The Schmersal Group

The privately owned Schmersal Group has been developing and manufacturing products to enhance the safety at work for decades. The company was founded in 1945 and is represented by seven manufacturing sites on three continents with its own companies and sales partners in more than 60 nations. In the demanding field of machine safety the Schmersal Group is one of the international market and component leaders. On the basis of a comprehensive product portfolio, the company’s approximate 2000 employees develop and design complete solutions for the safety of man and machine.

Customers of the Schmersal Group include “Global Players” from mechanical engineering and plant manufacturing and operators of machinery. They benefit from the comprehensive know-how of the company when it comes to the standard-compliant integration of safety technology in the production processes. Furthermore, Schmersal has special sector expertise in the application fields that demand high quality requirements and special characteristics from safety switching systems. This includes the foodstuff production, packaging industry, machine tool industry, lift switchgear, heavy industry and the automobile industry.

Against this background of growing standards and directives on machine safety, the tec.nicum offers a comprehensive range of Safety Services as part of the Schmersal Group services division: Certified functional safety engineers advise customers in creating suitable safety concepts keeping in mind the legitimate requirements, and this is done on a worldwide scale.

www.schmersal.com
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We trust you will understand that the user must check our information and recommendations before using our equipment.

Service for designers

The online catalogue also includes the technical drawings of our products – a special service to designers. In this way, they can be downloaded and directly fed into CAD-systems.

The Schmersal homepage furthermore contains a-to-z information on general subjects, technical articles on machine safety as well as news regarding events and trainings. To be bookmarks!

The direct way

If you need further information or you want personal advice, you can call us as well. Tel. +49 (0) 2 02-64 74-0. We are at your disposal – anytime, anywhere, anyhow!

Descriptions of technical correlations, details on external control units, installation and operating instructions or similar have been provided to the best of our knowledge. This however does not mean that any warranted characteristics or other properties under liability law may be assumed, which extend beyond the “General Terms and Conditions of Delivery and Service of the Electrical Industry”.

You will also find detailed information regarding our product variety on our website:

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Warning!

The Schmersal programme is not intended for private consumers, i.e. that they are not consumer products within the meaning of the European Directives (in Germany within the meaning of § 451§ 451) or other national laws. Subject to technical modifications and errors. The data specified in this catalogue are carefully checked typical standard values.

Online documentation in 13 languages

The online catalogue for our customers is permanently updated. The main catalogue can be consulted on the Internet as much as six languages. The technical data of our entire product range are always up-to-date. The declarations of conformity, the test certificates and the mounting instructions can be consulted or even downloaded as well.

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Table of contents

- Technology and user advantages ............................................................................ Page 4

Electronic safety sensors
- Safety sensor RSS 16 – individually codeable, optionally with latching ............... Page 11
- Safety sensor RSS 260 – individually codeable, various actuators ....................... Page 17
- Safety sensor RSS 36 – individually codeable, optionally with latching ............... Page 23
- Safety sensor CSS 180 – thermoplastic enclosure M18 .................................... Page 29
- Safety sensor CSS 30 – metal enclosure M30 .................................................. Page 35
- Safety sensor CSS 305 – stainless steel enclosure M30 ..................................... Page 41
- Safety sensor CSS 300 – thermoplastic enclosure M30 ..................................... Page 47
- Safety sensor CSS 34 – large variety of actuator designs .................................... Page 53

Electronic solenoid interlocks and safety switches with separate actuator
- Solenoid interlock MZM 100 .............................................................................. Page 63
- Safety switch with interlocking function MZM 100 B ....................................... Page 65
- Solenoid interlock AZ 300 ............................................................................... Page 74
- Safety switch with separate actuator AZ 300 ................................................. Page 79
- Solenoid interlock AZM 200 ............................................................................ Page 83
- Safety switch with interlocking function AZM 200 B ....................................... Page 85
- Solenoid interlock with button and LED AZM 200,...-2568............................ Page 86
- Solenoid interlock AZM 200 D ........................................................................ Page 92
- Safety switch with separate actuator AZ 200 ................................................. Page 96
- Accessories - Connectors ................................................................................ Page 104

Serial diagnostic for function monitoring
- SD-Gateway SD-I-DP-V0-2 – for PROFIBUS ............................................... Page 108
- UNIVERSAL-Gateway SD-I-U-... – with different field bus interfaces .......... Page 109
- Y-adapter ........................................................................................................ Page 110
- SD-Y-POWER adapter .................................................................................... Page 112
- T-adapater ....................................................................................................... Page 114
- SD junction boxes ............................................................................................ Page 115

Safety controllers for electronic safety sensors and interlocks
- SRB031MC ..................................................................................................... Page 120
- SRB201LC ..................................................................................................... Page 122
- SRB211ST V.2 ............................................................................................... Page 124
- SRB301MA ................................................................................................... Page 126
- SRB301MC ................................................................................................... Page 128
- SRB301ST V.2 ............................................................................................... Page 130
- SRB324ST V.3 ............................................................................................... Page 132
- SRB504ST ..................................................................................................... Page 134
- PROTECT-PE ............................................................................................... Page 136
- PROTECT-SELECT ....................................................................................... Page 139

- Schmersal Worldwide ...................................................................................... Page 144
- Addresses ....................................................................................................... Page 146
Non-contact - Electronic Safety Sensors

With the CSS technology, the Schmersal Group has developed and patented an electronic operating principle for the non-contact communication between the safety sensor and the actuator. This “Coded Safety Sensor” (CSS) principle guarantees, in addition to a high switching distance, also a high degree of fail-safety and protection against tampering. The sensors can also be actuated misaligned; when the hysteresis limits are reached, a premature warning is emitted to inform the user in due time about possible misalignment of the door.

The electronic monitoring of moving safety guards including actuation in non-contact solenoid interlocks enables the wear-free and non-contact detection of the respective actuator. The patented pulseecho-technology permits large tolerances in the approach of the coded actuator, both in the switching distance and the misalignment. Despite this, the switching points and hysteresis are extremely repeatable and constant.

The performance and capabilities of the safety sensors and solenoid interlocks are covered by the following testing standards:

- Defined behaviour under fault conditions to EN 60947-5-3
- Requirements on safetyrelated parts up to PL e/category 4 to ISO 13849-1
- Requirements of IEC 61508 use up to SIL 3 applications

The requirements of IEC 61508 furthermore guarantee the user extremely high EM interference immunity. In addition, the standard allows that a signal is given for certain failures before the machinery completely switched off. This enables putting the machinery safely to a hold position before being switched off.

The using of microprocessor technology allows an intelligent diagnostic as well as a smooth and fast failure detection, e.g. in case of crosstalks or wiring errors.

The safety channels of the electronic sensors and electronic solenoid interlocks can be wired in series to build a chain of up to 31 components, depending on the type of device used. Because of the independent functional check, PL e/category 4 to ISO 13849-1 is retained for this series-wired chain. Due to the self-monitoring circuit technology and the resulting favourable PFH values, Sub-SIL 3 or Sub-PL e, to IEC 61508 (IEC 62061) or ISO 13849-1 is regularly obtained. The chains can also consist of a mix of the safety sensors and solenoid interlocks described in this brochure.

Operating principle

All products of the CSS series have the same operating principle. They use the pulseecho technology patented by Schmersal to detect the actuator.

The sensor emits electromagnetic pulses. When the actuator approaches the sensor, the actuator starts oscillating at a predetermined resonant frequency due to the induced energy. These oscillations are in turn read by the sensor and evaluated. The actuator identified by the sensor is interpreted as a closed safety guard and the safety outputs are enabled.

Due to this operating principle, the sensor is not suitable for mounting behind metal walls, considering that the oscillation to be detected cannot penetrate the metal. The CSS 30S stainless steel sensor is an exception here. This sensor can be used under covers in antimagnetic stainless steel.
The RSS range is the next step in the safety sensor technology. Considering that the RFID technology is integrated in the RSS, different variants can be generated, each featuring individual coding possibilities. In this way, the suitable tampering protection can be chosen for each application, depending on the requirements. The new electronic RSS safety sensor is, just like the other sensors featuring the CSS technology, suitable for series-wiring in safety circuits whilst offering the highest level of safety and moreover can be combined with all other components from the CSS family. In addition to that, the RSS 36 and RSS 16 features an optional, integrated latching function to keep flaps or small doors closed, even in de-energised condition.

Application
The electronic safety sensors and solenoid interlocks are used for monitoring moving safety guards. When the safety guard is opened, the machine is stopped and the dangerous restart of the machine is in all cases suppressed.

Their essential advantage is in the non-contact detection of the safety guard's position. They therefore are completely wear-free and insensitive to misalignment or offset of the sensor and the actuator.

Due to their compactness, there are numerous applications for CSS/RSS sensors. Because of their high repeatability, an extremely low hysteresis and the absence of double switching points in the actuation range, they can be fitted to a wide variety of safety guards or they can be employed for position monitoring on machines axes.

In this way, the sensors can be used in almost any place where required. The encapsulated sensors and their actuator are insensitive to shocks, vibrations and dirt.

The CSS/RSS safety sensors consequently can be used anywhere, especially where protection against dangerous run-down movements of the machine is not required.

The application possibilities of the RSS range are further enlarged by the different actuating planes as well as a large variety of actuators.

The CSS 30S safety sensor with stainless steel enclosure extends the range of application especially for hygienecritical applications. Due to its high resistance to mechanical or chemical influences, this safety sensor is also perfectly suitable for use in aggressive ambient conditions.

For doors, which are especially sensitive to tampering, the RSS safety sensors with different coding options offer a high degree of protection against tampering, considering that the adequate coding procedure can be selected.

The safety switchgears are classified according to ISO 14119 as type 4 switching devices. Designs with individual coding are classified as highly coded.

Because of a special feedback circuit monitoring with reset function, the CSS 34F sensors are suitable for the direct control of safety contactors. This enables saving on wiring expenses and avoids the need of buying a dedicated safety controller.
Safe locking - Electronic solenoid interlocks

Hazardous areas on machinery and plants must remain inaccessible until all dangerous machine movements have come to a standstill. For this reason, safety sensors may not be used. According to ISO 14119 solenoid interlocks have to be fitted.

A door offset of approximately 5 mm is permitted with the CSS/RSS sensors. The mechanical design of the actuator furthermore enables the swivelling of the complete enclosure, which is fitted to the safety guard.

In this way, irregular sagging of the safety guard can be compensated within large limits, i.e., in this situation, the actuator still can be smoothly and accurately inserted in the switch or in the solenoid interlock.

This mechanical design feature ensures that the component is not damaged despite the offset of the actuator and the component; this in turn leads to a higher machinery and plant productivity.

AZM 200 solenoid interlock

Because of their separate actuator unit, facilitating the intuitive and ergonomic operation of the safety guard, the AZ and the AZM 200 are particularly suitable for use on safety guards, protective fencing or machine housings.

The actuator unit also enables the integration of an additional sensor, which is used for safety guard monitoring. With the help of this second sensor, PL e/category 4 to ISO 13849-1 is realised with only one interlock and one switch on the safety guard. This unique feature replaces the second switch. This saves additional costs for the switch and its fitting.

Power-to-unlock / power-to-lock principle

The solenoid interlocks have two different operating principles: the power-to-unlock principle and the power-to-lock principle.

With the power-to-unlock principle, the safety guard is mechanically locked in de-energised condition by a spring and unlocked by energising the solenoid. With the power-to-lock principle, the safety guard is mechanically locked by magnetic force (i.e., by energising the solenoid) and unlocked by spring force. As the power-to-lock solenoid interlock can be unlocked in de-energised condition, it thus enabling the safety guard to be opened immediately, the use of power-to-unlock solenoid interlocks is strongly recommended for the protection of personnel against hazardous stored energy (e.g., run-on movements).

The AZM 200 is available both as power-to-unlock and as power-to-lock version.

Interlocks basically can be equipped with the following unlocking features:

Manual release

Machinery fitted with power-to-unlock solenoid interlocks normally have a way of opening the safety guard in case of power failure, usually by means of a tool such as a triangular key. The Schmersal solenoid interlocks are fitted with this kind of auxiliary unlocking mechanism, the so-called “manual release”.

Emergency exit

An emergency exit allows an intentional opening of the safety guard from inside the machine without tools, for example when staff are trapped inside a machine. It enables the unlocking and opening of the safety guard with just one hand movement by simply turning the emergency handle located on the inside of the hazardous area.

AZM 300 solenoid interlock

At the first glance the electronic solenoid interlock AZM 300 is already different from others available switchgears. A unique locking system based on a rotatable star handle enables that the solenoid interlock could be actuated from three sides. This provides universal applicability. Exactly the same model can be used for hinged guards with left and right hand opening and for sliding doors.

An integrated RFID sensor takes over the identification and coding of the actuator. This creates the precondition that the user can choose between three types of encoding. In the basic version the sensor accepts every suitable target.
The interlocking unit is installed on the safety guard; the actuator unit directly on the moveable guard door. To lock the actuator unit, the armature plate must be on the pole shoes of the current-carrying magnet.

The permanent monitoring of the magnetic parameters guarantees a safe holding force. The component is unlocked by switching off the magnet current.

MZM 100 electronic magnetic interlock
In this new generation of magnetic interlocks, the actuator simultaneously is the armature of the magnet, which is attracted with a force that can be monitored. This interlock can be used for monitoring guard doors or flaps.

The special features of this component are the monitoring of the potential holding force between the armature and the electromagnet means of a measurement of the magnetic parameters and the detection of the armature by means of the CSS principle. This "noncontact" operating principle offers extended adjustment possibilities for both units.

The actuator unit (armature) and the interlocking unit (magnet) build a closed circuit.

A second coded version reacts only with an individually assigned target. The teach-in process can be repeated indefinitely. Finally a third version is available that only accepts the target that was originally taught when first turned on. The second and third version ensure the coding level „High“ according to ISO 14119.

The latching force can be adjusted from approx. 25 N to approx. 50 N simply by turning the star handle 180°.

The pulse-echo technology prevents defeating of the component by simple means.

The second and third version ensure the coding level "High" according to ISO 14119.

The component is unlocked by switching off the magnet current.

These outputs are capable of controlling two contactors or one safety relay combination. They also can be monitored by a safety controller.

The interlocking unit is equipped with a dual-channel processor system with redundant structure to measure the holding force and to detect the actuator in the actuator unit; this system furthermore monitors both enabling paths.

The pulse-echo technology prevents defeating of the component by simple means.
Detecting and displaying

The integral electronics of the electronic safety sensors and the electronic solenoid interlocks allows an extensive diagnostic of the respective operating conditions.

The diagnostic is available in each individual component, but it can also be used when different safety components of the CSS/RSS range are serieswired.

The operating status is displayed by the easily visible diagnostic LED’s located on the component. It is additionally provided through a diagnostic output. To this end, two options can be chosen: the conventional diagnostic output or the serial diagnostic cable.

The diagnostics in the electronic safety sensors RSS and CSS, the solenoid interlocks AZM 200 and MZM 100 or the electric safety switch AZ 200 and MZM 100 B is identical, however adapted to the respective function. Further details can be found in the product data sheets in the product section.

<table>
<thead>
<tr>
<th>Display (red)</th>
<th>Flash codes</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td></td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td></td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td></td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td></td>
<td>Failure (warning) over-temperature</td>
<td>30 min</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td></td>
<td>Actuator fault</td>
<td>0 min</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td></td>
<td>Actuator combination fault</td>
<td>0 min</td>
</tr>
<tr>
<td>Continuous red</td>
<td></td>
<td>Internal failure</td>
<td>0 min</td>
</tr>
</tbody>
</table>

LED functions:
- Green: supply voltage on
- Yellow: operating status
- Red: error (refer to flash codes)

Example of the diagnostic function of the AZM 200 solenoid interlock

The serial diagnostic
Safety sensors and interlocks with serial diagnostic output have a serial input and output cable instead of the conventional diagnostic (signal) output. If these SD components are daisy-chained, the safety channels as well as the serial diagnostic cables are wired in series. The thus created “bus line” or “collecting main” of diagnostic information is passed to a serial diagnostic gateway for monitoring.

In this way, a maximum of 31 components can be consecutively daisychained, also as series-wiring of different components.

Further details can be found in the product data sheets in the product section.

Failure
Failures, which no longer guarantee the proper functioning of the safety device (internal failures), will result in an immediate deactivation of the safety outputs. Failures, which do not immediately affect the safety function of the safety device will result in a delayed switch-off.

Failure warning
The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position.

This prevents the breakage of tools and work pieces and increases the machine productivity.
Serial diagnostic gateways
The SD Gateways for the different field bus systems convert the serial diagnostic signal of the sensors and solenoid interlocks into the desired field bus protocol.

The SG Gateways are available for the following field busses:
- PROFIBUS DP-V0
- PROFINET IO
- DeviceNet
- EtherNet IP
- CC-Link
- CANopen and
- Modbus/TCP.

The SD Gateways are integrated as slave in the available field bus system. In this way, the diagnostic signals can be evaluated through the connected control system.

Every connected safety sensor/solenoid interlock loads status signals, warning or failure messages to the linked PLC. The PLC sends control commands to the components of the series-connected chain, e.g. to unlock a solenoid interlock.

This concept has multiple advantages: not only the amount of wiring is considerably reduced, it furthermore provides useful information about each participating sensor and the control of the individual interlock releases from the connected PLC.

This function can considerably reduce machine downtime.

Serial diagnostic in the series-wiring of safety sensors/switches/solenoid interlocks

Legend
Sensors with the serial diagnostic option:
(defined equipment category):
- RSS 16 (Hex: 39)
- RSS 36 (Hex: 37)
- RSS 260 (Hex: 3A)
- CSS 34 (Hex: 30)
- CSS 30S, CSS 300 (Hex: 34)
- AZM 200, AZ 200 (Hex: 31)
- AZ 300 (Hex: 3C)
- AZM 300 B (Hex: 36)
- AZM 300 Z (Hex: 3B)
- AZM 400 Z (Hex: 3B)
- MZM 100 (Hex: 32)
- MZM 100 B (Hex: 35)
Electronic Safety Sensors and Solenoid Interlocks

Safe evaluation

The Schmersal Group offers the user different application-oriented safety-monitoring modules for the safe signal evaluation.

The PROTECT range includes, amongst other things, safety-monitoring modules, safe compact controllers and a safe modular safety controller. These safety-monitoring modules are destined to the typical applications in safety-related parts of control systems of machinery. Examples of items that are safely evaluated are: the signal processing of emergency-stop control devices, interlocking devices, magnetic safety switches, optoelectronic safety devices and safety switchgear featuring the CSS/RSS technology with p-type outputs.

The use of electronic control systems is only useful when the safety circuits feature a certain degree of complexity. The applicable rule of thumb here is: as soon four safety-monitoring modules are used in a safety-related application, the use of the PROTECT-SELECT compact controller should be considered.

Most of the currently marketed programmable electronic safety control systems for machine safety meet the requirements of ISO 13849-1 (PL e) and have a 24 VDC power supply.

Selection and decision criterions of prime importance therefore are the number of inputs and outputs, their technology (inputs with or without potential either semi-conductor or relay outputs) as well as the enclosure design.

The Schmersal Group offers excellent solutions for these three fields of application. As of page 121, you will find a selection of safety-monitoring modules of the PROTECT-SRB series; details regarding the PROTECT-SELECT compact controller can be found as of page 143.

EC-Conformity to the new Machinery Directive

The design, labelling and included operating instructions of all PROTECT modules described in this brochure meet the requirements of the EC Machinery Directive 2006/42/EC. As logic controllers to ensure the safety functions, they come under Appendix IV, and as a consequence, they are subject to a special quality assurance system (= comprehensive quality assurance system to Appendix X of the Machinery Directive) during their development and production.

The Schmersal Group has implemented a quality assurance system certified by TÜV Rhineland and therefore is qualified and authorised to execute the machinery conformity assessment procedure, which is described in Appendix X of the Machinery Directive, including the components to ensure a safety function.
Electronic safety sensor RSS 16

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: 6,3 x 10^{-11} / h

Operation advantages
- Individually coded version with Coding level „High“ according to ISO 14119
- Three types of codings for demand-oriented protection against manipulation
- Three actuating directions
- Door stop with magnetic latching function
- Terminal box or plug connection

Wiring advantages
- Series-wiring possible by using a Y-adapter or directly in the terminal box

Application advantages
- High protection against tampering through RFID technology
- Compact design and subtle, elegant design
- Easy installation without additional angles
- Universal application through different actuators for typical installation situations
- Repeated universal or individual coding
The actuator, sealing kit and tamper-proof screws must be ordered separately.

Technical data

Standards: IEC 60947-5-3, IEC 61508, IEC 62061, ISO 13849-1

Enclosure: Plastic, glass-fibre, reinforced thermoplastic, self-extinguishing

Magnetic latching: Anchor plate and pole plates made of stainless steel 1.4016

Operating principle: RFID

Actuator: RST16-1, RST16-1-R

Series-wiring: unlimited number of components, however safety-dependent; max. 31 components for serial diagnosis

Connection:
- connector plug: M12, 8-pole, A-coded
- cage clamps: 10x 0.5 mm² … 1.5 mm²
- screw terminals: 10x 0.14 mm² … 1.5 mm²

Mechanical life: ≥ 1 million operations (when used as door stop) for safety guards ≤ 5 kg and actuating speed ≤ 0.35 m/s

Latching force (R):
- front: approx. 60 N
- from above or below: approx. 40 N

Switching distances to IEC 60947-5-3:
- Typical switching distance: 15 mm
- Assured switching distance \( s_{au} \): 12 mm
- On versions with latching \( s_{au} \): 5 mm
- Assured switch-off distance \( s_{ar} \): 30 mm
- Hysteresis: < 2.0 mm
- Repeat accuracy R: < 0.5 mm

Ambient conditions:
- Ambient temperature \( T_{u} \): -25 °C ... +70 °C
- Storage and transport temperature: -25 °C ... +85 °C
- Protection class: IP65 / IP66 / IP67 to IEC 60529
- Connector plug M12: IP65 / IP66 / IP67 to IEC 60529

Resistance to vibration: 10 ... 55 Hz, amplitude 1 mm

Resistance to shock: 30 g / 11 ms

Switching frequency f:
- Actuator: ≤ 1 Hz
- Inputs: ≤ 0.5 ms
- Duration of risk: ≤ 200 ms
- Time to readiness: ≤ 2 s

Minimum distance between adjacent sensors: 250 mm

Approvals

TÜV ü

Ordering details

<table>
<thead>
<tr>
<th>RSS16...-R</th>
<th>RSS 16</th>
</tr>
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<tbody>
<tr>
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<tr>
<td>➀</td>
<td>I1</td>
</tr>
<tr>
<td>➋</td>
<td>I2</td>
</tr>
<tr>
<td>➁</td>
<td>D</td>
</tr>
<tr>
<td>➂</td>
<td>SD</td>
</tr>
<tr>
<td>➃</td>
<td>R</td>
</tr>
<tr>
<td>➄</td>
<td>Without latching</td>
</tr>
<tr>
<td>➋</td>
<td>ST8H</td>
</tr>
<tr>
<td>➋</td>
<td>CC</td>
</tr>
<tr>
<td>➋</td>
<td>SK</td>
</tr>
</tbody>
</table>

Note

The actuator, sealing kit and tamper-proof screws must be ordered separately.

Approvals

TÜV ü

Note

Wiring and connectors refer to page 104

The safety switch-gears are classified according to ISO 14119 as type 4 switching devices. Designs with individual coding are classified as highly coded.
Electronic safety sensor RSS 16

**Technical data**

**Electrical data:**
- Rated operating voltage $U_e$: 24 VDC $-15\% / +10\%$
- (PELV to IEC 60204-1)
- Rated operating current $I_e$: 2.1 A
- Minimum operating current $I_{n\min}$: 0.5 mA
- Required rated short-circuit current: 100 A
- Rated insulation voltage $U_i$: 32 V
- Rated impulse withstand voltage $U_{imp}$: 800 V
- No-load current $I_{n}$: 45 mA
- Overvoltage category: III
- Degree of pollution: 3

**Safety inputs X1/X2:**
- Rated operating voltage $U_{e\text{lim}}$: 24 VDC $-15\% / +10\%$
- (PELV unit)
- Power consumption per input: 5 mA

**Safety outputs Y1/Y2:**
- p-type, short-circuit proof
- Rated operating current $I_{e\text{lim}}$: je max. 1 A

**Utilisation category:**
- DC-12, DC-13: $U_e/I_e$: 24 VDC / 1 A / 55°C
- DC-12, DC-13: $U_e/I_e$: 24 VDC / 0.5 A / 65°C
- DC-12, DC-13: $U_e/I_e$: 24 VDC / 0.25 A / 70°C

**Voltage drop:**
- Rated short-circuit current: 100 A
- Rated insulation voltage $U_i$: 32 V
- Rated impulse withstand voltage $U_{imp}$: 800 V
- No-load current $I_{n}$: 45 mA

**Overvoltage category:**
- III

**Degree of pollution:**
- 3

**Safety inputs X1/X2:**
- Rated operating voltage $U_{e\text{lim}}$: 24 VDC $-15\% / +10\%$
- (PELV unit)
- Power consumption per input: 5 mA

**Safety outputs Y1/Y2:**
- p-type, short-circuit proof
- Rated operating current $I_{e\text{lim}}$: je max. 1 A

**Utilisation category:**
- DC-12, DC-13: $U_e/I_e$: 24 VDC / 1 A / 55°C
- DC-12, DC-13: $U_e/I_e$: 24 VDC / 0.5 A / 65°C
- DC-12, DC-13: $U_e/I_e$: 24 VDC / 0.25 A / 70°C

**Voltage drop:**
- Rated short-circuit current: 100 A
- Rated insulation voltage $U_i$: 32 V
- Rated impulse withstand voltage $U_{imp}$: 800 V
- No-load current $I_{n}$: 45 mA

**Overvoltage category:**
- III

**Degree of pollution:**
- 3

**Diagnostic output:**
- p-type, short-circuit proof
- Rated operating current $I_{e\text{lim}}$: max. 0.05 A

**Serial diagnostic:**
- short-circuit proof
- Operating current: 150 mA
- Wiring capacitance: max. 50 nF

**External cable protection:**
- fuse
- - with connector plug M12: 2.0 A
- - with cage clamps: 2.5 A
- - with screw terminals: 4.0 A

**Please observe the cable section!**

**LED functions:**
- green: Supply voltage on
- yellow: Actuator in the detection range
- red: Fault

**Classification**
- Standards: ISO 13849-1, IEC 61508, IEC 62061
- Category: e
- PL: 4
- PFH: $6.3 \times 10^{-11}$/h
- PFD: $1.1 \times 10^{-5}$
- SIL: suitable for SIL 3 applications
- Mission time: 20 years

**Note**

**Requirements for the safety controller**
- Dual-channel safety input, suitable for p-type sensors with normally-open (NO) function.
- The internal function tests of the sensors cause the outputs to cyclically switch off for max. 0.25 ms, this must be tolerated by the safety controller. The safety controller must not be equipped with cross-wire detection.

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-... and in the instructions for the integration of the SD-Gateway.

**Misalignment**

**Lateral actuation**
- The axial misalignment (Y) is max. ± 9 mm.
- The height misalignment (X) is max. ± 27 mm.
- Latching versions X ± 2 mm, Y ± 2 mm.
- The latching force is reduced by misalignment.

**Actuating curves**
The actuating curves (S) represent the typical switching distance of the safety sensor during the approach of the actuator subject to the actuating direction.

**Height misalignment X**

**Axial misalignment Y**

**Preferred actuating directions:**
- From front or from the X direction.
- With lateral travel in the Y direction be aware of the side lobes.

**Coding procedure**

**Ordering option -I1:**
- During the individual coding, a RST actuator is taught by a simple routine during the start-up procedure, so that every form of tampering by means of a replacement or substitute actuator is permanently excluded.

**Ordering option -I2:**
- Teaching the individual coding of a RST actuator by a simple routine during the start-up procedure (as -I1). A protected coding process enables the teaching of a new actuator for service purposes.

**System components**

**Actuator RST16-1-R**

*Actuator, with latching RST16-1-R
(The latching function will be reached with the combination of RSS16-...R and RST16-1-R.)

*Actuator, without latching RST16-1
(Alternative suitable actuators with different design: refer to www.schmersal.net.)

**Ordering details**

*Actuator, with latching RST16-1-R
(Alternative suitable actuators with different design: refer to www.schmersal.net.)
Electronic safety sensor RSS 16

Series-wiring of the RSS 16 with conventional diagnostic output

Y1 and Y2 = Safety outputs → dual-channel safety monitoring module

The voltage is supplied to both safety inputs of the last safety sensor of the chain (considered from the safety-monitoring module). The safety outputs of the first safety sensor are wired to the safety-monitoring module. The diagnostic output can be connected for instance to a PLC.

Series-wiring of the RSS 16 with serial diagnostic function

Y1 and Y2 = Safety outputs → dual-channel safety monitoring module
SD-IN → Gateway → Field bus

The voltage is supplied to both safety inputs of the last safety sensor of the chain (considered from the safety-monitoring module). The safety outputs of the first safety sensor are wired to the safety-monitoring module. The serial Diagnostic Gateway is connected to the serial diagnostic input of the first safety sensor.
Electronic safety sensor RSS 16

Diagnostic of the RSS 16 safety sensor with conventional diagnostic output

The safety sensor indicates the operating condition and faults by means of three-colour LED’s. The green LED indicates that the safety sensor is ready for operation. The supply voltage is on.

The yellow LED always signals the presence of an actuator within range. If the actuator is operating near the limit of the hysteresis range of the safety sensor, the yellow LED is flashing. The flashing and even 2 Hz clocking diagnostic output can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine.

If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td></td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td></td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td></td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td></td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td></td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td>Continuous red</td>
<td></td>
<td>Internal device error</td>
</tr>
<tr>
<td>Continuous red with yellow flashing</td>
<td></td>
<td>Teach-in procedure</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The diagnostic output can also be used to detect clearance variations between the sensor and the actuator in the same way as the yellow LED. An active fault is visualised by the red LED and causes the diagnostic output to be disabled. The safety outputs are disabled after max. 30 minutes if the fault is not rectified. This signal combination, diagnostic output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

Example of the diagnostic function of the safety sensor with conventional diagnostic output

<table>
<thead>
<tr>
<th>Sensor function</th>
<th>LEDs</th>
<th>Diagnostic output</th>
<th>Safety outputs</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green</td>
<td>Red</td>
<td>Yellow</td>
<td>Y1, Y2</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>0 V</td>
</tr>
<tr>
<td>Actuated</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>24 V</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>off</td>
<td>off</td>
<td>flashes (1Hz)</td>
<td>24 V pulsed</td>
</tr>
<tr>
<td>Error warning, sensor actuated</td>
<td>off</td>
<td>flashes</td>
<td>off</td>
<td>0 V</td>
</tr>
<tr>
<td>Error</td>
<td>off</td>
<td>flashes</td>
<td>off</td>
<td>0 V</td>
</tr>
<tr>
<td>Teach actuator</td>
<td>off</td>
<td>on</td>
<td>flashes</td>
<td>0 V</td>
</tr>
<tr>
<td>Protection time</td>
<td>flashes</td>
<td>off</td>
<td>off</td>
<td>0 V</td>
</tr>
</tbody>
</table>

15
Electronic safety sensor RSS 16

Diagnostic of the RSS 16 safety sensor with serial diagnostic function

Sensors with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If RSS/CSS sensors are daisy-chained, the safety outputs as well as the inputs and outputs of the diagnostic channels are wired in series.

Max. 31 safety sensors can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC. The necessary software for the integration of the SD-Gateway is available for download at www.schmersal.net.

The response data and the diagnostic data are automatically and permanently written in the assigned input byte of the PLC for each safety sensor in the series-wired chain. The request data for each safety sensor are transmitted to the device through an output byte of the PLC. In the event of a communication error between the SD-Gateway and the safety sensor, the switching condition of the safety output of the safety sensor is maintained.

Bit 0: safety outputs enabled
Bit 1: safety sensor actuated, actuator identified
Bit 4: both safety inputs live
Bit 5: safety sensor actuated in hysteresis area
Bit 6: error warning, switch-off delay activated
Bit 7: error, safety outputs switched off

Error
A fault has occurred, which causes the safety outputs to be disabled. The fault is reset, when the cause is eliminated and bit 7 of the request byte changes from 1 to 0 or the safety guard is opened. Faults at the safety outputs are only deleted upon the next release, as the fault rectification cannot be detected sooner.

Error warning
A fault has occurred, which causes the safety outputs to be disabled after 30 minutes. The safety outputs initially remain enabled. This enables the shutdown of the process in a controlled manner. An error warning is deleted when the error cause is eliminated.

