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Today's functional safety challenges

Erik Seidl

The terms safety, functional safety, safety integrity level, risk, hazard, security etc. are used in the sense of the International Electrotechnical Vocabulary (IEV) which can be accessed at electropedia.org and is published also as a set of publications in the IEC 60050 series.

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Schneider Electric has industrial safety roots dating back to the early 1970s. They were one of the first to protect press operators from serious accidents with initial offerings for eccentric hydraulic press applications. Today, demand for upgrading machine safety on existing and new machines is larger than ever. Erik Seidl, Safety Marketing Director at Schneider Electric, discusses current industry safety issues and innovative solutions.

Q. Let's discuss market trends in general.

A. Machine users and manufacturers want to ensure that new and existing machines are safe, connected for diagnostics, flexible in design, reliable (with minimal downtime), and ready for now as well as the future. The balance of machine complexity, needed interventions on the machine and the skill set of operators and maintenance engineers are all key decisions when selecting associated safety architecture devices. Machines must be online quickly and, if or when an issue is detected by the control system, it must be quick and easy to identify where and why the machine is not operational. Generally from all machine manufactures and users this is the key, as machine downtime costs industry far more than the cost of the components used within the machine itself.

For many years, the European market has led the direction for safe machines. In addition, during the last 10 years, we have seen strong developments in North America and in some South American countries such as Brazil. In Asian countries the trend is strong; nevertheless, in comparison to the number of machines manufactured in the region, it is still relatively small compared to where it should be. I believe as China continues to introduce and monitor the implementation of the legislation as well as changing more to a country of machine exports within the upcoming years, we will see huge growth in China and the region.

In addition, large manufacturers are impacting countries that have no local regulations. Many companies that we work with set targets in terms of number of accidents, protecting assets and ensuring the well-being of their workforce globally.

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Therefore they try to ensure that all their sites comply with company rules and expectations irrelevant of the manufacturing location. When risks are identified from site audits, the site must implement risk reduction measures that very often impact the surrounding companies of system integrators, OEMs, and governmental organizations.

For the past few years we have seen more demand on embedded safety systems due to large benefits of simpler architectures because of less wiring and cabling. It also increases functionality that improves the uptime of the machine, such as speed monitoring features like safe limited speed, which allows operators to quickly interact with the machine and resume full operation in shorter times. The overall market demand for simpler devices such as safety modules and configurable controllers remains strong and is growing globally; likewise the same is true for relevant safety sensors and actuators.

In the upcoming years we will drive toward providing our customers with complete, scalable, intelligent safety solutions and opportunities to save cabling with more fieldbus-connected devices and wireless solutions. Our customers will benefit from IIoT features such as predictive maintenance and automatic alerts for safety-related actions such as proof test intervals.

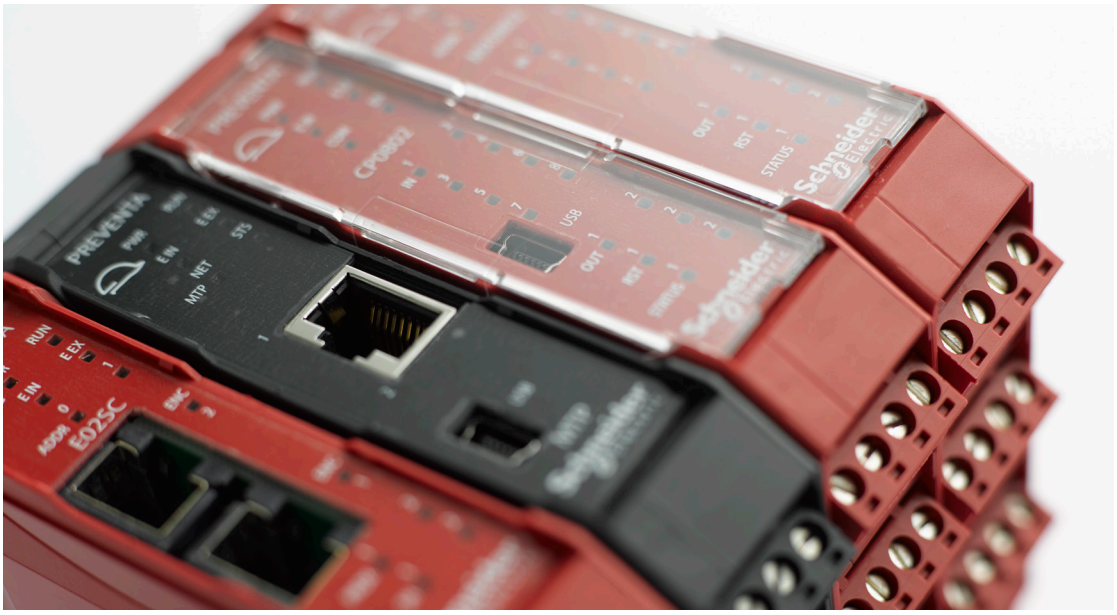
Safety will no longer be seen as a problem for the machine manufacturer but an added value beyond pure safeguarding interests.

