Guard locking systems for the protection of man and machine
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Most machine guarding on industrial machinery is fitted with guard-locking safety interlocks (solenoid interlocks). This has two reasons:

Firstly, EN 1088 requires that hazardous areas on machinery and plant remain inaccessible until all dangerous machine movements have stopped. This can be achieved by installing a solenoid interlock on movable machine safety guards.

Secondly, solenoid interlocks also serve to safeguard the process: any unauthorised intervention in the running processes or any unexpected machine stop by an unforeseen opening of a safety guard is avoided. For example, a solenoid interlock can ensure that a robot completes its entire cycle before it stops. Moreover, solenoid interlocks can prevent damage to a machine tool through an unexpected stop, thus helping to ensure maximum productivity.

In addition, solenoid interlocks can also help meet the safety requirements defined in EN 1037, i.e. the protection against unexpected start-up of machinery.

The Schmersal Group offers its customers the largest program of safety control systems for the protection of man and machine, in particular a large range of solenoid interlocks and intelligent accessories that facilitate the integration of solenoid interlocks into the user's application.

The program includes door handle switches, mounting sets and a large range of actuators, suitable even for small actuating radii. Together with fail-safe standstill monitors and safety control modules, complete system solutions can be configured.

This brochure contains a short overview of the individual product lines and the main accessories available within the Schmersal Group for guard locking applications. The technical data for the individual devices are complemented by wiring diagrams, which show how simply Schmersal components can be wired together into a complete system.
The Schmersal guard-locking safety interlocks are based on the principle of the “separate actuator” (Fig. 1): The actuating element (the actuator or “key”) is fitted to the movable part of the machine guard (usually a safety guard). The solenoid interlock itself is mounted to the stationary part of the guard, for example the door post. The machine can only start when the actuator (mounted on the movable guard) has entered the solenoid interlock and is locked in position.

To optimise the benefits of this principle, some basic rules for the design of the machine guard and interlock mounting, as well as during machine operation, must be observed. The following pages contain practical hints and advice on mounting and operating solenoid interlocks.
Solenoid interlocks should be fitted near the door handle
For trouble-free guard locking, it is imperative that the actuator smoothly enters the solenoid interlock throughout the guard’s intended lifetime. To achieve this, the safety guard must have a degree of stability that does not allow torsion or door-setting.

In addition, it is recommended to fit the safety guard handle as close as possible to the solenoid interlock. This ensures that the actuator can always be easily extracted or inserted into the solenoid interlock, even in case of a deformed or distorted safety guard (see Fig. 3).

Fig. 2: Door handle switch TG with AZM 190

Fig. 3: Positioning of the solenoid interlock and door handle on a safety guard
End stop – for heavy safety guards fit a damper against rebound
The solenoid interlock must not be used as mechanical end stop or as a guide for the safety guard. A separate end stop is required. Even with an end stop, the rebound from a heavy safety guard can lead to serious damage to the solenoid interlock and/or actuator if, upon closing the door, the solenoid latches the actuator into the locked position. To prevent this, a damper can be fitted to the door.

All in one: door handle switch TG
For larger machines and assembly lines which have many safety guards, a separate unlocking button should be fitted near or on each safety guard to enable individual guard unlocking. In this way, the operator does not need to go to the machine control panel and unlock all safety guards; but can unlock and lock only the safety guard required.

The door handle switch TG developed by the Schmersal Group features a door lock control button with integrated LEDs to indicate if the safety guard is locked or released. This ergonomic aspect helps deter the operator from prematurely pulling on the door and jamming the unlocking mechanism. An emergency stop button can also be integrated into the door handle switch where required (Fig. 2).

Actuator: fixed or flexible?
The size of a hinged guard can limit the operating radius of the actuator. To guarantee smooth insertion of the actuator into the solenoid interlock in such cases, the Schmersal Group offers a large range of actuators specially designed for small actuating radii. On hinged guards the use of flexible adjustable actuators is recommended; for sliding guards, fixed actuators are more suitable (Fig. 5).

We recommend attaching the actuator inextricably to the safety guard, for example using one-way screws to avoid the actuator being removed for unauthorised use. As an alternative the actuator can be fitted in a concealed position, which also minimises the risk of injury from the actuator (Fig. 4).

Fig. 4: Concealed mounting
Fig. 5: Fixed and flexible actuator
Installation and operating solenoid interlocks

Operating principle: spring to lock or power to lock?
All solenoid interlocks developed by the Schmersal Group feature a fail-safe locking mechanism. This design feature, described in EN 1088, means that the solenoid locking bolt can only lock after the actuator has entered the interlock i.e. the safety guard is closed. This means that the safety circuit can be enabled using the solenoid contacts only. The actuator contacts are used solely for position indication of the safety guard.

Since solenoid interlocks featuring a fail-safe locking mechanism offer a higher degree of safety, the installation of a second device for monitoring safety guard position can be left out under certain circumstances (see page 28).

Solenoid interlocks have two different operating principles:
- Solenoid interlocks with spring to lock are locked by spring force and unlocked by energising the solenoid (Fig. 6).
- Solenoid interlocks with power to lock are locked by energising the solenoid and unlocked by spring force (Fig. 7).

Both principles are common on machine safety guards. For the protection of personnel against hazardous stored energy (e.g. run-on), the use of solenoid interlocks with spring to lock is strongly recommended.

Solenoid interlocks with power to lock may only be used in special cases after evaluating fully all the hazards, since in case of power failure or machine power switch off, the guard can be opened immediately and the operator exposed to the hazard.

On the other hand, solenoid interlocks with power to lock are suitable for machine and/or process safety. This type of solenoid interlock can deter the operator from interrupting a running process and, for example, avoiding damage to machine tools. The power to lock principle enables fast access into the machine in case of failure – when the machine power is switched off the safety guard can be unlocked. Using a solenoid interlock in this way can help optimise the machine productivity.
Mounting sets simplify fitted
Schmersal has developed mounting sets to enable quick and safe fitting of solenoid interlocks and actuators. The mounting sets are suitable for fitting on common steel and aluminium profile systems and simplify the alignment between actuator and solenoid interlock (Fig. 8).

The unique housing design of the AZM 190 allows a particularly elegant solution for hinged guards and aluminium profile systems. The angled actuating head allows the solenoid interlock to be mounted inside the hazardous area so that only the head is visible from outside. In addition to the practical advantages, this device can also improve the optical impression of the machine – an important factor on modern machines (Fig. 9).

Caution: Pre-tensioned safety guards!
In spite of careful safety guard design, the practice shows that they often become deformed, distorted or misaligned during their lifetime. With this in mind, a certain play between the actuator and the solenoid interlock is tolerated by design, so that the safety guard can be displaced from its ideal position. Safety guards are also pre-tensioned by operators trying to open a locked door. This force must not exceed a specific maximum pre-tension force for the solenoid interlock concerned, otherwise the solenoid will not be able to unlock, and the door cannot be opened. Schmersal’s patented toggle-lever system can withstand a maximum admissible pre-tension of up to 500 N (AZM 415).

In addition, a specific holding force (the so-called latching force) is present, so that the tensioned guard is held closed even in an unlocked condition.

When selecting the appropriate solenoid interlock, the maximum permissible holding force on the device in the locked position must be taken into account. Schmersal solenoid interlocks are available with a holding force of between 1000 N and 3500 N.
Since solenoid interlocks are either locked or unlocked by a solenoid, they require differing solutions for manual unlocking in a power-off condition (for example during installation or maintenance) than for unlocking during machine operation.

**Manual release**
Machinery fitted with spring to lock solenoid interlocks normally have a way of opening the safety guard during a power failure, usually by means of a tool such as a triangular key (Fig. 10). The Schmersal solenoid interlocks are fitted with such an auxiliary unlocking mechanism, the so-called “manual release”.

Upon operating the manual release, the positive break safety contacts are simultaneously opened thus preventing unexpected machine restart.

**Battery-operated release**
When spring to lock solenoid interlocks are installed in inaccessible or concealed positions, and in the case of power off or failure, the operator is confronted with the problem of how he gains access to the machine. In this case, it is useful to provide a separate power supply for the solenoid. This can be a battery-operated release in the control cabinet. The battery is charged during normal operation and in the case of power failure, can be switched on to unlock the safety guard.

* In preparation
Emergency exit
The emergency exit allows an intentional opening of the safety guard from inside the machine without tools, for example when personnel are trapped inside a machine (Fig. 12 and 13).

For this application, the Schmersal Group has developed the AZM 415 and TZFS.NN with emergency release which, used together with a B30 actuator and integrated emergency handle, allow an emergency exit from inside a machine guard (Fig. 11).

Emergency release
With an emergency release, the safety guard can be opened from outside the hazardous area without the operator using any tool, for example when a fast intervention into the hazardous area is required to guarantee process safety. Unlocking is possible without special tools, resetting however requires a repair-like intervention.

Standstill monitoring
Solenoid interlocks for personnel protection are used when the time taken to access the hazardous area from the safety guard can be less than the time needed for the hazard to have ceased (i.e. the moving parts have come to a standstill). The safety guard must remain locked until the machine hazard has been reduced to a minimum. In this case, the solenoid interlock can be combined with a fail-safe standstill monitor or – in case of constant run-down times – fail-safe delay timers. For these applications, the Schmersal Group has developed a comprehensive range of fail-safe standstill monitors (Fig. 14).