I/O data and diagnostic data

Communication directions: Request byte: from the PLC to the local safety sensor
Response byte: from the local safety sensor to the PLC
Warning/error byte: from the local safety sensor to the PLC

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Error warnings</th>
<th>Error messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>—</td>
<td>Safety output activated</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>—</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>—</td>
<td>—</td>
<td>Cross-wire Y1/Y2</td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>—</td>
<td>—</td>
<td>Temperature too high</td>
<td>Temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>—</td>
<td>Input condition X1 and X2</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>—</td>
<td>Actuated in limit area</td>
<td>Internal device error</td>
<td>Internal device error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>—</td>
<td>Error warning</td>
<td>Communication error between the field bus Gateway and the safety sensor</td>
<td>—</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Error reset</td>
<td>Error (enabling path switched off)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Function of the visual diagnostic LEDs, the serial status signals and the safety outputs by means of an example

Flash code as in previous version

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDs green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Status signals serial diagnostic byte Bit n° 7 6 5 4 3 2 1 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not actuated, inputs X1 and X2 enabled</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>0 V</td>
<td>0 0 0 1 0 0 0 0</td>
</tr>
<tr>
<td>Actuated, safety outputs enabled</td>
<td>on</td>
<td>off</td>
<td>on</td>
<td>24 V</td>
<td>0 0 0 1 0 0 1 1</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>on</td>
<td>off</td>
<td>flashes (1 Hz)</td>
<td>24 V</td>
<td>0 0 1 0 0 0 1 1</td>
</tr>
<tr>
<td>Actuated, warning</td>
<td>off</td>
<td>flashes</td>
<td>on</td>
<td>24 V</td>
<td>1 0 1 0 0 0 1 1</td>
</tr>
<tr>
<td>Actuated, fault</td>
<td>off</td>
<td>on/fflashes</td>
<td>on</td>
<td>0 V</td>
<td>1 1 0 1 0 0 1 0</td>
</tr>
</tbody>
</table>

The shown bit sequence of the diagnostic byte is an example. A different combination of the operating conditions will lead to a change of the bit sequence.
Electronic safety sensor RSS 260

**Classification:**
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: 6.8 x 10^{-10} / h

**Application advantages**
- Individually coded version with Coding level „High“ according to ISO 14119
- Compact form factor and subtle, elegant design
- Easy installation without additional angles
- Universal application through different actuators for typical installation situations
- Repeated universal or individual coding

**Wiring advantages**
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Unlimited number of devices in the series-wiring, however – fuse-dependent –
  max. 31 devices in case of serial diagnostic in PL e / category 4 to ISO 13849-1
- Integrated cross-wire, wire breakage and external voltage monitoring of the safety cable up to the control cabinet

**Diagnostic advantages**
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
Electronic safety sensor RSS 260

**RSS 260**

- Thermoplastic enclosure
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Repeated universal or individual coding through RFID technology
- Actuation from front and side possible
- Safety and diagnostic signals wired in series
- Integrated cross-wire, wire breakage and external voltage monitoring of the safety cable up to the control cabinet
- LED status display
- With integrated connector
- Protection class IP65 / IP67 to IEC 60529

**RST 260-1**

- Thermoplastic enclosure
- Design identical to that of the safety sensor

### Technical data

- **Standards:** IEC 60947-5-3, ISO 13849-1, IEC 61508, IEC 62061
- **Enclosure:** thermoplastic
- **Operating principle:** RFID
- **Coding level according to ISO 14119:**
  - I1-version: high
  - I2-version: high
  - Standard coding version: low
- **Series-wiring:** Unlimited number of components, please observe external cable protection, max. 31 components in case of serial diagnostics
- **Connection:** Connector plug M8, 8-pole, A-coded
- **Switching distances to IEC 60947-5-3:**
  - Typical switching distance: 12 mm;
  - in case of lateral actuation: 9 mm
  - Assured switching distance $s_{sw}$: 10 mm;
  - in case of lateral actuation: 6 mm
  - Assured switch-off distance $s_{sh}$: 18 mm;
  - in case of lateral actuation: 15 mm
  - Hysteresis: < 2.0 mm
  - Repeat accuracy $R$: < 0.5 mm
- **Ambient conditions:**
  - Ambient temperature $T_u$: $-25 \, ^\circ\text{C} \ldots +65 \, ^\circ\text{C}$
  - Storage and transport temp.: $-25 \, ^\circ\text{C} \ldots +85 \, ^\circ\text{C}$
  - Protection class: IP65 / IP67 to IEC 60529
- **Resistance to vibration:** 10 ... 55 Hz, Amplitude 1 mm
- **Resistance to shock:** 30 g / 11 ms
- **Switching frequency $f$:** 1 Hz
- **Drop-out time - Actuator:** ≤ 100 ms
- **Duration of risk:** ≤ 200 ms
- **Time to readiness:** ≤ 5 s
- **Electrical data:**
  - Rated operating voltage $U_e$: 24 VDC −15% / +10% (PELV to IEC 60204-1)
  - Rated operating current $I_e$: 0.6 A
  - Minimum operating current $I_m$: 0.5 mA
  - Required rated short-circuit current: 100 A
  - Rated insulation voltage $U_{I_{ins}}$: 32 V
  - Rated impulse withstand voltage $U_{imp}$: 800 V
  - Residual current $I_r$: < 0.5 mA
  - No-load current $I_n$: 35 mA
  - Overvoltage category: III
  - Degree of pollution: 3

### Ordering details

**RSS260-➀-ST**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀</td>
<td>I1</td>
<td>Standard coding</td>
</tr>
<tr>
<td>❼</td>
<td>I2</td>
<td>Individual coding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual coding, re-teaching enabled</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>With diagnostic output</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>With serial diagnostic</td>
</tr>
</tbody>
</table>

The actuator, sealing kit and tamper-proof screws must be ordered separately.

**Certification in combination with safety sensor**

**Note**

Wiring and connectors refer to page 104

The safety switchgears are classified according to ISO 14119 as type 4 switching devices. Designs with individual coding are classified as highly coded.

- Alternative suitable actuators with different design: refer to [www.schmersal.net](http://www.schmersal.net)
Electronic safety sensor RSS 260

Technical data

Safety inputs X1/X2:
Rated operating voltage $U_{e1}$: 24 VDC −15% / +10% (PELV unit)
Power consumption per input: 5 mA

Safety outputs Y1/Y2: p-type, short-circuit proof
Rated operating current $I_{e1}$: max. 0.25 A
Utilisation category: DC-12: $U_{e1}$/I: 24 VDC / 0.25 A;
DC-13: $U_{e1}$/I: 24 VDC / 0.25 A

Voltage drop: $U_{e1} < 1$ V

Diagnostic output: p-type, short-circuit proof
Rated operating current $I_{e2}$: max. 0.05 A
Utilisation category: DC-12: $U_{e1}$/I: 24 VDC / 0.05 A;
DC-13: $U_{e1}$/I: 24 VDC / 0.05 A

Voltage drop: $U_{e1} < 2$ V

Serial diagnostic: short-circuit proof
Operating current: 150 mA
Wiring capacitance: max. 50 nF
Device fuse rating: ± 2 A when used to UL 508

LED functions:
green: Supply voltage on
yellow: Actuator in the detection range
red: Fault

Classification:
Standards: ISO 13849-1, IEC 61508,
IEC 62061
PL: e
Category: 4
PFH: $6.8 \times 10^{-10}$/h
PFD: $1.2 \times 10^{-4}$
SIL: suitable for SIL 3 applications
Mission time: 20 years

Misalignment

Lateral actuation

The axial misalignment (Y) is max. ± 18 mm.
The height misalignment (X) is max. ± 8 mm.

Actuating curves

The actuating curves (S) represent the typical switching distance of the safety sensor during the approach of the actuator subject to the actuating direction.

Axial misalignment Y

Height misalignment X

Preferred actuation directions:
From front or from side in case of a lateral actuation, the switching distances are reduced by approx. 3 mm.

Coding procedure

Ordering option -I1:
During the individual coding, a RST actuator is taught by a simple routine during the start-up procedure, so that every form of tampering by means of a replacement or substitute actuator is permanently excluded.

Ordering option -I2:
Teaching the individual coding of a RST actuator by a simple routine during the start-up procedure (as -I1). A protected coding process enables the teaching of a new actuator for service purposes.

System components

Sealing kit
103004733
To seal the mounting holes

Note

Requirements for the safety controller
Dual-channel safety input, suitable for p-type sensors with normally-open (NO) function.
The internal function tests of the sensors cause the outputs to cyclically switch off for max. 0.25 ms, this must be tolerated by the safety controller. The safety controller must not be equipped with cross-wire detection.

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-... and in the instructions for the integration of the SD-Gateway.

Schmersal
Electronic safety sensor RSS 260

**Series-wiring of the RSS 260 with conventional diagnostic output**

![Diagram](image)

Y1 and Y2 = Safety outputs → dual-channel safety monitoring module

The voltage is supplied to both safety inputs of the last safety sensor of the chain (considered from the safety-monitoring module). The safety outputs of the first safety sensor are wired to the safety-monitoring module. The diagnostic output can be connected for instance to a PLC.

**Series-wiring of the RSS 260 with serial diagnostic function**

![Diagram](image)

Y1 and Y2 = Safety outputs → dual-channel safety monitoring module

SD-IN → Gateway → Field bus

The voltage is supplied to both safety inputs of the last safety sensor of the chain (considered from the safety-monitoring module). The safety outputs of the first safety sensor are wired to the safety-monitoring module. The serial Diagnostic Gateway is connected to the serial diagnostic input of the first safety sensor.
Electronic safety sensor RSS 260

Diagnostic of the RSS 260 safety sensor with conventional diagnostic output

The safety sensor indicates the operating condition and faults by means of three-colour LED's located in the lateral surfaces of the sensor. The green LED indicates that the safety sensor is ready for operation.

The supply voltage is on. The yellow LED always signals the presence of an actuator within range. If the actuator is operating near the limit of the hysteresis range of the safety sensor, the LED is flashing. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine.

If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>__________</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>__________</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>__________</td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>__________</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>__________</td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td>Continuous red</td>
<td>__________</td>
<td>Internal fault, with yellow flashing teaching procedure</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The diagnostic output can also be used to detect clearance variations between the sensor and the actuator in the same way as the yellow LED. An active fault is visualised by the red LED and causes the diagnostic output to be disabled. The safety outputs are disabled after max. 30 minutes if the fault is not rectified. This signal combination, diagnostic output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

Example of the diagnostic function of the safety sensor with conventional diagnostic output

<table>
<thead>
<tr>
<th>Sensor function</th>
<th>LEDs</th>
<th>Diagnostic output</th>
<th>Safety outputs</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>0 V 0 V</td>
</tr>
<tr>
<td>Actuated</td>
<td>on</td>
<td>off</td>
<td>on</td>
<td>24 V 24 V</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>on</td>
<td>off</td>
<td>flashes (1Hz)</td>
<td>24 V pulsed 24 V</td>
</tr>
<tr>
<td>Error warning, sensor actuated</td>
<td>off</td>
<td>flashes on</td>
<td>0 V</td>
<td>24 V 24 V</td>
</tr>
<tr>
<td>Error</td>
<td>off</td>
<td>flashes on</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Teach actuator</td>
<td>off</td>
<td>on</td>
<td>flashes</td>
<td>0 V 0 V</td>
</tr>
<tr>
<td>Protection time</td>
<td>flashes</td>
<td>off</td>
<td>off</td>
<td>0 V 0 V</td>
</tr>
</tbody>
</table>
Electronic safety sensor RSS260

Diagnostic of the RSS 260 safety sensor with serial diagnostic function

Sensors with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If RSS/CSS sensors are daisy-chained, the safety outputs as well as the inputs and outputs of the diagnostic channels are wired in series.

Max. 31 safety sensors can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC. The necessary software for the integration of the SD-Gateway is available for download at www.schmersal.net.

The response data and the diagnostic data are automatically and permanently written in the assigned input byte of the PLC for each safety sensor in the series-wired chain. The request data for each safety sensor are transmitted to the device through an output byte of the PLC. In the event of a communication error between the SD-Gateway and the safety sensor, the switching condition of the safety output of the safety sensor is maintained.

Bit 0: safety outputs enabled
Bit 1: safety sensor actuated, actuator identified
Bit 4: both safety inputs live
Bit 5: safety sensor actuated in hysteresis area
Bit 6: error warning, switch-off delay activated
Bit 7: error, safety outputs switched off

Error
A fault has occurred, which causes the safety outputs to be disabled. The fault is reset, when the cause is eliminated and bit 7 of the request byte changes from 1 to 0 or the safety guard is opened. Faults at the safety outputs are only deleted upon the next release, as the fault rectification cannot be detected sooner.

Error warning
A fault has occurred, which causes the safety outputs to be disabled after 30 minutes. The safety outputs initially remain enabled. This enables the shutdown of the process in a controlled manner. An error warning is deleted when the error cause is eliminated.

I/O data and diagnostic data

Communication directions: Request byte: from the PLC to the local safety sensor
Response byte: from the local safety sensor to the PLC
Warning/error byte: from the local safety sensor to the PLC

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Error warnings</th>
<th>Error messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>—</td>
<td>Safety output activated</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>—</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>—</td>
<td>—</td>
<td>Cross-wire Y1/Y2</td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>—</td>
<td>—</td>
<td>Temperature too high</td>
<td>Temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>—</td>
<td>Input condition X1 and X2</td>
<td>—</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>—</td>
<td>Actuated in limit area</td>
<td>Internal device error</td>
<td>Internal device error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>—</td>
<td>Error warning</td>
<td>Communication error between the field bus Gateway and the safety sensor</td>
<td>—</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Error reset</td>
<td>Error (enabling path switched off)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Function of the visual diagnostic LEDs, the serial status signals and the safety outputs by means of an example
Flash code as in previous version

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDs</th>
<th>Safety outputs Y1, Y2</th>
<th>Status signals serial diagnostic byte Bit n°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>green</td>
<td>red</td>
<td>yellow</td>
</tr>
<tr>
<td>Not actuated, inputs X1 and X2 enabled</td>
<td>on</td>
<td>off</td>
<td>off</td>
</tr>
<tr>
<td>Actuated, safety outputs enabled</td>
<td>on</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>on</td>
<td>off</td>
<td>flashes (1 Hz)</td>
</tr>
<tr>
<td>Actuated, warning</td>
<td>off</td>
<td>flashes</td>
<td>on</td>
</tr>
<tr>
<td>Actuated, fault</td>
<td>off</td>
<td>on/flashes</td>
<td>on</td>
</tr>
</tbody>
</table>

The shown bit sequence of the diagnostic byte is an example. A different combination of the operating conditions will lead to a change of the bit sequence.
Electronic safety sensor RSS 36

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508

Actuation advantages
- Non-contact principle, no mechanical wear
- Higher protection against tampering because of the optional individual coding of the safety sensor and the actuator
- Optionally version with latching available
- High repeat accuracy of the switching points

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Unlimited number of devices in the series-wiring, however – fuse-dependent - max. 31 devices in case of serial diagnostic in PL e / category 4 to ISO 13849-1
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
Electronic safety sensor RSS 36

**RSS 36**
- Thermoplastic enclosure
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Increased protection against tampering by optional individual coding of safety sensor and actuator
- Optional version with latching available
- Safety and diagnostic signals can be wired in series
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet
- LED status indication
- Sensor with connecting cable or with integrated connector
- Robust due to the used cleaning agent-resistant materials and protection class up to IP69K

**RST 36-1**
- Thermoplastic enclosure
- Flexible fitting through universal mounting holes

**Technical data**
- Standards: IEC 60947-5-3, IEC 61508, ISO 13849-1
- Enclosure: glass-fibre reinforced thermoplastic
- Mode of operation: RFID
- Actuator: RST 36-1, RST 36-1-R
- Series-wiring: unlimited number of components, however safety-dependent; max. 31 components for serial diagnosis
- Connection: Integrated connector M12 or connecting cable
  - Integrated connector: M12, 8-pole, A-coded
  - Connecting cable: Y-UL 2517 / 8 x AWG 22 / 8 x 0.35 mm², 2 m
- Temperature resistance of the cable:
  - At rest: -30 °C ... +105 °C
  - In movement: -10 °C ... +105 °C
- Cable length: max. 30 m
  (Cable length and cable section alter the voltage drop depending on the output current)
- Switching distances to IEC 60947-5-3:
  - Rates switching distance \( S_n \): 12 mm
  - Assured switch-on point \( S_{ao} \): 10 mm
  - Assured switch-off point \( S_{ar} \): 16 mm
  - Hysteresis: < 2.0 mm
  - Repeat accuracy: < 0.5 mm
  - Minimum distance between two sensors: 100 mm
- Ambient conditions:
  - Ambient temperature \( T_u \): -25 °C ... +70 °C
  - Storage and transport temperature: -25 °C ... +85 °C
  - Protection class: IP65 / IP67 to IEC 60529
  - Connector: IP69K to DIN 40050-9
  - Resistance to vibration: 10...55 Hz, amplitude 1 mm
  - Resistance to shock: 30 g / 11 ms
  - Switching frequency \( f \): 1 Hz
  - Response time: ≤ 100 ms
  - Duration of risk: ≤ 200 ms
  - Time to readiness: ≤ 5 s
- Electrical data:
  - Rated operating voltage \( U_{e} \): 24 VDC -15% / +10% (PELV)
  - Rated operating current \( I_{e} \): 0.6 A
  - Lowest operating current \( I_{m} \): 0.5 mA
  - Required rated short-circuit current: 100 A

**Approvals**
- Certification in combination with safety sensor

**Ordering details**

<table>
<thead>
<tr>
<th>RSS 36</th>
<th>①</th>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11</td>
<td></td>
<td>Standard coding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td></td>
<td>Individual coding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>②</td>
<td></td>
<td>Individual coding, unlimited</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td></td>
<td>With diagnostic output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>⑥</td>
<td></td>
<td>With connecting cable 2 m</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RST 36-1</th>
<th>⑥</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>⑥</td>
<td>RST 36-1-R</td>
<td>Actuator, with latching magnet</td>
</tr>
<tr>
<td>⑥</td>
<td>RST 36-1-R</td>
<td>Actuator, with latching magnet (The latching function is only active when RSS 36-...R is combined with RST 36-1-R.)</td>
</tr>
</tbody>
</table>

Alternative suitable actuators with different design: refer to www.schmersal.net.

**Note**
- Wiring and connectors refer to page 108
- The safety switchgears are classified according to ISO 14119 as type 4 switch devices. Designs with individual coding are classified as highly coded.

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Actuator, sealing kit and tamper-proof screws must be ordered separately.
Electronic safety sensor RSS 36

**Technical data**

- **Rated insulation voltage** \( U_{i} \): 32 V
- **Rated impulse withstand voltage** \( U_{imp} \): 800 V
- **No-load current** \( I_{0} \): 35 mA
- **Protection class**: II
- **Overvoltage category**: III
- **Degree of pollution**: 3
- **Safety inputs X1/X2**: p-type, short-circuit proof
- **Rated operating voltage** \( U_{e1} \): 24 VDC -15\% / +10\% (PELV to IEC 60204-1)
- **Current consumption per input**: 5 mA
- **Safety outputs Y1/Y2**: p-type, short-circuit proof
- **Rated operating current** \( I_{e1} \): max. 0.25 A
- **Utilisation category**: DC-12: \( U_{e} / I_{e} \): 24 VDC/0.25 A
- **Voltage drop**: \(< 1 \text{ V}\)
- **Diagnostic output**: p-type, short-circuit proof
- **Rated operating current** \( I_{e2} \): max. 0.05 A
- **Utilisation category**: DC-12: \( U_{e} / I_{e} \): 24 VDC/0.05 A
- **Voltage drop**: \(< 2 \text{ V}\)
- **Serial diagnostic**: short-circuit proof
- **Operating current**: 150 mA
- **Wiring capacitance for serial diagnostic**: max. 50 nF
- **External cable protection**: Fuse
- **Integrated connector**: 2.0 A
- **Connecting cable**: 4.0 A

**LED functions:**
- Green: Supply voltage on
- Yellow: Operating status
- Red: Error

**Classification:**
- **ISO 13849-1, IEC 61508, IEC 62061**
- **PL**: e
- **PFH**: \( 2.7 \times 10^{-10} \text{h} \)
- **PFD**: \( 2.1 \times 10^{-5} \)
- **SIL**: suitable for SIL 3 applications
- **Mission time**: 20 years

**Note**

**Requirements for the safety controller**

- Dual-channel safety input, suitable for p-type sensors with normally-open (NO) function.
- The internal function tests of the sensors cause the outputs to cyclically switch off for max. 0.25 ms, this must be tolerated by the safety controller. The safety controller must not be equipped with cross-wire detection.

**Coding procedure**

**Ordering option -1:**

During the individual coding, a RST actuator is taught by a simple routine during the start-up procedure, so that every form of tampering by means of a replacement or substitute actuator is permanently excluded.

**Ordering option -2:**

Teaching the individual coding of a RST actuator by a simple routine during the start-up procedure (as -1). A protected coding process enables the teaching of a new actuator for service purposes.

**System components**

**Sealing kit**

- ACC RSS 36-SK 101215048 for sealing the mounting holes and as spacer (approx. 3 mm) to facilitate the cleaning below the mounting surface (also suitable as tampering protection for the screw fastening)

- Tamperproof screws (not displayed)
  - NRS-M4X25-FHS-4PCS 101217746
  - NRS-M4X30-FHS-4PCS 101217747

**Preferred actuating directions:**

from front or from side

**Misalignment**

- **Lateral actuation**
  - The axial misalignment (Y) is max. \( \pm 18 \text{ mm} \).
  - The height misalignment (X) is max. \( \pm 8 \text{ mm} \).
  - Latching versions X \( \pm 5 \text{ mm} \), Y \( \pm 3 \text{ mm} \).
  - The latching force is reduced by misalignment.

- **Actuating curves**
  - The actuating curves (S) represent the typical switching distance of the safety sensor during the approach of the actuator subject to the actuating direction.

**Preferred actuating directions:**

from front or from side

**Preferred actuating directions:**

from front or from side

**System components**

**Sealing kit**

Sealing kit ACC RSS 36-SK 101215048 for sealing the mounting holes and as spacer (approx. 3 mm) to facilitate the cleaning below the mounting surface (also suitable as tampering protection for the screw fastening)

Tamperproof screws (not displayed)
  - NRS-M4X25-FHS-4PCS 101217746
  - NRS-M4X30-FHS-4PCS 101217747

**Preferred actuating directions:**

from front or from side
Electronic safety sensor RSS 36

**Series-wiring of the RSS 36 with conventional diagnostic output**

Y1 and Y2 = Safety outputs → Safety controller

The voltage is supplied to both safety inputs of the last safety sensor of the chain (considered from the safety-monitoring module). The safety outputs of the first safety sensor are wired to the safety-monitoring module. The diagnostic output can be connected to a PLC for instance.

**Series-wiring of the RSS 36 with serial diagnostic function**

Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus

The voltage is supplied to both safety inputs of the last safety sensor of the chain (considered from the safety-monitoring module). The safety outputs of the first safety sensor are wired to the safety-monitoring module. The SD-Gateway is connected to the serial diagnostic input of the first safety sensor.
Electronic safety sensor RSS 36

Diagnostic of the RSS 36 safety sensor with conventional diagnostic output

The safety sensor indicates the operating condition and faults by means of three-colour LED’s located in the lateral surfaces of the sensor. The green LED indicates that the safety sensor is ready for operation. The supply voltage is on.

If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The flash code can be used to prematurely detect changes in the distance between the sensor and the actuator (e.g. sagging of a guard door). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>0</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>000</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>000000</td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>0000000</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>00000000</td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td>Continuous red</td>
<td>0000000</td>
<td>Internal device error</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The diagnostic output can also be used to detect clearance variations between the sensor and the actuator in the same way as the yellow LED. An active fault causes the diagnostic output to be disabled. The safety outputs are disabled after max. 30 minutes if the fault is not rectified. This signal combination, diagnostic output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

Example of the diagnostic function of the safety sensor with conventional diagnostic output

<table>
<thead>
<tr>
<th>Sensor function</th>
<th>LEDs</th>
<th>Diagnostic output</th>
<th>Safety outputs</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Green; Red; Yellow</td>
<td>0 V</td>
<td>0 V</td>
<td>Voltage on, no evaluation of the voltage quality</td>
</tr>
<tr>
<td>Actuated</td>
<td>off; off; on</td>
<td>24 V</td>
<td>24 V</td>
<td>The yellow LED always signals the presence of an actuator within range</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>off; off; flashes (1Hz)</td>
<td>24 V pulsed</td>
<td>24 V</td>
<td>The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine</td>
</tr>
<tr>
<td>Error warning, sensor actuated</td>
<td>off; flashes</td>
<td>0 V</td>
<td>24 V</td>
<td>After 30 minutes → error</td>
</tr>
<tr>
<td>Error</td>
<td>off; flashes</td>
<td>0 V</td>
<td>0 V</td>
<td>Refer to table with flash codes</td>
</tr>
</tbody>
</table>
Electronic safety sensor RSS 36

Diagnostic of the RSS 36 safety sensor with serial diagnostic function

Sensors with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If RSS/CSS sensors are daisy-chained, the safety outputs as well as the inputs and outputs of the diagnostic channels are wired in series.

Max. 31 safety sensors can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC. The necessary software for the integration of the SD-Gateway is available for download at www.schmersal.net.

The operational information of the response and diagnostic data is automatically and permanently written in an input byte of the PLC for each safety sensor in the series-wired chain. The request data for each safety sensor are transmitted to the component through an output byte of the PLC. In the event of a communication error between the SD-Gateway and the safety sensor, the switching condition of the safety output of the safety sensor is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safetyguard is opened. Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

I/O data and diagnostic data
Communication directions:
Request byte: from the PLC to the local electronic safety switchgear
Response byte: from the local electronic safety switchgear to the PLC
Warning/error byte: from the local electronic safety switchgear to the PLC

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Error warnings</th>
<th>Error messages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>—</td>
<td>Safety output activated</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>—</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>—</td>
<td>—</td>
<td>Cross-wire Y1/Y2</td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>—</td>
<td>—</td>
<td>Temperature too high</td>
<td>Temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>—</td>
<td>Input condition X1 and X2</td>
<td>—</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>—</td>
<td>Actuated in limit area</td>
<td>Internal device error</td>
<td>Internal device error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>—</td>
<td>Error warning</td>
<td>Communication error between the field bus Gateway and the safety switch</td>
<td>—</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Error reset</td>
<td>Error (enabling path switched off)</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Function of the visual diagnostic LEDs, the serial status signals and the safety outputs by means of an example
Flash code as in previous version

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDS green</th>
<th>LEDS red</th>
<th>LEDS yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Status signals serial diagnostic byte Bit n°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not actuated, inputs X1 and X2 enabled</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>0 V</td>
<td>0 0 0 1 0 0 0 0</td>
</tr>
<tr>
<td>Actuated, safety outputs enabled</td>
<td>off</td>
<td>off</td>
<td>on</td>
<td>24 V</td>
<td>0 0 0 1 0 0 1 1</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>off</td>
<td>off</td>
<td>flashes (1Hz)</td>
<td>24 V</td>
<td>0 0 1 1 0 0 1 1</td>
</tr>
<tr>
<td>Actuated, warning</td>
<td>off</td>
<td>on/flashes</td>
<td>off</td>
<td>24 V</td>
<td>0 1 0 1 0 0 1 1</td>
</tr>
<tr>
<td>Actuated, fault</td>
<td>off</td>
<td>on/flashes</td>
<td>off</td>
<td>0 V</td>
<td>1 1 0 1 0 0 1 0</td>
</tr>
</tbody>
</table>

The shown bit sequence of the diagnostic byte is an example. A different combination of the operating conditions will lead to a change of the bit sequence.
Electronic safety sensor CSS 180

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: $2.5 \times 10^{-9} / h$

Actuation advantages
- Non-contact principle, no mechanical wear
- Suitable for flush mounting
- Rated switching distance 8 mm
- Misaligned actuation possible
- High repeat accuracy of the switching points

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 500 mA)
- Self-monitored series-wiring of max. 16 sensors in PL e / category 4 to ISO 13849-1
- Max. length of the sensor chain 200 m
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
- Controlled shutdown of the machine under observation of the running processes in case of emergency
Electronic safety sensor CSS 180

CSS 180

- Connecting cable or connecting cable and connector
- Thermoplastic enclosure
- Electronic, non-contact, coded system
- High repeat accuracy of the switching points
- Self-monitored series-wiring of max. 16 sensors
- Max. length of the sensor chain 200 m
- Early warning when operating near the limit of the sensor’s hysteresis range
- 2 short-circuit proof, p-type safety outputs (24 VDC per 500 mA)
- EX version available

CSS 180 ST

- Integrated connector
- Multifunction device
- Available: CSS 8-180-2P+D-M-ST

Technical data

Standards: IEC 60947-5-3, ISO 13849-1, IEC 61508
Enclosure: glass-fibre reinforced thermoplastic
Mode of operation: inductive
Actuator: CST 180-1, CST 180-2
Series-wiring: max. 16 components
Connection: cable or cable with connector M12 or integrated connector M12
Cable section: according to execution:
  4 x 0.5 mm², 5 x 0.34 mm², 7 x 0.25 mm²
Switching distances to IEC 60947-5-3:
  Rates switching distance \( S_{nc} \): 8 mm
  Assured switch-on distance \( S_{op} \): 7 mm
  Assured switch-off distance \( S_{op}' \): 10 mm
  Hysteresis: ≤ 0.7 mm
  Repeat accuracy: ≤ 0.2 mm
  Cable length: max. 200 m
  (Cable length and cable section alter the voltage drop depending on the output current)
Ambient conditions:
  Ambient temperature \( T_{a} \):
    - 500 mA/output: -25 °C ... +55 °C
    - 200 mA/output: -25 °C ... +65 °C
    - 100 mA/output: -25 °C ... +70 °C
  Storage and transport temperature: -25 °C ... +85 °C
Resistance to shock: 30 g / 11 ms
Switching frequency \( f \): 3 Hz
Response time: < 30 ms
Duration of risk: ≤ 30 ms
Electrical data:
  Rated operating voltage \( U_{op} \): 24 VDC
  Required rated short-circuit current: 100 A
  Rated insulation voltage \( U_{i} \): 32 V
  Rated impulse withstand voltage \( U_{imp} \): 800 V
  No-load current \( I_{0} \): ≤ 0.05 A
  Leakage current \( I_{r} \): ≤ 0.5 mA

Approvals

Ordering details

<table>
<thead>
<tr>
<th>CSS 8-180-1-2-P-2P+D-M-ST</th>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2P</td>
<td>2 p-type safety outputs</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2P+D</td>
<td>2 p-type safety outputs and 1 p-type signal contact (diagnostic)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>E</td>
<td>End or single device</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Y</td>
<td>Device for series-wiring</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>M</td>
<td>Multifunction device</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>L</td>
<td>Connecting cable</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>LST</td>
<td>Connecting cable and connector</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>ST</td>
<td>Integrated connector</td>
</tr>
</tbody>
</table>

Sensor and actuator must be ordered separately.

Note

Legend

- S: Switching distance
- V: Misalignment
- \( S_{on} \): Switch-on distance
- \( S_{off} \): Switch-off distance
- \( S_{op} \) = \( S_{on} \) + \( S_{off} \)
- \( S_{std} \): Assured switch-on distance
- \( S_{sfr} \): Assured switch-off distance

Misalignment
Electronic safety sensor CSS 180

Technical data

<table>
<thead>
<tr>
<th>Protection class:</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overvoltage category:</td>
<td>III</td>
</tr>
<tr>
<td>Degree of pollution:</td>
<td>3</td>
</tr>
<tr>
<td>Safety inputs X1/X2:</td>
<td>Rated operating voltage $U_{oc}$: 24 VDC $\pm 15%$ / $+10%$</td>
</tr>
<tr>
<td></td>
<td>PELV to IEC 60204-1</td>
</tr>
<tr>
<td>Safety outputs Y1/Y2:</td>
<td>Rated operating current $I_{oc}$: 1 A</td>
</tr>
<tr>
<td>Rated operating current $I_{oc}$:</td>
<td>p-type, short-circuit proof</td>
</tr>
<tr>
<td>Utilisation category:</td>
<td>DC-12 $U_{oc}/I_{oc}$ 24 VDC/0.5 A</td>
</tr>
<tr>
<td></td>
<td>DC-13 $U_{oc}/I_{oc}$ 24 VDC/0.5 A</td>
</tr>
<tr>
<td>Voltage drop:</td>
<td>0.5 V</td>
</tr>
<tr>
<td>Diagnostic output:</td>
<td>p-type, short-circuit proof</td>
</tr>
<tr>
<td>Rated operating voltage $U_{oc}$:</td>
<td>min. $U_{oc}$ - 4 V</td>
</tr>
<tr>
<td>Rated operating current $I_{oc}$:</td>
<td>max. 0.05 A</td>
</tr>
<tr>
<td>Classification:</td>
<td>Standards: ISO 13849-1, IEC 61508</td>
</tr>
<tr>
<td>PL:</td>
<td>e</td>
</tr>
<tr>
<td>Category:</td>
<td>4</td>
</tr>
<tr>
<td>PFH:</td>
<td>$2.5 \times 10^{-9}$ / h</td>
</tr>
<tr>
<td>SIL:</td>
<td>suitable for SIL 3 applications</td>
</tr>
<tr>
<td>Mission time:</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Connection

End or single device: CSS-8-16-2P+...-E-L...

- Connecting cable (2 m):
  - Cable section
    - 4-pole: 4 x 0.5 mm²
    - 5-pole: 5 x 0.35 mm²

Series-wiring device: CSS-8-16-2P-Y-L...

- Inputs (IN):
  - (0.25 m) grey cable
  - 4-pole, 4 x 0.5 mm²
  - Outputs (OUT): (2 m)
  - black cable
  - 4-pole, 4 x 0.5 mm²

Multifunction device: CSS-8-16-2P+D-M...

- Connecting cable (2 m):
  - Cable section 7-pole: 7 x 0.25 mm²

Note

- Series-wiring of sensors:
  A chain of 16 self-monitored CSS 180 safety sensors can be wired in series without loss of PL e and category 4 to ISO 13849-1. In this configuration, the redundant output of the first sensor is wired into the input of the next sensor.
- The voltage drop over a long sensor chain should be taken into account when planning cable routing. It depends on several factors, which are operating voltage, cable length and section, ambient temperature, number of series-wired sensors and the input load of the safety controller.

Ordering details

Requirements for the safety controller

Dual-channel p-type safety input. The internal function tests of the sensors cause the outputs to cyclically switch off for max. 2 ms, this must be tolerated by the safety controller.

Wiring and connectors

refer to page 108

The safety switchgears are classified according to ISO 14119 as type 4 switching devices.

 SCHMERSAL
Electronic safety sensor CSS 180

System components

Actuator CST 180-1

Actuator CST 180-2

Terminal mounting H 18

Magnetic ball catch CSA-M-1

Ordering details

Actuator CST 180-1
Actuator CST 180-2
Terminal mounting H 18
Magnetic ball catch CSA-M-1

Sensor and actuator must be ordered separately.
Electronic safety sensor CSS 180

Series-wiring of the CSS 180 with common cable for safety inputs and outputs

BK and RD = Safety outputs Y1 and Y2 → Safety controller

CSS 8-180-2P-E-L as single or end device of the chain. In this sensor type, the supply voltage is internally supplied to the safety inputs. A series-wiring of multiple safety sensors is realised by wiring in the control cabinet either in junction boxes on site. A CSS 8-180-2P+D-M-L safety sensor can also be used as end device of the chain. In this case, the positive operating voltage must be connected to both safety inputs of this safety sensor. The positive operating voltage for the last safety sensor in a series-wiring must be supplied to both safety inputs. A series-wiring of multiple safety sensors is realised by wiring in the control cabinet either in junction boxes on site.

