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Flexibility and safe control technology

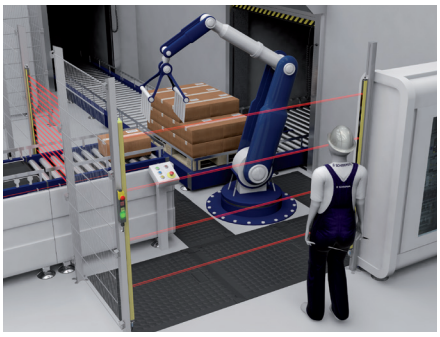
In the packaging industry, however also in other sectors of machinery manufacture, flexibility is becoming an increasingly important characteristic of machines and systems. Batch sizes are becoming smaller, and it must be possible to adapt the machines to different products and market conditions both straightforwardly and quickly. As a result there are also new requirements on the safe control technology.

Machines and systems in the packaging sector often operate with short cycle rates for 24 hours a day, and are also often integrated into interlinked overall systems. This situation has always been typical for packaging machine manufacturing. An additional trend is that these days machines must be more flexible than a few years ago. This situation is due to shortening product life cycles, an increase in promotional items and special sizes, and both the trade and consumers want greater product and packaging variety. This issue has effects on the integrated packaging systems and their configuration.

The trend: modular machines
For the reasons stated, filling and packaging machines are often of a modular design. This modularity makes it possible to react to market requirements more flexibly. Packaging manufacturers also want quick format changes so that a very wide range of package sizes can be manufactured efficiently. These requirements, which also exist in other sectors in very similar form, have effects on machine safety. Greater flexibility can be best realised in relation to safety by using modern, safe control technology. Programmable and configurable electronics permit the adaptation of the safety functions to the specific application. A major advantage is the modular design of the control technology.

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 controller Protect PSC1 manufactured by Schmersal. The key components of this control system are two freely programmable compact controllers (PSC1-C-10 and PSC1-C-100). In the basic version both have 14 safe inputs (up to PL e according to ISO 13849 or SIL 3 according to IEC 61508), 4 safe semiconductor outputs, two safe relay outputs, two signalling outputs and two pulse outputs for sensors with contacts.

Flexible expansion – additional functions
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 (Safe Device to Device Communication). In addition, using the »Safe Drive Monitoring« module (SDM) it is possible to monitor up to 12 axes safely using comprehensive functions. In this way it is also possible to integrate safe drive monitoring with all the related functions (safe stop, shutdown, movement, positioning…) in the compact control system. The features developed for the compact controllers include a universal communication interface available as an option. It permits the straightforward selection and configuration in software of various fieldbus protocols. In this way the user can establish a connection to all common fieldbus systems via a homogeneous hardware platform.



The packaging industry places special requirements on machine safety. All figures: Schmersal

This feature increases flexibility and also reduces development costs. At the same time, the interface also permits safe remote IO communication with a decentral layout and safe cross-communication between the compact controllers.

Comprehensive diagnostic functions for safe machine operation
The SDBus gateway, which can be integrated as an option, permits the connection of up to 31 safety sensors with expanded diagnostic functions. The diagnostic information from the individual sensors is transmitted to the controller via a »1-cable solution«. This solution significantly reduces the wiring effort and the space required in the switch cabinet and 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 to form complex applications using »Drag & Drop«.

Programmable, modular, multifunctional and cost-saving

The new safety controller Protect PSC1 from Schmersal is compact and of modular design, and therefore extraordinarily flexible in use. The Protect PSC1 comprises a freely programmable compact controller with IO expansion modules for the safe processing of signals from mechanical and electronic safety switches. The compact controllers can be equipped with a universal communication interface as an option.

The universal communication interface makes possible:

- Safe communication within the PSC1 system (remote IO and cross-communication) as well as with other safety controllers,
- Continuous information exchange (status and diagnostics) from the sensor level to the controller level,
- With only one piece of hardware the configuration in software of simultaneous communication with the fieldbus level (exchange of information between the controllers), the local level (between the modules PSC1) and the sensor level (Schmersal serial diagnostics bus).

In addition it is possible to monitor up to 12 axes safely using the comprehensive functions. There are also safety functions such as Safe Limited Speed, Safe Stop 1/2, Safety Limited Increment, Safe CAM, etc. according to the standard EN 61800-5-2.

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Also at the field level – the figure shows a safety interlock on the guard door for a packaging machine – flexibility is required.

Application example 1:
meat processing machine
How can such a safety system be adapted to the related application? Here there are already examples covering a broad spectrum. In »standalone« machines for meat processing, e.g. on cutters and bowl cutters, the smaller variant of the central module PSC1-C-10 is used. In this case it is equipped with the SDM option for safe axis monitoring, a memory card for storing the application programs and fieldbus communication for functional control. Along with the emergency stop button and a safety interlock for the bowl cover, safety sensors for safe axis monitoring on the mixing or cutting tool are also integrated into the safety circuit.

Example 2: filling machine
A filling machine for viscous media such as yoghurt is equipped with a large number of guard doors that permit access to the workstations (feeding, filling, sealing, labelling…). All safety interlocks on the guard doors as well as several emergency stop buttons and rotary encoders for safe drive monitoring are connected to the Protect PSC1 system, which in this case comprises the compact controller PSC-1-C-100, IO expansion modules and the »Safe Drive Monitoring« module (SDM) for the safe monitoring of the drives.

Example 3:
complex filling and packaging system
On complex machines, e.g. on a combined filling and packaging system, designers often select a decentral control architecture. The Protect PSC1 system can be optimally adapted to this situation by installing the compact controller PSC1-C-100 in the switch cabinet and several decentral expansion modules in the distribution boxes. In this case the safe remote IO communication ensures the safe exchange of signals with the decentral expansion modules. The safety controller also communicates with the controller operating the system via the universal communication interface.

Presentation at SPS IPC Drives
At SPS IPC Drives (24-26 November 2015) the Schmersal Group will present the safety control system Protect PSC1. Other key exhibits in Nuremberg will be a new an electric motor-powered safety interlock for

heavy guard doors and a new series of universal safety relay modules. A focus at the show will also be the safety switches with integrated interface for the bus system »AS-Interface Safety at Work« (AS-i Safety), which permits flexible adaptation of the safety functions to the specific application. As flexibility is a characteristic that is also increasingly in demand at the field level: the organisation operating a machine wants to be able to adapt a system, once installed, to changing requirements at any time. This statement also applies to expansion with additional safety switches and the individual configuration and definition of parameters for the switches, e.g. safety-related operators, stop categories and filter times.

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.

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