Technical article, published in:
Computer & Automation, 11-22, WEKA FACHMEDIEN GmbH

# MACHINE SAFETY – TAILOR-MADE!

Safety functions are gradually shifting from hardware level to software level. As such, it makes sense for machine builders to work with their safety systems suppliers early on when developing new products. There are particular benefits to be gained from the use of OEM-specific software.

Development objectives in the project planning of protective devices include seamless integration of safety functions into the process, transparency with regard to operating states and minimised installation effort as well as maximum connectivity. The shifting of many safety functions from the hardware to the software, coupled with the use of electronic safety switchgear devices and safety controllers, creates the boundary conditions needed to achieve these objectives.

**Individual rather than from a catalogue**

In the event that the particular requirements of an application go beyond the mainstream (and not only then), a customer-specific adaptation of the safety functions can help to optimise the interaction of machine safety and the process. Schmersal has established a solution path for this, with individual software modules both for programmable safety controllers and parametrisable small safety controllers, as these can be supplied ex works with customer-specific software.

These customer-specific safety solutions are developed and planned by a project team at Schmersal operating in the 'Systems and Solutions' division. Here are some real-life examples:

**Compact controller replaces thirteen relay modules**

A company that manufactures food-processing machines and had developed a new series of machines consulted Schmersal with the hope of optimising and consolidating the selection of safety-related 'hardware' for the monitoring of several guard doors and flaps on a cutting system. The challenge was to standardise the thirteen different types of safety evaluation that had been installed in the machine manufacturer's different product series. The trigger for this was a mixture of availability requirements, exacerbated by safety standards and discontinuations on the part of manufacturers.

Working with Schmersal, the functions of these thirteen different safety modules were combined into a single device – the 'Protect Select' compact safety controller, or more specifically, the OEM version supplemented by customer-specific software modules. With this, a single version of the compact controller can now be used in all product series, with no limitation on functionality. As part of the project, the safety parameters were determined and all machine safety requirements were taken into consideration.

The user can now enjoy improvements such as better diagnostic options in the event of errors and irregularities.

**Fig. 1: Protect PSC1 programmable safety controllers are based on many safety solutions, with customer-specific software if requested.**

**Customer-specific standstill monitoring**

A manufacturer of bread slicing machines for supermarkets was looking for a solution for the monitoring and integration of protective devices for standstill monitoring of the slicing device, protective guard interlock, sensor monitoring of the protective guard and emergency stop. In competition between multiple suppliers, Schmersal was also able to stand out with its 'Protect Select' compact safety controller concept, in OEM version. The concept, with customer-specific software, takes all of the machine manufacturer's individual requirements into consideration. The controller can be used universally for multiple series, enables comprehensive diagnostic functions and, when compared to conventional standstill monitoring, offers considerable cost benefit.

**Installation of safety switchgear**

There are also benefits when it comes to the installation and integration of customised safety switchgear in the field, as the third example demonstrates: A manufacturer of packaging machines monitors the guard doors of a series of machines using, inter alia, solenoid interlocks (AZM 300), safety sensors (RSS 260), command devices and an emergency stop. Schmersal's Application Engineering division suggested connecting these (safety) switchgear devices via a 'Safety Fieldbox'. This enables field connection of up to eight safety switchgear devices of different types. Both the safety-related and the operational signals are captured and connected to higher-level controllers via Profinet/Profisafe. In the future, users will also have access to versions with connection to Ethernet/IP, CIP Safety and Ethercat FSoE. This will give machine builders the benefit of simplified installation and users benefits such as quick diagnosis in the event of an error.

**Fig. 2: The Protect Select small safety controller can be ordered in OEM versions with customer-specific programming.**

**Routes out of materials shortages**

The 'Systems and Solutions' project team has been given a new task in recent months, brought about by the ongoing shortage of electronic components. At Schmersal, this shortage has meant that, at certain times, it has been impossible to produce the latest generations of electronic safety switchgear in particular in the quantities the market requires.