Series-wiring of the CSS 180 in plants of comprehensive dimension

WH and BK = Safety outputs Y1 and Y2 → Safety controller

CSS 8-180-2P-E-L as single or end device of the chain. In this sensor type, the supply voltage is internally supplied to the safety inputs. The CSS 8-180-2P-Y-L A safety sensors have separated input and output cables. The outputs of the first sensor are wired to the inputs of the next sensor and so on. In this way, a 200 meters long sensor chain can be set up. A safety sensor of the type CSS 8-180-2P-Y-L can also be used as end device of a chain, in which case additional wiring however is required. The positive operating voltage must be connected to both safety inputs.
Electronic safety sensor CSS 180

Diagnostic function of the CSS 180

The operating condition of the sensor as well as possible faults are signalled by means of three-color LEDs in the end cap of the sensor. The green LED indicates that the safety sensor is ready for operation. The sensor is not actuated.

When the safety sensor is actuated by the actuator, the indication LED switches from green to yellow. The safety outputs of the safety sensor are enabled. If the actuator is near the limit of the sensor's switching distance, the yellow LED will flash. The safety outputs remain enabled. The sensor can be readjusted before the safety outputs are disabled, thus stopping the machine.

Errors in the coding of the actuator, at the outputs of the sensor or in the sensor are signalled by the red LED. After a short analysis of the active fault, signalled by the red permanent signal, the defined error is indicated by flash pulses. The safety outputs are disabled in a delayed manner, when the fault is active for 1 minute.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>___</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>_____</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>_______</td>
<td>Cross-wire, error safety outputs 1 and 2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>___________</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>_____________</td>
<td>Actuator error, coding error</td>
</tr>
</tbody>
</table>

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The closed condition of the safety guard, i.e. the sensor is actuated, is indicated through a positive signal. If the sensor is operating near the limit of its switching distance, e.g. due to the sagging of the safety guard, the sensor will emit a 2 Hz cyclic signal before the safety outputs are disabled. An active fault will disable the diagnostic output after a short analysis.

Examples of the diagnostic function of the safety sensor

<table>
<thead>
<tr>
<th>Sensor condition</th>
<th>LEDs</th>
<th>Diagnostic output</th>
<th>Safety output</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not actuated</td>
<td>Green</td>
<td>0V</td>
<td>0 V</td>
<td>Supply voltage on, no evaluation of the voltage quality</td>
</tr>
<tr>
<td>Actuated</td>
<td>Yellow</td>
<td>24 V</td>
<td>24 V</td>
<td>The yellow LED always signals the presence of an actuator within range</td>
</tr>
<tr>
<td>Actuated in limit range</td>
<td>Flashes yellow</td>
<td>24 V 2 Hz pulsed</td>
<td>24 V</td>
<td>The sensor must be readjusted before the actuator gets outside of the maximum switching range and the safety outputs are disabled, thus stopping the machine.</td>
</tr>
<tr>
<td>Failure warning, sensor actuated</td>
<td>Flashes red</td>
<td>10 s delayed 24 V → 0 V</td>
<td>1 min delayed 24 V → 0 V</td>
<td>After 1 minute -&gt; failure</td>
</tr>
<tr>
<td>Failure</td>
<td>Red</td>
<td>10 s delayed 24 V → 0 V</td>
<td>not delayed 24 V → 0 V</td>
<td>–</td>
</tr>
</tbody>
</table>
Electronic safety sensor CSS 30

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: $2.5 \times 10^{-9}$/h

Actuation advantages
- Non-contact principle, no mechanical wear
- Suitable for flush mounting
- Rated switching distance 15 mm
- Misaligned actuation possible
- High repeat accuracy of the switching points

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 500 mA)
- Self-monitored series-wiring of max. 16 sensors in PL e / category 4 to ISO 13849-1
- Max. length of the sensor chain 200 m
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
- Controlled shutdown of the machine under observation of the running processes in case of emergency
Electronic safety sensor CSS 30

CSS 30

• Metal enclosure M30
• 2 short-circuit proof, p-type safety outputs (24 VDC per 500 mA)
• Self-monitored series-wiring of max. 16 sensors for PL e and category 4 to ISO 13849-1
• Max. length of the sensor chain 200 m
• Integral cross-wire, wire breakage and external voltage monitoring of the safety outputs

CST 30-1

• Thermoplastic enclosure

Technical data

- Standards: IEC 60947-5-3; ISO 13849-1; IEC 61508
- Enclosure: nickel-plated brass
- Mode of operation: inductive
- Actuator: CST 30-1, CST 34-S-3

Switching distances to IEC 60947-5-3:
- CST 30-1: 15 mm
- CST 34-S-3: 12 mm

Assured switch-on distance Sso:
- CST 30-1: 12 mm (≤ 1 mm)
- CST 34-S-3: 10 mm

Assured switch-off distance Ssr:
- CST 30-1: 19 mm
- CST 34-S-3: 16 mm

Hysteresis: max. 2.0 mm

Repeat accuracy R: < 1 mm

Switching frequency f: 3 Hz

Series-wiring: max. 16 components

Cable length: max. 200 m
(Cable length and cable section alter the voltage drop depending on the output current)

Certification in combination with safety sensor

Approvals

Ordering details

CSS 15-30-2P+D-M-L

Sensor and actuator must be ordered separately.

Actuator

CST 30-1

Approvals

Ordering details

Note

Requirements for the safety controller

The safety monitoring module must tolerate internal functional tests of the safety outputs for 250 μs ... 1500 μs.

The 250 μs switch-off time of the safety sensor additionally will be extended depending on the cable length and the capacity of the cable used. Typically, a switch-off time of 500 μs is reached with a 100 m connecting cable. The safety monitoring module does not need to have a cross-wire short monitoring function.
Electronic safety sensor CSS 30

### Technical data

- **Rated insulation voltage** $U_i$: 32 V
- **Rated impulse withstand voltage** $U_{imp}$: 800 V
- **No-load current** $I_0$: 0.05 A
- **Response time**:  $< 30$ ms
- **Duration of risk**:  $\leq 30$ ms
- **Protection class**:  II
- **Overvoltage category**:  III
- **Degree of pollution**:  3
- **Safety inputs X1/X2:**
  - Rated operating voltage $U_{op}$: 24 VDC
  - (PELV to IEC 60204-1)
  - Rated operating current $I_{op}$: 1 A
- **Safety outputs Y1/Y2:**
  - NO function, 2-channel, p-type, short-circuit proof
  - Voltage drop: 0.5 V
  - Rated operating voltage $U_{op}^\prime$: $U_e - 0.5$ V
  - Leakage current $I_{op}^\prime$: $\leq 0.5$ mA
  - Rated operating current $I_{op}^\prime$: max. 0.5 A ambient temperature-dependent
- **Minimum operating current $I_{op}^\prime$:** 0.5 mA
- **Utilisation category:** DC-12 $U_e/I_e$ 24 VDC/0.5 A
- **Diagnostic output:** p-type, short-circuit proof
  - $U_{op}^\prime$: min. $U_e - 4$ V
  - Rated operating current $I_{op}^\prime$: max. 0.05 A
- **Utilisation category:** DC-12 $U_e/I_e$ 24 VDC/0.05 A
- **DC-13 $U_e/I_e$ 24 VDC/0.5 A
- **Classification:**
  - **Standards:** ISO 13849-1, IEC 61508
  - **Category:** e
  - **PFH:** $2.5 \times 10^{-9}/h$
  - **SIL:** suitable for SIL 3 applications
  - **Mission time:** 20 years

### Misalignment

The actuating curves represent the switch-on and switch-off distances of the CSS 30 safety sensor by the approach of the CST 30-1 actuator.

In case of concealed mounting, the switching distance varies.

### System components

- **Actuator CST 34-S-3**
- **Terminal mounting H 30**
- **Magnetic ball catch CSA-M-1**

### Note

**Wiring and connectors**

Refer to page 108

The safety switchgears are classified according to ISO 14119 as type 4 switching devices.
Electronic safety sensor CSS 30

Series-wiring of the CSS 30 with common cable for safety inputs and outputs

BK and RD = Safety outputs Y1 and Y2 → Safety controller

For the last safety sensor in a series-wiring, the positive operating voltage must be supplied to both safety inputs. A series-wiring of multiple safety sensors is realised by wiring in the control cabinet either in junction boxes on site.
Electronic safety sensor CSS 30

Diagnostic function of the CSS 30

The operating condition of the sensor as well as possible faults are signalled by means of three-color LEDs in the end cap of the sensor. The green LED indicates that the safety sensor is ready for operation. The sensor is not actuated.

When the safety sensor is actuated by the actuator, the indication LED switches from green to yellow. The safety outputs of the safety sensor are enabled. If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The safety outputs remain enabled. The sensor can be readjusted before the safety outputs are disabled, thus stopping the machine.

Errors in the coding of the actuator, at the outputs of the sensor or in the sensor are signalled by the red LED. After a short analysis of the active fault, signalled by the red permanent signal, the defined error is indicated by flash pulses. The safety outputs are disabled in a delayed manner, when the fault is active for 1 minute.

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</tr>
<tr>
<td>5 flash pulses</td>
<td>_______</td>
<td>Actuator error, coding error</td>
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</table>

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The closed condition of the safety guard, i.e. the sensor is actuated, is indicated through a positive signal. If the sensor is operating near the limit of its switching distance, e.g. due to the sagging of the safety guard, the sensor will emit a 2 Hz cyclic signal before the safety outputs are disabled. An active fault will disable the diagnostic output after a short analysis.

Examples of the diagnostic function of the safety sensor

<table>
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<tr>
<th>Sensor condition</th>
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<td>Yellow</td>
<td>24 V</td>
<td>24 V</td>
<td>The yellow LED always signals the presence of an actuator within range</td>
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<tr>
<td>Actuated in limit range</td>
<td>Flashes yellow</td>
<td>24 V</td>
<td>2 Hz pulsed</td>
<td>24 V</td>
</tr>
<tr>
<td>Failure warning, sensor actuated</td>
<td>Flashes red</td>
<td>10 s delayed</td>
<td>1 min delayed</td>
<td>24 V → 0 V</td>
</tr>
<tr>
<td>Failure</td>
<td>Red</td>
<td>10 s delayed</td>
<td>not delayed</td>
<td>24 V → 0 V</td>
</tr>
</tbody>
</table>
Humanity first and foremost
Safety Consulting

For detailed information, check out www.schmersal.com
Electronic safety sensor CSS 30S

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: $3.6 \times 10^{-9} / h$

Actuation advantages
- Non-contact principle, no mechanical wear
- Robust enclosure in 1.4404 (V4A) to EN 10088
- Hygiene-compliant design with IP69K protection class
- Sensor can also be fitted under V4A covers
- Suitable for flush mounting
- Misaligned actuation possible

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors in PL e / category 4 to ISO 13849-1
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
Electronic safety sensor CSS 30S

**Technical data**

- **Standards:** IEC 60947-5-3, ISO 13849-1, IEC 61508
- **Enclosure:** stainless steel, 1.4404 to EN 10088
- **Mode of operation:** inductive
- **Switching distances to IEC 60947-5-3:**
  - Rates switching distance \( S_{n} \): 11 mm
  - Assured switch-on distance \( S_{ap} \): 8 mm
  - Assured switch-off distance \( S_{ar} \): 15 mm
  - Hysteresis: < 2 mm
  - Repeat accuracy: < 1 mm
  - Switching frequency \( f \): 3 Hz
- **Design of electrical connection:** M12, 8-pole
- **Series-wiring:** max. 31 components
- **Fuse:** external, 2 A
- **Cable length:** max. 200 m
- **Ambient conditions:**
  - Ambient temperature \( T_{a} \): \(-25 °C \ldots +65 °C\)
  - Storage and transport temperature: \(-25 °C \ldots +85 °C\)
  - Resistance to vibration: 10 ... 55 Hz, amplitude 1 mm
  - Resistance to shock: 30 g / 11 ms
- **Protection class:** IP69K, to DIN 40050-9, IP65, IP67, IP68 to IEC 60529
- **Electrical data:**
  - Rated operating voltage \( U_{e} \): 24 VDC
    - \(-15% / +10\%\) (stabilised PELV)
  - Rated operating current \( I_{e} \): 0.6 A
  - No-load current \( I_{0} \): max. 0.1 A; average 50 mA
  - Protection class: II
  - Overvoltage category: III
  - Degree of pollution: 3
  - Rated impulse withstand voltage \( U_{imp} \): 0.8 kV
  - Rated insulation voltage \( U_{i} \): 32 V
  - Response time: < 60 ms
  - Duration of risk: < 60 ms
  - Safety inputs X1/X2:
    - Rated operating voltage \( U_{e} \): 24 VDC
      - \(-15% / +10\%\) PELV to IEC 60204-1
  - Rated operating current \( I_{c} \):
    - 1 A

**Note**

Requirements for the safety controller

The safety monitoring module must tolerate internal functional tests of the safety outputs for 250 \( \mu \)s ...1500 \( \mu \)s.

The 250 \( \mu \)s switch-off time of the safety sensor additionally will be extended depending on the cable length and the capacity of the cable used. Typically, a switch-off time of 500 \( \mu \)s is reached with a 100 m connecting cable. The safety monitoring module does not need to have a cross-wire short monitoring function.

**Ordering details**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D SD</td>
<td>with diagnostic output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with serial diagnostic function</td>
</tr>
</tbody>
</table>

Sensor and actuator must be ordered separately.

**Approvals**

- TUV
- IP69K
- CE

- TUV
- IP69K
- CE

Certification in combination with safety sensor

**Actuator**

CSS 11-30S-1-M-ST

<table>
<thead>
<tr>
<th>CSS 30S</th>
<th>CST 30S-1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSS 30S</strong></td>
<td><strong>CST 30S-1</strong></td>
</tr>
<tr>
<td>![CSS 30S diagram]</td>
<td>![CST 30S-1 diagram]</td>
</tr>
</tbody>
</table>

• Stainless steel enclosure M30
• suitable for concealed mounting behind stainless steel
• 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
• Self-monitored series-wiring of max. 31 sensors
• Max. length of the sensor chain 200 m
• Integral cross-wire, wire breakage and external voltage monitoring of the safety outputs
• With integrated connector

• Stainless steel enclosure M30

![CSS 11-30S-1-M-ST diagram]
Electronic safety sensor CSS 30S

Technical data

Safety outputs Y1/Y2:
- NO function, 2-channel, p-type, short-circuit proof
Rated operating voltage $U_{\text{e1}}$: 24 VDC
Voltage drop: $< 1$ V
Leakage current $I_{\text{L}}$: $< 0.5$ mA
Rated operating current $I_{\text{e1}}$: max. 0.25 A
Minimum operating current $I_{\text{m}}$: 0.5 mA
Utilisation category: DC-12, DC-13
$U_{\text{e1}}/I_{\text{e1}}$: 24 VDC / 0.25 A
Required rated short-circuit current: 100 A
Diagnostic output: p-type, short-circuit proof
Rated operating voltage $U_{\text{e2}}$: 24 VDC
Voltage drop: $< 5$ V
Rated operating current $I_{\text{e2}}$: max. 0.05 A
Utilisation category: DC-12, DC-13
$U_{\text{e2}}/I_{\text{e2}}$: 24 VDC / 0.05 A
Serial diagnostic:
Operating current: 150 mA short-circuit proof
Wiring capacitance for serial diagnostic: max. 50 nF
Classification:
Standards: ISO 13849-1, IEC 61508
PL: e
Category: 4
PFH: $3.6 \times 10^9$/h
SIL: suitable for SIL 3 applications
Mission time: 20 years

Misalignment

The actuating curves represent the switch-on and switch-off distances of the safety sensor by the approach of the CST 30S-1 actuator.

When the safety sensor is fitted under non-magnetic stainless steel (V4A) or in case of concealed mounting, the switching distance varies.

Legend
- S Switching distance
- V Misalignment
- $S_{\text{on}}$ Switch-on distance
- $S_{\text{off}}$ Switch-off distance ($S_{\text{on}} < S_h < S_{\text{off}}$)
- $S_h$ Hysteresis area
- $S_{\text{ao}}$ Assured switch-on distance
- $S_{\text{ar}}$ Assured switch-off distance

System components

Terminal mounting H 30

Magnetic ball catch CSA-M-1

Note

Wiring and connectors refer to page 104

The safety switchgears are classified according to ISO 14119 as type 4 switching devices.

Note

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFINET-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-..., and in the instructions for the integration of the SD-Gateway.

Ordering details

Terminal mounting H 30
Magnetic ball catch CSA-M-1
Electronic safety sensor CSS 30S

Series-wiring of the CSS 30S with conventional diagnostic output

Y1 and Y2 = Safety outputs → Safety controller

The safety inputs of the last sensor of the chain (considered from the safety-monitoring module) are connected to the voltage supply. The safety outputs of the first sensor are wired to the safety controller.

Series-wiring of the CSS 30S with serial diagnostic function

Y1 and Y2 = Safety outputs → Safety controller

SD-IN → Gateway → Field bus

The safety outputs of the first sensor (considered from the safety-monitoring module) are connected to the safety-monitoring module. The field bus Gateway is connected to the serial diagnostic input of the first sensor.
Electronic safety sensor CSS 30S

Diagnostic function of the CSS 30S with conventional diagnostic output

The safety sensor indicates the operating condition and faults by means of three-colour LED’s located in the connection area. The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. The yellow LED always signals the presence of an actuator within range.

If the actuator is near the limit of the sensor's switching distance, the LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. Signaled by the alternating red/green flashing of the Duo LED on the device. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td></td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td></td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td></td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td></td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td></td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td>Continuous red</td>
<td></td>
<td>Internal error</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The diagnostic output can also be used to detect clearance variations between the sensor and the actuator in the same way as the yellow LED. An active fault causes the diagnostic output to be disabled. The safety outputs are disabled after max. 30 minutes if the fault is not rectified. This signal combination, diagnostic output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

Examples of the diagnostic function of the safety sensor with conventional diagnostic output

<table>
<thead>
<tr>
<th>System condition</th>
<th>Duo-LED green</th>
<th>LED yellow</th>
<th>Diagnostic output</th>
<th>Safety outputs Y1, Y2</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on, not actuated</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Actuated</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V cyclic</td>
<td>24 V</td>
</tr>
<tr>
<td>Actuated, failure warning</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Actuated, failure</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Actuated, internal failure</td>
<td>Off</td>
<td>On</td>
<td>On</td>
<td>0 V</td>
<td>0 V</td>
</tr>
</tbody>
</table>
Electronic safety sensor CSS 30S

Diagnostic of the CSS 30S safety sensor with serial diagnostic function

Sensors with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If CSS sensors are wired in series, the safety channels as well as the inputs and outputs of the diagnostic lines are wired in series.

Max. 31 safety sensors can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The response data, like status signals, warnings or failure messages, are automatically and permanently written in the assigned input byte of the PLC for each safety sensor in the series-wired chain. The request data for each safety sensor are transmitted to the device through an output byte of the PLC.

Bit 0: Safety outputs enabled
Bit 1: Safety sensor actuated, actuator identified
Bit 4: Safety inputs energised
Bit 5: Sensor actuated in hysteresis area
Bit 6: Failure warning, switch-off delay activated
Bit 7: Failure, safety outputs disabled

Functional example of the status signals, warnings or failure messages

Communication directions:
- Request byte: from the PLC to the local CSS
- Response byte: from the local CSS to the PLC
- Warning/failure byte: from the local CSS to the PLC

<table>
<thead>
<tr>
<th>Bit no*</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>---</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>---</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>---</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>---</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>---</td>
<td>Actuated in limit area</td>
<td>Internal error</td>
<td>Internal error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>---</td>
<td>Failure warning</td>
<td>Communication error between fieldbus gateway and safety sensor</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Function of the diagnostic LEDs, the serial status signals and the safety outputs

Flash code as in previous version

<table>
<thead>
<tr>
<th>System condition</th>
<th>Duo-LED green</th>
<th>red</th>
<th>LED yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Response byte no*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage on, not actuated</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>Actuated, safety outputs released</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>0 0 0 1 0 0 1 0</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V</td>
<td>0 0 1 0 0 0 1 0</td>
</tr>
<tr>
<td>Actuated, failure warning</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>24 V</td>
<td>0 1 0 1 0 0 1 1</td>
</tr>
<tr>
<td>Actuated, failure</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
<td>1 0 0 1 0 0 1 0</td>
</tr>
</tbody>
</table>

The shown bit sequence of the diagnostic byte is an example. A different combination of the operating conditions will lead to a change of the bit sequence.
Electronic safety sensor CSS 300

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: $3.6 \times 10^{-9} / \text{h}$

Actuation advantages
- Non-contact principle, no mechanical wear
- Suitable for concealed mounting behind stainless steel
- Suitable for flush mounting
- High repeat accuracy of the switching points

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors in PL e / category 4 to ISO 13849-1
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
Electronic safety sensor CSS 300

**CSS 300**

- Thermoplastic enclosure
- Ø M30
- Suitable for concealed mounting behind stainless steel
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors
- Comfortable diagnose through sensor LED and diagnostic output
- Max. length of the sensor chain 200 m
- Integral cross-wire, wire breakage and external voltage monitoring of the safety outputs
- With integrated connector

**CST 30S-1**

- Stainless steel enclosure
- Ø M30

---

**Technical data**

<table>
<thead>
<tr>
<th>Standards:</th>
<th>IEC 60947-5-3, ISO 13849-1, IEC 61508</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure:</td>
<td>thermoplastic</td>
</tr>
<tr>
<td>Mode of operation:</td>
<td>inductive</td>
</tr>
<tr>
<td>Switching distances to IEC 60947-5-3:</td>
<td></td>
</tr>
<tr>
<td>Rates switching distance $S_{\text{SN}}$:</td>
<td>11 mm</td>
</tr>
<tr>
<td>Assured switch-on point $S_{\text{SO}}$:</td>
<td>8 mm</td>
</tr>
<tr>
<td>Assured switch-off point $S_{\text{SS}}$:</td>
<td>15 mm</td>
</tr>
<tr>
<td>Hysteresis:</td>
<td>&lt; 2 mm</td>
</tr>
<tr>
<td>Repeat accuracy:</td>
<td>&lt; 1 mm</td>
</tr>
<tr>
<td>Switching frequency f:</td>
<td>3 Hz</td>
</tr>
<tr>
<td>Integrated connector:</td>
<td>M12, 8-pole</td>
</tr>
<tr>
<td>Series-wiring:</td>
<td>max. 31 components</td>
</tr>
<tr>
<td>Fuse:</td>
<td>external, 2 A</td>
</tr>
<tr>
<td>Cable length:</td>
<td>max. 200 m</td>
</tr>
<tr>
<td>Ambient conditions:</td>
<td></td>
</tr>
<tr>
<td>Storage temperature:</td>
<td>−25 °C ... +60 °C</td>
</tr>
<tr>
<td>Resistance to vibration:</td>
<td>10...55 Hz, amplitude 1 mm</td>
</tr>
<tr>
<td>Resistance to shock:</td>
<td>30 g / 11 ms</td>
</tr>
<tr>
<td>Protection class:</td>
<td>IP65, IP67 to IEC 60529</td>
</tr>
<tr>
<td>Electrical data:</td>
<td></td>
</tr>
<tr>
<td>Rated operating voltage $U_e$:</td>
<td>24 VDC −15% / +10% (stabilised PELV)</td>
</tr>
<tr>
<td>Rated operating current $I_e$:</td>
<td>0.6 A</td>
</tr>
<tr>
<td>No-load current $I_0$:</td>
<td>max. 0.1 A; average 50 mA</td>
</tr>
<tr>
<td>Protection class:</td>
<td>II</td>
</tr>
<tr>
<td>Overvoltage category:</td>
<td>III</td>
</tr>
<tr>
<td>Degree of pollution:</td>
<td>3</td>
</tr>
<tr>
<td>Rated impulse withstand voltage $U_{\text{imp}}$:</td>
<td>0.8 kV</td>
</tr>
<tr>
<td>Rated insulation voltage $U_i$:</td>
<td>32 V</td>
</tr>
<tr>
<td>Response time:</td>
<td>&lt; 60 ms</td>
</tr>
<tr>
<td>Duration of risk:</td>
<td>&lt; 60 ms</td>
</tr>
<tr>
<td>Safety inputs X1/X2:</td>
<td></td>
</tr>
<tr>
<td>Rated operating voltage $U_e$:</td>
<td>24 VDC −15% / +10% (stabilised PELV)</td>
</tr>
<tr>
<td>Rated operating current $I_e$:</td>
<td>1 A</td>
</tr>
</tbody>
</table>

**Ordering details**

<table>
<thead>
<tr>
<th>CSS 11-300-3-M-ST</th>
<th>Actuator CST 30S-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Description</td>
</tr>
<tr>
<td>1 D</td>
<td>with diagnostic output</td>
</tr>
<tr>
<td></td>
<td>with serial diagnostic function</td>
</tr>
</tbody>
</table>

Sensor and actuator must be ordered separately.

**Approvals**

- TÜV
- CE

**Ordering details**

| Certification in combination with safety sensor |

**Note**

Requirements for the safety controller

The safety monitoring module must tolerate internal functional tests of the safety outputs for 250 μs –1500 μs.

The 250 μs switch-off time of the safety sensor additionally will be extended depending on the cable length and the capacity of the cable used. Typically, a switch-off time of 500 μs is reached with a 100 m connecting cable. The safety monitoring module does not need to have a cross-wire short monitoring function.
Electronic safety sensor CSS 300

Technical data

Safety outputs Y1/Y2:
- NO function, 2-channel, p-type, short-circuit proof

Rated operating voltage \(U_{\text{e1}}\):
- 24 VDC

Voltage drop:
- \(-15\% / +10\%\)

Leakage current \(I_{\text{r}}\):
- < 0.5 mA

Rated operating current \(I_{\text{e1}}\):
- max. 0.25 A

Minimum operating current \(I_{\text{m}}\):
- 0.5 mA

Utilisation category:
- DC-12, DC-13

\(U_{\text{e1}}/I_{\text{r}}\):
- 24 VDC / 0.25 A

Required rated short-circuit current:
- 100 A

Diagnostic output:
- p-type, short-circuit proof

Rated operating voltage \(U_{\text{e2}}\):
- 24 VDC

Voltage drop:
- \(-15\% / +10\%\)

Rated operating current \(I_{\text{e2}}\):
- max. 0.05 A

Utilisation category:
- DC-12, DC-13

\(U_{\text{e2}}/I_{\text{e2}}\):
- 24 VDC / 0.05 A

Serial diagnostic:
- Operating current: 150 mA short-circuit proof

Wiring capacitance for serial diagnostic:
- max. 50 nF

Classification:
- Standards:
  - ISO 13849-1, IEC 61508
  - PL: e
  - Category: 4
- PFH:
  - \(3.6 \times 10^{-9} \text{ h}\)
- SIL:
  - suitable for SIL 3 applications
- Mission time:
  - 20 years

Notes

Wiring and connectors
- refer to page 104

The safety switchgears are classified according to ISO 14119 as type 4 switching devices.

Misalignment

The actuating curves represent the switch-on and switch-off distances of the safety sensor by the approach of the CST 30S-1 actuator.

If the safety sensor is mounted behind non-ferromagnetic stainless steel (V4A) either flush-mounted, the switching distance is reduced.

Legend

- S: Switching distance
- V: Misalignment
- \(S_{\text{on}}\): Switch-on distance
- \(S_{\text{off}}\): Switch-off distance
- \(S_h\): Hysteresis area \(S_h = S_{\text{on}} - S_{\text{off}}\)
- \(S_{\text{a}}\): Assured switch-on distance
- \(S_{\text{ar}}\): Assured switch-off distance

System components

Terminal mounting H 30

Magnetic ball catch CSA-M-1

Note

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-..., and in the instructions for the integration of the SD-Gateway.

Ordering details

- Terminal mounting
- Magnetic ball catch
- H 30
- CSA-M-1
Electronic safety sensor CSS 300

Series-wiring of the CSS 300 with conventional diagnostic output

Y1 and Y2 = Safety outputs → Safety controller

The safety inputs of the last sensor of the chain (considered from the safety-monitoring module) are connected to the voltage supply.
The safety outputs of the first sensor are wired to the safety controller.

Series-wiring of the CSS 300 with serial diagnostic function

Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus

The safety outputs of the first sensor (considered from the safety-monitoring module) are connected to the safety-monitoring module.
The field bus Gateway is connected to the serial diagnostic input of the first sensor.
Electronic safety sensor CSS 300

Diagnostic function of the CSS 300 with conventional diagnostic output

The safety sensor indicates the operating condition and faults by means of three-colour LED's located in the connection area. The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. The yellow LED always signals the presence of an actuator within range.

If the actuator is near the limit of the sensor’s switching distance, the LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. Signaled by the alternating red/green flashing of the Duo LED on the device. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td></td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td></td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td></td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td></td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td></td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td>Continuous red</td>
<td></td>
<td>Internal error</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The diagnostic output can also be used to detect clearance variations between the sensor and the actuator in the same way as the yellow LED. An active fault causes the diagnostic output to be disabled. The safety outputs are disabled after max. 30 minutes if the fault is not rectified. This signal combination, diagnostic output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

Examples of the diagnostic function of the safety sensor with conventional diagnostic output

<table>
<thead>
<tr>
<th>System condition</th>
<th>Duo-LED green</th>
<th>LED yellow</th>
<th>Diagnostic output</th>
<th>Safety outputs Y1, Y2</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power on, not actuated</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Power on, no evaluation of the voltage quality</td>
</tr>
<tr>
<td>Actuated</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The yellow LED always signals the presence of an actuator in the detection area</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V cyclic</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The sensor must be readjusted before the actuator gets outside the maximum switching range and the safety outputs are disabled, thus stopping the machine</td>
</tr>
<tr>
<td>Actuated, failure warning</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>After 30 minutes: error condition activated, safety outputs disabled</td>
</tr>
<tr>
<td>Actuated, failure</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>refer to table „Flash codes“</td>
</tr>
<tr>
<td>Actuated, internal failure</td>
<td>Off</td>
<td>On</td>
<td>On</td>
<td>0 V</td>
<td>0 V</td>
</tr>
</tbody>
</table>

–
Electronic safety sensor CSS 300

Diagnostic function of the CSS 300 with serial diagnostic function

Sensors with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If CSS sensors are wired in series, the safety channels as well as the inputs and outputs of the diagnostic lines are wired in series.

Max. 31 safety sensors can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The response data, like status signals, warnings or failure messages, are automatically and permanently written in the assigned input byte of the PLC for each safety sensor in the series-wired chain. The request data for each safety sensor are transmitted to the device through an output byte of the PLC.

Bit 0: Safety outputs enabled
Bit 1: Safety sensor actuated, actuator identified
Bit 4: Safety inputs energised
Bit 5: Sensor actuated in hysteresis area
Bit 6: Failure warning, switch-off delay activated
Bit 7: Failure, safety outputs disabled

Functional example of the status signals, warnings or failure messages

<table>
<thead>
<tr>
<th>Communication directions:</th>
<th>Request byte: from the PLC to the local CSS</th>
<th>Response byte: from the local CSS to the PLC</th>
<th>Warning/failure byte: from the local CSS to the PLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit n° Request byte</td>
<td>Response byte</td>
<td>Diagnostic Failure warning</td>
<td>Diagnostic Failure</td>
</tr>
<tr>
<td>Bit 0: ---</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1: ---</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2: ---</td>
<td>---</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3: ---</td>
<td>---</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>Bit 4: ---</td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>Actuator error, coding error</td>
</tr>
<tr>
<td>Bit 5: ---</td>
<td>Actuated in limit area</td>
<td>Internal error</td>
<td>Internal error</td>
</tr>
<tr>
<td>Bit 6: ---</td>
<td>Failure warning</td>
<td>Communication error between fieldbus gateway and safety sensor</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7: Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Function of the diagnostic LEDs, the serial status signals and the safety outputs

Flash code as in previous version

<table>
<thead>
<tr>
<th>System condition</th>
<th>Duo-LED green</th>
<th>LED yellow</th>
<th>Safety outputs</th>
<th>Response byte n°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage on, not actuated</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
</tr>
<tr>
<td>Actuated, safety outputs released</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V</td>
</tr>
<tr>
<td>Actuated, failure warning</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>24 V</td>
</tr>
<tr>
<td>Actuated, failure</td>
<td>Off</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
</tr>
</tbody>
</table>

The shown bit sequence of the diagnostic byte is an example. A different combination of the operating conditions will lead to a change of the bit sequence.
Electronic safety sensors CSS 34

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: 1.3 x 10^{-10} / h

Actuation advantages
- Non-contact principle, no mechanical wear
- 4 actuating directions
- Side faces can be rotated in 3 positions
- Many actuator designs
- Sensor functioning with max. 53 mm misalignment with regard to the actuator
- High repeat accuracy of the switching points

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors in PL e / category 4 to ISO 13849-1
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
Electronic safety sensor CSS 34

**CSS 34**

- Thermoplastic enclosure
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors
- Max. length of the sensor chain 200 m
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet
- Sensor with connecting cable or with integrated connector

**CSS 34F0/F1**

- Additional functions of the CSS 34F0/F1:
  - To control positive-guided relays without downstream safety controller
  - Suitable as individual or end device in series-wired chains of standard sensors to replace the safety controller
  - Self-monitored series-wiring of up to 30 CSS 34 sensors and one CSS 34F. sensor
  - CSS 34F. sensor with integrated connector
  - CSS 34F0: without edge monitoring of the enabling button, suitable for automatic start
  - CSS 34F1: with edge monitoring of the reset button

---

### Technical data

**Standards:** IEC 60947-5-3, ISO 13849-1; IEC 61508

**Enclosure:** glass-fibre reinforced thermostatic

**Mode of operation:** inductive

**Actuator and switching distances** (IEC 60947-5-3):
- refer to table “Actuator / switching distances”

**Series-wiring:**
- max. 31 components
- Cable length: max. 200 m

**Hysteresis:**
- max. 1.5 mm

**Repeat accuracy:**
- < 0.5 mm

**Switching frequency f:**
- 3 Hz

**Cable:**
- Y-UL 2517 / 8 x AWG 22
- 8 x 0.35 mm², 2 m long

**Temperature resistance of the cable:**
- At rest:
  - −30 °C ... +105 °C
- In movement:
  - −10 °C ... +105 °C

**Integrated connector:**
- M12, 8-pole

**Ambient conditions:**

- Ambient temperature Tu:
  - for output current ≤ 0.1 A/output
    - −25 °C ... +70 °C
  - ≤ 0.25 A/output
    - −25 °C ... +65 °C
- Storage and transport temperature:
  - −25 °C ... +65 °C

**Resistance to vibration:**
- 10 ... 55 Hz, amplitude 1 mm

**Resistance to shock:**
- 30 g / 11 ms

**Protection class:**
- IP65, IP67 to IEC 60529

**Electrical data:**

- **Rated operating voltage Uₑ:** 24 VDC
  - −15% / +10% (stabilised PELV)
- **Rated operating current Iₑ:**
  - 0.6 A
- **Required rated short-circuit current:**
  - 100 A
- **Fuse (circuit breaker):**
  - for cables
  - Up to 45°C: 4.0 A
  - Up to 60°C: 3.15 A
  - At 65°C: 2.5 A
  - At 70°C: 2.0 A
  - For connectors: 2.0 A

The cable section of the interconnecting cable must be observed for both wiring variants.