For these types of machine an emergency stop safety control module with delay on de-energisation (stop category 1 to EN 60204-1) must not be used, since the failure mode of the delay function is t = 0. This would result in the safety guard unlocking too soon in case of failure.
Installation and operating solenoid interlocks

Hazardous areas of machinery and plant can be so large, that the machine can be entered completely by personnel.

The Machinery Directive requires that in this case personnel cannot be inadvertently locked into the hazardous area.

To prevent this situation, solenoid interlocks can be fitted with the emergency exit system described previously.

This allows personnel to evacuate the hazardous area easily. By operating the emergency release, the safety circuit of the machine is interrupted and the machine is shut down.

However, in order not to endanger personnel that could be inside the hazardous area during the start-up or restart, the following aspects have to be taken into account.
First of all, the start button must be installed in a location where the operator has a complete overview of the hazardous area. In addition, the start button must not be accessible from inside the hazardous area.

Secondly, it is strongly recommended to use a safety control module with a monitored start circuit. These safety control modules enable only a trailing edge signal from the start button, i.e. they enable when the button is released, not when it is pressed. The trailing edge control module can thus detect a failure in the start button (e.g. contact welding) and manipulation (button held down).

The comprehensive range of safety control modules from the Schmersal Group include monitored start (trailing edge) function.
Typical applications

On machine tools

Typical mounting positions for solenoid interlocks on machine tools

On guard fencing systems

Installation of a solenoid interlock AZM 190 with emergency exit from inside the hazardous area

Installation of a solenoid interlock AZM 161 with emergency exit from inside the hazardous area

Installation of a solenoid interlock AZM 161 on a sliding guard

Installation of a solenoid interlock AZM 415 with emergency exit from inside the hazardous area
## Selection table: Solenoid interlocks

<table>
<thead>
<tr>
<th></th>
<th>AZM 170</th>
<th>AZM 161</th>
<th>TZF/TZM</th>
<th>AZM 190</th>
<th>AZM 415</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size in mm</strong></td>
<td>90 x 84 x 30</td>
<td>130 x 90 x 30</td>
<td>129 x 92 x 41</td>
<td>89 x 178 x 41</td>
<td>130 x 100 x 46,5</td>
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<tr>
<td><strong>Application</strong></td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td><strong>Max. holding force</strong></td>
<td>1000 N</td>
<td>2000 N</td>
<td>1700 N 2500 N *</td>
<td>2000 N</td>
<td>3500 N</td>
</tr>
<tr>
<td><strong>Actuator alignment tolerance</strong></td>
<td>± 2 mm</td>
<td>± 2 mm</td>
<td>± 4 mm</td>
<td>± 4 mm</td>
<td>± 3 mm</td>
</tr>
<tr>
<td><strong>Max. actuator play (in locked condition)</strong></td>
<td>4 mm</td>
<td>5 mm</td>
<td>11 mm</td>
<td>5 mm</td>
<td>3 mm</td>
</tr>
<tr>
<td><strong>Min. radius for hinged guards</strong></td>
<td>50 mm</td>
<td>95 mm</td>
<td>150 mm</td>
<td>150 mm</td>
<td>250 mm</td>
</tr>
<tr>
<td><strong>Number of actuating directions</strong></td>
<td>2</td>
<td>3</td>
<td>3 **</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>
| **Contacts**     | Solenoid: 1NC  
Actuator: 2NC or 1NO/1NC | Solenoid: 1NO/1NC or 1NO/2NC  
Actuator: 1NO/3NC, 2NO/2NC or 1NO/2NC | Solenoid: 1NC or 1NO/1NC  
Actuator: 2NC or 1NO/1NC | Solenoid: 1NO/1NC or 2NC  
Actuator: 1NC or 1NO | Solenoid: 1NO/1NC  
Actuator: 1NO/1NC |
| **Latching force** | 30 N | 30 N | 30 N | 30 N | bis 500 N |
| **Approvals**    | BG, UL, CSA | BG, UL, CSA | BG, UL, CSA | BG, UL, CSA | BG, UL, CSA |
| **Mounting set** | Yes | Yes | Yes *** | Yes | Yes *** |
| **Material**     | Thermoplastic | Thermoplastic | Thermoplastic | Thermoplastic | Metal alloy |
| **Page**         | 16 | 17 | 18 | 19 | 20 |

* = Only in conjunction with reinforcing bracket TZ-44  
** = 4 upon request  
*** = Only in conjunction with B30 actuator
Solenoid interlocks

AZM 170

Actuators

Accessories

Characteristics

Enclosure: glass-fibre reinforced thermoplastic, self extinguishing
Protection class: IP 67
Termination: cut clamp terminals (IDC)
Cable size: 0.75 – 1.0 mm², flexible
U₉: 250 V
I₉: 10 A
Utilisation category: AC-15; DC-13
Iₑ/Uₑ: 4 A / 230 VAC
4 A / 24 VDC
Power consumption: max 10 W
Solenoid duty rating: 100% ED
Uₑ: 24 VAC/DC
110 VAC, 50/60 Hz
230 VAC, 50/60 Hz
Mechanical life: > 1 million operations
Holding force Fₘₐₓ: 1000 N

Standards

IEC/EN 60947-5-1; EN 1088; BG-GS-ET-19

Approvals

Ordering details

<table>
<thead>
<tr>
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<td>SK</td>
<td>IDC terminals</td>
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</tr>
<tr>
<td>2</td>
<td>11</td>
<td>1NO/1NC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>02</td>
<td>2NC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>a</td>
<td>Power to lock</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>ST</td>
<td>Connector M 12 x 1</td>
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<tr>
<td>5</td>
<td>24 VAC/DC</td>
<td>Uₑ 24 VAC/DC</td>
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<tr>
<td>6</td>
<td>110 VAC</td>
<td>Uₑ 110 VAC</td>
<td></td>
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<td>7</td>
<td>230 VAC</td>
<td>Uₑ 230 VAC</td>
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Ordering details

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<th>AZM 170</th>
<th>No.</th>
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<td>6</td>
<td>SK</td>
<td>IDC terminals</td>
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<tr>
<td>8</td>
<td>1</td>
<td>1NO/1NC</td>
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<tr>
<td>9</td>
<td>2</td>
<td>2NC</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>a</td>
<td>Power to lock</td>
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<tr>
<td>11</td>
<td>ST</td>
<td>Connector M 12 x 1</td>
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<tr>
<td>12</td>
<td>24 VAC/DC</td>
<td>Uₑ 24 VAC/DC</td>
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<tr>
<td>13</td>
<td>110 VAC</td>
<td>Uₑ 110 VAC</td>
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<tr>
<td>14</td>
<td>230 VAC</td>
<td>Uₑ 230 VAC</td>
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</table>
Solenoid interlocks

**AZM 161**

**Actuators**

- **Straight actuator B1**
- **Straight actuator B1E**
- **Flexible actuator B6**

**Accessories**

- **Mounting set**
- **Connector plug M 12 x 1 (with cable)**
- **Slot sealing plug**
- **Release types**

**Characteristics**

- **Enclosure:** glass-fibre reinforced thermoplastic, self extinguishing
- **Protection class:** IP 67
- **Termination:** screw terminals or cage clamps
- **Ue:** 250 V
- **Ie:** 10 A
- **Utilisation category:** AC-15; DC-13
- **Ie/Ue:** 4 A / 230 VAC; 2.5 A / 24 VDC
- **Power consumption:** max 10 W
- **Solenoid duty rating:** 100% ED
- **Ue:** 24 VAC/DC; 110 VAC, 50/60Hz; 230 VAC, 50/60 Hz
- **Mechanical life:** > 1 million operations
- **Holding force Fmax:** 2000 N

**Standards**

IEC/EN 60947-5-1; EN 1088; BG-GS-ET-19

**Approvals**

- CE

**Ordering details**

**AZM 161**

- **No.**
  - SK
  - CC
- **Replace**
  - 12/12
  - 24
  - 33
- **Description**
  - Screw terminals
  - Cage clamp
  - 2NO/4NC
  - 2NO/4NC
  - 3NO/3NC
  - Spring to lock
  - Power to lock
- **AZM 161-B1**
- **AZM 161-B1E**
- **AZM 161-B6**

