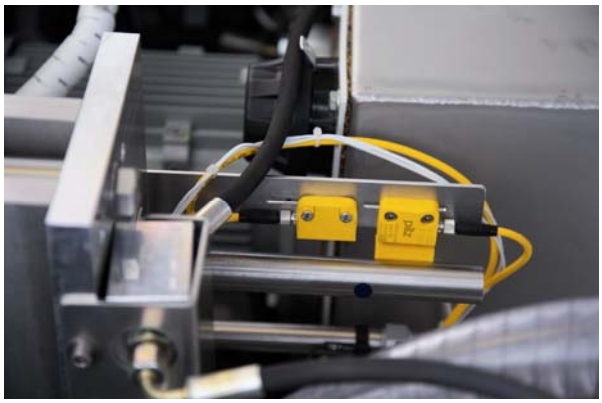
Concepts for secure safety gate monitoring - The right sensor for every requirement

Where there's flying metal swarf or hazardous movements on plant and machinery, safety guards or gates ensure the safety of operating personnel. Their position can now be monitored with a wide range of safety switches, which consider not just the safety-related aspects, but economic considerations too. The challenge for the designer is to harmonise safety, productivity and user friendliness on the plant or machine.



The legal position is clear. Before a machine is placed on the market, a hazard analysis and risk assessment must be carried out and documented. The safety concept for the respective plant or machine can then be worked out from the risk assessment. These days, almost all new plant and machinery are safeguarded by means of safety gates, flaps, fences or enclosures for the purposes of machinery safety and personal protection.

One key reason for using safety gates is to protect operating personnel from injuries resulting from intervention within the process. This includes protection from potential emissions as well as flying metal swarf. In the food industry it is also necessary to satisfy hygienic requirements.

To give operators as much freedom as possible, lift gates and rolling shutter-like constructions have become increasingly popular alongside the classic swing gates or sliding gates. The fact that plant and machinery has become ever more compact has meant that the sensor technology protecting the safety gates has had to adapt to the environmental conditions. This has resulted in a wide range of version types, which meet high IP protection classes or have ATEX approval as well as having the required resistance to cleaning agents.

Spoilt for choice

It is usually the design engineer who implements the safety-related requirements and selects the components used for safe monitoring. These days he has access to a wide range of design options and a large selection of safety switches that operate to different principles.

Cost effectiveness and productivity on each machine are the priorities. However, if user-friendliness is not far behind, it is not unusual for safety equipment to be manipulated. For this reason the designer also has the task of identifying potential reasons why devices might be manipulated and to eliminate these in advance at the machine's development stage. Despite all the technology, the concept of a totally safe machine is merely an illusion, as it would be practically impossible to operate. So a justifiable residual risk remains. To keep this residual risk as low as possible the designer should listen carefully to the machine operator's requirements and use the appropriate sensor technology.

Today's safety gates are mainly protected using mechanical safety gate switches or roller switches – in accordance with the risk classification. One example would be the Pilz mechanical switches PSENmech, which are also available with guard locking. For many applications they are still state-of-the-art. Mechanical switches comply with safety-related considerations such as positive-opening and, under certain conditions, can also meet the requirement for manipulation security in accordance with EN 1088. The signals are evaluated through compatible safe control technology, which also stops the machine and its process in the case of danger. However, solutions that use mechanical safety gate switches or roller switches do have certain constraints, due in part to the additional work involved in their precision adjustment and their limited service life. From an ergonomic consideration, many users also feel restricted by a mechanical solution, which can often lead to safety equipment being manipulated.

Robust, non-contact, safe

Non-contact safety switches operating to different principles have been available on the market for many years. Safety switches such as the PSENmag from Pilz are robust, compact and are based on a magnetic action principle, providing clear

benefits. Thanks to the non-contact principle, precision adjustment is unnecessary and high availability is guaranteed over the product's service life, as there's almost no wear and tear. The benefits of non-contact switches are clear to see, particularly on gates which are frequently operated, or in areas with increased environmental requirements such as dust or humidity, for example in the food or woodworking industry.

Coded against manipulation

A very recent trend in non-contact safety switches is transponder technology (RFID). It combines all the benefits of non-contact safety switches and also guarantees the highest level of manipulation security through individual coding of the actuator. So it is possible to achieve a high level of safety with just one switch. When used with machine tools and machining centres with metal cutting functions, coded safety switches such as Pilz's PSENcode have the advantage of not attracting metal swarf, unlike non-contact magnetic safety switches.