---

**Ordering details**

<table>
<thead>
<tr>
<th>CSS ①-34-②-③-M-④</th>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①2</td>
<td></td>
<td>Head actuation</td>
<td></td>
</tr>
<tr>
<td>①4</td>
<td></td>
<td>Sideways actuation</td>
<td></td>
</tr>
<tr>
<td>②S</td>
<td></td>
<td>Lateral actuating surface</td>
<td></td>
</tr>
<tr>
<td>③V</td>
<td></td>
<td>Frontal actuating surface</td>
<td></td>
</tr>
<tr>
<td>③D</td>
<td></td>
<td>With diagnostic output</td>
<td></td>
</tr>
<tr>
<td>③SD</td>
<td></td>
<td>With serial diagnostic function</td>
<td></td>
</tr>
<tr>
<td>④L</td>
<td></td>
<td>With connecting cable</td>
<td></td>
</tr>
<tr>
<td>④ST</td>
<td></td>
<td>With integrated connector</td>
<td></td>
</tr>
</tbody>
</table>

Sensor and actuator must be ordered separately.

---

**Note**

Requirements for the safety controller

Dual-channel safety input, suitable for p-type sensors with normally-open (NO) function. The internal function tests of the sensors cause the outputs to cyclically switch off for max. 0.5 ms, this must be tolerated by the safety controller. The safety controller must not be equipped with cross-wire detection.

---

**Approvals**

[Approvals icon]
# Electronic safety sensor CSS 34

## Technical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated insulation voltage ( U_i )</td>
<td>32 V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage ( U_{imp} )</td>
<td>800 V</td>
</tr>
<tr>
<td>No-load current ( I_0 )</td>
<td>0.1 A</td>
</tr>
<tr>
<td>Response time</td>
<td>&lt; 30 ms</td>
</tr>
<tr>
<td>Duration of risk</td>
<td>&lt; 60 ms</td>
</tr>
<tr>
<td>Protection class</td>
<td>II</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Degree of pollution</td>
<td>3</td>
</tr>
<tr>
<td>Safety inputs X1/X2:</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Rated operating voltage ( U_{op} )</td>
<td>24 VDC / 0.25A</td>
</tr>
<tr>
<td>Rated operating current ( I_{op} )</td>
<td>1 A</td>
</tr>
<tr>
<td>Voltage drop</td>
<td>&lt; 1 V</td>
</tr>
<tr>
<td>Rated operating voltage ( U_{op1} )</td>
<td>min. ( (U_{op} - 1 ) V)</td>
</tr>
<tr>
<td>Leakage current ( I_r )</td>
<td>&lt; 0.5 mA</td>
</tr>
<tr>
<td>Rated operating current ( I_{op1} )</td>
<td>max. 0.25 A, ambient temperature-dependent</td>
</tr>
<tr>
<td>Minimum operating current ( I_{op2} )</td>
<td>0.5 mA</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>DC-12, DC-13</td>
</tr>
<tr>
<td>Diagnostic output:</td>
<td>p-type, short-circuit proof</td>
</tr>
<tr>
<td>Voltage drop</td>
<td>&lt; 5 V</td>
</tr>
<tr>
<td>Rated operating voltage ( U_{op2} )</td>
<td>min. ( (U_{op} - 5 ) V)</td>
</tr>
<tr>
<td>Rated operating current ( I_{op2} )</td>
<td>max. 0.05 A</td>
</tr>
<tr>
<td>Utilisation category</td>
<td>DC-12, DC-13</td>
</tr>
<tr>
<td>Wiring capacitance for serial diagnostic</td>
<td>max. 50 nF</td>
</tr>
<tr>
<td>Classification</td>
<td>ISO 13849-1, IEC 61508</td>
</tr>
<tr>
<td>Standards:</td>
<td></td>
</tr>
<tr>
<td>PL:</td>
<td>e</td>
</tr>
<tr>
<td>Category:</td>
<td>4</td>
</tr>
<tr>
<td>PFH:</td>
<td>( 1.3 \times 10^{-10} ) h</td>
</tr>
<tr>
<td>SIL:</td>
<td>suitable for SIL 3 applications</td>
</tr>
<tr>
<td>Mission time</td>
<td>20 years</td>
</tr>
</tbody>
</table>

## Misalignment

### Sideways actuation

The long side allows for a max. height misalignment (X) of sensor and actuator of 36 mm (e.g. mounting tolerance or due to guard door sagging). Increased misalignment, max. 53 mm, possible when the CST 34-S-2 actuator is used. The axial misalignment (Y) is max. ± 10 mm.

### Head actuation

The front side allows for a maximum transverse misalignment (Z) of approx. 8 mm.

## Note

**Wiring and connectors**

Refer to page 104

The safety switchgears are classified according to ISO 14119 as type 4 switching devices.

**Note**

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-…. and in the instructions for the integration of the SD-Gateway.
Electronic safety sensor CSS 34

**Actuator**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V</td>
<td>Frontal actuating surface</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>Lateral actuating surface</td>
</tr>
</tbody>
</table>

Actuator CST-34-1

Sensor and actuator must be ordered separately.

- Sensor CSS 34 and actuator are isometric
- Front and lateral actuation of the sensor possible

**Actuator CST-34-S-2**

Also suitable:

- Actuator CSS 180
  - CST-34-S-3*
  - CST 34-V

* Certification in combination with safety sensor

**Actuator CST 180-1**

- Actuators are isometric, but CST 180-1 incl. H18 clamp
- Front and lateral actuation of the sensor possible

**Actuator CST 180-2**

- Front and lateral actuation of the sensor possible

**Ordering details**

**CST 34-V**

- Frontal actuating surface
- Lateral actuating surface

Actuator with double solenoid, for increased misalignment, lateral actuating surface

- Certification in combination with safety sensor

**CST 34-S-3**

Small actuator (enables lateral and frontal actuation of the sensor)

- Certification in combination with safety sensor

**CST 180-1**

- Actuator CSS 180 with terminal mounting
- Without terminal mounting

- Certification in combination with safety sensor

* Certification in combination with safety sensor under preparation
## Electronic safety sensor CSS 34

### Selection table: Actuator

<table>
<thead>
<tr>
<th>Safety sensor</th>
<th>Actuator</th>
<th>Actuation</th>
<th>Switching distances to IEC 60947-5-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 14-34-S</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSS 180-1 / CST 180-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 34-S-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 34-S-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 34-S-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 34-V-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 34-S-2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 34-S-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CST 180-1 / CST 180-2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Electronic safety sensor CSS 34

Series-wiring of the CSS 34 with conventional diagnostic output

Y1 and Y2 = Safety outputs → Safety controller

The voltage is supplied to both safety inputs of the last sensor of the chain (starting from the safety controller). The safety outputs of the first sensor are wired to the safety controller.

Series-wiring of the CSS 34 with serial diagnostic function

Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus

The safety outputs of the first sensor are wired to the safety controller. The serial Diagnostic Gateway is connected to the serial diagnostic input of the first sensor.
Electronic safety sensor CSS 34

Single device CSS 34F0 with conventional diagnostic output

The CSS 34 F0 safety sensor ensures the direct control of auxiliary contactors1) or relays1). The monitoring of the contactors or relays is enabled by the feedback loop, which consists of the NC contacts of K1, K2. As no other switches are used, the auxiliary contactors1) or relays1) are immediately enabled as soon as the safety guard is closed.

The feedback loop can be extended by an enabling button. The sensor is enabled as soon as the button is pressed. The set-up is shown in the following wiring example of the CSS 34F1. The internal evaluation of the variant F0 has no edge detection of the button. If necessary, the “manual reset” to ISO 13849-1 must be executed by means of other components of a local control system.

In this example, the CSS 34F0 safety sensor is connected as single device. To this effect, the safety inputs are connected to 24 VDC.

Direct control of the positive-action relays

Automatic start through the feedback circuit. Optionally, an enabling switch can be integrated in the feedback circuit. The sensor is switched on when the button is pushed. Variant F0 has no edge monitoring for the switch.

Wiring with auxiliary relay to control high-capacity contactors

The NC contacts of the load-switching contactors are monitored. Optional executions of the feedback circuit with one button, see wiring examples on page 54.
Electronic safety sensor CSS 34

Series-wiring of the CSS 34 and CSS 34F1 with conventional diagnostic outputs

The voltage is supplied to both safety inputs of the last sensor of the chain (starting from the safety controller). The safety outputs of the first sensor control and monitor contactor K1/K2. The safety outputs of the CSS 34F1 are enabled after the reset button has been actuated.
Electronic safety sensor CSS 34

Diagnostic of the CSS 34 safety sensor with conventional diagnostic output

The safety sensor indicates the operating condition and faults by means of three-colour LED's located in the lateral surfaces of the sensor. The green LED indicates that the safety sensor is ready for operation. The sensor is not actuated.

If the actuator is near the limit of the sensor’s switching distance, the LED will flash. The flash code can be used to prematurely detect changes in the distance between the sensor and the actuator (e.g. sagging of a guard door). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>LED (red)</th>
<th>Flash codes</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>___</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>___ ___</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>___ ___ ___</td>
<td>Cross-wire Y1/Y2</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>___ ___ ___ ___</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>___ ___ ___ ___ ___</td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td>Continuous red</td>
<td>___</td>
<td>Internal error</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The electronic diagnostic output signals faults before the safety outputs are disabled, thus enabling a controlled shutdown.

The diagnostic output is not a safety-related output.

The diagnostic output can also be used to detect clearance variations between the sensor and the actuator in the same way as the yellow LED. An active fault causes the diagnostic output to be disabled. The safety outputs are disabled after max. 30 minutes if the fault is not rectified. This signal combination, diagnostic output disabled and safety channels still enabled, can be used to stop the production process in a controlled manner.

Example of the diagnostic function of the CSS 34 or CSS 34F safety sensor with conventional diagnostic output

<table>
<thead>
<tr>
<th>Sensor condition</th>
<th>LEDs</th>
<th>Diagnostic output</th>
<th>Safety outputs</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green</td>
<td>Red</td>
<td>Yellow</td>
<td></td>
</tr>
<tr>
<td>I. Supply voltage</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Supply voltage on, no evaluation of the voltage quality</td>
</tr>
<tr>
<td>II. Actuated</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The yellow LED always signals the presence of an actuator within range</td>
</tr>
<tr>
<td>III. Actuated in limit area</td>
<td>On</td>
<td>Off</td>
<td>Flashes (1Hz)</td>
<td>24 V pulsed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The sensor must be readjusted before the actuator gets outside of the maximum switching range and the safety outputs are disabled, thus stopping the machine</td>
</tr>
<tr>
<td>IV. Actuated and feedback circuit open *</td>
<td>On</td>
<td>Off</td>
<td>Flashes (6Hz)</td>
<td>24 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The sensor waits for a signal from the feedback circuit: F0 – Close feedback circuit F1 – Trailing edge on feedback circuit</td>
</tr>
<tr>
<td>V. Actuated in limit area and feedback circuit open *</td>
<td>On</td>
<td>Off</td>
<td>Flashes alternatively (1Hz/5Hz)</td>
<td>24 V pulsed</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The LED indication combines the sensor functions III and IV.</td>
</tr>
<tr>
<td>VI. Failure warning, sensor actuated</td>
<td>On</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>After 30 minutes if the fault is not eliminated</td>
</tr>
<tr>
<td>VII. Failure</td>
<td>On</td>
<td>Flashes</td>
<td>On</td>
<td>0 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>refer to table „Flash codes”</td>
</tr>
</tbody>
</table>

* only for CSS 34F0/F1 with feedback circuit
Electronic safety sensor CSS 34

Diagnostic of the CSS 34 safety sensor with serial diagnostic function

Sensors with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If CSS sensors are daisy-chained, the safety outputs as well as the inputs and outputs of the diagnostic channels are wired in series.

Max. 31 safety sensors can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The operational information of the response and diagnostic data is automatically and permanently written in an input byte of the PLC for each safety sensor in the series-wired chain. The request data for each safety sensor are transmitted to the component through an output byte of the PLC.

In case of a communication error between the fieldbus gateway and the safety sensor, the switching condition of the safety switch is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened. Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

I/O data and diagnostic data

Communication directions:
- Request byte: from the PLC to the local CSS
- Response byte: from the local CSS to the PLC
- Warning/failure byte: from the local CSS to the PLC

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Warning or failure byte</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failure reset</td>
<td>Safety output enabled</td>
<td>Failure warnings</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>Actuator detected</td>
<td>Error output Y1</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>---</td>
<td>Error output Y2</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>---</td>
<td>Cross-wire</td>
</tr>
<tr>
<td></td>
<td>Start function is missing / Feedback circuit opened (only CSS 34F.)</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>Incorrect or defective actuator</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>Actuated in limit area</td>
<td>Internal error</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>Failure warning</td>
<td>Internal error between fieldbus gateway and safety sensor</td>
</tr>
<tr>
<td></td>
<td>Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>Operating voltage too low</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Function of the diagnostic LEDs, the serial status signals and the safety outputs

Flash code as in previous version

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDs</th>
<th>Safety outputs Y1, Y2</th>
<th>Status signalling serial diagnostic byte Bit n°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>green</td>
<td>red</td>
<td>yellow</td>
</tr>
<tr>
<td>Supply voltage on, not actuated</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>Actuated, feedback circuit open / not actuated (only CSS 34F.)</td>
<td>On</td>
<td>Off</td>
<td>Flashes (5 Hz)</td>
</tr>
<tr>
<td>Actuated, safety outputs released</td>
<td>On</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>Actuated in limit area</td>
<td>On</td>
<td>Off</td>
<td>Flashes (1 Hz)</td>
</tr>
<tr>
<td>Actuated, failure warning</td>
<td>On</td>
<td>On/Flashes</td>
<td>On</td>
</tr>
<tr>
<td>Actuated, failure</td>
<td>On</td>
<td>On/Flashes</td>
<td>On</td>
</tr>
</tbody>
</table>

The shown bit sequence of the diagnostic byte is an example. A different combination of the operating conditions will lead to a change of the bit sequence.
Electronic solenoid interlock MZM 100 and safety sensor with interlocking function MZM 100 B

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: 3.5 x 10⁻⁹ / h

Actuation advantages:
- Patented operating principle for solenoid interlocks (for personal protection applications)
- The safety switchgear must be used as end stop
- Variably adjustable latching
- Latching force generated through permanent magnet, approx. 30 N, also in de-energised condition
- Accurate adjustment through slotted holes
- Actuator free from play, i.e. neutralisation of undesired noises
- Sensor technology permits an offset between actuator and interlock

Wiring advantages:
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors in PL e / category 4 to ISO 13849-1
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages:
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
Solenoid interlock (Solenoild interlock monitoring)
- Innovating and unique operating principle
- Accurate adjustment through slotted holes
- Power to lock principle
- Solenoid interlock must be used as end stop.
- Automatic latching with variable adjustment
- Latching force through permanent magnet approx. 30 N, also in de-energised condition
- Sensor technology permits an offset between actuator and interlock of ± 5 mm vertically and ± 3 mm horizontally
- Intelligent diagnostic signalling of failures
- 3 LEDs to show the operating status
- Series-wiring of max. 31 components, without detriment to the category
- AS-Interface Safety at Work available

**Technical data**

- **Standards:** IEC 60947-5-3, ISO 13849-1, IEC 61508
- **Enclosure:** glass-fibre reinforced thermoplastic, self-extinguishing
- **Mechanical life:** ≥ 1 million operations (for guards ≤ 5 kg; actuating speed ≤ 0.5 m/s)
- **Electrically adjustable latching force (RE):** 30 N ... 100 N
- **Permanent magnet (M):** 30 N
- **Holding force F typically:** 750 N
- **Holding force F guaranteed:** 500 N
- **Protection class:** IP65 / IP67
- **Protection class:** II, III
- **Overvoltage category:** III
- **Degree of pollution:** 3
- **Connection:** connector M12 or M23
- **Series-wiring:** max. 31 components
- **Cable length:** max. 200 m

**Ambient conditions:**
- **Ambient temperature:** -25 °C ... +55 °C
- **Storage and transport temperature:** -25 °C ... +85 °C
- **Relative humidity:** 30% ... 95%, non-condensing, no icing
- **Resistance to vibration:** (0.35 mm/5 g)
- **Resistance to shock:** 10 ... 150 Hz
- **Switching frequency f:** 1 Hz
- **Response time:** < 150 ms
- **Duration of risk:** < 150 ms
- **Time to readiness:** < 4 s

**Electrical data:**
- **Rated operating voltage Ue:** 24 VDC
- **Operating current:** max. 0.6 A plus current through the safety outputs
- **Rated operating current Ue:** 1 A
- **Rated impulse withstand voltage Uimp:** 800 V
- **Rated insulation voltage Ur:** 32 VDC
- **Device insulation:** ≤ 2 A to UL 508; depending on the number of components and loads (Y1, Y2 and OUT)

**Diagnosis output OUT:**
- **Voltage range – 3V ... 5V:** Low
- **Voltage range 15V ... 30V:** High, typically 4 mA at 24 V

**Solenoid control IN:**
- **Voltage range – 3V ... 5V:** Low
- **Voltage range 15V ... 30V:** High, typically 10 mA at 24 V, dynamically 20 mA

**Standards:**
- **Classification:** Standard: ISO 13849-1, IEC 61508
- **PL:** e
- **Category:** 4
- **PFH:** 3.5 x 10^-9 / h
- **SIL:** suitable for SIL 3 applications
- **Mission time:** 20 years

**Diagnostic function** refer to page 71

### Ordering details

**MZM 100 ①-②-③-④-A**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>ST</td>
<td>Connector M23, (8+1)-pole M12, 8-pole 1 diagnostic output and 2 safety outputs, all p-type with combined diagnostic signal: safety guard closed and magnetic interlock locked</td>
</tr>
<tr>
<td>②</td>
<td>ST2</td>
<td>Serial diagnostic output and 2 safety outputs, p-type</td>
</tr>
<tr>
<td>③</td>
<td>1P2PW</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>SD2P</td>
<td></td>
</tr>
</tbody>
</table>

**Connection**

- **Integrated connectors** M23, (8+1)-pole (Suffix: -ST)
- **Actuators and accessories** refer to page 67
- **Wiring and connectors** refer to page 110
- **Wiring diagrams** refer to page 70

**Technical data**

- **Safet inputs X1 and X2:**
  - **Voltage range – 3V ... 5V:** Low
  - **Voltage range 15V ... 30V:** High
- **Safety outputs Y1 and Y2:** p-type, short-circuit proof
- **Ue1:** 24 V
- **Ie1:** 0.25 A
- **Voltage drop:** < 1 V
- **Utilisation category:** DC-13
- ** Leakage current Ic:** ≤ 0.5 mA
- **Diagnostic output OUT:** p-type, short-circuit proof
- **Ue2:** 0 V up to 4 V under Ue
- **Ie2:** max. 0.05 A
- **Utilisation category:** DC-13
- **Wiring capacitance for serial diagnostic:** max. 50 nF
- **Solenoid control IN:**
  - **Voltage range – 3V ... 5V:** Low
  - **Voltage range 15V ... 30V:** High, typically 10 mA at 24 V, dynamically 20 mA
  - **Solenoid:** 100% ED

**LED functions**
- **Green:** Supply voltage on
- **Yellow:** Operating status
- **Red:** Error

**Classification**
- **Red:** 61508

- **Diagnostic function** refer to page 71
Electronic solenoid interlock and safety switch MZM 100 (B)

**MZM 100 B**

### Technical data

- **Standards:** IEC 60947-5-3, ISO 13849-1, IEC 61508
- **Enclosure:** glass-fibre reinforced thermoplastic, self-extinguishing
- **Mechanical life:** ≥ 1 million operations (for guards ≤ 5 kg; actuating speed ≤ 0.5 m/s)
- **Electrically adjustable latching force (RE):** 30 N ... 100 N
- **Permanent magnet (M):** 30 N
- **Holding force F<sub>max</sub> typically:** 750 N
- **Holding force F guaranteed:** 500 N
- **Protection class:** IP65 / IP67
- **Protection class:** II, III
- **Overvoltage category:** III
- **Degree of pollution:** 3
- **Connection:** connector M12 or M23
- **Switching distances to IEC 60947-5-3:**
  - assured switching distance s<sub>sw</sub>: 0 mm
  - assured switch-off distance s<sub>so</sub>: 1 mm
- **Series-wiring:** max. 31 components
- **Cable length:** max. 200 m
  - (Cable length and cable section after the voltage drop depending on the output current)
- **Ambient conditions:**
  - Ambient temperature: −25 °C ... +55 °C
  - Storage and transport temperature: −25 °C ... +85 °C
  - Relative humidity: 30% ... 95%, non-condensing, no icing
  - Resistance to vibration: 10...150 Hz (0.35 mm/5 g)
  - Resistance to shock: 30 g / 11 ms
  - Switching frequency f: 1 Hz
  - Response time: < 150 ms
  - Duration of risk: < 150 ms
  - Time to readiness: < 4 s
- **Electrical data:**
  - Rated operating voltage U<sub>e</sub>: 24 VDC
  - −15% / +10% (stabilised PELV)
  - Operating current: max. 0.6 A plus current through the safety outputs
  - Rated operating current I<sub>e1</sub>: 0.25 A
  - Rated impulse withstand voltage U<sub>imp</sub>: 800 V
  - Rated insulation voltage U<sub>i</sub>: 32 VDC
  - Device insulation: ≤ 2 A to UL 508; depending on the number of components and loads (Y1, Y2 and OUT)

### Ordering details

**MZM 100 B**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>ST</td>
<td>Connector M23, (8+1)-pole connector M12, 8-pole 1 diagnostic output and 2 safety outputs, all p-type with combined diagnostic signal: safety guard closed and can be locked</td>
</tr>
<tr>
<td>②</td>
<td>ST2</td>
<td>Connector M23, (8+1)-pole connector M12, 8-pole 1 diagnostic output and 2 safety outputs, all p-type with combined diagnostic signal: safety guard closed and can be locked</td>
</tr>
<tr>
<td>③</td>
<td>1P2PW2</td>
<td>Serial diagnostic output and 2 safety outputs, p-type</td>
</tr>
<tr>
<td>④</td>
<td>SD2P</td>
<td>Permanent magnet approx. 30 N</td>
</tr>
<tr>
<td>⑤</td>
<td>M</td>
<td></td>
</tr>
</tbody>
</table>

**Technical data**

- **Safety inputs X1 and X2:**
  - Voltage range: 3V ... 6V: Low
  - Voltage range: 15V ... 30V: High, typically 4 mA at 24 V
- **Safety outputs Y1 and Y2:**
  - p-type, short-circuit proof
  - Leakage current I<sub>L</sub>: max. 0.05 A
  - Utilisation category: DC-13
- **Diagnostic output OUT:**
  - p-type, short-circuit proof
  - Leakage current I<sub>L</sub>: max. 0.05 A
  - Utilisation category: DC-13
- **Wiring capacitance for serial diagnostic:** max. 50 nF
- **Solenoid control IN:**
  - Voltage range: 3V ... 5V: Low
  - Voltage range: 15V ... 30V: High, typically 10 mA at 24 V, dynamically 20 mA
- **Solenoid:** 100% ED

**LED functions**

- **Green:** Supply voltage on
- **Yellow:** Operating status
- **Red:** Error

**Classification**

- **Standards:** ISO 13849-1, IEC 61508
- **PL:** e
- **Category:** 4
- **PFH:** 3.5 x 10<sup>9</sup> / h
- **SIL:** suitable for SIL 3 applications
- **Mission time:** 20 years

The latching force of the MZM 100 B can be set in steps of approx. 10 N each within a range of approx. 30 N (factory setting) to approx. 100 N. To this end, the adjustment target MZM 100 TARGET is used directly on the fitted MZM 100 B.

### Approvals

- CE

### Ordering details

The safety sensor with interlocking function, the actuating unit and the adjustment target must be ordered separately.

The wiring examples of the MZM 100 B are identical to those of the MZM 100 series (refer to page 70).

Diagnostic tables refer to page 73.

### Connection

- **Integrated connectors**
  - M23, (8+1)-pole (Suffix -ST)
  - M12, 8-pole (Suffix -ST2)

Actuators and accessories refer to page 67

Wiring and connectors refer to page 110

Wiring diagrams refer to page 70

Diagnostic function refer to page 71
Electronic solenoid interlock and safety switch MZM 100 (B)

Safety monitoring module
Interlocks with power to lock principle may only be used in special cases after a thorough evaluation of the accident risk, since the guarding device can immediately be opened on failure of the electrical power supply or when the main switch is opened.

Diagnostic
Depending on the component variant, the following diagnostic signals are transmitted:

MZM 100 ..-1P2PW variant:
OUT Combined diagnostic signal:
safety guard closed and
magnetic interlock locked

MZM 100 B ..-1P2PW2 variant:
OUT Combined diagnostic signal:
safety guard closed and
can be locked

Operating principle of the diagnostic output
The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC.

The diagnostic output is not a safety-relevant output.

Serial diagnostic
Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-.... and in the instructions for the integration of the SD-Gateway.

Misalignment

<table>
<thead>
<tr>
<th>Misalignment</th>
</tr>
</thead>
</table>
| Misalignment

±5mm

±3mm
Electronic solenoid interlock and safety switch MZM 100 (B)

<table>
<thead>
<tr>
<th>System components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting kit MS MZM 100-W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MZM 100-B1.1</th>
<th>MZM 100 TARGET</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="Image 1" /></td>
<td><img src="#" alt="Image 2" /></td>
</tr>
</tbody>
</table>

• The magnetic interlocks and the actuator unit must be ordered separately.
• Actuator free from play, i.e. neutralisation of undesired noises

• Adjustment target for variable adjustment of the latching force of the MZM 100
• Gradually adjustable by steps of approx. 10 N each within the range from approx. 30 N to 100 N
• The adjustment target must be ordered separately

**Ordering details**

<table>
<thead>
<tr>
<th>Actuator</th>
<th>Adjustment target</th>
<th>Mounting kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MZM 100-B1.1</td>
<td>MZM 100 TARGET</td>
<td>MS MZM 100-W</td>
</tr>
</tbody>
</table>

(screws included in delivery)

Approvals only in combination with switches MZM 100
Electronic solenoid interlock and safety switch MZM 100 (B)

Series-wiring of the MZM 100 (B) with conventional diagnostic output

Y1 and Y2 = Safety outputs → Safety controller
The voltage is supplied to both safety inputs of the last safety switchgear of the chain (considered from the safety-monitoring module). The safety outputs of the first safety switchgear are connected to the safety-monitoring module.

Series-wiring of the MZM 100 (B) with serial diagnostic function

Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus
The safety outputs of the first safety switchgear are connected to the safety-monitoring module. The serial Diagnostic Gateway is connected to the serial diagnostic input of the first safety switchgear.
Electronic solenoid interlock and safety switch MZM 100 (B)

Diagnostic of the MZM 100 solenoid interlock with diagnostic output

The operating condition of the solenoid interlock as well as possible failures and faults are signalled by means of three-colour LEDs, installed to the front of the device.

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

If a failure or failure warning is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>Flash codes (red)</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
<td>Cross-wire between the output cables or error at both outputs. After 30 min., voltage must be switched on/off</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Actuator (target) error</td>
<td>0 min</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Holding force error</td>
<td>0 min</td>
<td>The required holding force &gt; 500 N is not obtained (misalignment/soiling).</td>
</tr>
<tr>
<td>10 flash pulses</td>
<td>Magnet temperature too high</td>
<td>0 min</td>
<td>The magnet is too hot: T &gt; 70 °C</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
<td>–</td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC.

The diagnostic output is not a safety-relevant output.

Depending on the component variant, the following diagnostic signals are transmitted:

OUT Combined diagnostic signal: safety guard closed and solenoid interlock locked

Failure

Failures, which no longer guarantee the proper functioning of the MZM 100 solenoid interlock (internal failures), will result in the deactivation of the safety outputs for as long as the risk persists. Failures, which do not immediately affect the safety function of the MZM 100 solenoid interlock (cross-wire, temperature error, shortcircuit + 24 VDC at safety output), will result in a delayed switch-off (refer to table).

After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard. When the safety guard is relocked, the safety outputs are enabled.

Failure warning

A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

<table>
<thead>
<tr>
<th>System condition</th>
<th>Solenoid control IN</th>
<th>LED green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Diagnostic output OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator in</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Flashes</td>
<td>0 V/24 V</td>
</tr>
<tr>
<td>Safety guard closed and locked</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Safety guard closed, holding force too low</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Failure warning1), safety guard locked</td>
<td>24 V</td>
<td>On</td>
<td>Flashes 2)</td>
<td>On</td>
<td>24 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Failure</td>
<td>0 V/24 V</td>
<td>On</td>
<td>Flashes 2)</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Unauthorized violent separation of solenoid interlock and actuator</td>
<td>24 V</td>
<td>On</td>
<td>Flashes 2)</td>
<td>Flashes 2)</td>
<td>0 V</td>
<td>0 V</td>
</tr>
</tbody>
</table>

1) after 30 minutes -> failure
2) refer to flash codes
Electronic solenoid interlock and safety switch MZM 100 (B)

Diagnostic of the MZM 100 solenoid interlock with serial diagnostic function

Magnetic interlocks with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If solenoid interlocks are daisy-chained, the diagnostic input an output data are transmitted through this series-wiring.

Max. 31 solenoid interlocks can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The operational information of the request and response bytes is automatically and permanently written in an input byte of the PLC for each solenoid interlock in the series wired chain. The request data for each magnetic interlock are transmitted to the component through an output byte of the PLC.

In case of a communication error between the fieldbus gateway and the solenoid interlock, the switching condition of the solenoid interlock is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened.

Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

Diagnostic failure (warning)
If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

I/O data and diagnostic data
Communication directions:
- Request byte: from the PLC to the local electronic safety switchgear
- Response byte: from the local electronic safety switchgear to the PLC
- Warning/failure byte: from the local electronic safety switchgear to the PLC

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Request byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0</td>
<td>Magnet in, failure reset</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1</td>
<td>Latching force bit</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2</td>
<td>Latching force bit</td>
<td>Solenoid interlock locked</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3</td>
<td>Latching force bit</td>
<td>---</td>
<td>Magnet temperature too high</td>
<td>Magnet temperature too high</td>
</tr>
<tr>
<td>Bit 4</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>Locking blocked or F &lt; 500 N</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>Bit 5</td>
<td>---</td>
<td>---</td>
<td>Internal error</td>
<td>Internal error</td>
</tr>
<tr>
<td>Bit 6</td>
<td>---</td>
<td>Failure warning</td>
<td>Communication error between fieldbus gateway and solenoid interlock</td>
<td>Unauthorised violent separation of solenoid interlock and actuator</td>
</tr>
<tr>
<td>Bit 7</td>
<td>Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>Operating voltage too low</td>
<td>Operating voltage too low</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Functional example of the diagnostic LEDs, the serial status signals and the safety outputs

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDs green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs</th>
<th>Response byte Bit n°</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Y1, Y2</td>
<td>0 V</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Safety guard closed, actuator present</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>0 V</td>
<td>0 V</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Safety guard closed and locked</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>0 V</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Solenoid interlock cannot be locked. Safety guard not correctly closed or magnet soiled</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>0 V</td>
<td>0 V</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Failure warning 1), safety guard locked &amp;</td>
<td>On</td>
<td>Flashes</td>
<td>On</td>
<td>24 V</td>
<td>0 V</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Failure</td>
<td>On</td>
<td>Flashes</td>
<td>Off</td>
<td>0 V</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>X</td>
<td>0</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

1) after 30 minutes -> failure
2) refer to flash codes
Electronic solenoid interlock and safety switch MZM 100 (B)

**Diagnostic of the MZM 100 B safety switch with diagnostic output**

The operating condition of the solenoid interlock as well as possible failures and faults are signalled by means of three-colour LEDs, installed to the front of the device.

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. If a failure or failure warning is detected, the red LED will be activated.

If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>Flash codes (red)</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning)</td>
<td></td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning)</td>
<td></td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning)</td>
<td></td>
<td>Cross-wire between the output cables or error at both outputs. After 30 min., voltage must be switched on/off.</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Actuator (target) error</td>
<td></td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Holding force error</td>
<td></td>
<td>The required holding force &gt; 500 N is not obtained (misalignment/soiling).</td>
</tr>
<tr>
<td>10 flash pulses</td>
<td>Magnet temperature too high</td>
<td></td>
<td>The magnet is too hot; T &gt; 70 °C</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal Fault</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Operating principle of the diagnostic output**

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. (refer to table)

The diagnostic output is not a safety-relevant output.

**Failure**

Failures, which no longer guarantee the proper functioning of the safety switch (internal failures), will result in the deactivation of the safety outputs for as long as the risk persists. Failures, which do not immediately affect the safety function of the safety switch (cross-wire, temperature error, short-circuit + 24 VDC at safety output), will result in a delayed switch-off (refer to table).

After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard. When the safety guard is relocked, the safety outputs are enabled.