**Ordering details**

- **Mounting set:** MS AZM 161
- **Connector plug M 12 x 1, 5 m cable length:** 5121508000
- **A-coded:** 5121508000
- **B-coded:** 5121519000
- **without cable:**
  - **A-coded:** 5080371000
  - **B-coded:** 5121494000
- **Slot sealing plug (3 pieces):** 3025755000
- **Manual release**
- **Emergency exit**
- **Release types**
  - **Mounting set:** MS AZM 161
  - **Connector plug M 12 x 1, 5 m cable length:** 5121508000
  - **A-coded:** 5121508000
  - **B-coded:** 5121519000
  - **without cable:**
    - **A-coded:** 5080371000
    - **B-coded:** 5121494000
  - **Slot sealing plug (3 pieces):** 3025755000
  - **Manual release**
  - **Emergency exit**
  - **Ordering details**
  - **Mounting set:** MS AZM 161
  - **Connector plug M 12 x 1, 5 m cable length:** 5121508000
  - **A-coded:** 5121508000
  - **B-coded:** 5121519000
  - **without cable:**
    - **A-coded:** 5080371000
    - **B-coded:** 5121494000
  - **Slot sealing plug (3 pieces):** 3025755000
  - **Manual release**
  - **Emergency exit**
  - **Release types**
  - **Mounting set:** MS AZM 161
  - **Connector plug M 12 x 1, 5 m cable length:** 5121508000
  - **A-coded:** 5121508000
  - **B-coded:** 5121519000
  - **without cable:**
    - **A-coded:** 5080371000
    - **B-coded:** 5121494000
  - **Slot sealing plug (3 pieces):** 3025755000
  - **Manual release**
  - **Emergency exit**
  - **Release types**
  - **Mounting set:** MS AZM 161
  - **Connector plug M 12 x 1, 5 m cable length:** 5121508000
  - **A-coded:** 5121508000
  - **B-coded:** 5121519000
  - **without cable:**
    - **A-coded:** 5080371000
    - **B-coded:** 5121494000
  - **Slot sealing plug (3 pieces):** 3025755000
  - **Manual release**
  - **Emergency exit**

**Ordering details**

- **Ordering details**
  - **Ordering details**
  - **Ordering details**
  - **Ordering details**
Solenoid interlocks

TZM / TZF

Actuators

Accessories

Characteristics

Enclosure: glass-fibre reinforced thermoplastic
Protection class: IP 67
Termination: screw terminals
Cable size: max. 2.5 mm²
Ui: 250 V
Ith: 10 A
Utilisation category: AC-15; DC-13
Ie/Ue: 8 A / 250 VAC
5 A / 24 VDC
Power consumption: max. 7 W
Solenoid duty rating: 100% ED
Us: 24 VDC
115 VAC, 50/60 Hz
230 VAC, 50/60 Hz
Mechanical life: 2 million operations
Holding force Fmax.: 1700 N
2500 N in conjunction with TZ-44

Standards

IEC/EN 60947-5-1; EN 1088; BG-GS-ET-19

Approvals

Ordering details *

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<th>Replace</th>
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<tr>
<td>➀</td>
<td>M</td>
<td>Power to lock</td>
</tr>
<tr>
<td>F</td>
<td>Spring to lock</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>W</td>
<td>11-12, 21-22 in series</td>
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<td>C</td>
<td>11-12, 21-22 individually</td>
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<tr>
<td>③</td>
<td>S</td>
<td>Without manual release</td>
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<tr>
<td>S.NN</td>
<td>With manual release</td>
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<tr>
<td>④</td>
<td>115</td>
<td>Uₖ 115 VAC</td>
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<tr>
<td>230</td>
<td>Uₖ 230 VAC</td>
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Ordering details

Straight actuator rubber mounting (included in delivery):
Angled actuator:
Flexible actuator rubber mounting:
Shortened actuator rubber mounting:
Reinforcing bracket:
Angled triangular key:

Notice:
Actuator head can be repositioned

* available from Elan Schaltelemente GmbH & Co. KG

Ordering details

Reinforcing bracket:
Angled triangular key:

* available from Elan Schaltelemente GmbH & Co. KG
Solenoid interlocks

**AZM 190**

**Actuators**

- **Straight actuator B1**
- **Flexible actuator B3/2x15**
- **Actuator with front mounting B5**
- **Flexible actuator B3/15**
- **Flexible actuator B3/7,5**
- **Flexible actuator B3/2x15**
- **Mounting set**
- **Triangular key M3**
- **Axial cable entry ZPG 190**

### Characteristics

- **Enclosure:** glass-fibre reinforced thermoplastic
- **Protection class:** IP 67
- **Termination:** screw terminals
- **Cable size:** max 1.5 mm²
- **Cable entry:** 2 x M 20
- **Uᵢ:** 400 V
- **Iᵢ:** 10 A
- **Utilisation category:** AC-15; DC-13
  - Iᵢ/Uᵢ: 8 A / 230 VAC
  - 5 A / 24 VDC
- **Power consumption:** max 8.5 W
- **Solenoid duty rating:** 100% ED
- **Uᵢ:**
  - 24 VDC: 110 VAC, 50/60 Hz
  - 230 VAC, 50/60 Hz
- **Mechanical life:** 2 million operations
- **Holding force Fₘₐₓ:** 2000 N

### Standards

IEC/EN 60947-5-1; EN 1088; BG-GS-ET-19

### Approvals

- CE

### Ordering details

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<td>02/10</td>
<td>Solenoid: 2NC, Actuators: 1NO</td>
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<tr>
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<tr>
<td>a</td>
<td>Spring to lock</td>
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<tr>
<td>24 VDC</td>
<td>Power to lock</td>
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<tr>
<td>110 VAC</td>
<td>Uᵢ, 24 VDC</td>
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<td>230 VAC</td>
<td>Uᵢ, 110 VAC</td>
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<tr>
<td>230 VAC</td>
<td>Uᵢ, 230 VAC</td>
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</tbody>
</table>

**Notice:**

Actuator head can be repositioned
Solentoid interlocks

AZM 415

Actuators

Accessories

Characteristics

Enclosure: light-alloy diecast, paint finish
Protection class: IP 67
Termination: screw terminals
Cable size: max 2.5 mm²
Cable entry: 2 x M 20
(Ui: 250 V
Ie: 6 A
Utilisation category: AC-15
Ie/Ue: 4 A / 230 VAC
Power consumption: max 10 W
Solenoid duty rating: 100% ED
Ui: 24 VAC/DC
110 VAC, 50/60 Hz
230 VAC, 50/60 Hz
Mechanical life: > 1 million operations
Holding force Fmax: 3500 N

Standards
IEC/EN 60947-5-1; EN 1088; BG-GS-ET-19

Approvals
CE

Ordering details

AZM 415 - zpk -

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<td>3</td>
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<td>triangular key</td>
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<td>M20</td>
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<tr>
<td>5</td>
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<td>Ue 24 VAC/DC</td>
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<td>6</td>
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<td>Ue 110 VAC</td>
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<tr>
<td>7</td>
<td>230 VAC</td>
<td>Ue 230 VAC</td>
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Ordering details

Straight actuator:
Flexible actuator:
Actuator B30:

Ordering details

Mounting set:
see page 11

SCHMORSAL
### Selection table: Actuators B30 and mounting sets

<table>
<thead>
<tr>
<th>Actuator with emergency handle B30</th>
<th>TZF/TZM</th>
<th>AZM 161</th>
<th>AZM 415</th>
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<tbody>
<tr>
<td>Hinge R/switch inside</td>
<td>TZF/TZM - B30 - 01</td>
<td>AZM 161 - B30 - 01</td>
<td>AZ/AZM 415 - B30 - 01</td>
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<tr>
<td>Hinge L/switch inside</td>
<td>TZF/TZM - B30 - 02</td>
<td>AZM 161 - B30 - 02</td>
<td>AZ/AZM 415 - B30 - 02</td>
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<td>TZF/TZM - B30 - 05</td>
<td>AZM 161 - B30 - 05</td>
<td>AZ/AZM 415 - B30 - 05</td>
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<td>TZF/TZM - B30 - 06</td>
<td>AZM 161 - B30 - 06</td>
<td>AZ/AZM 415 - B30 - 06</td>
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<tr>
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<td>1 x MP TZF/TZM 1 x MP TZF/TZM - B30 2 x MP AZ/AZM 415 - B30</td>
<td>Parallel mounting 1 x MP AZM 161 - 01 2 x MP AZ/AZM 415 - B30</td>
<td>1 x MP AZM 415 - 22 2 x MP AZ/AZM 415 - B30</td>
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<table>
<thead>
<tr>
<th>Actuator without emergency handle B30</th>
<th>TZF/TZM</th>
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</thead>
<tbody>
<tr>
<td>Hinge R/switch inside</td>
<td>TZF/TZM - B30 - 03</td>
<td>AZM 161 - B30 - 03</td>
<td>AZ/AZM 415 - B30 - 03</td>
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<tr>
<td>Hinge L/switch inside</td>
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<td>AZM 161 - B30 - 04</td>
<td>AZ/AZM 415 - B30 - 04</td>
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<td>Parallel mounting 1 x MP AZM 161 - 01 1 x MP AZ/AZM 415 - B30</td>
<td>1 x MP AZM 415 - 22 1 x MP AZ/AZM 415 - B30</td>
</tr>
</tbody>
</table>

A detailed product description can be found in the brochure „Safety Guard Door Systems STS“
## Door-handle switches

### TG-W GR 1Öx

#### Characteristics
- Release button: 1 change-over contact
- Emergency Stop button: no
- Uₑ: 24 VDC ± 15%
- Contact load capacity: max 30 VAC, 36 VDC, max 1.5 A (cos ϕ = 1)
- Termination: connector M 12 x 1, 8-pole
- Status indicator: 2 LED
- Protection class: IP 65 with connector
- Enclosure: PA + POM

