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Eliminating the risk

Solenoid interlock for reliable locking and unlocking under difficult conditions

In areas such as machine tool construction, solenoid interlocks offer protection for man and machine. To further optimise this, the Wuppertal-based company has developed a solenoid interlock whose design combines compact dimensions, a strong holding force, a bistable principle of operation and an electric-motor-powered locking bolt. In this way, the product not only fulfils the desires of the users but also the requirements of new safety standards.

The safety doors of large CNC machining centres 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 solenoid interlocks with electric rather than door handle actuation. With the AZM400, the Schmersal Group has developed a new range of solenoid interlocks for these applications. For various technologies of this new development, the company has applied for a patent.

Unlocking against high lateral forces assured

The essential elements of pre-development included intensive talks with customers from the machine tool construction industry. They expressed a desire for a solenoid interlock especially for large safety doors that can also be locked and unlocked reliably under unfavourable conditions and thereby ensure a high level of machine availability. Furthermore, flexible connection to various controller types was required as well as unlocking against high lateral forces.

The latter requires some explanation. The 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.

Position monitoring by means of RFID sensor

How did the development engineers at Schmersal realise these demands in design terms? Located in the compact housing of the solenoid interlock is an electric-motor-powered and intelligent locking bolt, along with sensors that communicate with the actuator. The locking bolt engages in the locking aperture of the actuator and thereby keeps the door secure. In doing so, a holding force of 10 000 N is reached. Conventional solenoid interlocks for smaller safety doors operate with holding forces of 500 to 2 000 N.

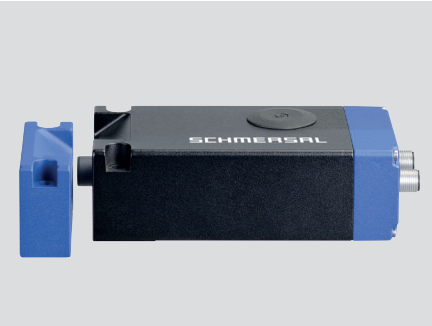
As soon as the locking bolt has reached a sufficient engagement depth, the system is released. The position is monitored during engagement in the locking aperture by two permanent magnets in the actuator and by the locking bolt's intelligent unit. Moreover, a safety-enhanced RFID sensor is integrated in the housing of the interlock. It monitors – by communicating with the RFID tag in the actuator – the correct position of the safety door and is responsible for ejecting the locking bolt.

The RFID technology makes it possible, among other things, for the user to choose between three types of coding and thereby determine the appropriate level of anti-tamper safety: In the basic version, the

AZM400 accepts any suitable actuator. A second version only accepts the actuator associated with the teach-in process during initial activation. With a third version, this teaching-in process can be repeated as many times as required. A release block of ten minutes prevents an actuator from being replaced in the short term and enhances anti-tampering safety as a result. In this way, the user can choose a coding version that best suits his needs and also determine the level of anti-tampering protection. Due to the integration of RFID into the safety sensor technology, the individually coded versions achieve coding level high in accordance with ISO 14119.

Safe operation thanks to bistable principle

Conventional solenoid interlocks usually work based on the quiescent current principle:¬ The locking bolt is held in the locked position by spring pressure and is opened by electromagnetic means. For applications not orientated around safety, the working current principle can also be employed where the interlock is open in the rest position. The solenoid interlock from Schmersal, on the other hand, has a bistable operating principle, i.e. it maintains the current respective position in the event of a



01 The solenoid interlock is a fail-safe bolt locking device that is particularly well suited for heavy safety doors

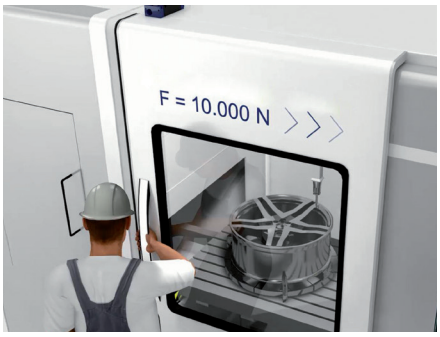
power failure. This ensures safe operation in any operating mode of the machine and guarantees, in the event of potentially hazardous run-on movements, that the safety door stays securely closed should the power supply be interrupted.

Great value was placed on a high level of safety during development in terms of the new 14119 standard. This is an added benefit to the user not just when it comes to the standard but also with regard to the strong forces imparted in the working area, e.g. of machine tools. For the locking and also holding function, the solenoid interlock achieves PL e and cat. 4 performance values in accordance with DIN EN ISO 13849-1 as well as SIL 3 in accordance with IEC 61508. The high level of safety for the holding function is achieved here, among other things, by the two channel release signal. In this way, assurance is provided that a cross-wire, for example, will not cause unintentional release and thereby allow access to a danger zone. The AZM400 thereby fulfils the safety specifications as required by ISO 14119.

Individual functions and high sensitivity

Among the safety and convenience functions are also an emergency exit release (from the hazard area) or a manual auxiliary release. As an option, the solenoid interlock can be fitted with an electric auxiliary unlocking device that is supplied with power via an independent current supply (USV). This makes it possible in the event of a power failure or after switching off the main power supply to move the locking bolt to a position that allows the safety door to be opened.

As far as the mechanical engineering is concerned, the device is extremely tough. All “hardware” components are sturdy and well protected against unfavourable environmental conditions. At the same time, the integrated safety-orientated sensors ensure a high level of sensitivity with regard to detection of the safety door and bolt position. The electronics facilitate – in connection with sensors – additional functions such as the detection of faulty operating conditions. An example: If the locking bolt does not reach its “locked” status at the first attempt at locking, a second attempt is made automatically. Only if this also fails does the AZM400 report a malfunction. This reduces the number of malfunction reports and, at the same time, protects the device against damage.



02 The locking bolt of the solenoid interlock is capable of a holding force of 10 000 N

Images:
K.A. Schmersal GmbH & Co. KG, Wuppertal

Author:
Dipl.-Ing. (FH) Stephan Frick, MBA,
Product Manager of Safety Technology,
K.A. Schmersal GmbH & Co. KG, Wuppertal
sfrick@schmersal.com

K. A. Schmersal GmbH & Co. KG
Möddinghofe 30
42279 Wuppertal
Telefon: +49 202 6474-0
info@schmersal.com
www.schmersal.com