization?

“Invest in safety leadership training for senior leaders to highlight the employer’s legal expectations and obligations, but also the importance of leadership when it comes to safety,” says Coldwell. “Many

serious accidents that occur can be attributed to a leadership decision that was made at some point.”

It is also important to “ensure your organizational structure is designed to support a world-class health and safety culture through adequate staffing of health and safety leadership,” Coldwell adds.

“Safety needs to be owned by all employees,” says Farley. “Demonstrate leadership commitment, build the capability of your employees...prioritize your risks and implement the controls, and measure both leading and lagging metrics.”

“Involve your employees,” says Lay. “They are probably aware of what will work and what won’t work. Talk to them, engage them and involve them. They’ve been running that machine for 10, 20, 30 years. They’ve seen it before and they know what will work and what won’t work.”

“It’s not going to happen over night,” says Shorthouse. “Safety culture doesn’t change over night.”

But when a company has a safety program that engages employees, and has committed leadership that manages and measures risks regularly, everybody wins. Because ultimately, says Shorthouse, everyone wants the same thing.

“Safety is something that everybody wants at the end of the day, whether it’s at work or at home.”

MACHINE SAFETY DESIGN: Relays versus a single safety controller

BY KIAN SANJARI

There comes a point in machine safety design when the designer needs to decide if it makes more sense to use multiple safety relays or to upgrade to a safety controller. This point typically occurs when the application requires three or more safety relays.

There are three key influencing factors that will impact this decision for the designer: basic hardware design, safety controller configuration software and cost implications.

In terms of functionality and safety I/O density, a safety controller solution is a step above a safety relay solution and a step below a safety PLC. Safety controllers must typically be configured using software. The software allows for simple-to-implement safety circuit flexibility and functionality.

Basic hardware design

One of the key influencing factors that will impact whether a designer selects multiple safety relays or a safety controller is hardware design. This includes:

- **Load switching:** Most safety relay designs have traditionally used safety relays constructed with internal electro-mechanical, force-guided relays. The key advantage here is voltage flexibility, as nearly any typical control voltage can be switched. As an example, the nominal current at 24 VDC is about six amps for a resistive-based load. Contrast this with a safety controller with typically solid-state outputs that is only designed to switch 24 VDC at a typical maximum of two amps.
- **Modularity:** Safety controllers are typically modular, so safety I/O can be added. If safety controller expansion modules are needed, these costs will be an important consideration.

- **Dimensions:** Width and space are also important factors if DIN-rail space is valued. Safety relay width is directly proportional to the number of safety output contacts and overall functionality.
- **The number of safety I/O:** Safety controllers carry a bigger number of available safety I/O in a relatively compact housing compared to a standalone safety relay. This contrast in size becomes very apparent when wiring for Safety Category 4 or Performance level “e”.

Safety controller configuration software

For a designer accustomed to using safety relays, a safety controller’s configuration software is one of the main intimidating unknowns. Designers may worry about the required programming expertise level and additional costs. In this writer’s opinion, the configuration software can be a positive aspect. It increases flexibility and offers advanced functionality that a multiple safety relay circuit cannot provide. The software includes:

- **Drag-and-drop menus:** Today’s safety controller software is designed with “drag-and-drop” functionality with “non-programmers” in mind to simplify the design process. (See Figure 2)
- **Safety project simulation:** Another powerful aspect of the safety controller is the availability of a “Safety Simulation Mode.” This mode is perfect for designing a safety project at your desk and going into simulation mode to validate your safety project before going onsite to download it to the safety controller itself. Simulation mode is a perfect way to begin your evaluation of a safety controller. It’s a no risk “test drive” of the fully functional

software without the need of any hardware attached.

- **Monitoring and diagnostics:** Next, consider the diagnostics ability of the software. It will save time during startup and the troubleshooting of safety circuit failures. Troubleshooting a discrete safety relay circuit can be a daunting task due to all of the wiring and the variety of safety relays being used. With a safety controller, you can connect the software via the USB, upload the project and go online. At this point, the software will indicate the reason the circuit failed to activate.
- **Documentation:** Safety documentation can be a very important part of the machine delivery package. Software configuration packages have a predetermined offering where you can easily document key details pertaining to the safety program.

Cost implications

Let’s do a cost comparison exercise. For this cost comparison, we will use a baseline of safety relays with basic functionality. This writer assumes that a fair price for a safety relay with dual input channels and two normally open safety outputs is around \$220. This writer will also say that a fairly priced safety controller lists for around \$800.