#### Standards
- IEC/EN 60947-5-1, IEC/EN 60947-5-5, DIN VDE 0660-200, EN 418

#### Approvals
- under preparation

#### Ordering details
- TG-W GR 1Öx

### TG-W GR 2Öx

#### Characteristics
- Release button: 1 change-over contact
- Emergency Stop button: 2 NC contacts
- Uₑ: 24 VDC ± 15%
- Contact load capacity: max 30 VAC, 36 VDC, max 1.5 A (cos ϕ = 1)
- Termination: connector M 23 x 1, 12-pole
- Status indicator: 2 LED
- Protection class: IP 65 with connector
- Enclosure: PA + POM

#### Standards
- IEC/EN 60947-5-1, IEC/EN 60947-5-5, DIN VDE 0660-200, EN 418

#### Approvals
- under preparation

#### Ordering details
- TG-W GR 2Öx

### TG-S GR 2ÖSR

#### Characteristics
- Release button: 1 NO contact
- Emergency Stop button: 2 NC contacts
- Push button: 1 NO contact
- Uₑ: 24 VDC ± 15%
- Contact load capacity: max 30 VAC, 36 VDC, max 1.5 A (cos ϕ = 1)
- Termination: connector M 23 x 1, 12-pole
- Status indicator: 3 LED
- Protection class: IP 65 with connector
- Enclosure: PA + POM

#### Standards
- IEC/EN 60947-5-1, IEC/EN 60947-5-5, DIN VDE 0660-200, EN 418

#### Approvals
- under preparation

#### Ordering details
- TG-S GR 2ÖSR
Door-handle switches

Accessories

Connector plug M 12 x 1, 8-pole

Connector plug M 23 x 1, 12 pole

Ordering details

Connector plug M 12 x 1, 8-pole, with 5 m cable length: 01362195

Connector plug M 23 x 1, 12-pole, without cable: 01362200
Safety control modules - Multi-function

SRB 308IT

Characteristics
- $U_e$: 24 VDC –15%/+20%, 24 VAC, 48 VAC, 115 VAC, 230 VAC
- $I_e$: 0.1 A (DC version)
- Feedback circuit: yes
- Stop category: 0
- Control category: 4
- Monitored inputs: 1 or 2 channels
- Enabling contacts: 3 enabling paths
- Contact load capacity: max 250 VAC, max 6 A (cos $\phi = 1$)
- Signalling output: 8 transistor outputs, total 100 mA, short-circuit proof
- Termination: plug-in screw terminals
- Cable size: max 2.5 mm$^2$
- Status indicator: 5 LED
- Dimensions: 45 x 100 x 121 mm

Standards
IEC/EN 60204-1; BG-GS-ET-20

Approvals
under preparation

Ordering details
SRB 308 IT - ➀
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<td>24 VAC/DC</td>
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<td>115 V</td>
<td>115 V</td>
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<tr>
<td>230 V</td>
<td>230 V</td>
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</table>

SRB 219IT

Characteristics
- $U_e$: 24 VDC –15%/+20%, 24 VAC –15%/+10%
- $I_e$: max 0.19 A (DC version)
- Feedback circuit: yes
- Stop category: 2 x “Stop 0”, 1 x “Stop 1”
- Control category: 4
- Monitored inputs: 1 or 2 channels
- Enabling contacts: 2 enabling paths, 1 enabling path 1 … 30 s delayed
- Contact load capacity: max 250 VAC, max 6 A (cos $\phi = 1$)
- Signalling output: 1 NC, potential-free, 8 transistor outputs total 100 mA, short-circuit proof
- Termination: plug-in screw terminals
- Cable size: max 2.5 mm$^2$
- Status indicator: 7 LED
- Dimensions: 22.5 x 100 x 121 mm

Standards
IEC/EN 60204-1; EN 954-1; BG-GS-ET-20

Approvals
under preparation

Ordering details
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<td>24 VAC/DC</td>
</tr>
</tbody>
</table>

SRB 301LC

Characteristics
- $U_e$: 24 VAC - 15%/ + 10% residual ripple max. 10%
- $I_e$: max. 0.08 A
- Feedback circuit: yes
- Stop category: 3 x Stop 0
- Control category: 4
- Monitored inputs: 1 or 2 channels
- Enabling contacts: 3 enabling paths
- Signalling output: 1 NC contact
- Termination: screw terminals
- Cable size: max 2.5 mm$^2$
- Status indicator: 4 LED
- Dimensions: 22.5 x 100 x 121 mm

Standards
IEC/EN 60204-1; BG-GS-ET-20

Approvals
under preparation

Ordering details
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<td>24 VAC/DC</td>
</tr>
</tbody>
</table>
### SRB 301ST

**Characteristics**

- **Ue**: 24 VDC - 15% / + 20% residual ripple max. 10%
- **Ie**: 0.16 A
- **Start conditions**: reset button, (trailing edge) autostart
- **Feedback circuit**: yes
- **Stop category**: 3 x Stop 0
- **Control category**: 4
- **Monitored inputs**: 1 or 2 channels
- **Enabling contacts**: 3 enabling paths
- **Drop-out delay**: 20 ms
- **Signalling output**: –
- **Termination**: plug-in screw terminals
- **Cable size**: max 2.5 mm²
- **Status indicator**: 4 LED
- **Dimensions**: 22.5 x 100 x 121 mm

### SRB 211ST

**Characteristics**

- **Ue**: 24 VAC - 15% / + 10% residual ripple max. 10%
- **Ie**: 0.24 A
- **Start conditions**: reset button, (trailing edge) autostart
- **Feedback circuit**: yes
- **Stop category**: 2 x Stop 0, 1 x Stop 1 (1...30 s delayed)
- **Control category**: 4
- **Monitored inputs**: 6 x 2 channels (NC/NC)
- **Enabling contacts**: 2 enabling paths
- **Drop-out delay**: 30 ms
- **Signalling output**: –
- **Termination**: plug-in screw terminals
- **Cable size**: max 2.5 mm²
- **Status indicator**: 5 LED
- **Dimensions**: 22.5 x 100 x 121 mm

### SRB 206

**Characteristics**

- **Ue**: 24 VAC - 15% / + 10% residual ripple max. 10%
- **Ie**: max. 0.125 A (DC Version)
- **Start conditions**: reset button, (trailing edge) autostart
- **Feedback circuit**: yes
- **Stop category**: 2 x Stop 0
- **Control category**: 4
- **Monitored inputs**: 6 x 2 channels (NC/NC)
- **Enabling contacts**: 2 enabling paths
- **Drop-out delay**: F 30 ms
- **Signalling output**: –
- **Termination**: screw terminals
- **Cable size**: max 2.5 mm²
- **Status indicator**: 4 LED
- **Dimensions**: 45 x 100 x 121 mm

### Standards

- IEC/EN 60204-1; EN 954-1; BG-GS-ET-20

### Approvals

- CE

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</tr>
<tr>
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<td>230 V</td>
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### Ordering details

**SRB 301ST**

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**SRB 211ST**

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<td>24 VAC/DC</td>
</tr>
<tr>
<td>4</td>
<td>230 V</td>
</tr>
</tbody>
</table>
### FWS 1205
![Image of FWS 1205](image1)

#### Characteristics
- \(U_e: 24 \text{ VDC } \pm 15\%\)
- \(I_e: 0.2 \text{ A}\)
- Control category: 3
- Monitored inputs: 2 channels, pulse generator p-type
- Start conditions: Automatic
- Enabling contacts: 2 enabling path
- Contact load capacity: max 250 VAC, max 6 A (cos \(\Phi = 1\))
- Signalling output: 2 transistor outputs, \(Y_1 + Y_2 = \text{max } 100 \text{ mA}, \) p-type, short-circuit proof
- Termination: screw terminals
- Cable size: max 2.5 mm²
- Status indicator: LED (ISD)
- Dimensions: 22.5 x 100 x 121 mm

#### Standards
IEC/EN 60204-1; EN 954-1; BG-GS-ET-20

#### Approvals
H C D under preparation

#### Ordering details

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<td>Standstill frequencies Inputs X1/X2:</td>
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<tr>
<td>A</td>
<td>✔️</td>
<td>1 Hz/2 Hz</td>
</tr>
<tr>
<td>B</td>
<td>✔️</td>
<td>2 Hz/2 Hz</td>
</tr>
<tr>
<td>C</td>
<td>✔️</td>
<td>1 Hz/1 Hz</td>
</tr>
</tbody>
</table>

### FWS 1206
![Image of FWS 1206](image2)

#### Characteristics
- \(U_e: 24 \text{ VDC } \pm 15\%\)
- \(I_e: 0.2 \text{ A}\)
- Control category: 3
- Monitored inputs: 1 or 2 channels, pulse generator p-type
- Start conditions: Automatic
- Enabling contacts: 2 enabling path
- Contact load capacity: max 250 VAC, max 6 A (cos \(\Phi = 1\))
- Signalling output: 2 transistor outputs, \(Y_1 + Y_2 = \text{max } 100 \text{ mA}, \) p-type, short-circuit proof
- Termination: screw terminals
- Cable size: max 2.5 mm²
- Status indicator: LED (ISD)
- Dimensions: 22.5 x 100 x 121 mm

#### Standards
IEC/EN 60204-1; EN 954-1; BG-GS-ET-20

#### Approvals
H C D under preparation

#### Ordering details

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<td>✔️</td>
<td>1 Hz/2 Hz</td>
</tr>
<tr>
<td>C</td>
<td>✔️</td>
<td>1 Hz/1 Hz</td>
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</tbody>
</table>