**Failure warning**

A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

**The diagnostic function of the MZM 100 B safety switch with additional interlocking function**

<table>
<thead>
<tr>
<th>System condition</th>
<th>Solenoid control IN</th>
<th>LED green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Diagnostic output OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator in</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Safety guard closed and locked</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Solenoid interlock cannot</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>be locked. Safety guard not</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>correctly closed or magnet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>soiled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure warning1), actuator in</td>
<td>0 V/24 V</td>
<td>On</td>
<td>Flashes2)</td>
<td>Flashes/ On</td>
<td>24 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Failure</td>
<td>0 V/24 V</td>
<td>On</td>
<td>Flashes2)</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
</tbody>
</table>

1) s. refer to flash codes
2) after 30 minutes -> failure
Electronic solenoid interlock and safety switch MZM 100 (B)

Diagnostic of the MZM 100 B safety switch with serial diagnostic function

Safety switches with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If safety switches are daisy-chained, the diagnostic input an output data are transmitted through this series-wiring.

Max. 31 safety switches can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The operational information of the request and response bytes is automatically and permanently written in an input byte of the PLC for each safety switch in the series-wired chain. The request data for each safety switch are transmitted to the component through an output byte of the PLC.

In case of a communication error between the fieldbus gateway and the safety switch, the switching condition of the safety switch is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened.

Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

Diagnostic failure (warning)
If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

<table>
<thead>
<tr>
<th>Bit n°.</th>
<th>Request byte</th>
<th>Request byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>Magnet in, failure reset</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>Latching force bit</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>Latching force bit</td>
<td>Solenoid interlock locked</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>Latching force bit</td>
<td>---</td>
<td>Magnet temperature too high</td>
<td>Magnet temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>Locking blocked or F &lt; 500 N</td>
<td>Actuator error, coding error</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>---</td>
<td>---</td>
<td>Internal error</td>
<td>Internal error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>---</td>
<td>Failure warning</td>
<td>Communication error between fieldbus gateway and safety switch</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>Operating voltage too low</td>
<td>Operating voltage too low</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Functional example of the diagnostic LEDs, the serial status signals and the safety outputs

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDs red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Response byte Bit n°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>On</td>
<td>Off</td>
<td>0 V</td>
<td>0 0 0 X 0 0 0 0</td>
</tr>
<tr>
<td>Safety guard closed, actuator present</td>
<td>Off</td>
<td>Off</td>
<td>24 V</td>
<td>0 0 0 1 0 0 1 0</td>
</tr>
<tr>
<td>Safety guard closed and locked</td>
<td>Off</td>
<td>Off</td>
<td>24 V</td>
<td>0 0 0 1 0 1 1 1</td>
</tr>
<tr>
<td>Solenoid interlock cannot be locked. Safety guard not correctly closed or magnet soiled</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 0 0 1 0 0 0 0</td>
</tr>
<tr>
<td>Failure warning¹, actuator present</td>
<td>On</td>
<td>Flash2</td>
<td>24 V</td>
<td>0 1 0 1 0 X 1 1</td>
</tr>
<tr>
<td>Failure</td>
<td>On</td>
<td>Flash2</td>
<td>0 V</td>
<td>1 0 0 X 0 X 0</td>
</tr>
</tbody>
</table>

¹) after 30 minutes -> failure
²) refer to flash codes
Electronic solenoid interlock AZM 300 and safety switch with separate actuator AZ 300

Actuation advantages
- Symmetrical mounting for right- and left-hinged doors
- Only one version for hinged and sliding doors
- Can be used as end stop
- Individually coded version with Coding level „High“ according to ISO 14119
- With manual release, emergency exit or emergency release

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Up to 31 safety sensors can be wired in series, self-monitoring in PL e / category 4 to ISO 13849-1
- Integrated cross-wire, wire breakage and external voltage monitoring of the safety cable up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
**Electronic solenoid interlock and safety switch AZ/AZM 300**

**Technical data**

- **Standards:** IEC 60947-5-1, IEC 60947-5-3, ISO 14119, ISO 13849-1, IEC 61508, IEC 62061
- **Enclosure:** glass-fibre reinforced thermoplastic, self-extinguishing
- **Operating principle:** RFID
- **Coding level according to ISO 14119:** - II-level: high, - I2-level: high
- **Standard coding version:** low
- **Series-wiring:** Unlimited number of components, please observe external cable protection, max. 31 components in case of serial diagnostics
- **Length of the sensor chain:** max. 200 m
- **Response time:** ≤ 100 ms
- **Duration of risk:** ≤ 200 ms
- **Time to readiness:** ≤ 5 s
- **Actuator:** AZ/AZM 300-B1
- **Switching distances:**
  - Typical switching distance 6n: 2 mm
  - Assured switching distance \( d_{as} \): 1 mm
  - Assured switch-off distance \( d_{ao} \): 20 mm
- **Mechanical data:**
  - Connection: Connector plug M12, 8-pole, A-coded
  - Mechanical life: ≥ 1,000,000 operations
  - when used as end stop: ≥ 50,000 operations for safety guards ≤ 5 kg and actuating speed ≤ 0.5 m/s
  - Angular misalignment between solenoid interlock and actuator: ≤ 2°
  - Fixing screws: 2x M6
  - Max. tightening torque: 25 N / 50 N
  - Holding force F: 1,000 N
- **Ambient conditions:**
  - Temperature: 0°C ... +60°C
  - Storage and transport temp.: −10°C ... +90°C
  - Protection class: IP66, IP67, IP69 to IEC 60529
  - Resistance to vibration: 30 g / 11 ms
  - Resistance to shock: 10 ... 150 Hz, amplitude 0.35 mm

**Technical data**

- **Insulation values to IEC 60664-1:**
  - Rated impulse withstand voltage \( U_{imp} \): 32 VDC
  - Rated supply voltage \( U_{sup} \): 0.8 kV
  - - Over-voltage category: III
  - - Degree of pollution: 3
- **Operating voltage \( U_{Op} \):** 24 VDC -15% / +10% (stabilised PELV unit)
- **Switching frequency:** 0.5 Hz
- **Power consumption without load:** 0.1 A
- **Power consumption with solenoid enabled:** 0.25 A
- **Magnet switch-on time ED:** 100 %
- **Required rated short-circuit current:** 100 A
- **External device fuse rating:** 2 A (T)

**Electrical data - Safety outputs**

- **Safety inputs:** X1 and X2
- **Switching thresholds:** ~ 3 V ... 5 V (Low), 15 V ... 30 V (High)
- **Power consumption:** ≤ 5 mA / 24 V

**Electrical data - Diagnostic output**

- **Diagnostic output:** OUT
- **Switching elements:** p-type, short-circuit proof
- **Utilisation category:** DC-12, DC-13
- **Rated operating voltage \( U_{op} \):** 0 V ... 4 V under supply voltage UB
- **Rated operating current \( I_{op} \):** 0.25 A
- **Residual current \( I_{r} \):** ≤ 0.5 mA
- **Test impulse width:** ≤ 50 ms
- **Test frequency:** 1 Hz

**Electrical data - Diagnostic output**

- **Diagnostic output:** OUT
- **Switching elements:** p-type, short-circuit proof
- **Utilisation category:** DC-12, DC-13
- **Rated operating voltage \( U_{op} \):** 0 V ... 4 V under supply voltage UB
- **Rated operating current \( I_{op} \):** 0.05 A

**Approval**

- **TUV**
- **ECOLAB**
- **CE**

**Ordering details**

- **AZM300-1-2-ST-3-4-5-6**
- **No.** | **Option** | **Description**
- ① | Z | Solenoid interlock monitored
- ② | B | Actuator monitored
- ③ | I1 | Standard coding
- ④ | I2 | Individual coding
- ⑤ | 1P2P | 1 p-type diagnostic output and 2 p-type safety outputs
- ⑥ | SD2P | Serial diagnostic output and 2 p-type safety outputs
- ⑦ | A | Power to lock
- ⑧ | N | Manual release
- ⑨ | T | Emergency release
- ⑩ | T8 | Emergency exit, distance 8.5 mm

**Ordering details**

- **No.** | **Option** | **Description**
- ① | A | Power to lock
- ② | N | Manual release
- ③ | T | Emergency exit
- ④ | T8 | Emergency exit, distance 8.5 mm

**Note**

The solenoid interlock and the actuator unit must be ordered separately.

---

**Approvals**

- **TUV**
- **ECOLAB**
- **CE**

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**Graphical representation of the device**

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**Additional information**

- Symmetrical mounting for right- and left-hinged doors
- Only one version for hinged and sliding doors
- Can be used as end stop
- Three actuating directions
- High tolerance to door misalignment
- Holding force 1,000 N
- Switchable latching force (25 N / 50 N)
- PL e / SIL 3
- Series-wiring without reduction of the safety level
- More than 30,000 different codings
- Serial diagnostic
- Low power consumption
- Power to lock or power to unlock
- Actuator or solenoid interlock monitoring
- Hygiene-compliant design
- Protection class IP69
- Actuator or solenoid interlock monitoring
- Power to lock or power to unlock
- Low power consumption
- Serial diagnostic
- Assurance switch-off distance \( s_{as} \): 2 mm
- Assured switch-off distance \( s_{ao} \): 20 mm
- Assured switching distance \( s_{as} \): 2 mm
- Assured switch-off distance \( s_{ao} \): 20 mm
- Mechanical life: ≥ 1,000,000 operations
- Holding force 1,000 N
- Angular misalignment between solenoid interlock and actuator: ≤ 2°
- Fixing screws: 2x M6
- Max. tightening torque: 25 N / 50 N
- Holding force F: 1,000 N
- Ambient temperature: 0°C ... +60°C
- Storage and transport temp.: −10°C ... +90°C
- Protection class: IP66, IP67, IP69 to IEC 60529
- Resistance to vibration: 30 g / 11 ms
- Resistance to shock: 10 ... 150 Hz, amplitude 0.35 mm

---

**Standards**

- IEC 60947-5-1, IEC 60947-5-3, ISO 14119, ISO 13849-1, IEC 61508, IEC 62061
- PL e / SIL 3
- Switchable latching force (25 N / 50 N)
- Holding force 1,000 N
- Angular misalignment between solenoid interlock and actuator: ≤ 2°
- Fixing screws: 2x M6
- Max. tightening torque: 25 N / 50 N
- Holding force F: 1,000 N
- Ambient temperature: 0°C ... +60°C
- Storage and transport temp.: −10°C ... +90°C
- Protection class: IP66, IP67, IP69 to IEC 60529
- Resistance to vibration: 30 g / 11 ms
- Resistance to shock: 10 ... 150 Hz, amplitude 0.35 mm

---

**Technical data**

- **Connection:** Connector plug M12, 8-pole, A-coded
- **Mechanical life:** ≥ 1,000,000 operations
- **When used as end stop:** ≥ 50,000 operations for safety guards ≤ 5 kg and actuating speed ≤ 0.5 m/s
- **Angular misalignment between solenoid interlock and actuator:** ≤ 2°
- **Max. lightening tor...
Electronic solenoid interlock and safety switch AZ/AZM 300

### Technical data

**Electrical data - Magnet control:**
- **IN**
- **Switching thresholds:**
  - Low: $-3 \text{ V} \ldots 5 \text{ V}$
  - High: $15 \text{ V} \ldots 30 \text{ V}$
- **Power consumption:**
  - $10 \text{ mA} / 24 \text{ V}$
- **Magnet switch-on time ED:**
  - $100 \%$

**LED status display:**
- **green LED:**
  - Supply voltage
- **yellow LED:**
  - Device condition
- **red LED:**
  - Internal device error

**Classification - of the interlocking function:**
- **Standards:**
  - ISO 13849-1, IEC 61508, IEC 62061
- **PL:**
  - e
- **Category:**
  - 4
- **PFH:**
  - $5,2 \times 10^{-10} / \text{ h}$
- **PFD:**
  - $4,5 \times 10^{-5}$
- **SIL:**
  - suitable for SIL 3 applications
- **Mission time:**
  - 20 years

**Classification - of the guard locking function:**
- **Standards:**
  - ISO 13849-1, IEC 61508, IEC 62061
- **PL:**
  - d
- **Category:**
  - 2
- **PFH:**
  - $2,0 \times 10^{-9} / \text{ h}$
- **PFD:**
  - $1,8 \times 10^{-4}$
- **SIL:**
  - suitable for SIL 2 applications
- **Mission time:**
  - 20 years

### System components

- **Actuator**
  - AZ/AZM300-B1
- **Mounting plate**
  - MP-AZ/AZM300-1
- **Lockout tag**
  - SZ 200-1
- **Connecting cables with female connector**
  - M12, 8-pole - 8 x 0,23 mm²
  - Cable length 2.5 m: 101209963
  - Cable length 5.0 m: 101209964
  - Cable length 10.0 m: 101209960
- **Connecting cables**
  - M12, 8-pole - 8 x 0,21 mm²
  - Cable length 5.0 m: 101210560
  - Cable length 5.0 m (angled): 101210561

### Mounting

- **Manual release**
- **With variants that have both emergency exit and emergency release, the red lever is loosely supplied. The lever should be fastened to the position intended with the supplied screws before first being used.**

### Note

- **Wiring and connectors**
  - refer to page 106
- **Wiring examples**
  - refer to page 76
- **Diagnostic functions**
  - refer to page 81

### Ordering details

- **Actuator**
  - AZ/AZM300-B1
- **Mounting plate**
  - MP-AZ/AZM300-1
- **Lockout tag**
  - SZ 200-1

### Diagnostic functions

- **Operating principle of the diagnostic output**
  - The short-circuit proof diagnostic output OUT can be used for central visualisation or control functions, e.g. in a PLC.

- **Serial diagnostic**
  - Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-OP-V0-2 and the Universal-Gateway SD-I-U-... and in the instructions for integration of the SD-Gateway.
Electronic solenoid interlock and safety switch AZ/AZM 300

Series-wiring of the AZ/AZM 300 with conventional diagnostic output

Y1 and Y2 = Safety outputs → Safety monitoring module
For AZ300: PIN 8 without function.
The voltage is supplied at both safety inputs of the terminal safety component of the chain (considered from the safety-monitoring module). The safety outputs of the first safety component are wired to the safety-monitoring module.

Series-wiring of the AZ/AZM 300 with serial diagnostic function

Y1 and Y2 = Safety outputs → Safety monitoring module
SD-IN → Gateway → Field bus
The safety outputs of the first safety component are wired to the safety-monitoring module. The serial Diagnostic Gateway is connected to the serial diagnostic input of the first safety component.
Electronic solenoid interlock and safety switch AZ/AZM 300

Series-wiring of the AZM 300 with conventional diagnostic output

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If an error is detected, the red LED will be activated. If a failure or failure warning is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>Flash codes (red)</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
<td>Cross-wire between the output cables or error at both outputs. After 30 min., voltage must be switched on/off</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>Error (warning) temperature too high</td>
<td>30 min</td>
<td>The temperature measurement reveals an internal temperature that is too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Actuator (target) error</td>
<td>0 min</td>
<td>Incorrect or defective actuator, bracket broken</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Error rotary handle</td>
<td>0 min</td>
<td>Rotary handle not in authorised intermediate position</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
<td></td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The diagnostic output is not a safety-relevant output.

Depending on the component variant, the following diagnostic signals are transmitted:

OUT Combined diagnostic signal: safety guard closed and solenoid interlock locked

Failure

Failures, which no longer guarantee the proper functioning of the MZM 100 solenoid interlock (internal failures), will result in the deactivation of the safety outputs for as long as the risk persists. Failures, which do not immediately affect the safety function of the MZM 100 solenoid interlock (cross-wire, temperature error, shortcircuit + 24 VDC at safety output), will result in a delayed switch-off (refer to table). After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard.

Failure warning

A failure has occurred, which will disable the safety outputs after 30 minutes (LED „Fault“ flashes, refer to table). The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

<table>
<thead>
<tr>
<th>System condition</th>
<th>Solenoid control IN</th>
<th>LED</th>
<th>Safety outputs Y1, Y2</th>
<th>Diagnostic output OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power to unlock</td>
<td>Power to lock</td>
<td>green</td>
<td>red</td>
</tr>
<tr>
<td>Safety guard open</td>
<td>24 V (0 V)</td>
<td>0 V (24 V)</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Door closed, not locked</td>
<td>24 V</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Door closed, locking impossible</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Door closed and locked</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Error warning 1)</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Flashes 2)</td>
</tr>
<tr>
<td>Error</td>
<td>0 V (24 V)</td>
<td>24 V (0 V)</td>
<td>On</td>
<td>Flashes 2)</td>
</tr>
<tr>
<td>Additionally for variant 1I/2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teach-in procedure actuator started</td>
<td></td>
<td></td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>Only 1I: teach-in procedure actuator (release block)</td>
<td></td>
<td></td>
<td>Flashes</td>
<td>Off</td>
</tr>
</tbody>
</table>

1) after 30 min: disabling due to fault
2) refer to flash codes
Electronic solenoid interlock and safety switch AZ/AZM 300

**Diagnostic of the AZM 300 solenoid interlock with serial diagnostic function**

Solenoid interlocks with serial diagnostic function have a serial input and output cable instead of the conventional diagnostic output. If solenoid interlocks are daisy-chained, the diagnostic input and output data are transmitted through this series-wiring.

Max. 31 solenoid interlocks can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The operational information of the response and diagnostic data is automatically and permanently written in an input byte of the PLC for each solenoid interlock in the series-wired chain. The request data for each solenoid interlock are transmitted to the component through an output byte of the PLC. In case of a communication error between the fieldbus gateway and the solenoid interlock, the switching condition of the solenoid interlock is maintained.

**Failure**

A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened. Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

**Failure warning**

A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

**Diagnostic failure (warning)**

If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>Magnet in, independent of power-to-lock or power-to-unlock principle</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>---</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>---</td>
<td>Actuator detected and locked</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>---</td>
<td>---</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>Incorrect or defective actuator, bracket broken</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>---</td>
<td>Coding recognised</td>
<td>Internal device error</td>
<td>Internal device error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>---</td>
<td>Error warning ¹</td>
<td>Communication error between fieldbus gateway and solenoid interlock</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Error reset</td>
<td>Error (enabling path switched off)</td>
<td>Rotary handle not in authorised intermediate position</td>
<td>Rotary handle not in authorised intermediate position</td>
</tr>
</tbody>
</table>

¹ after 30 min -> fault

The described condition is obtained, when bit = 1
**Electronic solenoid interlock and safety switch AZ/AZM 300**

**Technical data**

- **Standards:** IEC 60947-5-1, IEC 60947-5-3, ISO 14119, ISO 13849-1, IEC 61508, IEC 62061
- **Enclosure:** glass-fibre-reinforced thermoplastic, self-extinguishing
- **Operating principle:** RFID
- **Coding level according to ISO 14119:**
  - I1-version: high
  - I2-version: high
  - Standard coding version: low
- **Series-wiring:** Unlimited number of components, please observe external cable protection, max. 31 components in case of serial diagnostics
- **Length of the sensor chain:** max. 200 m
- **Response time:** ≤ 100 ms
- **Duration of risk:** ≤ 200 ms
- **Time to readiness:** ≤ 5 s
- **Actuator:** AZ/AZM 300-B1
- **Switching distances**
  - Typical switching distance s1: 2 mm
  - Assured switching distance sa: 1 mm
  - Assured switch-off distance sar: 20 mm
- **Mechanical data**
  - **Connection:** Connector plug M12, 8-pole, A-coded
  - **Mechanical life:** ≥ 1,000,000 operations
    - when used as door stop: ≥ 50,000 operations for safety guards ≤ 5 kg and actuating speed ≤ 0.5 m/s
  - **Angular misalignment between solenoid interlock and actuator:** ≤ 2°
  - **Fixing screws:** 2x M6
  - **Max. tightening torque:** 1.8 Nm
  - **Latching force:** 25 N / 50 N
  - **Ambient conditions**
    - **Ambient temperature:** 0°C ... +60°C
    - **Storage and transport temp.:** −10°C ... +90°C
  - **Protection class:** IP66, IP67, IP69
  - **Protection class:** II
  - **Resistance to shock:** 30 g / 11 ms
  - **Resistance to vibration:** 10 ... 150 Hz, amplitude 0.35 mm

**Electrical data**

- **Operating voltage U0:** 24 VDC -15% / +10% (stabilised PELV unit)
- **Switching frequency:** 0.5 Hz
- **Power consumption without load:** 0.1 A
- **Required rated short-circuit current:** 100 A
- **External device fuse rating:** 2 A (T)
- **Switching thresholds:** ~ 3 V ... 5 V (Low), 15 V ... 30 V (High)
- **Power consumption:** ≤ 5 mA / 24 V
- **Safety outputs:** Y1 and Y2
- **Utilisation category:** DC-12, DC-13
- **Rated operating current Io:** 0.25 A
- **Residual current I0:** ≤ 0.5 mA
- **Test impulse width:** < 0.5 ms
- **Test frequency:** 1 Hz

**Classification**

- **Standards:** ISO 13849-1, IEC 61508, IEC 62061
- **PL:** e
- **Category:** 4
- **PFH:** 5.2 x 10^-10 / h
- **SIL:** suitable for SIL 3 applications
- **Mission time:** 20 years

**Mechanical data**

- **Connection:** Connector plug M12, 8-pole, A-coded
- **Mechanical life:** ≥ 1,000,000 operations
    - when used as door stop: ≥ 50,000 operations for safety guards ≤ 5 kg and actuating speed ≤ 0.5 m/s
- **Angular misalignment between solenoid interlock and actuator:** ≤ 2°
- **Fixing screws:** 2x M6
- **Max. tightening torque:** 1.8 Nm
- **Latching force:** 25 N / 50 N
- **Ambient temperature:** 0°C ... +60°C
- **Storage and transport temp.:** −10°C ... +90°C
- **Protection class:** IP66, IP67, IP69
- **Protection class:** II
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- **Power consumption:** ≤ 5 mA / 24 V
- **Safety outputs:** Y1 and Y2
- **Utilisation category:** DC-12, DC-13
- **Rated operating voltage U0:** 0 V ... 4 V under supply voltage UB
- **Rated operating current Io:** 0.25 A
- **Residual current I0:** ≤ 0.5 mA
- **Test impulse width:** < 0.5 ms
- **Test frequency:** 1 Hz

**Technical data - Diagnostic output**

- **Diagnostic output:** OUT
- **Utilisation category:** DC-12, DC-13
- **Rated operating voltage U0:** 0 V ... 4 V under supply voltage UB
- **Rated operating current Io:** 0.05 A
- **green LED:** Supply voltage
- **yellow LED:** Device condition
- **red LED:** Internal device error

**Classification**

- **Standards:** ISO 13849-1, IEC 61508, IEC 62061
- **PL:** e
- **Category:** 4
- **PFH:** 5.2 x 10^-10 / h
- **SIL:** suitable for SIL 3 applications
- **Mission time:** 20 years

**Mechanical data**

- **Connection:** Connector plug M12, 8-pole, A-coded
- **Mechanical life:** ≥ 1,000,000 operations
    - when used as door stop: ≥ 50,000 operations for safety guards ≤ 5 kg and actuating speed ≤ 0.5 m/s
- **Angular misalignment between solenoid interlock and actuator:** ≤ 2°
- **Fixing screws:** 2x M6
- **Max. tightening torque:** 1.8 Nm
- **Latching force:** 25 N / 50 N
- **Ambient temperature:** 0°C ... +60°C
- **Storage and transport temp.:** −10°C ... +90°C
- **Protection class:** IP66, IP67, IP69
- **Protection class:** II
- **Resistance to shock:** 30 g / 11 ms
- **Resistance to vibration:** 10 ... 150 Hz, amplitude 0.35 mm

**Insulation values to IEC 60664-1:**

- **Rated insulation voltage Ui:** 32 VDC
- **Rated impulse withstand voltage Uimp:** 0.8 kV
- **Over-voltage category:** III
- **Degree of pollution:** 3

**Note**

The safety switch and the actuator unit must be ordered separately.
Electronic solenoid interlock and safety switch AZ/AZM 300

System components

<table>
<thead>
<tr>
<th>Component</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator</td>
<td>AZ/AZM300-B1</td>
</tr>
<tr>
<td>Mounting plate</td>
<td>MP-AZ/AZM300-1</td>
</tr>
<tr>
<td>Lockout tag</td>
<td>SZ 200-1</td>
</tr>
<tr>
<td>Connecting cables</td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic

Operating principle of the diagnostic output
The short-circuit proof diagnostic output OUT can be used for central visualisation or control functions, e.g. in a PLC.

The diagnostic output is not a safety-related output.

Serial diagnostic
Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DP-V0-2 and the Universal-Gateway SD-I-U-…. and in the instructions for integration of the SD-Gateway.

Ordering details

<table>
<thead>
<tr>
<th>Component</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator</td>
<td>AZ/AZM300-B1</td>
</tr>
<tr>
<td>Mounting plate</td>
<td>MP-AZ/AZM300-1</td>
</tr>
<tr>
<td>Lockout tag</td>
<td>SZ 200-1</td>
</tr>
<tr>
<td>Connecting cables with female connector M12, 8-pole - 8 x 0.23 mm²</td>
<td></td>
</tr>
<tr>
<td>Cable length 2.5 m</td>
<td>101209963</td>
</tr>
<tr>
<td>Cable length 5.0 m</td>
<td>101209964</td>
</tr>
<tr>
<td>Cable length 10.0 m</td>
<td>101209960</td>
</tr>
<tr>
<td>Connecting cables with female connector M12, 8-pole - 8 x 0.21 mm²</td>
<td></td>
</tr>
<tr>
<td>Cable length 5.0 m</td>
<td>101210560</td>
</tr>
<tr>
<td>Cable length 5.0 m (angled)</td>
<td>101210561</td>
</tr>
</tbody>
</table>
Electronic solenoid interlock and safety switch AZ/AZM 300

Series-wiring of the AZ 300 with conventional diagnostic output

The safety switch signals the operational state as well as errors through three coloured LEDs installed on the device.

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If an error is detected, the red LED will be activated. If a failure or failure warning is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>Flash code(s)</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
<td>Cross-wire between the output cables or error at both outputs. After 30 min., voltage must be switched on/off</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>Error (warning) temperature too high</td>
<td>30 min</td>
<td>The temperature measurement reveals an internal temperature that is too high</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Actuator (target) error</td>
<td>0 min</td>
<td>Incorrect or defective actuator, bracket broken</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Error rotary handle</td>
<td>0 min</td>
<td>Rotary handle not in authorised intermediate position</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
<td></td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The diagnostic output is not a safety-relevant output.

Depending on the component variant, the following diagnostic signals are transmitted:

OUT Combined diagnostic signal: safety guard closed and solenoid interlock locked

Failure

Failures, which no longer guarantee the proper functioning of the MZM 100 solenoid interlock (internal failures), will result in the deactivation of the safety outputs for as long as the risk persists. Failures, which do not immediately affect the safety function of the MZM 100 solenoid interlock (cross-wire, temperature error, shortcircuit + 24 VDC at safety output), will result in a delayed switch-off (refer to table). After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard.

Failure warning

A failure has occurred, which will disable the safety outputs after 30 minutes (LED „Fault“ flashes, refer to table). The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

<table>
<thead>
<tr>
<th>System condition</th>
<th>LED green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Diagnostic output OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Error warning 1)</td>
<td>On</td>
<td>Flashes 2)</td>
<td>Off</td>
<td>24 V 1)</td>
<td>0 V</td>
</tr>
<tr>
<td>Error</td>
<td>On</td>
<td>Flashes 2)</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
</tbody>
</table>

Additionally for variant 11/12:

| Teach-in procedure actuator started | Off | On | Flashes | 0 V | 0 V |
| Only 12: teach-in procedure actuator (release block) | Flashes | Off | Off | 0 V | 0 V |

1) after 30 min: disabling due to fault
2) refer to flash codes
Electronic solenoid interlock and safety switch AZ/AZM 300

Diagnostic of the AZ 300 with serial diagnostic function

Safety switches with serial diagnostic cable have a serial input and output cable instead of the conventional diagnostic output. If safety switches are wired in series, the diagnostic data is transmitted through the series-wiring of the inputs and outputs.

Max. 31 safety switches can be wired in series. For the evaluation of the serial diagnostics line either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal-Gateway SD-I-U-… are used. This serial diagnostic interface is integrated as a slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The response data and the diagnostic data are automatically and permanently written in an input byte of the PLC for each safety switch in the series-wired chain. The request data for each safety switch is transmitted to the component through an output byte of the PLC. In case of a communication error between the field bus gateway and the safety switch, the switching condition of the safety switch is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened.

Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

Diagnostic failure (warning)
If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>---</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>---</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>---</td>
<td>---</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>---</td>
<td>---</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>Incorrect or defective actuator, bracket broken</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>---</td>
<td>Coding recognised</td>
<td>Internal device error</td>
<td>Internal device error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>---</td>
<td>Error warning ¹</td>
<td>Communication error between the field bus Gateway and the safety switchgear</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Error reset</td>
<td>Error (enabling path switched off)</td>
<td>Rotary handle not in authorised intermediate position</td>
<td>Rotary handle not in authorised intermediate position</td>
</tr>
</tbody>
</table>

¹ after 30 min -> fault

The described condition is obtained, when bit = 1
Electronic solenoid interlock AZM 200 and safety switch AZ 200 with separate actuator

Actuation advantages
- Integrated door detection sensor
- Sensor technology permits an offset of ± 5 mm between actuator and interlock
- 3 LEDs to show the operating status
- Accurate adjustment through slotted holes

Wiring advantages
- 2 short-circuit proof, p-type safety outputs (24 VDC per 250 mA)
- Self-monitored series-wiring of max. 31 sensors in PL e / category 4 to ISO 13849-1
- Integral cross-wire, wire breakage and external voltage monitoring of the safety cables up to the control cabinet

Diagnostic advantages
- Detailed status information through LED and diagnostic output
- Optionally serial diagnostic cables for series-wiring
- Increased availability by pre-signalling of failures during machine operation, e.g. sagging of a safety guard
## Electronic solenoid interlock and safety switch AZ/AZM 200

### AZM 200

![Image of AZM 200](image)

**Solenoid interlock**
- (Solenoid interlock monitoring)
  - Thermoplastic enclosure
  - Sensor technology permits an offset of ± 5 mm between actuator and interlock
  - Intelligent diagnostic
  - Accurate adjustment through slotted holes
  - 3 LEDs to show the operating status (refer to table)
  - Manual release
  - 2 safety outputs, 1 diagnostic output
  - Latching force 30 N
  - Available with AS-Interface Safety at Work

- Available with AS-Interface Safety at Work
- Latching force 30 N
- Protection class: IP67 to IEC 60529
- Overvoltage category: III
- Degree of pollution: 3
- Connection: screw terminals or cage clamps or connector M12 or M23
- Cable section: max. 0.25 mm²
- Thermoplastic enclosure (Solenoid interlock monitoring)
- Sensor technology permits an offset of ± 5 mm between actuator and interlock
- Intelligent diagnostic
- Accurate adjustment through slotted holes
- 3 LEDs to show the operating status (refer to table)
- Manual release
- 2 safety outputs, 1 diagnostic output
- Latching force 30 N
- Available with AS-Interface Safety at Work

**Approvals**

![TÜV](image)

**Technical data**

- **Standards:**
  - IEC 60947-5-1, ISO 14119, ISO 13849-1, IEC 61508, IEC 60947-5-3
- **Enclosure:**
  - glass-fibre reinforced thermoplastic, self-extinguishing
- **Mechanical life:** ≥ 1 million operations
- **Latching force:** 2000 N
- **Protection class:** IP67 to IEC 60529
- **Overvoltage category:** III
- **Degree of pollution:** 3
- **Connection:** screw terminals or cage clamps or connector M12 or M23
- **Cable section:** max. 1.5 mm² (incl. conductor ferrules)
- **Cable entry:** M20
- **Series-wiring:** max. 31 components
- **Cable length:** max. 200m
- **Ambient conditions:**
  - Ambient temperature: -25 °C ... +60 °C
  - Storage and transport temperature: -25 °C ... +85 °C
  - Relative humidity: 30% ... 95%, non-condensing
  - Resistance to vibration: 10...55 Hz, amplitude 1mm
  - Resistance to shock: 30 g / 11 ms
  - Switching frequency f: 1 Hz
  - Response time: < 60 ms
  - Duration of risk: ≤ 120 s
  - Time to readiness: ≤ 4 s
  - Acting speed: ≤ 0.2 m/s
- **Electrical data:**
  - Rated operating voltage U_e:
    - 24 VDC
    - ≤ 15% / +10% (stabilised PELV)
  - Rated operating current I_e:
    - 1.2 A
  - No-load current I_0:
    - max. 0.5 A
  - Rated impulse withstand voltage U_imp:
    - 800 V
  - Rated insulation voltage U_i:
    - 32 VDC
  - Fuse rating:
    - ≤ 4 A when used with UL 508,
    - ≤ 2 A
- **Fuses:**
  - Typically 10 mA at 24 V, typically 2 mA at 24 V
  - Typically 10 mA at 24 V, typically 2 mA at 24 V

**Technical data**

- **Safety inputs X1 and X2:**
  - U_x ≤ 24 V
  - U_x,typ ≥ 24 V
  - U_x,typ: typically 0.5 mA
- **Safety outputs Y1 and Y2:**
  - p-type, short-circuit proof
  - U_y: 0 V up to 4 V under U_y
  - I_y: max. 0.25 A
  - Utilisation category: DC-13
- **Diagnostic output OUT:**
  - p-type, short-circuit proof
  - U_o: 0 V up to 4 V under U_o
  - I_o: max. 0.05 A
  - Utilisation category: DC-13
- **Wiring capacitance for serial diagnostic:**
  - max. 50 nF
  - Solenoid control IN:
  - U_{in},typ: -3 V ... 5 V
  - U_{in},typ: 15 V ... 30 V
  - I_{in}: typically 10 mA at 24 V, typically 2 mA at 24 V
  - Solenoid: 100% ED

**LED functions:**
- Supply voltage on
- Operating status
- Error (refer to flash codes)

**Classification**
- of the interlocking function:
  - Standards: ISO 13849-1, IEC 61508
  - PL: e
  - Category: 4
  - PFH: 4.0 x 10^-9 / h
  - SIL: suitable for SIL 3 applications
  - Mission time: 20 years
- of the guard locking function:
  - Standards: ISO 13849-1, IEC 61508, IEC 60947-5-3
  - PL: d
  - Category: 2
  - PFH: 2.5 x 10^-9 / h
  - SIL: suitable for SIL 2 applications
  - Mission time: 20 years

**Ordering details**

<table>
<thead>
<tr>
<th>AZM 200</th>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK</td>
<td>1</td>
<td></td>
<td>Screw terminals</td>
</tr>
<tr>
<td>CC</td>
<td>2</td>
<td></td>
<td>Cage clamps</td>
</tr>
<tr>
<td>ST1</td>
<td>3</td>
<td></td>
<td>Connector M23, (8+1)-pole</td>
</tr>
<tr>
<td>ST2</td>
<td>4</td>
<td></td>
<td>Connector M12, 8-pole</td>
</tr>
<tr>
<td>1P2PW</td>
<td>5</td>
<td></td>
<td>1 diagnostic output and 2 safety outputs, all p-type and combined diagnostic signal: safety guard closed</td>
</tr>
<tr>
<td>SD2P</td>
<td>6</td>
<td></td>
<td>AND solenoid interlock locked</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td></td>
<td>Power to unlock</td>
</tr>
</tbody>
</table>

**Note**

The solenoid interlocks and the actuator unit must be ordered separately.