With guard locking devices, gates stay closed

Safety-related guard locking devices are necessary on an increasing number of applications. Cramped conditions mean that safety guards have to be located close to the hazardous movement. Not all movements can be stopped quickly enough to prevent a hazard to the user. That's why a safety gate has to be fitted with an interlock. The use of process guards in particular is showing an above average increase – they ensure that processes such as "gluing" or "coating" cannot be interrupted at just any position, whether intentionally or by accident, based on quality requirements. Another key factor in using safety-related guard locking devices can be seen in the example of a machine tool. Due to the hazardous overrun movement the safety gate must remain closed until the machining process is complete. The key factors here are the distance that the hazardous movement overruns once the plant or machine has stopped and how quickly the area can be accessed. If the distance is too short or the time required is not long enough, the lock cannot be released by the operator manually, but can only be released subject to safe standstill detection or a safe delay time. The enable cannot be issued until machine standstill has been detected safely or a safe delay time has elapsed. When considering a safe time, the worst case scenario should be considered: the time should be selected so that, even if a fault occurs, standstill is guaranteed to occur before the time elapses. With guard locking devices, the electromechanical principle has long been dominant: a mechanical bolt stops the safety gate being opened. The disadvantages lie in the service life and the need for precision adjustment. Guard locking devices with integrated position monitoring, based on a magnetic action principle, have recently come on to the market. One example is the PSENslock from Pilz. In a compact design with planar surfaces and IP67 protection, this guard locking device guarantees high availability and is also suitable for use in contaminated environments or in environments with high hygiene requirements, such as the food and packaging industry.

Secure packaging: complete solution for safety gate monitoring

Put plainly, safe sensor technology alone is only half the battle. Safety gate monitoring is incomplete without a corresponding safety relay on the output side, to evaluate the signals. With a one-stop solution, users can benefit from maximum compatibility between components.

Safety devices used to be viewed as obstructive, but now the opposite is true: modern safety systems such as the PNOZmulti make handling easier, and plant and machinery more productive.

In many industries, packing is still associated with manual work. Where man and machine are working together, the risk of injury must be minimised to the greatest possible extent.

The machine calls the tune: The semi-automatic vacuum-packing machine feeds in the bottom foil via a roller; it is then transported via a chain drive. The foil is brought up to temperature in the forming chamber; a special compressed air/forming procedure and the appropriate tool are used to create the desired tray shape for each packaged product. Staff use both hands to insert grilled sausages into the tray-shaped plastic film. Six pieces per row and per pack, before the conveyor moves on and another set emerges from the forming station. After the filling station comes the sealing station: The top film seal is fed through a second roller; a vacuum pump extracts the air and thereby the oxygen. Finally, the top and bottom film layers are impulse sealed under pressure in the sealing chamber. The product packaging is now secure and durable. At the machine outfeed, longitudinal and transverse cutters separate the packaged product into individual trays, which are then fed into

transport crates via conveyor.

Sprinter is the name of the latest development from Komet, manufacturer of semi and fully automatic vacuum packaging machines. So called because, in comparison to previous models, it can convey products to their packaging in an operation that's quicker and less complicated. That's because of a modern safety and control concept, which Pilz developed for Komet. PNOZmulti is a modular, flexible and intuitively configurable safety system. It saves time, space and money because there is no longer any complex individual wiring and all the safety-related functions are located in one housing.

Safe interaction between man and machine

On the *Sprinter*, PNOZmulti configures simpler, safer interaction between man and machine. By comparison the safety devices on its predecessor were simplistic and mainly based on individually wired switches and contactors. Large covers safeguarded wide-ranging potential danger zones such as the forming and sealing stations via switch contacts. The infeed area in between was narrow and only allowed a *one-up* arrangement. On the *Sprinter,* the cover on the forming station is reduced to a minimum. Instead, an advance security slide ensures that it is impossible to reach into either the forming or the sealing station from the filling station. If the slide switch is not closed, the safety system will prevent the bottom film from being formed and stop pressing and heat-sealing in the sealing station. Propulsion drives and valves are switched off, the central PMI operator terminal (Pilz Machine Interface) receives an error message, stating the cause and the source. Magnetic safety switches PSENmag monitor the mobile protective hood over the sealing station, the longitudinal and transverse cutters, the lower positions of the lift cylinder plus the security slide on the forming/sealing station. The PNOZmulti also monitors the E-STOP and the enables that control the heaters and valves. The risk of injury from the packaging machine, therefore, is kept to a minimum, both during operation and in setup mode. With PNOZmulti the machine has a flexible safety concept which is really easy to adapt to the requirements. Now the infeed area has a three-up arrangement, so assembly is quicker and easier, plus the machine is more productive.

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