### FWS 2316C
![Image of FWS 2316C](image3)

#### Characteristics
- \(U_e: 24 \text{ VDC } \pm 15\%\)
- \(I_e: 0.3 \text{ A (DC version)}\)
- Feedback circuit: yes
- Control category: 3
- Monitored inputs: 2 channels, pulse generator p-type
- Start conditions: Reset button
- Enabling contacts: 3 enabling paths
- Contact load capacity: max 250 VAC, max 6 A (cos \(\Phi = 1\))
- Signalling output: 2 transistor outputs, \(Y_1 + Y_2 = \text{max } 100 \text{ mA}, \) p-type, short-circuit proof
- Termination: screw terminals
- Cable size: max 4 mm²
- Status indicator: LED (ISD)
- Dimensions: 55 x 75 x 110 mm

#### Standards
IEC/EN 60204-1; EN 954-1; BG-GS-ET-20

#### Approvals
UL under preparation

#### Ordering details

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<td>2</td>
<td>✔️</td>
<td>230 VAC</td>
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**Ordering details**

**FWS 1205**

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**FWS 1206**

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**FWS 2316C**

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<td>2</td>
<td>✔️</td>
<td>230 VAC</td>
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</table>
**Fail-safe standstill monitors / Delay timers**

### AZR 31 S1
- **Characteristics**
  - $U_e$: 24 VDC ± 10%
  - $I_e$: 0.1 A at 24 VDC
  - Feedback circuit: yes
  - Control category: 4
  - Monitored inputs: 1 NC / 1 NO
  - Enabling contacts: 3 enabling paths
  - Contact load capacity: max 250 VAC, max 6 A (cos $\phi = 1$)
  - Signalling output: 2 transistor outputs, $Y_1 + Y_2 = 100$ mA, p-type, short-circuit proof
  - Termination: screw terminals
  - Cable size: max 4 mm$^2$
  - Status indicator: LED
  - Dimensions: 45 x 73.2 x 121 mm

- **Standards**
  - IEC/EN 60204-1
  - EN 954-1
  - BG-GS-ET-20

- **Approvals**
  - H

- **Ordering details**

<table>
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<td>24 VDC</td>
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<td>110 VAC</td>
</tr>
<tr>
<td>4</td>
<td>230 VAC</td>
<td>230 VAC</td>
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</table>

### EBW
- **Characteristics**
  - $U_e$: 24 VDC ± 10%
  - $I_e$: 0.08 A
  - Feedback circuit: yes
  - Control category: B
  - Monitored inputs: 1 pulse generator
  - Enabling contacts: 1 enabling path
  - Contact load capacity: max 240 VAC, max 3 A (cos $\phi = 1$), 24 VDC, max 2 A (cos $\phi = 1$)
  - Signalling output: 1 NC, positive break
  - Termination: screw terminals
  - Cable size: max 2.5 mm$^2$
  - Status indicator: 5 LED
  - Dimensions: 45 x 83 x 126.5 mm

- **Standards**
  - IEC/EN 60204-1
  - EN 954-1
  - BG-GS-ET-20

- **Ordering details**

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<tr>
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<td>AZ</td>
<td>Customer-specific settings</td>
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</table>

* available from Elan Schaltelemente GmbH & Co. KG

### AZS 2305
- **Characteristics**
  - $U_e$: 24 VDC ± 15 %
  - $I_e$: 0.1 A at 24 VDC
  - Feedback circuit: yes
  - Control category: 3
  - Monitored inputs: 1 NC / 1 NO
  - Enabling contacts: 3 enabling paths
  - Contact load capacity: max 250 VAC, max 6 A (cos $\phi = 1$)
  - Signalling output: 2 transistor outputs, $Y_1 + Y_2 = 100$ mA, p-type, short-circuit proof
  - Termination: screw terminals
  - Cable size: max 4 mm$^2$
  - Status indicator: LED (ISD)
  - Dimensions: 55 x 75 x 110 mm

- **Standards**
  - IEC/EN 60204-1
  - EN 954-1
  - BG-GS-ET-20

- **Approvals**
  - H

- **Ordering details**

<table>
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Wiring examples

General notes

The following wiring diagrams are very practice-oriented, and outline only a few examples of how solenoid interlocks can be integrated into the machine safety control system for various applications.

In order to obtain the indicated control categories to EN 954-1, the following points should be observed:

1. The specific safety regulations contained in the prevailing C-standards describe how solenoid interlocks should be integrated into the safety circuit of a machine. If the manufacturer fulfils these requirements, he simultaneously complies with the relevant essential requirements of the Machinery Directive by reason of the so-called presumption of conformity.

   The manufacturer may deviate from the C-standard, but in that case, he must show that his machine is designed in such a way that through equivalent measures, it conforms to the essential safety requirements laid down in the Directive.

   If no C-standard is available for the specific application, the B-standards must be consulted for information regarding the use of solenoid interlocks.

2. Second safety guard switch:

   The second safety guard switch can serve for fault recognition and fault control if the solenoid interlock incurs a critical failure, such as undetectable damage to the internal or external mechanism.

   The installation of a second safety guard switch can be omitted:
   • In case of thorough and proper safety guard design, i.e. a stable door mechanism with solid end stops, designed to operate correctly throughout the planned lifetime of the machine,
   • If the maximum admissible holding force and other mechanical limits of the solenoid interlock are observed,
   • If the actuator is inextricably attached to the safety guard (see page 7), preferably in a concealed position,
   • If the actuator blade is manufactured in one piece and not made of plastic or die-cast material,
   • If the solenoid interlock contains a fail-safe locking mechanism.

   However, we always recommend the use of a second safety guard switch:
   • for applications to control category 4 to EN 954-1,
   • for non-visible hazards such as radiation, electric shock, etc.

3. For applications where the higher safety requirements must be met, the following should be observed:
   • for applications in control category 4, the possible accumulation of faults must also be considered. To detect multiple faults all safety guards fitted with electromechanical devices must also be equipped with a start-up test, i.e. where solenoid interlocks are used, the safety guard must be opened and closed after powering up the machine. This ensures the detection of hidden faults that were erased due to the supply voltage being switched off.
   • for applications in control category 3 some faults are not always continuously recognised if the solenoid interlocks are connected in series. An accumulation of faults in one solenoid interlock could in this case lead to the loss of the safety function for a particular safety guard. For example, the recognition of a fault in a solenoid interlock circuit caused by short-circuit or cable breakage can be cancelled out by actuating another solenoid interlock. This fact must be considered in the risk analysis.
   • If the possibility of short-circuit or cross-wire faults cannot be excluded by special cable routing, the use of safety control modules with cross-wire detection is recommended.

The ultimate classification of a safety control circuit in a control category to EN 954-1 can only be defined for a specific application once all aspects of the system have been evaluated. For this reason, the control categories proposed in the following wiring diagrams apply solely to the input circuit and do not consider the safety control module or any other part of the safety control circuit.
Selection table: wiring diagrams

### Selection criteria

<table>
<thead>
<tr>
<th>Principal</th>
<th>Number of guards</th>
<th>Number of unlock buttons</th>
<th>Number of switches per guard</th>
<th>AZM 170</th>
<th>AZM 161</th>
<th>TZF/TZM</th>
<th>AZM 190</th>
<th>AZM 415</th>
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<tbody>
<tr>
<td>Spring to lock</td>
<td>1</td>
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<td>1</td>
<td>1.1</td>
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<td>1.2</td>
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<td>1</td>
<td>2</td>
<td>1.4</td>
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<td>3.2</td>
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<tr>
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<td>2</td>
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### Selection criteria

<table>
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<th>Input</th>
<th>Number pulse generators</th>
<th>Standstill signal</th>
<th>FWS 1205</th>
<th>FWS 1206</th>
<th>FWS 2316C</th>
<th>AZR 31 S1</th>
<th>EBW</th>
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<td></td>
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</tr>
</tbody>
</table>

### Selection criteria

| AZS 2305               | Fail-safe delay timer   | 7.1                |          |          |            |           |     |
Wiring diagram No. 1.1

Spring to lock solenoid

Features

Description:
- Monitoring of one safety guard
- Monitoring of hazardous run-on motion

Safety circuit:
- 2 channel

Input circuit:
- Control category 3 to EN 954-1
  (see general notes, page 28)

Comments:
- After unlocking, the safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit

Product selection

Solenoid interlocks: AZM 170-02zrk

Note:
The wiring diagram is shown with the safety guard closed and in de-energised condition.
Wiring diagram No. 1.2

Spring to lock solenoid

Features

Description:
- Monitoring of one safety guard
- Monitoring of hazardous run-on motion

Safety circuit:
- 2 channel

Input circuit:
- Control category 3 to EN 954-1 (see general notes, page 28)

Comments:
- Safety guard position as input signal to PLC
- After unlocking, the safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit

Product selection

Solenoid interlocks:
- AZM 161SK-12/12rk
- AZM 161CC-12/12rk
- AZM 161SK-33rk
- AZM 161CC-33rk
- AZM 415-22zpk
- TZFW