Their task is search for alternative solutions that require as few changes as possible from the machine builder's perspective, while offering full functionality from the user's perspective. This can be properly managed with just a little engineering effort and a careful analysis of the needs – particularly as some identical switches operating to a different principle remain available. For example: For RSS16 safety sensors with failsafe RFID technology (and a microcontroller), alternatives include the BNS16 magnetic safety sensor and the AZ16 electromechanical safety switch, both without a microcontroller. In some cases, however, you will perform safety calculations to determine which solution is actually appropriate, only to then find out that sadly, not all features that you need can be realised like for like.

An example from advisory practice: For one and the same application (cycle time 1000 s = 12,672 actuations per year, three devices connected in series), the RSS260 RFID safety sensor had a maximum Performance Level (PL) e and a high diagnostic coverage (DC). Performance Level d and a low diagnostic coverage were determined for the AZ16 electromechanical safety switch. PL c and no diagnostic coverage were determined for the BNS260. The reasons for this include wear (something that does not occur with RFID-based safety sensors), error masking and an absence of self-monitoring functions (for short-circuits, cross-faults, etc.). In addition, the series connection also negatively affects the Performance Level.

The designer can, however, benefit from the option of shifting certain functions (such as self-monitoring for short-circuits and cross-faults) to the evaluation, such as into the safety relay module.

As the examples demonstrate, early cooperation with a safety systems expert can be beneficial when it comes to designing new machine series or optimising existing machine series. This applies when the use of customised (safety) software is being tested.

# A QUESTION OF SAFETY

When it comes to safety certification, users often feel a sense of uncertainty. Tobias Thiesmann, Systems and Solutions Manager for the Schmersal Group, comments on current topics:

### INSTALLATION OF SAFETY SWITCHGEAR

**Mr Thiesmann, in view of current supply bottlenecks, people are switching to re-engineering and alternative solutions. What impact does this have on safety certification under the relevant safety standards? What's the way to prevent recertification?**

**Tobias Thiesmann:** In this case, there isn't a lot that can be done to prevent it. If the alternative components are within the given specification and have the same design, we evaluate it all internally and notify the respective notified body of the change. If the alternative component necessitates a significant change, such as a layout, circuit or software change, the notified body will have to verify these changes, all the way up to and including recertification.

**An ever increasing number of safety functions are being mapped in software. What should users pay attention to during realisation?**

**Tobias Thiesmann:** Mapping safety functions in software is not really a problem. What is important though, is that this software runs on hardware that is suitable for use in the field of functional safety. This can usually be identified by the manufacturer specifying the respective characteristic value, such as the Safety Integrity Level, Performance Level or Safety Category. The software itself must also satisfy certain requirements – standards ISO 13849-1 and 13849-2 offer an introduction to this. Programmable hardware that allows safety functions to be mapped in software is usually supplied by the manufacturer with a suitable programming environment. Once the software has been developed, validation needs to take place to help ensure that implementation of the software satisfies the requirements of things like the risk assessment.

**Fig. 3: Tobias Thiesmann, System and Solutions Manager, Schmersal Group**

**User software is also being used on safety controllers. What is the impact of this when it comes to compliance with safety certification?**

**Tobias Thiesmann:** The safety parameters specified by the manufacturer tend to apply only to the hardware and firmware of the safety controller. As the name suggests, user software is the responsibility of its developer, so the user. Software errors in the more narrow sense are often intercepted by the programming environment, although the actual program logic is not a part of this test. This means that not everything that is compiled is necessarily functionally safe. In addition to using safe hardware and a suitable programming environment, the user must also document the suitability of the software by means of validation. In addition to the suitability of the controller, questions relating to concrete application also play their part when it comes to attaining certain safety parameters, such as guarding against unexpected restarting or integrating feedback circuits.

**Schmersal is on hand to advise users. Which questions do you hear repeated most frequently? Where are the greatest challenges do you think?**

**Tobias Thiesmann:** The first question user asks is often about the right hardware for a specific job. This tends to be followed by advice to the customer on how the safety solution can and should be integrated into the application. What often gets neglected though is the use of synergy effects – state-of-the-art, programmable safety logic often offers the option to standardise safety solutions and provides other features, such as interfaces for documentation and for diagnosis and communication. This potential is often wasted because it does not immediately give rise to new sales for the user – users just prefer to 'leave things as they are'. Sadly, the long-term increase in productivity often gets ignored.

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