Outside of bringing new features in offers, we support our customers to build more machines in a shorter period by providing certified safety solutions, as architectures with documentation, wiring, safety calculation explanation, and the Sistema project file.

Q. What impact does today's environment have on safety?

A. After the introduction of the machinery directive within the European community we have seen continuous evolution of standards to help OEMs build safe machines and, likewise, more C-type standards focused around specific machine types or parts of machines. Many other countries have followed such an approach to create their own machinery directive oriented to their local rules, such as Brazil with their National regulation NR.12 or the technical regulation of the customs union TR CU 010 in Russia.

The evolution brings huge advantages to machine users and operators when placed in plants. However, for machine manufacturers there is added complexity to understand how to implement safety properly, meet the requirements



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according to the directive, and understand the local rules where the machinery will be used and/or sold. Many OEMs who have been manufacturing machines for years — and have had only a limited scope for implementation of safety devices — now have to implement a larger scope of safe design into their machinery. Many companies complain of the limited resources that have the right skill set as it is often impossible for smaller companies to have someone designated to follow the evolution of requirements for safe machine design. Therefore many machine manufacturers rely on component suppliers to support them on aspects such as training, risk assessment, application design, validation planning, and machine documentation.

Schneider Electric makes certified "Safety Chain Solutions," which are designed to be used either one-to-one or as a template to be adjusted according to application requirements.

The certified architectures play a strong role in supporting customers to reduce efforts in engineering. However, this is only one of the steps in designing machines. It is still necessary for machine builders to understand how to follow risk assessments, validation, documentation, and life cycle management for the life of the machinery.

Q. How else does Schneider Electric help OEMs meet these challenges?

A. Outside of the pure scope of designing machines to be safe, end customers using the OEM machinery want to have machines running with minimal downtime.

Machinery used in the past typically had large barriers, such as fences, surrounding the dangerous parts of the machines, and operators stopped the machinery to be able to interact with the equipment. Today, operators want to be closer and interact without fully stopping production. We design products with safe functions embedded on board, so they can bring the machine down to reduced speed — for instance to load a roll of film — and keep the risk level acceptable. In conjunction with the correct safety equipment, such as an enable switch, the machine operator can load the new material and ramp up production to full speed without a lengthy and costly production stop.

In addition, with improved detection mechanisms and response times of the safety systems by embedded safety technology, the safety distances that were previously required are reduced.

With the evolution of our embedded safety offer, which already supports our customers building

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modular machines over Ethernet, customers can design their machinery with optional parts. This allows our customers to design machinery that has a standard architecture and can be expanded by optional machine parts. This is great for their manufacturing as it allows customers to simplify their production as well as their overall engineering efforts. From one application project file they are able to cater to all their machinery types. The machine builder can focus on building one flexible safety concept and reduce time to market for selling their machines. Likewise, the end user sees huge benefits as with modular machine design they have the flexibility to change their production very quickly and not have multiple machine lines to do the same job as one can.

Simplicity is key when designing machinery and one key offer launch in the previous years is the Preventa™ XPS MCM modular safety controller — a configurable safety controller designed to protect operators and machines from moving parts. Last year the offer was expanded with new fieldbus option cards, HTL and TTL speed monitoring modules (for reduced downtime), and new features such as offline simulation within SoSafe configurable software. The XPS MCM modular safety controller can be used as a stand-alone or within a distributed architecture and it is quick and easy to configure thanks to its intuitive automation based on SoSafe configurable software, thus reducing time to market. It also has a wide range of fieldbus connections available for machine controllers, so it simplifies integration and maintenance.

Last but not least, a new series of Preventa™ safety modules targeted for both optimized performance and, in cases where a maximum of 3 safety functions are required, high performance machines will be launched at the beginning of 2019.

Despite single monitoring functionality, these modules can be configured to perform different safety functions using rotary switches. These switches are located at the front of the device and are protected from misoperation by secure transparent safety flaps. The offer is comprised of 7 different functionality or performance categories, all of which are equipped with two rows of removable terminals, both spring and screw, as well as two different supply voltage types (24 VAC/DC and 24-40 VAC/DC).

Monitoring capabilities of the module include that of 1, 2 or 6 e-stops, trip wire switches, mechanical switch guards, magnetic switch guards, proximity switch guards, or light curtains, or 1 safety mat, enabling switches, two-hand control IIIA stations, or two-hand control IIC stations. Safety applications can enable movement as well as management of

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either SS0 (with immediate outputs) or SS1 (with immediate and time delayed outputs) stop category safety stops.

One of the biggest benefits for the customer is a single smart diagnostic output, which must be connected to a standard PLC input. The function blocks provided enable the transmission of more than 40 diagnostic messages, which help to reduce machine downtime. Another customer benefit is the sourcing of preventative maintenance information by means of another function block to enable the maintenance department of the end user/provider to carry out maintenance operations on the machine at the same time. The second function block also sends reminders to the operator/maintenance personnel regarding the proof test at intervals established by the OEM. This information can be included in the maintenance plan to reduce the amount of machine stops.