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
### Features

**Description:**
- Monitoring of one safety guard
- Monitoring of hazardous run-on motion

**Safety circuit:**
- 2 channel

**Input circuit:**
- Control category 3 to EN 954-1 (see general notes, page 28)

**Comments:**
- Safety guard position as input signal to PLC
- After unlocking, the safety guard does not need to be opened and closed to allow the safety control module to re-enable the safety circuit

### Product selection

**Solenoid interlocks:**
- AZM 161SK-12/12rk
- AZM 161CC-12/12rk
- AZM 190-02/10rk

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
### Features

**Description:**
- Monitoring of one safety guard with a solenoid interlock and an second switch
- Monitoring of hazardous run-on motion

**Safety circuit:**
- 2 channel

**Input circuit:**
- With start-up test Control category 4 to EN 954-1 (see general notes, page 28)

**Comments:**
- Safety guard position as input signal to PLC
- After unlocking, the safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit

### Product selection

**Solenoid interlocks:**
- AZM 161SK-12/12rk
- AZM 161CC-12/12rk
- AZM 161SK-33rk
- AZM 161CC-33rk
- AZM 170-11zrk
- AZM 190-02/10rk
- AZM 415-22zpk
- TZFW

### Note:
The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Features**

Description: • Monitoring of multiple safety guards
• Multiple solenoid interlocks connected to one safety control module
• Monitoring of hazardous run-on motion

Safety circuit: • 2 channel

Input circuit: • Control category 3 to EN 954-1 (see general notes, page 28)

Comments: • After unlocking, a safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit

**Product selection**

Solenoid interlocks: AZM 170-02zrk

---

**Note:** The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Features**

Description: • Monitoring of multiple safety guards  
• Multiple solenoid interlocks connected to one safety control module  
• Monitoring of hazardous run-on motion

Safety circuit: • 2 channel

Input circuit: • Control category 3 to EN 954-1 (see general notes, page 28)

Comments: • Safety guard position as input signal to PLC  
• After unlocking, a safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit

**Product selection**

Solenoid interlocks:  
AZM 161SK-12/12rk  
AZM 161SK-33rk  
AZM 161CC-12/12rk  
AZM 161CC-33rk  
AZM 415-22zpk  
TZFW

**Note:** The wiring diagram is shown with the safety guard closed and in de-energised condition.
Wiring diagram No. 2.3

Spring to lock solenoid

Description:
- Monitoring of multiple safety guards
- Multiple solenoid interlocks connected to one safety control module
- Monitoring of hazardous run-on motion

Safety circuit:
- 2 channel

Input circuit:
- Control category 3 to EN 954-1 (see general notes, page 28)

Comments:
- Safety guard position as input signal to PLC
- After unlocking, a safety guard does not need to be opened and closed to allow the safety control module to re-enable the safety circuit

Features

Product selection

Solenoid interlocks:
- AZM 161SK-12/12rk
- AZM 161CC-12/12rk
- AZM 190-02/10rk

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
Description:  
- Monitoring of multiple safety guards  
- Multiple solenoid interlocks connected to one safety control module  
- Monitoring of hazardous run-on motion  
- All guards are unlocked using one switch

Safety circuit:  
- 2 channel

Input circuit:  
- Control category 3 to EN 954-1 (see general notes, page 28)

Comments:  
- After unlocking, a safety guard does not need to be opened because of the integrated actuator and solenoid contacts  
- Not recommended for larger machines (see page 7)

Solenoid interlocks:  
AZM 170-02zrk

Note:  
The wiring diagram is shown with the safety guard closed and in de-energised condition.
Features

Description:
- Monitoring of multiple safety guards
- Multiple solenoid interlocks connected to one safety control module
- Monitoring of hazardous run-on motion
- All guards are unlocked using one switch

Safety circuit:
- 2 channel

Input circuit:
- Control category 3 to EN 954-1 (see general notes, page 28)

Comments:
- After unlocking, the guards do not need to be opened because of the integrated actuator and solenoid contacts
- Not recommended for larger machines (see page 7)

Product selection

Solenoid interlocks:
- AZM 161SK-12/12rk
- AZM 161CC-12/12rk
- AZM 161SK-33rk
- AZM 161CC-33rk
- AZM 415-22zpk
- TZFW

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Features**

**Description:**
- Monitoring of multiple safety guards
- Multiple solenoid interlocks connected to one safety control module
- Monitoring of hazardous run-on motion
- All guards are unlocked using one switch

**Safety circuit:**
- 2 channel

**Input circuit:**
- Control category 3 to EN 954-1 (see general notes, page 28)

**Comments:**
- Safety guard position as input signal to PLC
- After unlocking, the safety guard does not need to be opened and closed to allow the safety control module to re-enable the safety circuit
- Not recommended for larger machines (see page 7)

**Product selection**

**Solenoid interlocks:**
- AZM 161SK-12/12rk
- AZM 161CC-12/12rk
- AZM 190-02/10rk

**Note:** The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Features**

- Monitoring of one safety guard
- 2 channel
- Control category 3 to EN 954-1 (see general notes, page 28)
- After unlocking, the safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit
- Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.

**Product selection**

- Solenoid interlocks: AZM 170-02zrka

**Note:** The wiring diagram is shown with the safety guard closed and in de-energised condition.
Features

Description: • Monitoring of one safety guard

Safety circuit: • 2 channel

Input circuit: • Control category 3 to EN 954-1 (see general notes, page 28)

Comments: • Safety guard position as input signal to PLC
  • After unlocking, the safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit
  • Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.

Product selection

Solenoid interlocks: AZM 161SK-12/12rka
AZM 161CC-12/12rka
AZM 161SK-33rka
AZM 161CC-33rka
AZM 415-22zpka
TZMW

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
Wiring diagram No. 4.3

Power to lock solenoid

Features

Description: • Monitoring of one safety guard

Safety circuit: • 2 channel

Input circuit: • Control category 3 to EN 954-1 (see general notes, page 28)

Comments: • Safety guard position as input signal to PLC
• After unlocking, the safety guard does not need to be opened and closed to allow the safety control module to re-enable the safety circuit
• Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.

Product selection

Solenoid interlocks:
AZM 161SK-12/12rka
AZM 161CC-12/12rka
AZM 190-02/10rka

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
Features

Description: • Monitoring of one safety guard with one solenoid interlock and a second switch

Safety circuit: • 2 channel

Input circuit: • With start-up test Control category 4 to EN 954-1 (see general notes, page 28)

Comments: • Safety guard position as input signal to PLC
• After unlocking, the safety guard must be opened and closed to allow the safety control module to re-enable the safety circuit
• Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.

Product selection

Solenoid interlocks: AZM 161SK-12/12rka
AZM 161CC-12/12rka
AZM 161SK-33rka
AZM 161CC-33rka
AZM 170-11zrka
AZM 190-02/10rka
AZM 415-22zpka
TZMW

Note: The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Features**

- **Description:**
  - Monitoring of multiple safety guards
  - Multiple solenoid interlocks connected to one safety control module
- **Safety circuit:**
  - 2 channel
- **Input circuit:**
  - Control category 3 to EN 954-1 (see general notes, page 28)
- **Comments:**
  - After unlocking, the guards do **not** need to be opened because of the integrated actuator and solenoid contacts
  - Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.
  - Not recommended for larger machines (see page 7)

**Product selection**

- **Solenoid interlocks:** AZM 170-02zrka

**Note:** The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Description:**
- Monitoring of multiple safety guards
- Multiple solenoid interlocks connected to one safety control module

**Safety circuit:**
- 2 channel

**Input circuit:**
- Control category 3 to EN 954-1 (see general notes, page 28)

**Comments:**
- Safety guard position as input signal to PLC
- After unlocking, a safety guard does **not** need to be opened because of the integrated actuator and solenoid contacts
- Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.
- Not recommended for larger machines (see page 7)

**Product selection**
- Solenoid interlocks:
  - AZM 161SK-33rka
  - AZM 161CC-33rka
  - AZM 415-22zpkka
  - TZMW

**Features**
- The wiring diagram is shown with the safety guard closed and in de-energised condition.
**Wiring diagram No. 5.3**

**Power to lock solenoid**

---

**Features**

- Monitoring of multiple safety guards
- Multiple solenoid interlocks connected to one safety control module

**Safety circuit:**
- 2 channel

**Input circuit:**
- Control category 3 to EN 954-1 (see general notes, page 28)

**Comments:**
- Safety guard position as input signal to PLC
- After unlocking, a safety guard does not need to be opened and closed to allow the safety control module to re-enable the safety circuit
- Solenoid interlocks with power to lock may only be used for personal protection after a thorough evaluation of the accident risk.
- Not recommended for larger machines (see page 7)

---

**Product selection**

Solenoid interlocks:
- AZM 161SK-12/12rka
- AZM 161CC-12/12rka
- AZM 190-02/10rka

---

**Note:** The wiring diagram is shown with the safety guard closed and in de-energised condition.
Fail-safe standstill monitor

Features

Description:

- Standstill monitoring using 1 or 2 pulse generators
- In case of 1 pulse generator, a jumper between X1 and X2 is required
- Additional standstill signal from the PLC

Product selection

Fail-safe standstill monitor: FWS 1206

Note: The wiring diagram is shown in de-energised condition.
**Features**

Description:
- Standstill monitoring using 1 or 2 pulse generators
- In case of 1 pulse generator, a jumper between X1 and X2 is required

**Product selection**

Fail-safe standstill monitor: FWS 1205

**Note:** The wiring diagram is shown in de-energised condition.
Fail-safe standstill monitor

- Standstill monitoring using 2 pulse generators
- Cross-wire monitoring of the pulse generators

Features

Product selection

Fail-safe standstill monitor: FWS 2316C

Note: The wiring diagram is shown in de-energised condition.
Fail-safe standstill monitor

Description: • Standstill monitoring using 1 pulse generator

Wiring diagram No. 6.4

Features

<table>
<thead>
<tr>
<th>Description</th>
<th>Product selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Standstill monitoring using 1 pulse generator</td>
<td>Fail-safe standstill monitor: EBW</td>
</tr>
</tbody>
</table>

Note: The wiring diagram is shown in de-energised condition.
## Wiring diagram No. 6.5

### Fail-safe standstill monitor

![Wiring diagram](image)

#### Features

**Description:**

- Sensor-free monitoring of standstill using e.m.f.