As long as the actuator unit is inserted in the solenoid interlock, the unlocked safety guard can be relocked. In this case, the safety outputs are re-enabled; **opening the safety guard is not required**.

**Actuators and accessories** refer to page 104

**Connection**

- Integrated connectors
  - M23, (8+1)-pole
    - (Suffix -ST1)
  - M12, 8-pole
    - (Suffix -ST2)

**Wiring and connectors** refer to page 110

---

[Image of AZM 200](image)
Electronic solenoid interlock and safety switch AZ/AZM 200

AZM 200 B

Technical data

Standards:
- IEC 60947-5-1, ISO 14119,
- ISO 13849-1, IEC 61508, IEC 60947-5-3

Enclosure:
glass-fibre reinforced thermoplastic, self-extinguishing

Mechanical life:
≥ 1 million operations

Fmax:
2000 N

Latching force:
30 N

Protection class:
IP67 to IEC 60529

Protection class:
II, III

Overvoltage category:
III

Degree of pollution:
3

Connection:
screw terminals or cage clamps or connector M12 or M23

Cable section:
min. 0.25 mm² max. 1.5 mm²
(incl. conductor ferrules)

Cable entry:
M20

Series-wiring:
max. 31 components

Ambient temperature:
−25 °C ... +60 °C

Storage and transport:
−25 °C ... +85 °C

Relative humidity:
30% ... 95%, non-condensing

Resistance to vibration:
10 ... 55 Hz, amplitude 1mm

Resistance to shock:
30 g / 11 ms

Switching frequency f:
1 Hz

Response time:
< 60 ms

Duration of risk:
< 120 ms

Time to readiness:
< 4 s

Actuating speed:
≤ 0.2 m/s

Electrical data:
Rated operating voltage Ue:
24 VDC

−15% / +10% (stabilised PELV)

Rated operating current Ie:
1.2 A

No-load current I0:
max. 0.5 A

Rated impulse withstand voltage Uimp:
800 V

Rated insulation voltage Ui:
32 VDC

Fuse rating:
- Screw terminals or cage clamps: ≤ 4 A
- when used to UL 508;
- Connector M12 or M23: ≤ 2 A

Connection

Integrated connectors
M23, (8+1)-pole
Suffix -ST1

M12, 8-pole
Suffix -ST2

Note
The safety switch with interlocking function and the actuator must be ordered separately.

Actuators and accessories refer to page 104

Wiring and connectors refer to page 110

SAFETY SWITCH WITH INTERLOCKING FUNCTION (ACTUATOR MONITORING)

- Thermostatic enclosure
- Sensor technology permits an offset of ± 5 mm between actuator and interlock
- Intelligent diagnostic
- Accurate adjustment through slotted holes
- 3 LEDs to show the operating status (refer to table)
- Manual release
- 2 safety outputs, 1 diagnostic output
- Latching force 30 N
- Available with AS-Interface Safety at Work

- Suitable for applications (without additional second switch)
  - up to PL e/category 4 to ISO 13849-1
  - suitable for SIL 3 applications to IEC 61508

- Series-wiring of max. 31 components, without detriment to the category

Approvals

TUV

Ordering details

AZM 200 B ①-T-②③

No. | Option | Description
--- | --- | ---
① | SK | Screw terminals
CC | Cage clamps
ST1 | Connector M23, (8+1)-pole
ST2 | Connector M12, 8-pole
② | 1P2PW | 1 diagnostic output and 2 safety outputs, all p-type and combined diagnostic signal: safety guard closed AND solenoid interlock locked
SD2P | Serial diagnostic output and 2 safety outputs, p-type
③ | A | Power to unlock

Note

The safety switch with interlocking function and the actuator must be ordered separately.

Actuators and accessories refer to page 104

Wiring and connectors refer to page 110

Connection

Integrated connectors
M23, (8+1)-pole
Suffix -ST1

M12, 8-pole
Suffix -ST2

Technical data

Safety inputs X1 and X2:
Ue: −3 V ... 5 V
Ie: typically 2 mA at 24 V

Safety outputs Y1 and Y2:
p-type, short-circuit proof
Ue: 0 V up to 4 V under Ue
Ie: max. 0.25 A

Utilisation category:
DC-13

Leakage current Ie:
≤ 0.5 mA

Diagnostic output OUT:
p-type, short-circuit proof
Ue: 0 V up to 4 V under Ue
Ie: max. 0.05 A

Utilisation category:
DC-13

Wiring capacitance for serial diagnostic:
max. 50 nF

Solenoid control IN:
Ue: −3 V ... 5 V
Ie: typically 10 mA at 24 V, dynamically 20 mA

Solenoid:
100% ED

LED functions:
Green
Supply voltage on
Yellow
Operating status
Red
Error (refer to flash codes)

Classification:
Standards:
ISO 13849-1; IEC 61508
PL:
e
Category:
4
PFH:
4.0 x 10⁻⁹ /h
SIL:
suitable for SIL 3 applications

Mission time:
20 years
Electronic solenoid interlock and safety switch AZ/AZM 200

MS-AZM 200…-2568

Solenoid interlock with button and LED
(Solenoid interlock monitoring)
• Thermoplastic enclosure
• Sensor technology permits an offset of ±5 mm between actuator and interlock
• Intelligent diagnostic
• Accurate adjustment through slotted holes
• 3 LEDs to show the operating status (refer to table)
• Manual release
• 2 safety outputs, 1 diagnostic output
• Latching force 30 N
• Connector M23, 12-pole

• Suitable for applications
(without additional second switch)
- up to PL e/category 4 to ISO 13849-1
- suitable for SIL 3 applications to IEC 61508
• Series-wiring of max. 31 components, without detrimental to the category

Technical data

Standards:
- IEC 60947-5-1,
  ISO 14119, ISO 13849-1,
  IEC 61508, IEC 60947-5-3
Enclosure:
glass-fibre reinforced
thermoplastic, self-extinguishing
Mechanical life: ≥ 1 million operations
Fmax: 2000 N
Latching force: 30 N
Protection class:
- IP65 to IEC 60529
- IP65, 24 VDC
- LED: IP65, white, 24 VDC
Protection class: III
Overvoltage category: III
Degree of pollution: 3
Connection: connector M23, 12-pole
Series-wiring: max. 31 components
Cable length: max. 200 m

Ambient conditions:
Ambient temperature:
- Power to unlock: −25 °C … +60 °C
- Power to lock: −25 °C … +50 °C
Storage and transport temperature:
−25 °C … +85 °C
Relative humidity:
30% … 95%, non-condensing
Resistance to vibration:
10…55 Hz, amplitude 1 mm
Resistance to shock:
30 g / 11 ms
Switching frequency f:
1 Hz
Response time:
< 60 ms
Duration of risk:
< 120 ms
Time to readiness:
< 4 s
Actuating speed:
≤ 0.2 m/s
Electrical data:
Rated operating voltage Ue:
24 VDC
−15% / +10% (stabilised PELV)
Rated operating current Ie:
1.2 A
No-load current Ile:
max. 0.5 A
Rated impulse withstand voltage Uimp:
900 V
Rated insulation voltage Ue:
32 VDC
Fuse rating:
≤ 4 A

Approvals

Ordering details

MS-AZM 200ST-T-1P2PW-(E)-2568

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>A</td>
<td>Power to unlock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power to lock</td>
</tr>
</tbody>
</table>

Note

The solenoid interlocks and the actuator unit must be ordered separately.

As long as the actuator unit is inserted in the solenoid interlock, the unlocked safety guard can be relocked. In this case, the safety outputs are re-enabled; opening the safety guard is not required.

Actuators and accessories refer to page 104

Wiring and connectors refer to page 110

Ordering details

- Integrated connectors
  M23, 12-pole
  Connector plug M23, 12-pole, 5 m 101208520

- Accessories
  - of the interlocking function:
  - of the guard locking function:

Technical data

Safety inputs X1 and X2:
Ue3/High: 15 V … 30 V
Ie3: 2 mA at 24 V
Saftey outputs Y1 and Y2:
Ue4/Low: −3 V … 5 V
Ie4: typically 10 mA at 24 V
Solenoid control IN:
Ue4/HIGH: −3 V … 5 V
Ie4: max. 0.05 A

Diagnostic output OUT:
Ue4/LOW: −3 V … 5 V
Ie4: max. 50 mA

Solenoid interlock with button and LED
(Solenoid interlock monitoring)
• Thermoplastic enclosure
• Sensor technology permits an offset of ±5 mm between actuator and interlock
• Intelligent diagnostic
• Accurate adjustment through slotted holes
• 3 LEDs to show the operating status (refer to table)
• Manual release
• 2 safety outputs, 1 diagnostic output
• Latching force 30 N
• Connector M23, 12-pole

• Suitable for applications
(without additional second switch)
- up to PL e/category 4 to ISO 13849-1
- suitable for SIL 3 applications to IEC 61508
• Series-wiring of max. 31 components, without detrimental to the category

Technical data

Standards:
- IEC 60947-5-1,
  ISO 14119, ISO 13849-1,
  IEC 61508, IEC 60947-5-3
Enclosure:
glass-fibre reinforced
thermoplastic, self-extinguishing
Mechanical life: ≥ 1 million operations
Fmax: 2000 N
Latching force: 30 N
Protection class:
- IP65 to IEC 60529
- IP65, 24 VDC
- LED: IP65, white, 24 VDC
Protection class: III
Overvoltage category: III
Degree of pollution: 3
Connection: connector M23, 12-pole
Series-wiring: max. 31 components
Cable length: max. 200 m

Ambient conditions:
Ambient temperature:
- Power to unlock: −25 °C … +60 °C
- Power to lock: −25 °C … +50 °C
Storage and transport temperature:
−25 °C … +85 °C
Relative humidity:
30% … 95%, non-condensing
Resistance to vibration:
10…55 Hz, amplitude 1 mm
Resistance to shock:
30 g / 11 ms
Switching frequency f:
1 Hz
Response time:
< 60 ms
Duration of risk:
< 120 ms
Time to readiness:
< 4 s
Actuating speed:
≤ 0.2 m/s
Electrical data:
Rated operating voltage Ue:
24 VDC
−15% / +10% (stabilised PELV)
Rated operating current Ie:
1.2 A
No-load current Ile:
max. 0.5 A
Rated impulse withstand voltage Uimp:
900 V
Rated insulation voltage Ue:
32 VDC
Fuse rating:
≤ 4 A

Approvals

Ordering details

MS-AZM 200ST-T-1P2PW-(E)-2568

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>A</td>
<td>Power to unlock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power to lock</td>
</tr>
</tbody>
</table>

Note

The solenoid interlocks and the actuator unit must be ordered separately.

As long as the actuator unit is inserted in the solenoid interlock, the unlocked safety guard can be relocked. In this case, the safety outputs are re-enabled; opening the safety guard is not required.

Actuators and accessories refer to page 104

Wiring and connectors refer to page 110

Ordering details

- Integrated connectors
  M23, 12-pole
  Connector plug M23, 12-pole, 5 m 101208520

- Accessories
  - of the interlocking function:
  - of the guard locking function:
Electronic solenoid interlock and safety switch AZ/AZM 200

<table>
<thead>
<tr>
<th>Safety monitoring module</th>
<th>Diagnostic</th>
<th>Serial diagnostic</th>
</tr>
</thead>
</table>
| Interlocks with power to lock principle may only be used in special cases after a thorough evaluation of the accident risk, since the guarding device can immediately be opened on failure of the electrical power supply or when the main switch is opened. | Depending on the component variant, the following diagnostic signals are transmitted:  
1P2PW-Variant: OUT  Combined diagnostic signal: safety guard closed and solenoid interlock locked | Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-.... and in the instructions for the integration of the SD-Gateway. |

**Operating principle of the diagnostic output**

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC.

The diagnostic output is not a safety-relevant output.

**Note**

For manual release the triangular key is included in delivery.
Electronic solenoid interlock and safety switch AZ/AZM 200

Series-wiring of the AZM 200 (B) with conventional diagnostic output

Y1 and Y2 = Safety outputs → Safety controller

The voltage is supplied to both safety inputs of the last safety switchgear of the chain (considered from the safety-monitoring module).
The safety outputs of the first safety switchgear are connected to the safety-monitoring module.

Series-wiring of the AZM 200 (B) with serial diagnostic function

Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus

The safety outputs of the first safety switchgear are connected to the safety-monitoring module.
The serial Diagnostic Gateway is connected to the serial diagnostic input of the first safety switchgear.
Humanity first and foremost
Safety Consulting

For detailed information, check out
www.schmersal.com
Electronic solenoid interlock and safety switch AZ/AZM 200

Diagnostic of the AZM 200 (B) solenoid interlock with diagnostic output

The operating condition of the solenoid interlock as well as possible failures and faults are signalled by means of three-colour LEDs, installed to the front of the device.

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>Flash codes (red)</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
<td>Cross-wire between the output cables or error at both outputs</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>Failure (warning) ambient temperature too high</td>
<td>30 min</td>
<td>Temperature measurement indicates too high an inner temperature</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Error target</td>
<td>0 min</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Error target combination</td>
<td>0 min</td>
<td>An invalid combination of targets was detected (Latch breakage or tampering attempt)</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
<td></td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The diagnostic output is not a safety-relevant output.

Depending on the component variant, the following diagnostic signals are transmitted:

- **OUT** Combined diagnostic signal: safety guard closed and solenoid interlock locked

Failure

Failures, which no longer guarantee the proper functioning of the AZM 200 solenoid interlock (internal failures), will result in a deactivation of the safety outputs. Failures, which do not immediately affect the safety function of the AZM 200 solenoid interlock (cross-wire, temperature error, short-circuit + 24 VDC at safety output), will result in a delayed switch-off (see table). After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard. The safety outputs are enabled and allow a restart of the machine.

A locking chain must be permanently locked to enable the restart.

Failure warning

A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset in the slave when the failure cause is eliminated.

<table>
<thead>
<tr>
<th>System condition</th>
<th>Solenoid control IN</th>
<th>LED</th>
<th>Safety outputs</th>
<th>Diagnostic output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Power-to-unlock</td>
<td>Power-to-lock</td>
<td>yellow</td>
<td>AZM 200...</td>
</tr>
<tr>
<td>Safety guard open</td>
<td>24 V (0 V)</td>
<td>0 V (24 V)</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Safety guard closed, actuator not inserted</td>
<td>24 V</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted, not locked</td>
<td>24 V</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted, locking impossible</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted and locked</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted and locked</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>Failure warning1), Solenoid interlock locked</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Flashes2)</td>
</tr>
<tr>
<td>Failure</td>
<td>0 V (24 V)</td>
<td>24 V (0 V)</td>
<td>On</td>
<td>Flashes2)</td>
</tr>
</tbody>
</table>

1) after 30 minutes -> failure
2) refer to flash codes

---

**Flash codes (red)**

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>Failure (warning) ambient temperature too high</td>
<td>30 min</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Error target</td>
<td>0 min</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Error target combination</td>
<td>0 min</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
</tr>
</tbody>
</table>
Electronic solenoid interlock and safety switch AZ/AZM 200

Diagnostic of the AZM 200 (B) solenoid interlock with serial diagnostic function

Solenoid interlocks with serial diagnostic function have a serial input and output cable instead of the conventional diagnostic output. If solenoid interlocks are daisy-chained, the diagnostic input an output data are transmitted through this series-wiring.

Max. 31 solenoid interlocks can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The operational information of the response and diagnostic data is automatically and permanently written in an input byte of the PLC for each solenoid interlock in the series-wired chain. The request data for each solenoid interlock are transmitted to the component through an output byte of the PLC.

In case of a communication error between the fieldbus gateway and the solenoid interlock, the switching condition of the solenoid interlock is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened.

Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

Diagnostic failure (warning)
If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>Magnet in, independent of power-to-lock or power-to-unlock principle</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>---</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>---</td>
<td>Actuator detected and locked</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>---</td>
<td>---</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>---</td>
<td>Safety guard detected</td>
<td>Internal error</td>
<td>Internal error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>---</td>
<td>Failure warning</td>
<td>Communication error between fieldbus gateway and solenoid interlock</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>Operating voltage too low</td>
<td>---</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1

Functional example of the diagnostic LEDs, the serial status signals and the safety outputs

<table>
<thead>
<tr>
<th>System condition</th>
<th>LEDs green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Response byte Bit n°.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage on, safety guard open</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 0 0 X 0 0 0 0 0</td>
</tr>
<tr>
<td>Safety guard closed, actuator present</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>0 V</td>
<td>0 0 0 X 0 0 1 0</td>
</tr>
<tr>
<td>Safety guard closed and locked</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V</td>
<td>0 0 0 1 0 1 1 1 1</td>
</tr>
<tr>
<td>Failure warning 1), safety guard locked</td>
<td>On</td>
<td>Flashes</td>
<td>On</td>
<td>24 V</td>
<td>0 0 0 1 0 1 0 1 1 1</td>
</tr>
<tr>
<td>Failure</td>
<td>On</td>
<td>Flashes</td>
<td>Off</td>
<td>0 V</td>
<td>1 0 0 X 0 X X 0</td>
</tr>
</tbody>
</table>

1) after 30 minutes -> Failure
Electronic solenoid interlock and safety switch AZ/AZM 200

** AZM 200 D **

- Latching force 30 N
- Holding force 2000 N
- Manual release
- 3 LEDs to show the operating status
- Accurate adjustment through slotted holes

Suitable for applications
- Safety guard monitoring
- Guard lock monitoring

** Approvals **

** Ordering details **

<table>
<thead>
<tr>
<th>AZM 200 D</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK</td>
<td>Screw terminals</td>
</tr>
<tr>
<td>CC</td>
<td>Cage clamps</td>
</tr>
<tr>
<td>ST1</td>
<td>Connector M23, (8+1)-pole</td>
</tr>
<tr>
<td>ST2</td>
<td>Connector M12, 8-pole</td>
</tr>
<tr>
<td>ST3</td>
<td>Connector M23, 12-pole</td>
</tr>
</tbody>
</table>

- Power to unlock
- Power to lock
- With button and LED, only for ST3

** Note **

As long as the actuator unit is inserted in the solenoid interlock, the unlocked safety guard can be relocked. In this case, the safety outputs are re-enabled; opening the safety guard is not required.

The solenoid interlocks and the actuator unit must be ordered separately.

Wiring and connectors refer to page 110

** Connection **

Integrated connectors
- M23, (8+1)-pole
  - (Suffix -ST1)
- M12, 8-pole
  - (Suffix -ST2)

- Solenoid control IN:
  - Ue4/Low: 0 V up to 4 V under Ue
  - Ue4/High: max. per 0,25 A

- Solenoid interlocks with:
  - Connector M12 or M23:
    - Ue4/Low: 0 V up to 4 V under Ue
    - Ue4/High: max. 0,1 A
  - - LED: IP67, white, 24 VDC

- Overvoltage category: III
- Battery: typically 2 mA at 24 V

- Safety outputs Y1 ... Y4:
  - Y1 and Y2: p-type, short-circuit proof
  - Y3 and Y4: max. 0,1 A

- Utilisation category: DC-13
  - IY3 + IY4 + IOUT ≤ 0,1 A

- Solenoid control IN:
  - Ue4/Low: 0 V up to 4 V under Ue
  - Ue4/High: max. per 0,25 A

LED functions:
- Green: Supply voltage on
- Yellow: Operating status
- Red: Error

- Rated impulse withstand voltage Uimp: 0,8 kV
- Rated insulation voltage Ue: 32 VDC
- Assured switch-off distance sar: ≤ 2 A

Technical data:

- Standards: IEC 60947-5-1, ISO 13849-1, IEC 61508, IEC 60947-5-3
- Enclosure: glass-fibre reinforced thermoplastic, self-extinguishing
- Mechanical life: ≥ 1 million operations
- Latching force: 2000 N
- Response time: < 60 ms
- Duration of risk: < 120 ms
- Time to readiness: < 4 s
- Actuating speed: ≤ 0,2 m/s
- Protection class: IP67 to IEC 60529
- - Button: IP65, 24 VDC
  - - LED: IP65, white, 24 VDC

- Overvoltage category: III
- Degree of pollution: 2
- Connection: screw terminals
- - Connector M12 or M23:
  - Cable section alter the voltage drop
  - min. 0,25 mm²
  - max. 1,5 mm²
  - (incl. conductor ferrules)
  - M20
  - max. 200m
  - (Cable length and cable section alter the voltage drop depending on the output current)

- Switching distances to IEC 60947-5-3:
  - Assured switching distance sαu: 14 mm
  - Assured switch-off distance sαr: 22 mm

Ambient conditions:
- Ambient temperature: −25 °C ... +60 °C
- Storage and transport temperature: −25 °C ... +85 °C
- Relative humidity: 30% ... 95%, non-condensing
- Resistance to vibration: 10...55 Hz, amplitude 1mm
- Resistance to shock: 30 g / 11 ms
- Actuating speed: typically 10 mA at 24 V
- ±5% between actuator and interlock

Electrical data:
- Rated operating voltage Ue: 24 VDC
- Ie3: ≤ 0,5 A
- Ie4: ≤ 0,1 A

- Safety inputs X1 and X2:
  - Ue3/Low: 0 V up to 4 V under Ue
  - Ue3/High: typically 2 mA at 24 V

- Safety outputs Y1 ... Y4:
  - Diagnostic output OUT:
  - - Y3, Y4, OUT: IY3 + IY4 + IOUT ≤ 0,1 A

- Rated operating current Ie:
  - max. 0,5 A
  - max. 0,1 A

- Rated impulse withstand voltage Uimp: 0,8 kV
- Rated insulation voltage Ue: 32 VDC
- Assured switching distance sar: 22 mm
- Assured switch-off distance sar: 14 mm

Screw terminals or cage clamps or connector M12 or M23
- Suitability: ± 5 mm between actuator and interlock

- Suitable for applications
- (without additional second switch)
- Safety guard monitoring
- - PL e/category 4 to ISO 13849-1
- - suitable for SIL 3 applications to IEC 61508
- Guard lock monitoring
- - PL d/category 3 to ISO 13849-1
- - suitable for SIL 2 applications to IEC 61508

- Sensor technology permits an offset
- 2 safety outputs for door closed,
- 2 safety outputs for door locked

- Integrated connectors
  - M23, (8+1)-pole
  - (Suffix -ST1)
- M12, 8-pole
  - (Suffix -ST2)

- Connector M23, (8+1)-pole
- (Suffix -ST1)
- M12, 8-pole
  - (Suffix -ST2)

- Connector M23, (8+1)-pole
- Integrated connectors
  - ST2
- Connector M12, 8-pole
  - Connector M23, 12-pole
  - ST3
  - only for -2568

- ST1
- Connector M23, (8+1)-pole

- Power to unlock
- Power to lock
- With button and LED, only for ST3

- With button and LED, only for ST3

- Sensor technology permits an offset
- 2 safety outputs for door closed,
- 2 safety outputs for door locked

- Integrated connectors
- ST2
- Connector M12, 8-pole
  - Connector M23, 12-pole
  - ST3
  - only for -2568

- ST1
- Connector M23, (8+1)-pole

- Power to unlock
- Power to lock
- With button and LED, only for ST3

- With button and LED, only for ST3

- Sensor technology permits an offset
- 2 safety outputs for door closed,
- 2 safety outputs for door locked

- Integrated connectors
- ST2
- Connector M12, 8-pole
  - Connector M23, 12-pole
  - ST3
  - only for -2568

- ST1
- Connector M23, (8+1)-pole

- Power to unlock
- Power to lock
- With button and LED, only for ST3

- With button and LED, only for ST3

- Sensor technology permits an offset
- 2 safety outputs for door closed,
- 2 safety outputs for door locked

- Integrated connectors
- ST2
- Connector M12, 8-pole
  - Connector M23, 12-pole
  - ST3
  - only for -2568

- ST1
- Connector M23, (8+1)-pole

- Power to unlock
- Power to lock
- With button and LED, only for ST3

- With button and LED, only for ST3

- Sensor technology permits an offset
- 2 safety outputs for door closed,
- 2 safety outputs for door locked

- Integrated connectors
- ST2
- Connector M12, 8-pole
  - Connector M23, 12-pole
  - ST3
  - only for -2568

- ST1
- Connector M23, (8+1)-pole

- Power to unlock
- Power to lock
- With button and LED, only for ST3

- With button and LED, only for ST3

- Sensor technology permits an offset
- 2 safety outputs for door closed,
Electronic solenoid interlock and safety switch AZ/AZM 200

Technical data

Classification:
- of the interlocking function:
  Standards: ISO 13849-1, IEC 61508, IEC 62061
  PL: e
  Category: 4
  PFH: $4 \times 10^{-9} / \text{h}$
  PFD: $1.0 \times 10^{-4}$
  SIL: suitable for SIL 3 applications
  Mission time: 20 years

- of the guard locking function:
  Standards: ISO 13849-1, IEC 61508, IEC 62061
  PL: d
  Category: 2
  PFH: $2.5 \times 10^{-9} / \text{h}$
  PFD: $2.2 \times 10^{-4}$
  SIL: suitable for SIL 2 applications
  Mission time: 20 years

Note

Enabling path 1 is represented by the safety outputs Y1/Y2 of the AZM 200 D. It switches when the actuator is detected for applications up to PL e / control category 4.

Enabling path 2 (Y3/Y4) enables both outputs, when the actuator is detected AND the locking target is detected AND the locking condition is detected.

Connection

Integrated connectors
M23, 12-pole,
(Suffix -ST3 only for -2568)

![Connector diagram]

Accessories:
Connector plug M23, 12-pole, 5 m 101208520

Note

Interlocks with power to lock principle may only be used in special cases after a thorough evaluation of the accident risk, since the guarding device can immediately be opened on failure of the electrical power supply or when the main switch is opened.
Electronic solenoid interlock and safety switch AZ/AZM 200

Diagnostic function of the AZM 200 D

The operating condition of the safety switch as well as possible failures and faults are signalled by means of three-colour LEDs, installed to the front of the device.

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

If a failure or failure warning is detected, the red LED will flash

<table>
<thead>
<tr>
<th>Flash codes (red)</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
<td>Cross-wire between the output cables or error at both outputs</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>Failure (warning) ambient temperature too high</td>
<td>30 min</td>
<td>Temperature measurement indicates too high an inner temperature</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Error target</td>
<td>0 min</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Error target combination</td>
<td>0 min</td>
<td>An invalid combination of targets was detected (Latch breakage or tampering attempt)</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
<td></td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The diagnostic output is not a safety-relevant output.

Depending on the component variant, the following diagnostic signals are transmitted:

OUT Combined diagnostic signal:safety guard closed and solenoid interlock locked

Failure

Failures, which no longer guarantee the proper functioning of the AZM 200 solenoid interlock (internal failures), will result in a deactivation of the safety outputs. Failures, which do not immediately affect the safety function of the AZM 200 solenoid interlock (cross-wire, temperature error, short-circuit + 24 VDC at safety output), will result in a delayed switch-off (see table). After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard. The safety outputs are enabled and allow a restart of the machine. A locking chain must be permanently locked to enable the restart.

Failure warning

A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset in the slave when the failure cause is eliminated.

<table>
<thead>
<tr>
<th>System condition</th>
<th>Solenoid control IN Power-to-unlock</th>
<th>Power-to-lock</th>
<th>LED green</th>
<th>red</th>
<th>yellow (Flashes 3 Hz)</th>
<th>Safety outputs Y1 Y2 Y3 Y4</th>
<th>Diagnostic output OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>24 V (0 V)</td>
<td>0 V (24 V)</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V 0 V 0 V 24 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator not inserted</td>
<td>24 V</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V 24 V 0 V 24 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted, not locked</td>
<td>24 V</td>
<td>0 V</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V 24 V 0 V 24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted, locking impossible</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
<td>Flashes</td>
<td>24 V 24 V 0 V 24 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted and locked</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V 24 V 24 V 0 V</td>
<td>24 V</td>
</tr>
<tr>
<td>Failure warning1), Solenoid interlock locked</td>
<td>0 V</td>
<td>24 V</td>
<td>On</td>
<td>Flashes</td>
<td>24 V 24 V 0 V 24 V</td>
<td>0 V</td>
<td></td>
</tr>
<tr>
<td>Failure</td>
<td>0 V (24 V)</td>
<td>24 V (0 V)</td>
<td>On</td>
<td>Flashes</td>
<td>0 V 0 V 24 V 0 V</td>
<td>0 V</td>
<td></td>
</tr>
</tbody>
</table>

1) after 30 minutes -> failure
2) refer to flash codes

Continuous red | Internal error | 0 min |

1) after 30 minutes -> failure
2) refer to flash codes
Up-to-date without fail.
The online product catalogue

For detailed information, check out
www.schmersal.net
Electronic solenoid interlock and safety switch AZ/AZM 200

### Technical data

**Standards:**
- IEC 60947-5-3, ISO 14119, ISO 13849-1, IEC 61508

**Enclosure:**
- Glass-fibre reinforced thermoplastic, self-extinguishing

**Mechanical life:**
- ≥ 1 million operations

**Holding force:**
- 30 N

**Overvoltage category:**
- III

**Degree of pollution:**
- III

**Connection:**
- Screw terminals or cage clamps or connector M12 or M23

**Cable section:**
- min. 0.25 mm², max. 1.5 mm² (incl. conductor ferrules)

**Cable entry:**
- M20

**Series-wiring:**
- max. 31 components

**Cable length:**
- max. 200m

**Switching distances to EN 60947-5-3:**
- Sn: 6.5 mm
- Sao: 4.0 mm
- Sar: 30 mm

**Hysteresis:**
- max. 1.5 mm

**Repeat accuracy:**
- < 0.5 mm

**Switching frequency f:**
- 1 Hz

**Ambient conditions:**
- Ambient temperature: -25 °C ... +70 °C
- Storage and transport temperature: -25 °C ... +85 °C
- Relative humidity: 30% ... 95%, non-condensing
- Resistance to vibration: 10 ... 55 Hz, amplitude 1 mm
- Resistance to shock: 30 g / 11 ms
- Switching frequency f: 1 Hz
- Response time: < 60 ms
- Duration of risk: < 120 ms
- Time to readiness: < 4 s
- Actuating speed: ≤ 0.2 m/s

**Protection class:**
- IP67 to IEC 60529

**Protection class:**
- II, X

**Overvoltage category:**
- III

**Degree of pollution:**
- 3

**Connection:**
- Screw terminals or cage clamps or connector M12 or M23

**Fuse rating:**
- - Screw terminals or cage clamps: ≤ 4 A when used to UL 508;
- - Connector M12 or M23: ≤ 2 A

**Rated impulse withstand voltage Uimp:**
- 800 V

**Rated insulation voltage Ui:**
- 32 VDC

**Fuse rating:**
- - Screw terminals or cage clamps: ≤ 4 A when used to UL 508;
- - Connector M12 or M23: ≤ 2 A

**Safety inputs X1 and X2:**
- only for -1P2P and -SD2P

**Ue3/Low:**
- − 3 V ... 5 V

**Ue3/High:**
- 15 V ... 30 V

**Ie3:**
- typically 2 mA at 24 V

**Safety outputs Y1 and Y2:**
- p-type, short-circuit proof

**Diagnostic output OUT:**
- p-type, short-circuit proof

**Wiring capacitance for serial diagnostic:**
- max. 50 nF

**LED functions:**
- Green: Supply voltage on
- Yellow: Operating status
- Red: Error (refer to flash codes)

**Classification:**
- Standards: ISO 13849-1; IEC 61508
- PL: e
- Category: 4
- PFH: 4.0 x 10⁻⁹ /h
- SIL: suitable for SIL 3 applications
- Mission time: 20 years

### Approvals

**TUV**

### Ordering details

<table>
<thead>
<tr>
<th>AZ 200</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀ SK</td>
<td>Screw terminals</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>Cage clamps</td>
<td></td>
</tr>
<tr>
<td>ST1</td>
<td>Connector M23, (8+1)-pole</td>
<td></td>
</tr>
<tr>
<td>ST2</td>
<td>Connector M12, 8-pole</td>
<td></td>
</tr>
<tr>
<td>➁ IP2P</td>
<td>1 diagnostic output and 2 safety outputs, p-type</td>
<td></td>
</tr>
<tr>
<td>SD2P</td>
<td>Serial diagnostic output and 2 safety outputs</td>
<td></td>
</tr>
</tbody>
</table>

### Note

The safety switch and the actuator must be ordered separately.

**Actuators and accessories** refer to page 104

**Wiring and connectors** refer to page 110

**Connector**

Integrated connector M23, (8+1)-pole (Suffix -ST1)

M12, 8-pole (Suffix -ST2)
## Electronic solenoid interlock and safety switch AZ/AZM 200

<table>
<thead>
<tr>
<th>Diagnostic</th>
<th>Serial diagnostic</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating principle of the diagnostic output</strong>&lt;br&gt;The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC.&lt;br&gt;The diagnostic output is not a safety-relevant output.</td>
<td><strong>Detailed information about the use of the serial diagnostics can be found in the operating instructions of the PROFIBUS-Gateway SD-I-DPV0-2 and the Universal-Gateway SD-I-U-.... and in the instructions for the integration of the SD-Gateway.</strong></td>
<td><strong>The wiring examples of the AZ 200 are identical to those of the AZM 200 series (refer to page 82).</strong>&lt;br&gt;<strong>Derogation:</strong> IN not assigned in the version with conventional diagnostic output.</td>
</tr>
</tbody>
</table>
Electronic solenoid interlock and safety switch AZ/AZM 200

Diagnostic of AZ 200 safety switch with diagnostic output

The operating condition of the safety switch as well as possible failures and faults are signalled by means of three-colour LEDs, installed to the front of the device.