Q. Are the people present in the workplace environment the only ones facing the risk of a hazardous event?

A. Dangers outside of the typical workplace are sometimes not observed as we are comfortable with our surroundings and are not alerted by many of devices or machines that we use on a daily basis in comparison to a manufacturing plant where normally regular trainings are held to remind the workforce what to look out for and avoid, and when accidents are most likely to occur.

In many cases, machine operators are standard workers or even children and retired people without any specific training regarding the operation of the machines they are using. Some very good examples are bread slicer operators in supermarkets as well as escalator and lift operators etc.

Many accidents happen on standard machines such as lifts. There have been many incidences in the past few years where the positioning of the lift cabin has resulted in users being injured and, in the worst cases, killed.

Q. What can be done to help OEMs reduce the engineering effort and overall time to market?

A. Our free of charge safety chain solutions offer provides our customers with the help required to reduce engineering efforts. Part of the safety chain solutions is a complete document explaining the principle, architecture, wiring, and safety calculations. In addition, many customers appreciate the Sistema project file as the philosophy can be understood from the documentation and, if there is a requirement to alter the components used, the customer is able to modify the Sistema project. Naturally, as the safety chain solution is certified, it supports as a basis to build the machine

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documentation. The support of our safety chain solutions solves at least one of the aspects of designing safe machinery, however OEMs still need to build a good risk assessment considering all life cycle duties. They need to look at maintenance, loading, and operations, and assess acceptable risk. We provide them with the tools to calculate and improve their machines, with or without our products. In addition, we provide a lot of presales support and either offer in addition services or support in consultancy, risk assessments, calculations, design, documentation … either from Schneider Electric or from a partner. The result is a safe machine world.

Our safety chain solutions are continuing to evolve. This year we will launch new architectures linked to our modular safety controller as well as to a new series of Preventa™ safety modules due for release at the beginning of 2019.

Q. Which new products can help OEMs innovate and future-proof their business?

A. Last year we launched roughly 40 new product references and 10 software function blocks for the Preventa XPS MCM modular safety controller, giving customers more variance, speed monitoring, more fields for connectivity, connectivity to different control systems, and more Ethernet-based fieldbuses and serial fieldbuses. Our technical and application support is also strong and growing to be able to support more safety applications — the extension of the portfolio now covers 80 to 85 percent of the market requirements.

Our unique value propositions for XPS MCM modular safety controller systems include:

- Intuitive software that is simpler, but offers extended capabilities for customers with a lot of logic who want a simpler method of implementation.
- Our hardware/software platform can be used from small to large machines — up to 128 inputs and 16 outputs. It's scalable and flexible — one system can cover the majority of an OEM's machines, thus saving engineering time and cost of spare parts.
- Embedded I/Os on the controllers — at only 22.5 cm, they are the size of a safety module, so cabinet space doesn't have to be increased; in fact, it is in most applications.
- Easy connection to the bus system — Many offers have the bus connection for I/O on one side, requiring dismounting and then reassembling the entire row of I/Os to change one module. Ours is much simpler. You can add modules where you like, no position requirements are necessary; removing/exchanging modules only requires the release of the DIN rail clip.

The new Preventa™ safety modules can aid in the creation of a completely new business model in the services industry due to the large amount of information they provide using the new function blocks. By storing this information with cloud technology, OEMs are able to run comparisons of safety messages sent during machine downtime or even help plan maintenance.

Q. How can we limit machine builders' workload and costs with the modular safety controller?

A. As our portfolio is flexible, customers can build their architecture as they want, centralized or decentralized. It's simple to set up the hardware, and when connecting to a non-safety automation system for reading diagnostics the large variance of fieldbuses that can be used together with our system covers the requirements for the majority of customers.

Offline simulation enables engineers to develop the application and test it before making a download to the controller, so they don't have to waste time with too many procedures for each modification.

Q. How can OEMs get your safety offers?

A. We sell the majority of our safety offer directly through distributors. Customers work with one of our skilled safety engineers to define their solutions, then go directly to their distributor. Schneider Electric offers all products needed to build a machine — from sensors, contactors, drives, pushbuttons, and switches to controllers, motion, and power supplies. Most importantly, safety is based on reputation, experience, and know-how. We've been in the business a long time, gained a lot of experience in the applications we target, have a strong brand image, and offer extensive support with our safety chain solutions.

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Erik Seidl joined Schneider Electric in 2010 and holds a Diploma in Electrical Engineering. He was appointed Safety Marketing Director in 2018, and previously held various positions within the field of Application of Support and Training, all of which were directly customer facing. Seidl defines and implements safety products and solutions within the Schneider Electric Machine Solutions Industry by evaluating worldwide offers and trends.

Schneider Electric

35 rue Joseph Monier
92500 Rueil Malmaison — France
Phone: +33 (0) 1 41 29 70 00

www.schneider-electric.com

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