#### Product selection

<table>
<thead>
<tr>
<th>Feature</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail-safe standstill monitor</td>
<td>AZR 31 S1</td>
</tr>
</tbody>
</table>

**Note:** The wiring diagram is shown in de-energised condition.
Fail-safe delay timer

Features

- Timer starts when contacts S13-14 / S21-22 change state

Product selection

Fail-safe delay timer: AZS 2305

Note: The wiring diagram is shown in de-energised condition.
Spring to lock

AZM 170

AZM 170-02zrk  
AZM 170-11zrk  
AZM 170-02zrka  
AZM 170-11zrka

AZM 161

AZM 161SK-33rk  
AZM 161CC-33rk  
AZM 161SK-33rka  
AZM 161CC-33rka

TZF / TZM

TZFW  
TZMW

AZM 190

AZM 190-02/10rk  
AZM 190-02/10rka

AZM 415

AZM 415-22zpk  
AZM 415-22zpka

Power to lock
Additional transistor output: An indication output which shows the condition of the evaluation unit or the guard device or gives an error code.

AES: Electronic evaluation unit for safety functions (Safety control module).

Appliance safety law: The appliance safety law forms the basis to put the EC Recommendations to Article 100a of the Articles of Rome into effect in national law. The individual EC Recommendations are put into effect by decrees. These apply to manufacturers and importers.

Cascading: Series-parallel circuits, e.g. of safety switching devices.

Change-over contact with double break: On actuation, opens and closes an electrical circuit at two contact points in each case, see contact diagrams.

Change-over contact with single break: On actuation, opens and closes an electrical circuit at one contact point in each case, see contact diagrams.

Contact diagrams to IEC 60617:
- Single break contact with 2 terminals
  - Symbol: #
  - Illustration: 
  - Type: A

- Double-break contact with 2 terminals
  - Symbol: #
  - Illustration: 
  - Type: X

- Change-over contact with single break, with 3 terminals
  - Symbol: #
  - Illustration: 
  - Type: C

- Change-over contact with double break, with 4 terminals
  - Note: The contacts are same polarity
  - Symbol: #
  - Illustration: 
  - Type: Za

- Change-over contact with double break, with 4 terminals
  - The two contact bridges are galvanically separated from each other
  - Symbol: #
  - Illustration: 
  - Type: Zb

Contact/Switch travel: The contact/switch travel details shown in the catalogue illustrate the switching behaviour on actuation from position 0 (= unactuated) up to the maximum end position. Closed contacts are represented by dark shading and open contacts by white areas. Other features are shown by means of symbols which are explained inside the back cover.

Contactor check: See feedback circuit.

Contactor with positively guided contacts: Contactor or relay on which the NC and NO contacts are galvanically separated from each other but mechanically connected together.

Control category: For the risk assessment to EN 954-1 for safety-relevant electrical circuits, there are five categories for safety related parts of control systems. These categories B, 1, 2, 3 and 4 describe the “resistance” of a control system to faults.

Conventional relay technology: The device is not equipped with microprocessors. Control and evaluation for instance of a safety guard monitor is carried out using relays.

Cross-wire monitoring of two adjacent contacts or switches, e.g. between S13 and S22. A safety control module can monitor this condition.

Declaration of Conformity: Declaration issued by the manufacturer for the use of a product within the European Community according to the appropriate standards.

Diversely programmed micro-processor: Two different programs for the same function, in order to recognise software errors.

Drop-out delay: Voltage-controlled drop-out of the relay after a preset or fixed time.

EMC Directive: Law on electromagnetic compatibility. The EMC Directive applies to appliances which contain electrical and/or electronic components which can cause electromagnetic interference or the operation which can be affected by such interference.

Emergency release: allows for a manual release of the solenoid interlock from outside the hazardous area without assistance in case of an emergency. The resetting of the operational state must require an effort comparable to a repair action.

Emergency Stop EN 60204-1: “Actions in case of emergency”
- Stopping in emergency: An action in a case of emergency which is determined to stop a process or movement which is dangerous.
- Switching off in emergency: An action in a case of emergency which is determined to cut off the electrical supply to a complete or a part of an electrical installation, if there is a risk of an electric shock or some other risk of electrical origin.

Emergency exit: allows a manual unlocking of the solenoid interlock from inside the hazardous area without assistance in case of danger.

Enabling output: Safety outputs, which are monitored for correct function by a safety control module.

Enabling path: An enabling path is the safe output of the safety control module which can be integrated in the safety circuit of the machine. In the safe switched-off condition, this circuit must always be open, since the safe condition must always be reached by switching off the electrical supply (“fail-safe” mode of operation). The enabling path is formed by the NO contacts of the safety relays wired in series.
Entry / Intervention time: Time needed for entry into or intervention in the dangerous area, as calculated based on an approach speed.

Exposure to risk: Probability of the occurrence of an injury or damage to health. The exposure to risk is related to the frequency of access to or time spent in the hazardous area.

Fail-safe locking mechanism: The design of the solenoid interlock ensures that the locking and the position of the safety guard can be simultaneously monitored by means of one contact array. Under all circumstances, it must be guaranteed that the contacts can close only after the safety guard is properly closed.

Fail-safe standstill monitor which gives the enable signal, when a machine has come to a standstill, e.g. to open a guard device. In case of a fault, the fail-safe standstill monitor takes up the safe condition. See also standstill monitor.

Fail-safe timer (AZS range): A timing relay which gives an enable signal, when a preset time has elapsed, e.g. to open a guard device. In case of a fault, the fail-safe timer takes up the safe condition.

Feedback circuit: Electrical circuit to monitor externally connected power contactors, etc., by means of a safety control module. The NC contacts are used to check whether external relays or contactors have taken up their safe condition (switched off) before their renewed energisation. The evaluation unit only gives the enable signal, when the feedback circuit is closed.

GS-ET...: Testing/inspection principles of the German assessment committee for electrical engineering

GS-ET-15: Testing/inspection principles for positive break position switches

GS-ET-19: Testing/inspection principles for locking devices with electromagnetic interlocking mechanism

GS-ET-20: Testing/inspection principles for relay safety combinations

Hazard: The word “hazard” appears very often in the Machinery Directive and the standards, in particular in word combinations, is however not commented on nor defined. It stands for an indefinite and not oriented hazard (i.e. not aimed directly against persons and/or objects).

Hazardous area: Any area in or around a machine in which a person is at risk of injury or danger to health. Note: The hazard which produces the risk is either always present or can occur unexpectedly. In newer proposals, the term “hazard zone” is also being used for this.

Input extension: To monitor several safety guards, modules can be linked together using parallel wiring.

Input expander, modular: To monitor a number of safety guards; modules are connected together by ribbon cables.

Interlock: A mechanical, electrical or other device to prevent operation of a machine element under pre-determined conditions (usually as long as a movable safety guard is not closed).

ISD (Integral System Diagnostics): With the assistance of the ISD, the switching conditions and possible errors in case of a fault can be quickly identified. Depending on the version of the safety control module, the switching conditions and faults are shown via multi-colour LED’s or provided to the user on a transistor output. The switching conditions and faults can be identified with the assistance of the ISD tables.

IP 54, IP 65, IP 67: Indications for the existing protection classes of a switching device according to EN 60529

1st figure: protection against the ingress of solid foreign bodies

2nd figure: protection against the ingress of water

Latching push button: Switch that has to be actuated manually

Machine to EN 292-1; 3.1: The entirety of parts or devices connected together, of which at least one is a moving part, also as applicable drive elements, control and supply circuits, etc., which are brought together for a particular application, such as processing, treating, material handling and preparation of material. The entirety of several machines, which are so arranged and controlled that they operate together as a single unit to achieve one and the same purpose, is also considered to be a “machine”.

Manipulation in a simple manner: Intentional overcoming of safety switches either manually or by using readily available items, e.g. screws, keys, coins or tools which are needed for the normal operation of the machine. See protection against manipulation.

Manual release: allows for a manual release of the solenoid interlock from outside the danger zone by means of a tool or key.

MBL...: Code of practice of German industrial assessors, which gives references and suggestions regarding technical products.