The green LED indicates that the safety sensor is ready for operation. The supply voltage is on. If the actuator is near the limit of the sensor’s switching distance, the yellow LED will flash. The flashing can be used to prematurely detect variations in the clearance between the sensor and the actuator (e.g. sagging of a safety guard). The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine. If an error is detected, the red LED will be activated.

<table>
<thead>
<tr>
<th>Flash codes</th>
<th>Meaning</th>
<th>Autonomous switch-off after</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 flash pulse</td>
<td>Failure (warning) output Y1</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y1 although the output is switched off</td>
</tr>
<tr>
<td>2 flash pulses</td>
<td>Failure (warning) output Y2</td>
<td>30 min</td>
<td>Error in output test or voltage at output Y2 although the output is switched off</td>
</tr>
<tr>
<td>3 flash pulses</td>
<td>Failure (warning) cross-wire</td>
<td>30 min</td>
<td>Cross-wire between the output cables or error at both outputs</td>
</tr>
<tr>
<td>4 flash pulses</td>
<td>Failure (warning) ambient temperature too high</td>
<td>30 min</td>
<td>Temperature measurement indicates too high an inner temperature</td>
</tr>
<tr>
<td>5 flash pulses</td>
<td>Error target</td>
<td>0 min</td>
<td>Wrong or defective actuator</td>
</tr>
<tr>
<td>6 flash pulses</td>
<td>Error target combination</td>
<td>0 min</td>
<td>An invalid combination of targets was detected (Latch breakage or tampering attempt)</td>
</tr>
<tr>
<td>Continuous red</td>
<td>Internal error</td>
<td>0 min</td>
<td></td>
</tr>
</tbody>
</table>

Operating principle of the diagnostic output

The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. The diagnostic output is not a safety-relevant output.

Depending on the component variant, the following diagnostic signals are transmitted:

| OUT | Safety guard closed, actuator inserted and no failure detected |

Failure

Failures, which no longer guarantee the proper functioning of the AZ 200 safety switch (internal failures), will result in an immediate deactivation of the safety outputs. Failures, which do not immediately affect the safety function of the AZ 200 safety switch (cross-wire, temperature error, short-circuit + 24 VDC at safety output), will result in a delayed switch-off (refer to table). After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard. The safety outputs are enabled and allow a restart of the machine.

Failure warning

A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

The diagnostic function of the AZ 200 safety switch

<table>
<thead>
<tr>
<th>System condition</th>
<th>LED green</th>
<th>red</th>
<th>yellow</th>
<th>Safety outputs Y1, Y2</th>
<th>Diagnostic output OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety guard open</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator not inserted</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
<tr>
<td>Safety guard closed, actuator inserted</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>24 V (when X1 = X2 = 24 V)</td>
<td>24 V</td>
</tr>
<tr>
<td>Failure warning1), actuator inserted, switch-off approaching</td>
<td>On</td>
<td>Flashes2)</td>
<td>On</td>
<td>24 V (when X1 = X2 = 24 V)</td>
<td>0 V</td>
</tr>
<tr>
<td>Failure</td>
<td>On</td>
<td>Flashes</td>
<td>Off</td>
<td>0 V</td>
<td>0 V</td>
</tr>
</tbody>
</table>

1) after 30 minutes -> 0 V
2) refer to flash codes
Electronic solenoid interlock and safety switch AZ/AZM 200

Diagnostic of the AZ 200 safety switch with serial diagnostic function

Safety switch with serial diagnostic function
Safety switches with serial diagnostic function have a serial input and output cable instead of the conventional diagnostic output. If safety switches are daisy-chained (i.e. wired in series), the diagnostic input an output data are transmitted through this series-wiring.

Max. 31 safety switches can be wired in series. For the evaluation of the serial diagnostic cable, either the PROFIBUS-Gateway SD-I-DP-V0-2 or the Universal Gateway SD-I-U-... are used. This serial diagnostic interface is integrated as slave in an existing field bus system. In this way, the diagnostic signals can be evaluated by means of a PLC.

The operational information of the response data and the diagnostic data is automatically and permanently written in an input byte of the PLC for each safety switch in the series-wired chain. The request data for each safety switch are transmitted to the component through an output byte of the PLC.

In case of a communication error between the fieldbus gateway and the safety switch, the switching condition of the safety switch is maintained.

Failure
A failure has occurred, which resulted in the immediate deactivation of the safety outputs. The failure is reset when the failure cause is eliminated and bit 7 of the request byte changes from 1 to 0 or when the safety guard is opened.

Failures at the safety outputs will only be deleted upon the next release, as the neutralisation of the failure cannot be detected earlier.

Failure warning
A failure has occurred, which will disable the safety outputs after 30 minutes. The safety outputs initially remain enabled in order to enable a controlled shutdown of the process and set the machine safely to a hold position. A failure warning is reset when the failure cause is eliminated.

Diagnostic failure (warning)
If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

<table>
<thead>
<tr>
<th>Bit n°</th>
<th>Request byte</th>
<th>Response byte</th>
<th>Diagnostic Failure warning</th>
<th>Diagnostic Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 0:</td>
<td>---</td>
<td>Safety output enabled</td>
<td>Error output Y1</td>
<td>Error output Y1</td>
</tr>
<tr>
<td>Bit 1:</td>
<td>---</td>
<td>Actuator detected</td>
<td>Error output Y2</td>
<td>Error output Y2</td>
</tr>
<tr>
<td>Bit 2:</td>
<td>---</td>
<td>---</td>
<td>Cross-wire</td>
<td>Cross-wire</td>
</tr>
<tr>
<td>Bit 3:</td>
<td>---</td>
<td>---</td>
<td>Ambient temperature too high</td>
<td>Ambient temperature too high</td>
</tr>
<tr>
<td>Bit 4:</td>
<td>---</td>
<td>Input condition X1 and X2</td>
<td>---</td>
<td>Target error, coding error or false target combination</td>
</tr>
<tr>
<td>Bit 5:</td>
<td>---</td>
<td>Safety guard detected</td>
<td>Internal error</td>
<td>Internal error</td>
</tr>
<tr>
<td>Bit 6:</td>
<td>---</td>
<td>Failure warning</td>
<td>Communication error between fieldbus gateway and safety switch</td>
<td>---</td>
</tr>
<tr>
<td>Bit 7:</td>
<td>Failure reset</td>
<td>Failure (enabling path switched off)</td>
<td>Operating voltage too low</td>
<td>---</td>
</tr>
</tbody>
</table>

The described condition is obtained, when bit = 1
Electronic solenoid interlock and safety switch AZ/AZM 200

AZ/AZM 200-B1-…

Technical data

Material:
- B1-housing: Grivory
- Actuator: zinc die-cast

Actuator B1 with emergency exit P0

Mechanical life:
- $F_{\text{max}}$ AZM 200: ≥ 1 million operations
- 2000 N

System components

Approvals

Approvals only in combination with switches AZ/AZM 200

Ordering details

AZ/AZM 200-B1-…

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L</td>
<td>Actuating direction left</td>
</tr>
<tr>
<td>1</td>
<td>R</td>
<td>Actuating direction right</td>
</tr>
<tr>
<td>2</td>
<td>P0</td>
<td>Without emergency exit</td>
</tr>
<tr>
<td>2</td>
<td>P0</td>
<td>With emergency exit</td>
</tr>
</tbody>
</table>

Ordering details

Actuator B1 with emergency exit

AZ/AZM 200-B1-…-P0

Lockout tag

- Lockout tag SZ 200-1
- Lockout tag SZ 200

Retrofit kit

RF-AZM200-N/-T

Note

The safety switches/solenoid interlocks and the actuator unit must be ordered separately.

100
Electronic solenoid interlock and safety switch AZ/AZM 200

**AZ/AZM 200-B30-...**

- Actuator for hinged guards
- One-hand emergency exit, even in de-energised condition
- With door detection sensor T
- Easy and intuitive operation
- No risk of injury from protruding actuator
- No supplementary door handles required
- Does not protrude into the door opening
- Various handles available
- Can be fitted with or without emergency exit

**Technical data**

- **Material:**
  - Actuator unit B30: glass-fibre reinforced thermoplastic, self-extinguishing, fixing holes with metal washer
  - Emergency exit P1: glass-fibre reinforced thermoplastic, self-extinguishing, fixing holes with metal washer
  - Door handle G1, G2: plastic coated aluminium
  - Panic handle P1, P20, P25: plastic coated aluminium
  - Actuator: zinc die-cast
- **Mechanical life:** $F_{\text{max}} \geq 1$ million operations
- **$F_{\text{max}} \text{AZM 200:}$** 2000 N

**System components**

- **Rotary button**
- **Emergency exit metal**
- **Inset handle**
- **Actuator B30 with lockout tag SZ**

**Approvals**

- Approvals only in combination with switches AZ/AZM 200

**Ordering details**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L</td>
<td>Door hinge on left-hand side</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>Door hinge on right-hand side</td>
</tr>
<tr>
<td>2</td>
<td>G1</td>
<td>With door handle</td>
</tr>
<tr>
<td></td>
<td>G2</td>
<td>With rotary button</td>
</tr>
<tr>
<td>3</td>
<td>P1</td>
<td>With emergency exit</td>
</tr>
<tr>
<td></td>
<td>P20</td>
<td>With emergency exit metal</td>
</tr>
<tr>
<td></td>
<td>P25</td>
<td>With emergency exit with inset handle</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Without lockout tag</td>
</tr>
<tr>
<td></td>
<td>SZ</td>
<td>With lockout tag</td>
</tr>
</tbody>
</table>

**Note**

The safety switches/solenoid interlocks and the actuator unit must be ordered separately.

The actuator can be combined with a three-point locking rod to increase the stability of large and especially double-leaf safety guards.

**Ordering details**

- Actuator with rotary button: AZ/AZM 200-...-G2
- Emergency exit metal with inset handle: AZ/AZM 200-...-P20, AZ/AZM 200-...-P25
- Actuator B30 with lockout tag SZ: AZ/AZM 200-B30-...-SZ
Electronic solenoid interlock and safety switch AZ/AZM 200

**AZ/AZM 200-B40-...**

- Actuator for hinged and movable safety guards, especially for hinged doors with overlapping hinge
- One-hand emergency exit, even in de-energised condition
- With door detection sensor T
- Easy and intuitive operation
- No risk of injury from protruding actuator
- No supplementary door handles required
- Does not protrude into the door opening
- Various handles available
- Can be fitted with or without emergency exit

**Technical data**

- **Material:**
  - Actuator unit B40: glass-fibre reinforced thermoplastic, self-extinguishing, fixing holes with metal washer
  - Emergency exit P1: glass-fibre reinforced thermoplastic, self-extinguishing, fixing holes with metal washer
  - Door handle G1, G2: plastic coated aluminium
  - Panic handle P1, P20, P25: plastic coated aluminium
  - Actuator: zinc die-cast
- **Mechanical life:** ≥ 1 million operations
- **F_{max} AZM 200:** 2000 N

**System components**

- **Rotary button**
- **Emergency exit metal**
- **Inset handle**
- **Lockout tag SZ 200-1**

**Approvals**

- Approvals only in combination with switches AZ/AZM 200

**Ordering details**

<table>
<thead>
<tr>
<th>AZ/AZM 200-B40-...</th>
<th>TA</th>
</tr>
</thead>
<tbody>
<tr>
<td>**No.</td>
<td>Option</td>
</tr>
<tr>
<td>1</td>
<td>L</td>
</tr>
<tr>
<td>2</td>
<td>R</td>
</tr>
<tr>
<td>3</td>
<td>G1</td>
</tr>
<tr>
<td>4</td>
<td>G2</td>
</tr>
<tr>
<td>5</td>
<td>P1</td>
</tr>
<tr>
<td>6</td>
<td>P20</td>
</tr>
<tr>
<td>7</td>
<td>P25</td>
</tr>
</tbody>
</table>

**Note**

The safety switches/solenoid interlocks and the actuator unit must be ordered separately.

**Ordering details**

- Actuator with rotary button: AZ/AZM 200-...-G2
- Emergency exit metal with inset handle: AZ/AZM 200-...-P20
- Lockout tag: SZ 200-1
Electronic solenoid interlock and safety switch AZ/AZM 200

**Technical data**

**Material:**
- Actuator unit B30: glass-fibre reinforced thermoplastic, self-extinguishing, fixing holes with metal washer
- Locking bar: zinc-plated metal
- Emergency exit: metal
- Door handle G1, G2: plastic coated aluminium
- Panic handle: plastic coated aluminium
- Actuator: zinc die-cast

**Mechanical life:** ≥ 1 million operations

**F\text{\textsubscript{max}}** AZM 200: 2000 N

**System components**

**Ordering details**

**AZ/AZM 200-B30-...-P30/P31**

- **Actuator for hinged and sliding guards, especially for double-leaf doors**
- **Three-point locking bar for applications with higher mechanical stability requirements (7,000 N)**
- **Door height max. 230 cm**
- **One-hand emergency exit, even in de-energised condition**
- **With door detection sensor T**
- **Easy and intuitive operation**
- **No risk of injury from protruding actuator**
- **Does not protrude into the door opening**
- **Various handles available**
- **Can be fitted with or without emergency exit**

**Approvals**

The safety switches/solenoid interlocks and the actuator unit must be ordered separately. Retrofitting kit (only for AZ/AZM 200-B30-...-P1 with emergency exit) on request

**Ordering details**

**AZ/AZM 200-B30-G2**

- Door hinge on left-hand side
- Door hinge on right-hand side
- With door handle
- With rotary button
- Without emergency exit
- Without lockout tag
- With lockout tag

**Note**

- The actuator unit must be ordered separately.
- Retrofitting kit (only for AZ/AZM 200-B30-...-P1 with emergency exit) on request
Accessories - Connectors

Connectors M12, 8-pole for CSS 34, CSS 30S, CSS 300, RSS 36, RSS 16

Function of the safety switchgear

<table>
<thead>
<tr>
<th>Pin configuration of the integrated connector</th>
<th>Colour code of the Schmersal connectors or of the integrated cable</th>
<th>Possible colour codes of other customary connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>with conventional diagnostic output</td>
<td>with serial diagnostics</td>
<td>according to EN 60947-5-2: 2008 to DIN 47100</td>
</tr>
<tr>
<td>A1 $U_a$</td>
<td>1 BN</td>
<td>BN WH</td>
</tr>
<tr>
<td>X1 Safety input 1</td>
<td>2 WH</td>
<td>WH BN</td>
</tr>
<tr>
<td>A2 GND</td>
<td>3 BU</td>
<td>BU GN</td>
</tr>
<tr>
<td>Y1 Safety output 1</td>
<td>4 BK</td>
<td>BK YE</td>
</tr>
<tr>
<td>OUT Diagnostic output</td>
<td>5 GY</td>
<td>GY GY</td>
</tr>
<tr>
<td>X2 Safety input 2</td>
<td>6 VT</td>
<td>VT PK</td>
</tr>
<tr>
<td>Y2 Safety output 2</td>
<td>7 RD</td>
<td>RD BU</td>
</tr>
<tr>
<td>IN CSS 34F2: On-site acknowledgment; others: without function</td>
<td>8 PK / -</td>
<td>PK OR RD</td>
</tr>
</tbody>
</table>

Ordering details

Connecting cables with female connector
IP67, M12, 8-pole - 8 x 0.23 mm²
Cable length 2.5 m 101209963
Cable length 5 m 101209964
Cable length 10 m 101209960

IP69K, M12, 8-pole - 8 x 0.21 mm²
Cable length 5 m 101210560
Cable length 5 m, angled 101210561

Legend: Colour code

<table>
<thead>
<tr>
<th>Code</th>
<th>Colour</th>
<th>Code Colour</th>
<th>Colour</th>
<th>Code Colour</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
<td>GN green</td>
<td>PK</td>
<td>pink</td>
<td>WH</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
<td>GY grey</td>
<td>RD</td>
<td>red</td>
<td>YE</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
<td>OR orange</td>
<td>VT</td>
<td>purple</td>
<td></td>
</tr>
<tr>
<td>VT</td>
<td>purple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Connectors M12, 8-pole for CSS 16, CSS 30, CSS 180

Function of the safety switchgear

<table>
<thead>
<tr>
<th>Pin configuration of the integrated connector</th>
<th>Colour code of the Schmersal connectors or of the integrated cable</th>
<th>Possible colour codes of other customary connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>with conventional diagnostic output</td>
<td>with serial diagnostics</td>
<td>according to EN 60947-5-2: 2008 to DIN 47100</td>
</tr>
<tr>
<td>A1 $U_a$</td>
<td>1 BN</td>
<td>BN WH</td>
</tr>
<tr>
<td>X1 Safety input 1</td>
<td>2 WH</td>
<td>WH BN</td>
</tr>
<tr>
<td>A2 GND</td>
<td>3 BU</td>
<td>BU GN</td>
</tr>
<tr>
<td>Y1 Safety output 1</td>
<td>4 BK</td>
<td>BK YE</td>
</tr>
<tr>
<td>OUT Diagnostic output</td>
<td>5 GY</td>
<td>GY GY</td>
</tr>
<tr>
<td>X2 Safety input 2</td>
<td>6 VT</td>
<td>VT PK</td>
</tr>
<tr>
<td>Y2 Safety output 2</td>
<td>7 RD</td>
<td>RD BU</td>
</tr>
<tr>
<td>IN without function</td>
<td>8 PK / -</td>
<td>PK OR RD</td>
</tr>
</tbody>
</table>

Ordering details

Connecting cables with female connector
IP67, M12, 8-pole - 8 x 0.23 mm²
Cable length 2.5 m 101209963
Cable length 5 m 101209964
Cable length 10 m 101209960

IP69K, M12, 8-pole - 8 x 0.21 mm²
Cable length 5 m 101210560
Cable length 5 m, angled 101210561

1) integrated cable of CSS 16 and CSS 180: 7-wire

Legend: Colour code

<table>
<thead>
<tr>
<th>Code</th>
<th>Colour</th>
<th>Code Colour</th>
<th>Colour</th>
<th>Code Colour</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
<td>GN green</td>
<td>PK</td>
<td>pink</td>
<td>WH</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
<td>GY grey</td>
<td>RD</td>
<td>red</td>
<td>YE</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
<td>OR orange</td>
<td>VT</td>
<td>purple</td>
<td></td>
</tr>
<tr>
<td>VT</td>
<td>purple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend: Colour code

<table>
<thead>
<tr>
<th>Code</th>
<th>Colour</th>
<th>Code Colour</th>
<th>Colour</th>
<th>Code Colour</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
<td>GN green</td>
<td>PK</td>
<td>pink</td>
<td>WH</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
<td>GY grey</td>
<td>RD</td>
<td>red</td>
<td>YE</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
<td>OR orange</td>
<td>VT</td>
<td>purple</td>
<td></td>
</tr>
<tr>
<td>VT</td>
<td>purple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Accessories - Connectors

## Connectors M8, 8-pole for RSS 260

<table>
<thead>
<tr>
<th>Function of the safety switchgear</th>
<th>Pin configuration of the integrated connector</th>
<th>Colour code of the Schmersal connectors according to DIN 47100</th>
<th>Possible colour codes of other customary connector according to IEC 60947-5-2: 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>with conventional diagnostic output</td>
<td>with serial diagnostics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>Ue</td>
<td>1</td>
<td>WH, BN</td>
</tr>
<tr>
<td>X1</td>
<td>Safety input 1</td>
<td>2</td>
<td>BN, WH</td>
</tr>
<tr>
<td>A2</td>
<td>GND</td>
<td>3</td>
<td>GN, BU</td>
</tr>
<tr>
<td>Y1</td>
<td>Safety output 1</td>
<td>4</td>
<td>YE, BK</td>
</tr>
<tr>
<td>OUT</td>
<td>Diagnostic output</td>
<td>5</td>
<td>GY, GY</td>
</tr>
<tr>
<td>X2</td>
<td>Safety input 2</td>
<td>6</td>
<td>PK, PK</td>
</tr>
<tr>
<td>Y2</td>
<td>Safety output 2</td>
<td>7</td>
<td>BU, VT</td>
</tr>
<tr>
<td>IN</td>
<td>without function</td>
<td>8</td>
<td>RD, OR</td>
</tr>
<tr>
<td></td>
<td>SD input</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Ordering details

**Connecting cables with female connector**

- **IP67, M8, 8-pole - 8 x 0.14 mm², straight**
  - Cable length 2 m: 103003638
  - Cable length 5 m: 103003639
  - Cable length 10 m: 103003640

- **Connecting cables with female connector**
  - **IP67, M8, 8-pole - 8 x 0.14 mm², angled**
    - Cable length 2 m: 103003641
    - Cable length 5 m: 103003642
    - Cable length 10 m: 103003643

- **Connection adapter M8 coupling M12 connector, IP 67, 8-pole - 8 x 0.14 mm²**
  - Cable length 0.3 m: 103009832
  - Cable length 2 m: 103003645

### Legend: Colour code

<table>
<thead>
<tr>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
<td>GN</td>
<td>green</td>
<td>PK</td>
<td>pink</td>
<td>WH</td>
<td>white</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
<td>GY</td>
<td>grey</td>
<td>RD</td>
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<td>yellow</td>
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<tr>
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<td>blue</td>
<td>OR</td>
<td>orange</td>
<td>VT</td>
<td>purple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Accessories - Connectors

#### Connectors M12, 8-pole for AZ/AZM 200, AZ/AZM 300, MZM 100

<table>
<thead>
<tr>
<th>Function of the safety switchgear</th>
<th>Pin configuration of the integrated connector</th>
<th>Colour code of the Schmersal connectors</th>
<th>Possible colours of other customary connector with serial diagnostics according to EN 60947-5-2:2007 to DIN 47100</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X1</td>
<td>Safety input 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y1</td>
<td>Safety output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUT</td>
<td>Diagnostic output</td>
<td>SD output</td>
<td></td>
</tr>
<tr>
<td>X2</td>
<td>Safety input 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y2</td>
<td>Safety output 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Solenoid control</td>
<td>SD input</td>
<td></td>
</tr>
</tbody>
</table>

#### Ordering details

**Connecting cables with female connector**

- **IP67, M12, 8-pole - 8 x 0.23 mm²**
  - Cable length 2.5 m: 101209963
  - Cable length 5 m: 101209964
  - Cable length 10 m: 101209960

- **IP69K, M12, 8-pole - 8 x 0.21 mm²**
  - Cable length 5 m: 101210560
  - Cable length 5 m, angled: 101210561

### Functions of the safety switchgear

| Pin configuration of the integrated connector | Colour code of the Schmersal connectors | Possible colours of other customary connector with serial diagnostics according to EN 60947-5-2:2007 to DIN 47100 |

#### Connectors M23, (8+1)-pole for AZ/AZM 200, AZ/AZM 300, MZM 100

<table>
<thead>
<tr>
<th>Function of the safety switchgear</th>
<th>Pin configuration of the integrated connector</th>
<th>Wire number of the Schmersal connectors</th>
<th>Possible colours of other customary connector with serial diagnostics according to EN 60947-5-2:2007 to DIN 47100</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X1</td>
<td>Safety input 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y1</td>
<td>Safety output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUT</td>
<td>Diagnostic output</td>
<td>SD output</td>
<td></td>
</tr>
<tr>
<td>X2</td>
<td>Safety input 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y2</td>
<td>Safety output 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>Solenoid control</td>
<td>SD input</td>
<td></td>
</tr>
</tbody>
</table>

#### Ordering details

**Connecting cables with female connector**

- **IP67, M23, 8+1-pole - (LIYY) 8 x 0.75 mm²**
  - Cable length 5 m: 101209959
  - Cable length 10 m: 101209958

**Connectors without cable**

- **IP67, M23, 8+1-pole**
  - with soldering terminal: 101209970
  - with crimp terminal: 101209994

**Legend: Colour code**

<table>
<thead>
<tr>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
<td>GN</td>
<td>green</td>
<td>PK</td>
<td>pink</td>
<td>WH</td>
<td>white</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
<td>GY</td>
<td>grey</td>
<td>RD</td>
<td>red</td>
<td>YE</td>
<td>yellow</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
<td>OR</td>
<td>orange</td>
<td>VT</td>
<td>purple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **WITH FUNCTION:**

- **WITHOUT FUNCTION:**

### Legend: Colour code

<table>
<thead>
<tr>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
<th>Code</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK</td>
<td>black</td>
<td>GN</td>
<td>green</td>
<td>PK</td>
<td>pink</td>
<td>WH</td>
<td>white</td>
</tr>
<tr>
<td>BN</td>
<td>brown</td>
<td>GY</td>
<td>grey</td>
<td>RD</td>
<td>red</td>
<td>YE</td>
<td>yellow</td>
</tr>
<tr>
<td>BU</td>
<td>blue</td>
<td>OR</td>
<td>orange</td>
<td>VT</td>
<td>purple</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Serial diagnostic for function monitoring

Advantages of the serial diagnostic function

- Series-wiring of max. 31 different safety switchgear
- Reduction of the wiring expenditure through loop-through diagnostic cable
- Automatic addressing of the safety switchgear on the serial input side
- Automatic and continuous transmission of the operational information of each participant in the diagnostic chain
- Bidirectional communication, i.e. reading of operational data and unlocking of a solenoid interlock
- Fast and accurate error messages with detailed information about the failure
- Increased availability by announcement of imminent errors when the machine is still running
- Smooth connection to conventional and commercially available PLC systems
- Available for established standard protocols: PROFIBUS, PROFINET, ETHERNET/IP, DeviceNet, CC-Link, CANopen, Modbus/TCP, EtherCAT

Y- or T-adapter and SD-junction box

RSS/CSS safety sensors and solenoid interlocks with serial diagnostic function can be wired together in a series-wiring through Y- and T-adapters and commercially available cables with 5/8-pole connectors and plug-in connectors.

SD-junction boxes are preferably suitable for series-wiring of MZM and AZM devices with high power needs. Optionally IP65 enclosure or open design IP00 for control cabinet mounting.
Serial diagnostic – SD Gateway for PROFIBUS

SD-I-DP-V0-2

**Technical data**

- **PROFIBUS interface:** 9-pole D-SUB connector standard PROFIBUS connection (DP-A, DP-B, 5V, GND)
- **Protocol:** PROFIBUS-DP – V0 upwards compatible
- **Transmission rate:** 9.6 kilo baud ... 12 mega baud
- **GSD file:** KAS_0b13.GSD
- **Short-circuit protection:** internal fuse to EN 60127 PolySwitch 0.5 A / 60 V
- **LED indications:** refer to table below
- **DIP-switch 8-pole:** S1 ... S7: addressing as PROFIBUS slave; S8: automatic addressing of the serial participants
- **Rated operating voltage \( U_{op} \):** 24 VDC, \(-15 \% / +20 \%\)
- **Rated operating current \( I_{op} \):** typically 180 mA, max. 250 mA
- **Rated insulation voltage \( U_{i} \):** 32 V
- **Rated impulse withstand voltage \( U \):** 0.5 kV
- **Overvoltage category:** II
- **Degree of pollution:** II
- **Storage temperature range:** \(-25 \degree \text{C} ... +85 \degree \text{C}, \text{non-condensing}\)
- **Operating temperature range:** \(-5 \degree \text{C} ... +55 \degree \text{C}, \text{non-condensing}\)
- **Relative humidity:** 5% - 95%, non-condensing
- **Protection class:** IP10
- **Short-circuit protection:** internal fuse to EN 60127 PolySwitch 0.5 A / 60 V
- **LED indications:**
  - "PB" Continuous red: Profibus error
  - "PB" Flashing signal: Profibus initialisation
  - "SD" Continuous red: SD Gateway error
  - "SD" Flashing signal: SD Gateway initialisation
  - "T" Continuous yellow: Initialisation error SD participant addresses, teaching required
  - "ON" Continuous green: Supply voltage on

**Approvals**

**Ordering details**

SD-I-DP-V0-2

**Wiring diagram**

![Wiring Diagram](image)

**Legend**

1. Safety monitoring module
2. Gateway SD
3. PROFIBUS DP
4. PLC with PROFIBUS DP interface
Serial diagnostic - UNIVERSAL-Gateway for SD-Interface

• UNIVERSAL-Gateway for the series-wiring of the diagnostic signals from safety switching components with integrated SD interface. Comprehensive status and diagnostic data from the SD components are transmitted to the control system through the field bus interface.

• Diagnostic lines of max. 31 safety switching components can be wired in series

• Series-wiring of different components enabled (CSS 34, RSS 36, AZM 200, MZM 100 etc.)

• Reduced wiring expenditure through the series-wiring of the safety channels and the diagnostic lines in the field

• Automatic addressing of the safety switching components in the SD interface

• IP20 component for quick-fix mounting onto standard DIN rails in the control cabinet

Available FIELD BUS interfaces:
• PROFINET IO
• EtherNet IP
• DeviceNet
• CC-Link
• CANopen
• Modbus/TCP

Technical data
- Operating voltage: 24 VDC –15 %/+20 % (stabilised PELV)
- Fuse rating: external fuse 1 A slow-blow
- Operating current at 24 VDC: max. 500 mA, internally protected
- Operating temperature range: 0 ... 55 °C, in case of vertical positioning
- Storage temperature range: –25 °C ... +70 °C
- Climatic stress: relative humidity 30 % ... 85 %, non-condensing
- Protection class: IP20
- Mounting location: earthed lockable control cabinet with at least IP54 protection class
- Resistance to vibrations: if fitted between two lateral clamping blocks on the rail

- to IEC 60068-2-6
  - 10 ... 57 Hz / 0.35 mm
  - 57 ... 150 Hz / 5 g

- to IEC 60068-2-29:
  - 10 g

- EMC rating:
  - to EN 61000-4-2 (ESD)
    - ±6 kV contact discharge / ±8 kV Air discharge
  - to EN 61000-4-3 (HF field)
    - 10 V/m / 80 % AM
  - to EN 61000-4-4 (Surge)
    - ±1 kV all connections
  - to EN 61000-4-6 (HF cables)
    - 0.5 kV all connections
  - to EN 61000-4-5 (Surge)
    - ±1 kV all connections
  - to EN 61000-6-4 (2002)
    - industrial interfering radiation

- Rated insulation voltage Uᵢ: 32 V
- Rated impulse withstand voltage Uᵢmp: 0.5 kV
- Overvoltage category: II
- Degree of pollution: 2

- Dimensions (W x H x D): 50 x 100 x 80 mm (= mounting height starting from rail)

Approvals

Ordering details
<table>
<thead>
<tr>
<th>SD-I-U-➀</th>
<th>PN</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>➀</td>
<td></td>
<td>PROFINET IO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EIP</td>
<td>EtherNet IP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DN</td>
<td>DeviceNet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CCL</td>
<td>CC-Link</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CAN</td>
<td>CANopen</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MT</td>
<td>Modbus/TCP</td>
<td></td>
</tr>
</tbody>
</table>

Wiring diagram

Legend
- ➀ Safety monitoring module
- ➁ Gateway SD
- ➂ Fieldbus
- ➃ PLC with fieldbus interface
Accessories for series-wiring with serial diagnostic - Y-adapter

Y-adapter CSS-Y-8P

Terminating plug

Accessories

• The CSS-Y-8P Y-adapter enables the series-wiring of SD components. To that effect, both the safety outputs and the serial diagnostics lines are wired in series.
• Extensions M12 can be used for the wiring. Please note that voltage losses could occur. The cable length, cable section, voltage drop per sensor all have an influence on the overall voltage drop of the series-wired chain of SD devices.

• Provides the safety outputs with operating voltage
• Leads the SD interface back to the control cabinet to connect further SD participants of other safety circuits.

Ordering details

<table>
<thead>
<tr>
<th>Y-adapter</th>
<th>Terminating plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS-Y-8P</td>
<td>CSS-Y-8P-VA</td>
</tr>
</tbody>
</table>

Technical data

<table>
<thead>
<tr>
<th>Operating temperature T_a</th>
<th>Ambient temperature T_a: −25 °C … +75 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. operating current</td>
<td>1 A</td>
</tr>
<tr>
<td>Max. fuse rating of power</td>
<td>4 A</td>
</tr>
<tr>
<td>SD devices</td>
<td>24 VDC (−15%/+10%)</td>
</tr>
<tr>
<td>Power supply</td>
<td>1 A</td>
</tr>
<tr>
<td>Protection class:</td>
<td>IP67</td>
</tr>
</tbody>
</table>

Approvals
Accessories for series-wiring with serial diagnostic - Y-adapter

**Wiring**

<table>
<thead>
<tr>
<th>Signal</th>
<th>PIN</th>
<th>Connector (2)</th>
<th>Color of wire</th>
<th>SCHMERSAL cable</th>
<th>Cable to IEC 60947-5-2</th>
<th>Cable to DIN 47100</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1</td>
<td>Ue</td>
<td>BN</td>
<td>BN</td>
<td>WH</td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>2</td>
<td>Ue</td>
<td>WH</td>
<td>WH</td>
<td>BN</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>3</td>
<td>GND</td>
<td>BU</td>
<td>BU</td>
<td>GN</td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>4</td>
<td>GND</td>
<td>BK</td>
<td>BK</td>
<td>YE</td>
<td></td>
</tr>
<tr>
<td>Y1</td>
<td>5</td>
<td>Safety output 1</td>
<td>GY</td>
<td>GY</td>
<td>GY</td>
<td></td>
</tr>
<tr>
<td>Y2</td>
<td>6</td>
<td>Safety output 2</td>
<td>VT</td>
<td>PK</td>
<td>PK</td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>7</td>
<td>SD input</td>
<td>RD</td>
<td>VT</td>
<td>BU</td>
<td></td>
</tr>
<tr>
<td>OUT</td>
<td>8</td>
<td>SD output</td>
<td>PK</td>
<td>OR</td>
<td>RD</td>
<td></td>
</tr>
</tbody>
</table>

**Technical engineering of SD line**

Engineering table with 24,0 VDC power supply without Y-Power adapter

<table>
<thead>
<tr>
<th>Device type</th>
<th>max. numbers (n) of SD devices</th>
<th>max. distance (X) between the SD-Y adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZM 300</td>
<td>8</td>
<td>up to 3 m</td>
</tr>
<tr>
<td>MZM 100</td>
<td>6</td>
<td>up to 3 m</td>
</tr>
<tr>
<td>AZM 200</td>
<td>5</td>
<td>up to 3 m</td>
</tr>
<tr>
<td>RSS / CSS</td>
<td>14</td>
<td>up to 3 m</td>
</tr>
</tbody>
</table>
The SD-Y-POWER adapter can be used to connect the power supply on multi points of a SD line. With the special power cord sets (wire diameter 4 x 0,75 mm²), the power supply can be connected with 1,5 mm² wire diameter.