Safety controller software

The next extremely important consideration is the potential cost of safety controller configuration software charges. Pricing for a safety controller configuration software package can range from a free download to around \$1,800. This writer recommends a free downloadable configuration software package with no licensing fees and a simu-

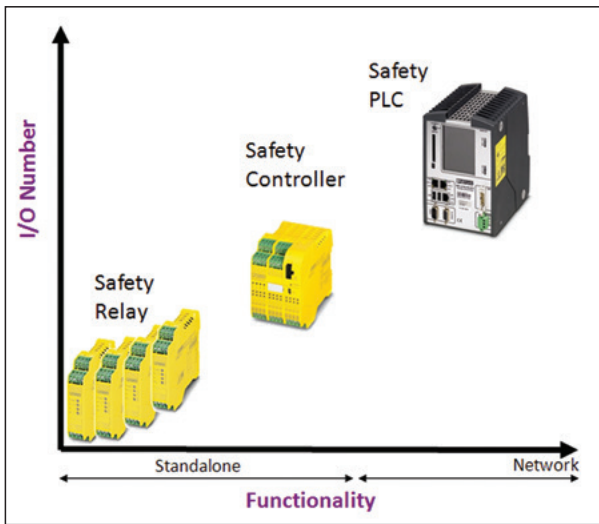


FIGURE 1: I/O number and functionality chart

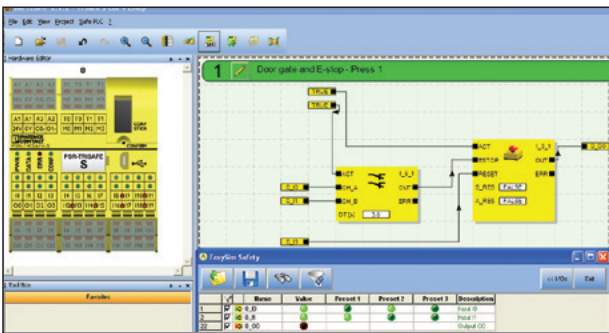


FIGURE 2: A screen capture from safety controller software

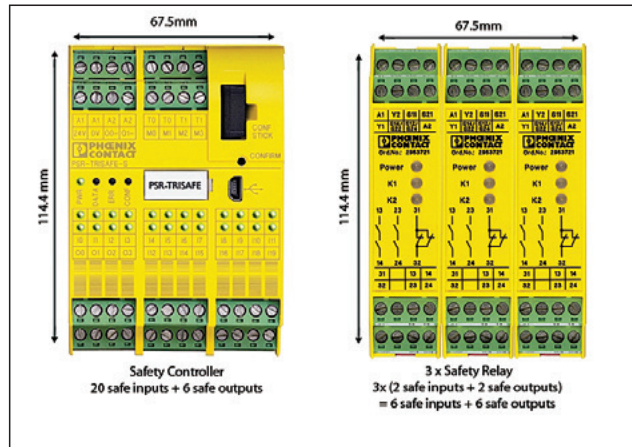


FIGURE 3: Three standard safety relays versus a safety controller

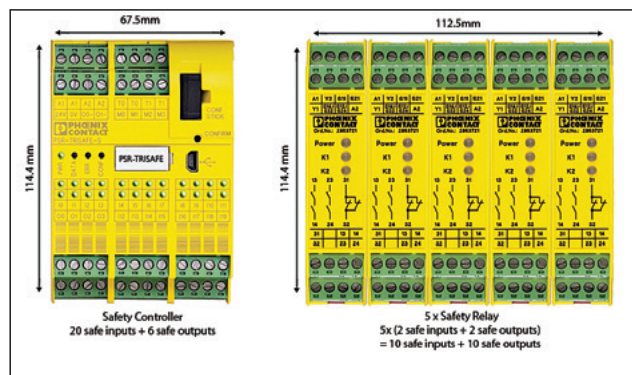


FIGURE 4: Five standard safety relays versus a safety controller

lation mode. Note: Since free options are available, we will not include configuration software in the pricing examples.

Pricing example A – Analysis

With three standard safety relays at \$220 each, the total cost is \$660. The safety controller is \$800. The safety relay solution costs \$140 less, and space is a trade-off. Since the price of safety relays is directly proportional to the number of safety contacts and to functionality, the safety relays would have to average more than \$266 each before the designer saw a cost advantage. However, safety controller flexibility, the ability to stock only one part number and other benefits might be attractive enough to

make the safety platform change.

Pricing example B – Analysis

With five standard safety relays at \$220 each, the total cost is \$1,100. The safety controller is \$800. The safety relay solution is \$300 (38 per cent) more expensive and uses 67 per cent more space on the DIN rail. If six safety outputs on a safety controller are enough, then it's no question the safety controller is a viable option at this point.

Conclusion

When an application requires at least three medium-priced safety relays, it makes economic sense to consider moving to a safety

controller platform. The more safety relays that are involved, the more this solution makes sense. If a platform change is decided, the next step is to evaluate the safety controller technology to determine if it fits the specific application needs. The designer should also consider functional flexibility, stocking a single part number and the monitoring/diagnostic power.



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