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Bowden cable and lockout tag for enhanced safety

Some three years ago, Schmersal introduced a safety interlock designed specifically for heavy safety guards and machine tools with heavy doors. Since its introduction the safety interlock has shown just how versatile it is, not least due to the launch of new accessories that further improve the safety level it achieves.

It is not always possible to stop a hazardous movement immediately on every type of machine and system. This is particularly true of machines where there is an overrun movement. For these machines, DIN EN ISO 14119 [1] defines „interlocking devices associated with guards“. The AZM series of safety interlocks from Schmersal [2] ensures that hinged, sliding and removable guards, such as hoods, grids or doors, can only be opened when hazardous conditions no longer exist. At our customer’s request these series have been supplemented by a special safety interlock. The customers wanted a safety interlock especially for large safety doors that can also be locked and unlocked reliably under unfavourable conditions and ensure a high level of machine availability.

Guard locking using a motor-driven locking bolt

The forces that can be expected to act on an interlocking device are an important criterion for the selection of guard locking devices The safety doors of large CNC machining centres

Fig. 1: The AZM400 safety interlock has a holding force of 10 000 N

or portal milling machines can be several metres high and/or wide. They are usually actuated electrically in this case. But also with medium-sized machine tools with manually-actuated safety doors there is a trend towards safety interlocks with electric rather than door handle actuation. Schmersal engineers have developed the AZM400 safety interlock (Fig. 1) precisely for this type of application. A bolt is housed in a compact rectangular metal enclosure. The bolt is driven into the actuator by an electric motor holding the safety guard closed. The high degree of reliability achieved by the unit is ensured by two sensor systems. A safety-enhanced RFID sensor, which is also used in other Schmersal electronic safety switch series, communicates with an RFID tag in the actuator and consequently monitors the correct position of the safety guard before the locking bolt extends (Fig. 2). As the bolt extends, the depth of insertion into the actuator is monitored by a magnetic sensor. The safety release is only given and the machine can only start when a defined depth is reached. The AZM400 applies a locking force of 10 000 N. Conventional safety interlocks for smaller safety guards operate with guard locking forces of 500 N to 2 000 N. The safe RFID technology also gives the user a choice of three types of code, enabling the level of tamper protection to be defined in accordance with DIN EN ISO 14119.

Lockout tag for protection against unintentional closing

For the selection and configuration of protective devices, it is not sufficient to take normal operation of the machine or system into account. Many occupational accidents occur during maintenance and troubleshooting. To prevent these accidents a range of useful accessories are available for the safety interlock: A lockout tag protects operating staff from being locked inside larger, walk-in systems and machines by mistake while they are performing servicing and repair work (Fig. 3) Service personnel attach a padlock to the lockout tag when entering the hazard zone. This prevents the guard door from being closed which in turn prevents the machine from being started unintentionally. The lockout tag is suitable for fitting inside and outside the hazard zone. Up to six padlocks can be attached to the lockout tag, meaning up to six people can enter the hazard zone at the same time.

Bowden cable for escape release and emergency unlocking

The AZM400 safety interlock is now also available with a Bowden cable (Fig. 4) for use if an operator is inadvertently locked inside the guarded enclosure of a machining

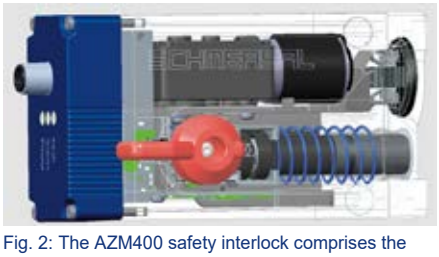

Fig. 2: The AZM400 safety interlock comprises the interlock unit with sensor system, a motor-driven locking bolt and an actuator. This contains an encoded RFID tag and a catch opening into which the locking bolt is inserted.

Fig. 4: The safe AZM400 bolt interlock from Schmersal with a Bowden cable release: The Bowden cable can be used as escape release.

Fig. 5: The safety interlock is used on heavy, frequently electrically operated safety guards from BAZ

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centre or large facility whilst performing maintenance. The Bowden cable can be used as an escape release within the hazardous area by the operator pulling on the pullcord. The device acts as an emergency release when used outside the hazard zone. In the standard version, the pullcord measures a total of 6 metres in length with sheathing 4 metres in length, which means it can also be used as a safety device on large systems. There is also a red lever directly on the safety interlock for manually activating the escape release. As an option, the safety interlock can be fitted with an electric auxiliary unlocking device that is supplied with power via an independent current supply (USV). This enables the locking bolt to be pulled back if the power fails or the mains supply has been switched off.
Another special feature of the AZM 400 is the bistable principle of operation. This means that: in case of a power failure, the safety interlock maintains its current position. Consequently the user does not have to decide between load and closed current principle. In addition, the safety door is also kept securely closed in the event of power failure, thereby preventing hazardous run-on movements.

Contribution to a high degree of machine availability

Machine operators want safety technology that actually increases machine availability. This aspect was also taken into account in the development of the AZM400. One example of how the AZM400 can contribute to machine availability is if the locking bolt tries to properly engage a second time if the locked condition was not achieved at the first attempt. The AZM 400 only reports a fault if the second attempt also fails. This reduces the number of malfunction reports and, at the same time, protects the device against damage.
„Unlocking against high lateral forces“ is a further feature of this safety interlock which helps to minimise downtimes. Safety doors are frequently sealed and/or insulated at the closing point causing them to spring back slightly after closing. The locking bolt then no longer sits centrally and freely in the locking aperture of the actuator. In actual fact, lateral forces are imparted on it, which must first be overcome before it can be opened. If these lateral forces cannot be dealt with, the safety door will not be opened – thus causing delays in the production process. The advantage of the AZM 400 is that it is not only capable of high locking forces, but it can also unlock where high transverse forces of up to 300 N are present. The large actuator tolerance of ±4 mm on the axis of the locking pin also contributes towards trouble-free operation of the safety interlock over a long period of time.

High level of safety

For the locking and also holding function, the safety interlock achieves PL e and cat. 4 performance values in accordance with DIN EN ISO 138491[3] as well as SIL3 in accordance with the series of standards DIN EN 61508 [3]. The high level of safety for the holding function is achieved here, among other things, by the two channel release signal. This ensures, for example, that a cross-wire will not cause unintentional release and thereby allow access to a danger zone. The AZM400 thereby fulfils the definitions as required by DIN EN ISO 14119.
The AZM400 safety interlock is now used in a wide range of industries; from the food and packaging industry, machine tool construction and the steel industry to automotive suppliers. In addition to the features already mentioned, users also appreciate the simple fitting as well as the compact and robust design of the safety interlock. (ih)

Literature

[1] DIN EN ISO 14119:201403 Safety of machinery – Interlocking devices associated with guards – Principles for design and selection. Berlin: Beuth
[2] K.A. Schmersal GmbH & Co. KG, Wuppertal: www.schmersal.com
[3] DIN EN ISO 138491:201606 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design. Berlin: Beuth
[4] Standards series DIN EN 61508 (VDE 0803) Functional safety of safety-related electrical/electronic/programmable electronic systems - Part 1: General principles for design. Berlin – Offenbach: VDE VERLAG

Fig. 3:
A lockout tag protects operating staff from being locked inside larger, walk-in systems and machines by mistake while they are performing servicing and repair work.