Non-separating protective device: A device without separating function, which eliminates or reduces a risk either alone or in combination with a separating protective device.

Normally closed contact / NC contact: A contact which is closed in the rest condition.

Normally open contact / NO contact: A contact which is open in the rest condition.

Output expander, modular: To provide additional enabling paths; modules are connected together by ribbon cables.

Output extensions: To increase the number of enabling circuits; modules can be linked together using parallel wiring.

Positive action to EN 60947-5-1: Connection between the actuator and the switch contact by means of which force exerted on the actuator is directly transmitted to the contact.
**Glossary**

**Positive actuation:** If a moving mechanical component automatically moves another with it either by means of direct contact or via rigid parts.

**Positive break (of a switch contact to EN 60204-1):** The version of a contact separation as direct result of a determined movement of the operating part of the switch via non-flexible parts.

**Positive drive (EN 60204-1):** The actuator and the normally-closed contact must be directly connected together via rigid (non-springing) parts.

**Power to lock solenoid:** The latching bolt of a solenoid interlocking device is held in the locked position by solenoid force and released by spring force.

**Protect:** For the “Protect” mode of operation, the enable of the switching output is carried out automatically after the end of the protected field interruption (or in case of activation of the restart interlock after resetting) and the end of the protected field interruption.

**Protection against manipulation:** Manipulation is when the function of a safety device or safety switch is made inoperative.

**Protection class IP (Enclosure rating):**
- Protection against the ingress of solid foreign bodies (Foreign body protection)
- Protection of persons against contact with live or moving parts (Protection against contact)
- Protection against the ingress of water (Water protection)

**Reaction time (EN 61496):** The maximum time duration between the response of the sensor function and the OFF condition of the output switching elements, see also response time.

**Redundancy (EN 60204-1):** Use of more than one device or system, in order to ensure that in case of faulty operation of one unit the function will be carried out by the other one.

**Remaining risk:** Risk which remains after carrying out protective measures; the remaining tolerable risk in spite of protective measures.

**Response time, reaction time:** The maximum period of time between actuation of the sensor function and the OFF condition of the output switching elements.

**Re-start interlock:** A device to prevent the automatic restart of a machine after interruption and renewed enable of the protected field during a dangerous part of the machine cycle or after a change in the mode of operation or actuation of the machine.

**Risk (EN 60204-1):** A combination of the probability and the severity of possible injury or damage to health in a dangerous situation, see EN 292-1, 3.7. The risk, in relation to the hazard seen, is also designated as a function of the amount of possible damage and the probability of this damage occurring.

**Risk analysis:** A complete identification and evaluation of all possible dangers for the risk evaluation, also termed danger analysis in the Machinery Directive. According to Article 100a, the risk situation and exposure to risk must be taken into account, according to Article 118a, the potential risk depends on the working conditions and the working environment.

**Risk assessment:** A complete assessment of the probability and the severity of possible injury or damage to health in a dangerous situation, in order to select suitable safety measures. In EN 1050, this term is used as a part of the risk analysis.

**Risk evaluation:** A process to determine whether a risk is acceptable, based on risk analysis and taking into account factors such as social, commercial and environmental aspects.

**Risk judgement:** A process of risk analysis and risk evaluation. In EN 292-1, these terms are not used in the same sense.

**Safety** is present if the risk is justifiably small or in the absence of risks.

**Safety guard (EN 60204-1):** A movable protective device or such as is used as a safety measure in order to protect persons from a present or potential hazard.

**Safety relay:** The main characteristic of a safety relay is that it has positive-drive contacts, which makes it possible to check the position of its NO contacts by means of a NC contact. The contacts are mechanically connected together. It is thus ensured that the NC contact is always open when the NO contact is closed.

**Sensorless standstill monitors:** Monitoring of the rotation of the motor is not carried out by sensors on the shaft but by direct monitoring of the back e.m.f. at the motor terminals.

**Slow action contact:** Switching system where the switching movement depends on the actuating speed.

**Snap action contact:** Switching system where the switching movement is carried out by spring action and is independent of the actuating speed.

**Solenoid interlock:** A solenoid interlock has the function of locking a separating guard device in the closed position. It is connected to the control system in such a way that the machine cannot be operated if the safety guard is not closed and interlocked and that the safety guard is held closed until there is no longer a risk of injury.

**Spring to lock solenoid:** the latching bolt of a solenoid interlocking device is held in the locked position by spring force and released by solenoid force

**Standards** regarding machine safety are classified in three types:

- **Type A standards:** The basic safety standards, which lay down the basic terms and the guiding principles for all machines.
- **Type B standards:** Safety group standards, which deal with a particular safety aspect that is applicable to a wide range of machines.
- **Type B1 standards:** Make more concrete statements and offer possible solutions for the safety aspects dealt with generally in the basic standards, such as safe distances, surface temperatures, etc.
- **Type B2 standards:** Include concrete statements or possible solutions for safety equipment such as two-hand operation circuits, interlocking devices, etc.
- **Type C standards:** Machine safety standards or subject standards which relate to specific safety characteristics of individual types of machine or of machine groups.
Glossary

**Standstill frequency:** A programmed fixed reference value for recognition of standstill. On frequency “standstill”, the enable circuits are switched on and solenoid interlocks connected can be opened.

**Start disable:** A function which causes the BWS to go into an interlocked condition when its electrical supply is switched on or interrupted and switched on again.

**Start function:** The feedback circuit can also be used to provide a start function by connecting an additional Start push button (NO) into the feedback circuit. The evaluation unit only gives the enable signal when the feedback circuit is closed.

**Start-up test:** A manual or automatic test to EN 61496-1, which is carried out when an ESPE or a safety guard monitor has been switched on, to test the complete safety-related control system before the first machine movement is started.

**Stop category 0 to EN 60204-1:** Shutdown by immediate switching-off of the power supply (uncontrolled shutdown).

**Stop category 1 to EN 60204-1:** When switching off, the supply is maintained until the machine has come to a standstill. When standstill has been reached, the power supply is interrupted (controlled shutdown).

**Stop category to EN 60204-1:** Division to describe the switching-off characteristics relating to actions in emergencies.

**Stopping time:** Duration until the hazard is removed, e.g. motor standstill.

**Test push button:** The Test push button can be used to check the switch-off function of an evaluation unit. When the Test button is operated, the enable contacts must open.

**Time monitoring** is only operative in stroke operation (single or double stroke). It prevents uncontrolled release of the machine stroke. This provides that interventions in the protected field are only accepted as strokes when they are carried out within a pre-determined time (e.g. 30s) after the stroke cancellation contact is closed. If this does not take place within this period of time, the re-start interlock is activated.

**Timer:** A timing relay which gives an enable signal when a preset time has elapsed, e.g. to open a guard device. In case of a fault, the secure timer takes up the safe condition.

**Universal current (UC):** Devices can be operated on AC or DC supplies.
**Explanation of symbols**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
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<td><img src="A" alt="NC contact with positive break" /></td>
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<td><img src="I" alt="Spanner size across flats" /></td>
<td>Spanner size across flats</td>
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Emergency stop, Safety guard, Safety light barrier, Safety light curtain, Laser scanner, Pull-wire switch, Two-hand control, Safety mat, Safety sensor, Fail-safe standstill monitor, Fail-safe delay timer, Removable safety guard, Hinged safety guard, Sliding safety guard, Safety guard in aluminium profiles, Control Category 1 to EN 954-1, Control Category 2 to EN 954-1, Control Category 3 to EN 954-1, Control Category 4 to EN 954-1, NC contact with positive break, Spanner size across flats.
The solenoid interlocks of the Schmersal Group comply to the latest editions of the standards. The following standards and technical data sheets are a guide to the design, operating principle, mounting and technical requirements of solenoid interlocks, and the safety relevant equipment on machinery:

**Standards:**

- **EN 292:** Safety of machinery: Basic concepts, general design principles
- **EN 953:** Safety of machinery: Movable safety guards
- **EN 954-1:** Safety of machinery: Principles for the design of safety-related parts of control systems
- **EN 999:** Safety of machinery: Classification of safety guards taking into account the approach velocity of body parts
- **EN 1037:** Safety of machinery: Avoiding unexpected start-up
- **EN 1088:** Safety of machinery: Interlocking devices associated with guards
- **EN 60204:** Safety of machinery: Electrical equipment of machines
- **EN 60947:** Low voltage switchgear and control gear

These standards can be obtained from Beuth Verlag GmbH
Burggraf-Straße 6
10787 Berlin
Internet: www2.beuth.de
Email: postmaster@beuth.de

**Other documentation:**

- **BG technical data sheet: BGI 575 (in preparation):** Selection and installation of electromechanical interlocking devices for safety functions
- **BIA-Report 6/97:** Categories for safety-relevant parts of control systems to EN 954-1
- **MRL-News:** News about “Safety of Machinery and Machine Controls” by Elan Schaltelemente GmbH & Co. KG

The Schmersal Group has published two technical books about machine safety in German. Several chapters of these books also contain detailed notes for the selection and the design of safety guards fitted with solenoid interlocks. An English version will be available in autumn 2002:


Even more information is available on the Internet:

www.schmersal.com
www.zvei.org
www.hsebooks.co.uk
Search word: „safeguarding”
www.europa.eu.int