

Technical article, published in:
GIT SICHERHEIT + MANAGEMENT 10/2016, WILEY-VCH Verlag

Best of all flexible Requirements on safe control technology

In the widely varying task areas in industrial production, flexibility is becoming an increasingly important characteristic of machines and installations. Batch sizes are becoming smaller, and it must be possible to adapt the machines to different products and market conditions both straightforwardly and quickly. As a result there are also special requirements on the safe control technology. A new generation of programmable modular safety controllers is extremely well suited to this requirement.

Automated production with a batch size of one. This is the basic principle of Industry 4.0 in a nutshell. Increasingly small batch sizes are already apparent in industrial practice; there are several reasons for this development. Consumers want increasingly individual products and markets differentiate. Online retailing reliably serves each of these small niches, and this trend is even more apparent in the packaging areas of production because there are increasing numbers of promotional articles and special sizes with which the manufacturers generate attention.

The trend: modular machines with short retooling time

This situation has effects on the design of the (packaging) machines, to remain with this example. They are increasingly of modular design, designed for quick format changes and also for quick troubleshooting. These requirements – which also apply to other sectors in similar form – have effects on machine safety. Greater flexibility can be best realised here by using modern, control technology. Programmable and configurable electronics permit the adaptation of the safety functions to the specific application. A further advantageous characteristic is the modular design of the control technology.

Also modular: safe control technology

How these requirements are implemented during the development of safety controllers and applied by the designers of packaging

machines is demonstrated by the latest generation of the safety controllers from Schmersal. The system called Protect PSC1 is of modular design – with two freely programmable compact controllers as its core components (PSC1-C-10 and PSC1-C-100). In the basic version both have 14 safe inputs (up to PL e according to ISO 13849 and SIL 3 according to IEC 61508), two safe relay outputs, two auxiliary outputs and two pulse outputs for sensors with contacts. The difference is in the number of configurable inputs and outputs as well as the configurable safe semiconductor outputs.

Integration of safe drive monitoring

Safe IO expansion modules are available for both variants; these modules can be installed both centrally in the switch cabinet and decentrally. The decentral modules communicate with the compact controller via Ethernet SDDC. In addition it is also possible to monitor up to 12 axes safely by means of comprehensive functions using the “Safe Drive Monitoring” module (SDM). In this way safe drive monitoring with all the related functions (safe stop, shutdown, movement, positioning...) can be integrated into the compact control unit. The modules developed for the compact controllers include a universal communication interface that permits the straightforward selection and configuration in software of various fieldbus protocols. The user can therefore establish a connection to all common fieldbus systems



The packaging industry places special requirements on machine safety



The machine manufacturer can expand the Protect PSC1 system using various modules, e.g. with additional inputs and outputs, universal fieldbus interface, safe cross-communication and safe drive monitoring

via a homogeneous hardware platform. This feature increases flexibility and also reduces development costs. Safe Remote-IO communication and safe cross-communication is also made possible.

Integrated diagnostic functions, versatile development environment

An optional SD bus gateway module permits the direct connection to the PSC1 central unit of up to 31 sensors with expanded diagnostic functions connected in series. This solution significantly reduces the wiring effort and the space required in the switch cabinet and it meets the requirements from many manufacturers and users of packaging machines for quick diagnostics in the event of a fault.

The programming software SafePLC2 offers the user a modern development-orientated environment. It has comprehensive libraries with pre-defined functions for

the safe monitoring of sensors and axes; these functions can be linked together straightforwardly to form complex applications using “Drag & Drop”.

Application example 1: meat processing machine

How can such a system be adapted to the related application? Here there are already examples from packaging machine manufacture covering a broad spectrum. In “standalone” machines for meat processing, e.g. on cutters and bowl cutters, the smaller variant of the central module is used. In this situation it is equipped with the SDM module for safe axis monitoring, an SD card for application programs and two universal fieldbus interfaces (Ethernet and standard). Along with the emergency stop button and a safety interlock for the bowl cover, two safety sensors for safe standstill monitoring on the mixing and cutting tool are also integrated into the safety circuit.

Application example 2: filling machine

A filling machine for viscous media such as yoghurt is equipped with a total of eight guard doors that permit access to the eight workstations (feeding, filling, sealing, labelling...). All safety interlocks on the guard doors (Figure 4) as well as several emergency stop buttons and two rotary encoders for safe drive monitoring are connected to the Protect PSC1 system, which in this case comprises the basic module PSC-1-C-100, two expansion modules and the SMD2 module for the safe monitoring of two drives.

Application example 3: complex filling and packaging system

On complex machines such as the combined filling and packaging systems, designers often select a decentral control architecture.



The safety controller Protect PSC1 can be flexibly adapted to the specific application

The Protect PSC1 system can be optimally adapted to this situation by installing the central module PSC1-C-100 in the switch cabinet and several decentral expansion modules in the distribution boxes. The safe cross-communication via SDDC ensures the safe exchange of signals in this case. The safety controller also communicates with the system controller via the universal fieldbus module FB1.

Advice and service for setting up and programming

The Protect PSC1 system can be conveniently adapted to individual requirements using the programming software SafePLC2. The package is also based on a parameter configuration software application for fast application-specific configuration. The software is easy to use. However, in view of the many possible ways the user can utilise these options, it is sensible to make use of the support provided by Schmersal.

In its “academy” business unit, tec.nicum, the newly founded division of the Schmersal Group for safety services, offers training courses especially for the adaptation of the Protect PSC1 system to the individual application.

And the software developers in the tec.nicum engineering business unit apply these adaptations in consultation and collaboration with the machine manufacturer.



Flexibility is also required at the field level – the figure shows a safety interlock of type AZM 300 on the guard door for a packaging machine

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