

Technical article, published in:  
trade magazine etz, 11/2015, VDE Verlag

## Solenoid interlock for heavy safety doors

**At the SPS IPC Drives trade fair, the Schmersal Group is presenting a new solenoid interlock designed specifically for heavy safety doors. Among its main properties are the electric-motor-powered locking bolt, a holding force of 10 000 N and the bistable principle of operation.**

The basic function of a solenoid interlock is actually quite simple: A locking bolt prevents the safety door from opening while the machine is in operation. With heavy safety doors that are often powered electrically, for example those of large machining centres, the locking bolt is also actuated by an electric motor. Here, the detailed design of this kind of solenoid interlock requires intensive development because the way it works isn't quite as easy as previously mentioned. This is also evident in the following example of the AZM 400: a new solenoid interlock for heavy safety doors that Schmersal has now developed up to series production level. It celebrated its debut at the SPS IPC Drives trade fair in November in Nuremberg.

### Strong holding force

The fact that safety switchgear of this kind has to be capable of imparting higher holding forces than smaller safety doors stands to reason. Though, 10 000 N does seem a little excessive at first glance. A comparison: A (strong) adult exerts a maximum of 1 300 N when attempting to open a closed safety door.

However, particularly with heavy safety doors, there is often a leverage effect between the interlock and the point at which force is exerted. And with electrically operated, side-sliding safety doors, dynamic effects also have to be taken into account, such as springing back of the potentially sealed safety door during closing, once it has reached the end position. To be on the

safe side, therefore, the machine builder has set the holding force at the high end for large safety doors, thereby also benefiting the operator of the machine. The dynamic effect previously described can result in the locking bolt of the interlock no longer being centralised and positioned freely in the locking aperture. The drive must then overcome lateral forces, as otherwise the interlock will not open and cause delays in the production process. To prevent this, the locking bolt and associated drive of the AZM 400 are designed in such a way that the bolt releases at lateral forces of up to 300 N as well. Furthermore, the large actuator tolerance of 4 mm about the axis of the locking bolt contributes towards trouble-free operation of the solenoid interlock over a long period of time.

### Tough exterior, RFID technology-equipped interior

In terms of the mechanical engineering, the new solenoid interlock is a very sturdy device. All "hardware components" are tough and well protected against adverse environmental conditions in a rectangular metal housing. In this way, effective measures are taken to prevent the ingress of dirt in the housing of the interlock when the locking bolt moves into position. Well protected on the inside is the "brainpower", which works through intelligent evaluation in connection with numerous sensors. A safety-enhanced RFID sensor monitors – by communicating with the RFID tag in the actuator – the correct position of the safety door and is responsible for ejecting



**01 On large machine tools, not only the safety doors but also the locking bolt of the solenoid interlock are actuated electrically**

the locking bolt. Its position is monitored during ejection by two permanent magnets. This ensures sufficient overlap of the bolt in the locking aperture of the actuator. This reliable RFID technology is also employed in other safety switchgear series, such as the AZM 300. Among other things, it enables the user to choose between three types of coding and thereby determine the appropriate level of anti-tamper protection – up to individually coded versions of coding stage "high" in accordance with DIN EN ISO 14119.

### Bistable principle of operation

Another special feature of the AZM 400 is the bistable principle of operation. This means: In the event of a power failure, the solenoid interlock maintains its current position. The user, therefore, does not have to choose between load and closed current principle, and the safety door is also kept securely closed in the event of power failure, thereby preventing hazardous run-on movements. The integrated electronics facilitate – in connection with the sensors – numerous additional func-



**02 The solenoid interlock AZM 400 will be debuted at the SPS IPC Drives trade fair. The red lever is the manual emergency exit release**

tions that increase the availability of the interlock. If, for example, 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 device report a malfunction. This reduces the number of malfunction reports and, at the same time, protects the device against damage.

#### **Flexible integration in safety system**

In terms of the electronics, the new solenoid interlock is designed in such a way that it can be integrated easily in conventional safety circuits and systems. To make this possible, experts have realised a new input circuit for actuation of the interlocking function specifically for this purpose. It means that the same type of interlock can be connected not only to safety controllers with P/P outputs but also those with P/N outputs. The basic version of the AZM 400 with 8-pin M12 connector already features a diagnostic output and two safety outputs as well as two channel actuation of the interlocking function. A functionally-enhanced version is also equipped with a 5-pin

connector that enables further diagnostic systems to be connected along with an electric auxiliary release.

#### **High level of safety**

Since with large machines it is often about making major risks safe, it goes without saying that the AZM 400 has to fulfil high standards, which indeed it does: Both the locking and also interlocking function meet PL e and category 4 according to DIN EN ISO 13849-1 as well as SIL3 according to DIN EN 61508-1 (VDE 0803-1). This means that even the high safety requirements according to DIN EN ISO 14119 are complied with. The high level of safety for the interlocking 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.

#### **Rounding-off the programme**

With the AZM 400, the Schmersal Group is enhancing its programme of solenoid interlocks – the portfolio has hitherto not included an electric-motor-driven interlock. Since the development took place in agreement and co-operation with machine manufacturers, series production is expected to start in the short term. Companies from all walks of industry can discover more about the new product in Nuremberg: in hall 9, stand 460.



**03 The integrated sensors for monitoring the position of the locking bolt in the actuator are based on RFID technology, as in the AZM 300 shown. The ejected position of the locking bolt is monitored by permanent magnets**

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