The SD-Y-POWER adapter is inserted at the start and / or at the end of a SD line.

### Technical data

- **Operating voltage SD devices:** 24 VDC
- **Rated operating voltage adapter:** 30 VDC
- **Max. operating current power connection:** 4 A
- **Max. fuse rating of power supply (cable protection):** 4 A
- **Ambient temperature:** – 25 °C ... + 75 °C
- **Protection class:** IP67

### Accessories

- **Cable SD-Y-POWER adapter IP67, M12, 4-pole, 4 x 0,75 mm²**
  - Cable length 2,5 m: 103009363
  - Cable length 5,0 m: 103009364
  - Cable length 10 m: 103009365

- **Cable SD-Y-POWER adapter IP67, M12, 4-pole, 4 x 0,75 mm² with stainless steel hex nut**
  - Cable length 2,5 m: 103009366
  - Cable length 5,0 m: 103009367
  - Cable length 10 m: 103009368

### Ordering details

- **Y-Power adapter**
  - SD-Y-POWER
  - SD-Y-POWER-VA
**Accessories for series-wiring with serial diagnostic - SD-Y-POWER adapter**

### Wiring

<table>
<thead>
<tr>
<th>Signal</th>
<th>PIN</th>
<th>Connector (2)</th>
<th>SCHMERSAL cable</th>
<th>Color of wire</th>
<th>Cable to IEC 60947-5-2</th>
<th>Cable to DIN 47/100</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1</td>
<td>Ue</td>
<td>BN</td>
<td>WH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1</td>
<td>2</td>
<td>Ue</td>
<td>WH</td>
<td>WH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>3</td>
<td>GND</td>
<td>BU</td>
<td>GN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2</td>
<td>4</td>
<td>GND</td>
<td>BK</td>
<td>YE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y1</td>
<td>5</td>
<td>Safety output 1</td>
<td>GY</td>
<td>GY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y2</td>
<td>6</td>
<td>Safety output 2</td>
<td>VT</td>
<td>PK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>7</td>
<td>SD input</td>
<td>RD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OUT</td>
<td>8</td>
<td>SD output</td>
<td>PK</td>
<td>OR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Diagram of Wiring](image)

### Technical engineering of SD line

![Diagram of Technical engineering of SD line](image)

**Engineering table with 24 VDC power supply and two Y-Power adapters**

<table>
<thead>
<tr>
<th>Device type</th>
<th>max. numbers (n) of SD devices</th>
<th>max. distance (X) between the SD-Y adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZM 300</td>
<td>18</td>
<td>up to 3 m</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>up to 5 m</td>
</tr>
<tr>
<td>MZM 100</td>
<td>12</td>
<td>up to 3 m</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>up to 5 m</td>
</tr>
<tr>
<td>AZM 200</td>
<td>10</td>
<td>up to 3 m</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>up to 5 m</td>
</tr>
<tr>
<td>RSS / CSS</td>
<td>28</td>
<td>up to 3 m</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>up to 5 m</td>
</tr>
</tbody>
</table>

**Note:** If only one Y-Power adapter is used you can connect the half number of SD devices with the same cable length.
Accessories for series-wiring with serial diagnostic - T-adapter

**T-adapter CSS-T**

- Enables the series-wiring of safety sensors. To this end, both the safety channels and the serial diagnostic cable are wired in series.
- For the wiring, M12 cable extensions can be used. The voltage drop (due to the cable length, cable section, voltage drop per sensor) should be taken into account, as it reduces the maximum number of safety sensors that can be wired in series.

**Technical data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating voltage of the SD devices to be connected</td>
<td>24 V (–15%/+10%)</td>
</tr>
<tr>
<td>Rated operating current of the SD devices to be connected</td>
<td>0.6 A</td>
</tr>
<tr>
<td>Fuse of the connecting cables (circuit breaker)</td>
<td>2 A</td>
</tr>
<tr>
<td>Ambient temperature Tₘₐₓ</td>
<td>–25 °C ... +70 °C</td>
</tr>
</tbody>
</table>

**Wiring diagram**

[Diagram showing wiring connections]

**Ordering details**

- T-adapter: CSS-T
- Terminal connector: CSS-T-A

**Approvals**

- CE

**Terminal connector**

- Supplies the safety channels with operating voltage

**Ordering details**

- CSS-T: T-adapter
- CSS-T-A: Terminal connector
Accessories for series-wiring with serial diagnostic - SD junction box

SD-2V-F-SK

- For field applications, junction box for 2 components, with screw terminals
- The terminals of the junction box are located in a closed enclosure

SD-2V-S-SK

- For control cabinet mounting, junction box for 2 components, with screw terminals
- Enables wiring in the control cabinet onto standard DIN rails

Technical data

| Standards:    | VDE 0100 
| Enclosure:    | thermoplastic, self-extinguishing |
| Protection class: | SD-2V-F-SK: IP65  
|               | SD-2V-S-SK: IP00  
|               | to IEC 60529 |
| Insulation protection class: | SD-2V-F-SK: II  
|               | SD-2V-S-SK: II |
| Overvoltage category: | III |
| Degree of pollution: | SD-2V-F-SK: 3  
|               | SD-2V-S-SK: 2 |
| Connection: | Screw terminals |
| Cable section: | min. 0.25 mm²,  
|               | max. 2.5 mm² (incl. conductor ferrules) |
| Cable entry: | SD-2V-F-SK: 4 x M20,  
|               | for cladding diameter 8 ... 13 mm |
| Number of connections: | to each SD junction box, 2 (optionally 3) components can be connected |
| Fuse rating: | 3 internal fine fuses,  
|               | 2 A slow blow, 5 x 20 |

Ambient conditions:

- Ambient temperature: -25 °C ... +70 °C
- Storage and transport temperature: -25 °C ... +85 °C
- Relative air humidity: 30% ... 95%, non-condensing

Electrical data:

- Rated operating voltage $U_e$: 24 VDC -15% / +10% (stabilised PELV)
- Rated operating current $I_e$: 16 A
- Rated impulse withstand voltage $U_{imp}$: 800 V
- Rated insulation voltage $U_i$: 32 VDC
- Fuse rating: 16 A

Approvals

Ordering details

SD junction box for field applications  SD-2V-F-SK

SD junction box for control cabinet mounting  SD-2V-S-SK
A basket full of solutions
Food

For detailed information, check out www.schmersal.com
Overview of the application-related features:

Apart from the conventional safety controllers, the Schmersal Group also offers microprocessor-controlled safety technology.

Depending on the complexity and the number of safety circuits, integral solutions with safety monitoring modules, safety controls or safety field bus systems featuring many visualisation and diagnostic possibilities are available.
Safety controllers

The table lists the programme of safety controllers, which are recommended for use with electronic safety sensors, solenoid interlocks and safety switches.

<table>
<thead>
<tr>
<th>Type</th>
<th>Operating voltage</th>
<th>ISO 13849-1</th>
<th>Sensor inputs</th>
<th>Safety release</th>
<th>Diagnostic contacts</th>
<th>Diagnostic outputs</th>
<th>Reset options</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRB031MC</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>3 x Stop 1</td>
<td>1x 2A</td>
<td>–</td>
<td>• Manual without edge detection • Automatic</td>
<td>120</td>
</tr>
<tr>
<td>SRB201LC</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>2 x Stop 0</td>
<td>–</td>
<td>1 x 100 mA</td>
<td>• Manual without edge detection • Automatic</td>
<td>122</td>
</tr>
<tr>
<td>SRB211ST V.2</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>2 x Stop 0</td>
<td>1 x Stop 1</td>
<td>0,1…30 s dropout delay</td>
<td>• Manual with edge detection • Automatic</td>
<td>124</td>
</tr>
<tr>
<td>SRB301MA</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>3 x Stop 0</td>
<td>1x 2A</td>
<td>–</td>
<td>• Manual with edge detection</td>
<td>126</td>
</tr>
<tr>
<td>SRB301MC</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>3 x Stop 0</td>
<td>1x 2A</td>
<td>–</td>
<td>• Manual without edge detection • Automatic</td>
<td>128</td>
</tr>
<tr>
<td>SRB301ST V.2</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>3 x Stop 0</td>
<td>1x 2A</td>
<td>–</td>
<td>• Manual with edge detection • Automatic</td>
<td>130</td>
</tr>
<tr>
<td>SRB324ST V.3</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>3 x Stop 0</td>
<td>1x 2A</td>
<td>3 x 100 mA</td>
<td>• Manual with edge detection • Automatic</td>
<td>132</td>
</tr>
<tr>
<td>SRB504ST</td>
<td>24 VAC/DC</td>
<td>Cat. 4 / PL e</td>
<td>2P</td>
<td>5 x Stop 0</td>
<td>1x 2A</td>
<td>3 x 100 mA</td>
<td>• Manual with edge detection • Automatic</td>
<td>134</td>
</tr>
<tr>
<td>PROTECT-PE</td>
<td>24 VAC/DC</td>
<td>Cat. 3 / PL d</td>
<td>4P</td>
<td>Refer to data sheet</td>
<td>2x 2A</td>
<td>5 x 100 mA</td>
<td>• Input expanders only with downstream safety-monitoring module</td>
<td>136</td>
</tr>
</tbody>
</table>

Further details about suitable safety controllers can be found at www.schmersal.net.
Safety controllers

The safety outputs Y1/Y2 must be connected to the safety controller in the following way.

<table>
<thead>
<tr>
<th>Sensors/Solenoid interlocks</th>
<th>Safety output 1</th>
<th>Safety output 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 30/30S/300</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>CSS 34</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>CSS 180</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>RSS 16</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>RSS 260</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>RSS 36</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>AZ/AZM 200</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>AZ/AZM 300</td>
<td>Y1</td>
<td>Y2</td>
</tr>
<tr>
<td>MZM 100</td>
<td>Y1</td>
<td>Y2</td>
</tr>
</tbody>
</table>

Notes:
- The wiring examples are represented with the safety guards closed and in de-energised condition.
- Sensor and safety controller require the same mass potential.
- The shown application examples are suggestions. The user however must carefully check if the configuration is suitable for his specific application.

Refer to page

<table>
<thead>
<tr>
<th>Safety controller</th>
<th>Safety channel 1</th>
<th>Safety channel 2</th>
<th>Feedback/Start contact connection</th>
<th>Start contact</th>
<th>Notes bridge</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRB031MC</td>
<td>S 12</td>
<td>S 22</td>
<td>X1 - X2</td>
<td>X1 - X2</td>
<td>–</td>
<td>120</td>
</tr>
<tr>
<td>SRB201LC</td>
<td>S 12</td>
<td>S 22</td>
<td>X1 - X2</td>
<td>X1 - X2</td>
<td>–</td>
<td>122</td>
</tr>
<tr>
<td>SRB211ST V.2</td>
<td>S 12</td>
<td>S 22</td>
<td>X1 - X2/X3</td>
<td>X1 - X2/X3</td>
<td>–</td>
<td>124</td>
</tr>
<tr>
<td>SRB301MA</td>
<td>S 12</td>
<td>S 22</td>
<td>X1 - X2</td>
<td>X1 - X2</td>
<td>–</td>
<td>126</td>
</tr>
<tr>
<td>SRB301MC</td>
<td>S 12</td>
<td>S 22</td>
<td>X1 - X2</td>
<td>X1 - X2</td>
<td>–</td>
<td>128</td>
</tr>
<tr>
<td>SRB301ST V.2</td>
<td>S 12</td>
<td>S 22</td>
<td>S12 - X2/X3</td>
<td>S12 - X2/X3</td>
<td>–</td>
<td>130</td>
</tr>
<tr>
<td>SRB324ST V.3</td>
<td>S 12</td>
<td>S 32</td>
<td>X1 - X2</td>
<td>X3 - X4</td>
<td>S22 - S21</td>
<td>132</td>
</tr>
<tr>
<td>SRB504ST</td>
<td>S 12</td>
<td>S 32</td>
<td>X1 - X2</td>
<td>X3 - X4</td>
<td>S22 - S21</td>
<td>134</td>
</tr>
<tr>
<td>PROTECT-PE</td>
<td>S 1, S 3, S 5, S 7</td>
<td>S 2, S 4, S 6, S 8</td>
<td>realised by the downstream safety-monitoring module</td>
<td>–</td>
<td>136</td>
<td></td>
</tr>
</tbody>
</table>
Safety controllers

SRB031MC

- Suitable for signal processing of potential-free outputs, e.g., emergency stop command devices and interlocking devices
- Suitable for signal processing of connected to potentials (AOPDs) and magnetic safety sensors
- 1 or 2 channel control
- 3 safety contacts delayed (factory-configurable: 0.4 s; 0.7 s; 1.1 s; 1.5 s)
- 1 additional acknowledgement output
- Automatic reset function
- Optionally with short-circuit recognition (through switch)
- 4 LEDs to show operating conditions

Technical data

Standards: IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508
Start conditions: Automatic or start button
Feedback circuit (Y/N): yes
ON delay with automatic start: typ. 100 ms
Drop-out delay in case of emergency stop: Drop-out delay time ≥ 30% for 24 VDC and duty cycle > 3.5 s
Drop-out delay on „supply failure“: Drop-out delay time ≥ 30% for 24 VDC and duty cycle > 3.5 s
Rated operating voltage Ud: 24 VDC –15%+20% residual ripple max. 10% 24 VAC –15%+10%
Frequency range: 50 / 60 Hz
Fuse rating for the operating voltage: Internal electronic protection, tripping current > 500 mA, reset after approx. 1 sec
Internal electronic protection (Y/N): yes
Power consumption: max. 2.0 W; 4.9 VA
Monitored inputs:
- Short-circuit recognition: optional
- Wire breakage detection: yes
- Earth connection detection: yes
Number of NC contacts: 2
Number of NO contacts: 0
Max. conduction resistance: max. 40 Ω
Outputs:
Stop category: 1
Number of safety contacts: 3 (17-18; 27-28; 37-38)
Number of auxiliary contacts: 1 (45-46)
Max. switching capacity of the safety contacts: 230 VAC, 8 A ohmic (inductive in case of appropriate protective wiring)
Max. switching capacity of the auxiliary contacts: 24 VDC, 2 A
Utilisation category to IEC 60947-5-1: AC-15: 230 V / 6 A; DC-13: 24 V / 6 A
Fuse rating of the safety contacts: 8 A slow blow
Fuse rating of the auxiliary contacts: 2 A slow blow
Mechanical life: 10 million operations
Ambient conditions:
Ambient temperature: −25 °C ... +60 °C
Storage and transport temperature: −40 °C ... +85 °C
Protection class: Enclosure: IP40, Terminals: IP20, Clearance: IP54
Mounting: Snaps onto standard DIN rail to EN 60715
Connection type: Screw terminals
- min. cable section: 0.25 mm²
- max. cable section: 2.5 mm²
Weight: 250 g
Dimensions (Height x Width x Depth): 100 x 22.5 x 121 mm

Approvals

Ordering details

SRB031MC-24V-➀
No. | Option | Description
--- | --- | ---
0.4S | 0.4 seconds | Time delay:
0.7S | 0.7 seconds |
1.1S | 1.1 seconds |
1.5S | 1.5 seconds |

Classification

Safety parameters:

<table>
<thead>
<tr>
<th>Contact load</th>
<th>n-op/y</th>
<th>t-cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 %</td>
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<tr>
<td>60 %</td>
<td>75,087</td>
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</tr>
<tr>
<td>80 %</td>
<td>30,918</td>
<td>17.0 min</td>
</tr>
<tr>
<td>100 %</td>
<td>12,223</td>
<td>43.0 min</td>
</tr>
</tbody>
</table>

The PFH value of 2.00 x 10⁻⁷/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts. Diverging applications upon request.
Safety controllers

Note
Connection of an AZM 200 solenoid interlock to the SRB031MC safety controller

LED
The integrated LEDs indicate the following operating states.
• Position relay K1
• Position relay K2
• Supply voltage U_B
• Internal operating voltage U_i

Note
• The wiring diagram is shown with guard doors closed and in de-energised condition.
Safety controllers

SRB201LC

- Suitable for signal processing of potential-free outputs, e.g. emergency stop command devices, position switches, solenoid interlocks with and without interlocking function and magnetic safety switches
- Suitable for the signal treatment of potential-loaded outputs, e.g. electronic safety sensors with p-type semi-conductor outputs as well as safety light grids and light curtains
- 1 or 2 channel control
- 2 safety contacts, STOP 0
- 1 signalling output
- 3 LEDs to show operating conditions

Technical data

| Standards: | IEC 60204-1, IEC 60947-5-1, ISO 13849-1, IEC 61508 |
| Feedback circuit (Y/N): | Automatic or start button yes |
| ON delay: | typ. 100 ms |
| Drop-out delay in case of emergency stop: | typ. 25 ms / max. 30 ms |
| Drop-out delay on „supply failure“: | typ. 70 ms |
| Bridging in case of voltage drops: | typ. 60 ms |
| Rated operating voltage Uo: | 24 VDC –15% / +20%, residual ripple max. 10%; 24 VAC –15% / +10% |
| Frequency range: | 50 Hz / 60 Hz |
| Fuse rating for the operating voltage: | Internal electronic protection, tripping current > 500 mA, reset after approx. 1 sec max. 2.0 W / 5.2 VA |

Power consumption:

- Monitored inputs:
  - Short-circuit recognition: no
  - Wire breakage detection: yes
  - Earth connection detection: yes
- Number of NO contacts: 0
- Number of NC contacts: 2
- Max. conduction resistance: max. 40 Ω

Outputs:

- Stop category: 0
- Number of safety contacts: 2 (13-14, 23-24)
- Number of signalling outputs: 1 (Y1)
- Max. switching capacity of the safety contacts: max. 250 V, 4 A ohmic (inductive in case of appropriate protective wiring); min. 5 V / 1 mA
- Max. switching capacity of the signalling outputs: 24 VDC / 100 mA
- Utilisation category to IEC 60947-5-1: AC-15: 230 V / 2 A; DC-13: 24 V / 1 A
- Fuse rating of the safety contacts: External (Iₚ = 1000 A) to IEC 60947-5-1 safety fuse 6 A quick blow, 4 A slow blow
- Fuse rating of the signalling outputs: Internal electronic protection, tripping current > 100 mA
- Mechanical life: 10 million operations

Ambient conditions:

- Ambient temperature: −25 °C … +60 °C
- Storage and transport temperature: −40 °C … +85 °C
- Protection class: Enclosure: IP40, Terminals: IP20, Clearance: IP54
- Mounting: Snaps onto standard DIN rail to EN 60715
- Connection type:
  - min. cable section: 0.25 mm²
  - max. cable section: 2.5 mm²
- Weight: 160 g
- Dimensions (Height x Width x Depth): 100 x 22.5 x 121 mm

Approvals

Ordering details

SRB201LC

Classification

Safety parameters:

| Standards: | ISO 13849-1, IEC 61508 |
| PL: | STOP 0: up to e |
| Category: | STOP 0: up to 4 |
| PFH value: | STOP 0: ≤ 2.00 x 10⁻⁸/h |
| SIL: | STOP 0: up to 3 |
| Mission time: | 20 years |

The PFH value of 2.00 x 10⁻⁸/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.

<table>
<thead>
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<th>t-cycle</th>
</tr>
</thead>
<tbody>
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<td>525,600</td>
<td>1.0 min</td>
</tr>
<tr>
<td>40 %</td>
<td>210,240</td>
<td>2.5 min</td>
</tr>
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<td>75,087</td>
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<td>17.0 min</td>
</tr>
<tr>
<td>100 %</td>
<td>12,223</td>
<td>43.0 min</td>
</tr>
</tbody>
</table>

24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.

Diverging applications upon request.

Schmersal
**Safety controllers**

**Note**

- **Input level:** The example shows a 2-channel control of a guard door monitoring with two position switches, whereof one with positive break, external reset button J; cross-wire monitoring and feedback circuit S.
- The control recognises cable break and earth leakages in the monitoring circuit.
- **Relay outputs:** Suitable for 2-channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- For 1-channel control, connect NC contact to S11/S12 and bridge S12/S22
- **Automatic start:**
  - The automatic start is programmed by connecting the feedback circuit to the terminals X1/X2. If the feedback circuit is not required, establish a bridge.
  - a) = Logic

**LED**

The integrated LEDs indicate the following operating states.
- Position relay K1
- Position relay K2
- Internal operating voltage U

**Wiring diagram**

**Note**

- The wiring diagram is shown with guard doors closed and in de-energised condition.
### Safety controllers

**SRB211ST V.2**

- Suitable for signal processing of potential-free outputs, e.g. emergency stop command devices, position switches, solenoid interlocks and magnetic safety switches
- Suitable for signal processing of outputs connected to potentials (AOPDs), e.g. safety light grids/curtains
- 1 or 2 channel control
- 2 safety contacts, STOP 0
- 1 safety contact, STOP 1
- 1 signalling output (transistor output)
- Optionally with short-circuit recognition, reset with edge detection or automatic start
- 6 LEDs to show operating conditions
- Plug-in screw terminals

### Technical data

- **Standards:** IEC 60947-5-1; ISO 13849-1; IEC 61508
- **Start conditions:** Automatic or start button (monitored)
- **Feedback circuit (Y/N):** yes
- **ON delay with automatic start:** typ. 120 ms
- **ON delay with reset button:** typ. 25 ms
- **Drop-out delay in case of emergency stop:** (STOP 0: 13-14; 23-24) ≤ 20 ms
- **Drop-out delay on ‚supply failure‘:** typ. 55 ms
- **Rated operating voltage \( U_e \):** 24 VDC –15%/+20%, residual ripple max. 10%; 24 VAC –15%/+10%
- **Frequency range:** 50 / 60 Hz
- **Fuse rating for the operating voltage:** Internal electronic protection, tripping current F1: > 750 mA; F2: > 75 mA; reset after disconnection of supply voltage; tripping current F3: > 140 mA
- **Internal electronic protection (Y/N):** yes
- **Power consumption:** 2.4 W; 5.9 VA plus signalling output

#### Monitored inputs:
- - Short-circuit recognition: optional
- - Wire breakage detection: yes
- - Earth connection detection: yes
- **Number of NC contacts:** 2
- **Number of NO contacts:** 0
- **Max. conduction resistance:** max. 40 Ω

#### Outputs:
- **Stop category:** 0/1
- **Number of safety contacts:** 3 (STOP 0: 13-14; 23-24) (STOP 1: 37-38)
- **Number of signalling outputs:** 1 (Y1)
- **Max. switching capacity of the safety contacts:** (STOP 0: 13-14; 23-24) 250 VAC, 8 A Ohmic; min. 5 V, 5 mA
  (STOP 1: 37-38) 250 VAC, 6 A Ohmic; min. 10 V, 10 mA
  (inductive in case of appropriate protective wiring)
- **Max. switching capacity of the signalling outputs:** 24 VDC, 100 mA
- **Utilisation category to IEC 60947-5-1:** AC-15; DC-13
- **Fuse rating of the safety contacts:** (STOP 0: 13-14; 23-24) 8 A slow blow
  (STOP 1: 37-38) 6.3 A slow blow
- **Fuse rating of the signalling outputs:** Internal electronic protection, tripping current F4: 100 mA
- **Mechanical life:** 10 million operations
- **Ambient conditions:**
  - **Ambient temperature:** –25 °C … +60 °C
  - **Storage and transport temperature:** –40 °C … +85 °C
  - **Protection class:** Enclosure: IP40, Terminals: IP20, Clearance: IP54
  - **Mounting:** Snaps onto standard DIN rail to EN 60715
  - **Connection type:** Screw terminals, plug-in
  - **- min. cable section:** 0.25 mm²
  - **- max. cable section:** 2.5 mm²
- **Dimensions (Height x Width x Depth):** 100 x 22.5 x 121 mm

### Classification

#### Safety parameters:
- **Standards:** ISO 13849-1; IEC 61508
- **PL:** STOP 0: up to e; STOP 1: up to d
- **Category:** STOP 0: up to 4; STOP 1: up to 3
- **PFH value:** STOP 0: ≤ 2.00 x 10⁻⁸/h; STOP 1: ≤ 2.00 x 10⁻⁷/h
- **SIL:** STOP 0: up to 3; STOP 1: up to 2
- **Mission time:** 20 years

The PFH values of 2.00 x 10⁻⁸/h and 2.00 x 10⁻⁷/h apply to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.

<table>
<thead>
<tr>
<th>Contact load</th>
<th>n-op/y</th>
<th>t-cycle</th>
</tr>
</thead>
<tbody>
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<td>43.0 min</td>
</tr>
</tbody>
</table>

At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.

Diverging applications upon request.

### Approvals

### Ordering details

**SRB211ST V.2**

- Suitable for signal processing of potential-free outputs, e.g. emergency stop command devices, position switches, solenoid interlocks and magnetic safety switches
- Suitable for signal processing of outputs connected to potentials (AOPDs), e.g. safety light grids/curtains
- 1 or 2 channel control
- 2 safety contacts, STOP 0
- 1 safety contact, STOP 1
- 1 signalling output (transistor output)
- Optionally with short-circuit recognition, reset with edge detection or automatic start
- 6 LEDs to show operating conditions
- Plug-in screw terminals
Safety controllers

**Note**

- Input level: The example shows a 2-channel control of a guard door monitoring with two position switches, whereof one with positive break, external reset button and feedback circuit.
- The control recognises cross-short, cable break and earth leakages in the monitoring circuit.
- F1 = hybrid fuse
- Relay outputs: Suitable for 2 channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
- Switch setting:
  The cross-wire short detection function (factory default) is programmed by means of the switch located underneath the front cover of the module.

**Position nQS (top):**
- no cross-wire short protection, suitable for 1-channel applications and applications with outputs with potential in the control circuits.

**Position QS (bottom):**
- cross-wire short protection, suitable for 2-channel applications without outputs with potential in the control circuits.
  - For 1-channel control, connect NC contact to S11/S12 and bridge S12/S22
  - Connect potential p-type outputs of safety light grids/curtains to S12/S22. The devices must have the same reference potential.
- Automatic start:
  The automatic start is programmed by connecting the feedback circuit to the terminals X1/X3. If the feedback circuit is not required, establish a bridge.
- Time delay:
  The time-delayed safety enable 37/38 is adjustable for 1 to 30 seconds drop-out delay (see setting instructions).
  - The safety enabling circuit 37/38 conforms to IEC 60204-1 for STOP Category 1. The safety enabling circuits 13/14 and 23/24 conform to IEC 60204-1 for STOP Category 0.
  - Setting of the drop-out delay time is carried out by means of a potentiometer from the front of the enclosure.

**LED**

The integrated LEDs indicate the following operating states.
- Position relay K1
- Position relay K2
- Position relay K3
- Position relay K4
- Supply voltage U_B
- Internal operating voltage U_i

**Wiring diagram**

The wiring diagram is shown with guard doors closed and in de-energised condition.
- Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

**Note**

- The wiring diagram is shown with guard doors closed and in de-energised condition.
- Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.
Safety controllers

SRB301MA

- Suitable for the signal treatment of potential-free contacts, e.g. emergency stop command devices, position switches, interlocking devices with and without interlocking function and magnetic safety switches
- Suitable for the signal treatment of potential-loaded outputs, e.g. electronic safety sensors with p-type semiconductor outputs as well as safety light grids and light curtains
- 1 or 2 channel control
- 3 safety contacts, STOP 0
- 1 additional acknowledgement output
- Reset function with trailing edge
- Optionally with short-circuit recognition (through switch)
- 4 LEDs to show operating conditions

Technical data

Standards:
IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508
Start conditions:
Start button (monitored)
Feedback circuit (Y/N):
yes
ON delay with reset button:
typ. 15 ms
Drop-out delay in case of emergency stop:
≤ 15 ms
Drop-out delay on „supply failure“:
typ. 80 ms
Rated operating voltage Uₑ:
24 VDC –15%/+20%, residual ripple max. 10%;
24 VAC –15%/+10%
Frequency range:
50 / 60 Hz
Fuse rating for the operating voltage:
Internal electronic protection, tripping current > 500 mA, reset after approx. 1 sec
Internal electronic protection (Y/N):
yes
Power consumption:
1.8 W; 4.4 VA
Monitored inputs:
- Short-circuit recognition:
optional
- Wire breakage detection:
yes
- Earth connection detection:
yes
Number of NC contacts:
2
Number of NO contacts:
0
Max. conduction resistance:
max. 40 Ω
Outputs:
Stop category:
0
Number of safety contacts:
3 (13-14; 23-24; 33-34)
Number of auxiliary contacts:
1 (41-42)
Max. switching capacity of the safety contacts:
230 VAC, 8 A ohmic (inductive in case of appropriate protective wiring); min. 10 V, 10 mA
Max. switching capacity of the auxiliary contacts:
24 VDC, 2 A
Utilisation category to IEC 60947-5-1:
AC-15: 230 V / 6 A
DC-13: 24 V / 6 A
Fuse rating of the safety contacts:
8 A slow blow
Fuse rating of the auxiliary contacts:
2 A slow blow
Mechanical life:
10 million operations
Ambient conditions:
Ambient temperature:
−25 °C … +60 °C
Storage and transport temperature:
−40 °C … +85 °C
Protection class:
Enclosure: IP40, Terminals: IP20, Clearance: IP54
Mounting:
Snaps onto standard DIN rail to EN 60715
Connection type:
Screw terminals
- min. cable section:
0.25 mm²
- max. cable section:
2.5 mm²
Weight:
250 g
Dimensions (Height x Width x Depth):
100 x 22.5 x 121 mm

Approvals

Ordering details

SRB301MA

Classification

Safety parameters:
Standards:
ISO 13849-1, IEC 61508
PL:
STOP 0: up to e
Category:
STOP 0: up to 4
PFH value:
STOP 0: ≤ 2.00 x 10⁻⁸/h
SIL:
STOP 0: up to 3
Mission time:
20 years

The PFH value of 2.00 x 10⁻⁸/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.

Diverging applications upon request.

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126
Safety controllers

Note
Connection of an AZM 200 solenoid interlock to the SRB301MA safety controller

Wiring diagram

Note
The integrated LEDs indicate the following operating states.
• Position relay K1
• Position relay K2
• Supply voltage U_B
• Internal operating voltage U_i

LED
The wiring diagram is shown with guard doors closed and in de-energised condition.
Safety controllers

SRB301MC

• Suitable for the signal treatment of potential-free contacts, e.g. emergency stop command devices, position switches, interlocking devices with and without interlocking function and magnetic safety switches
• Suitable for the signal treatment of potential-loaded outputs, e.g. electronic safety sensors with p-type semi-conductor outputs as well as safety light grids and light curtains
• 1 or 2 channel control
• 3 safety contacts, STOP 0
• 1 additional acknowledgement output
• Automatic reset function
• Optionally with short-circuit recognition (through switch)
• 4 LEDs to show operating conditions

Technical data

| Standards: | IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508 |
| Feedback circuit (Y/N): | yes |
| ON delay with automatic start: | typ. 100 ms |
| ON delay with reset button: | typ. 20 ms |
| Drop-out delay in case of emergency stop: | ≤ 20 ms |
| Drop-out delay on „supply failure“: | typ. 80 ms |
| Rated operating voltage Ue: | 24 VDC –15%/+20%, residual ripple max. 10%; 24 VAC –15%/+10% |
| Frequency range: | 50 / 60 Hz |
| Fuse rating for the operating voltage: | Internal electronic protection, tripping current > 500 mA, reset after approx. 1 sec |
| Internal electronic protection (Y/N): | yes |
| Power consumption: | 2.0 W; 4.9 VA |
| Monitored inputs: | - Short-circuit recognition: optional - Wire breakage detection: yes - Earth connection detection: yes |
| Number of NC contacts: | 2 |
| Number of NO contacts: | 0 |
| Max. conduction resistance: | max. 40 Ω |
| Outputs: | Stop category: 0 |
| Number of safety contacts: | 3 (13-14; 23-24; 33-34) |
| Number of auxiliary contacts: | 1 (41-42) |
| Max. switching capacity of the safety contacts: | 230 VAC, 8 A ohmic (inductive in case of appropriate protective wiring) |
| Max. switching capacity of the auxiliary contacts: | 24 VDC, 2 A |
| Utilisation category to IEC 60947-5-1: | AC-15: 230 V / 6 A DC-13: 24 V / 6 A |
| Fuse rating of the safety contacts: | 8 A slow blow |
| Fuse rating of the auxiliary contacts: | 2 A slow blow |
| Mechanical life: | 10 million operations |

Ambient conditions:
| Ambient temperature: | −25 °C ... +60 °C |
| Storage and transport temperature: | −40 °C ... +85 °C |
| Protection class: | Enclosure: IP40, Terminals: IP20, Clearance: IP54 |
| Mounting: | Snaps onto standard DIN rail to EN 60715 |
| Connection type: | Screw terminals |
| - min. cable section: | 0.25 mm² |
| - max. cable section: | 2.5 mm² |
| Weight: | 250 g |
| Dimensions (Height x Width x Depth): | 100 x 22.5 x 121 mm |

Approvals

Ordering details

SRB301MC-24V

Classification

Safety parameters:
| Standards: | ISO 13849-1, IEC 61508 |
| Category: | STOP 0: up to e |
| PFH value: | STOP 0: ≤ 2.00 x 10⁻⁸/h |
| SIL: | STOP 0: up to 3 |
| Mission time: | 20 years |

The PFH value of 2.00 x 10⁻⁸/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.

<table>
<thead>
<tr>
<th>Contact load</th>
<th>n-op/y</th>
<th>t-cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>525,600</td>
<td>1.0 min</td>
</tr>
<tr>
<td>40%</td>
<td>210,240</td>
<td>2.5 min</td>
</tr>
<tr>
<td>60%</td>
<td>75,087</td>
<td>7.0 min</td>
</tr>
<tr>
<td>80%</td>
<td>30,918</td>
<td>17.0 min</td>
</tr>
<tr>
<td>100%</td>
<td>12,223</td>
<td>43.0 min</td>
</tr>
</tbody>
</table>

Diverging applications upon request.
Safety controllers

Note

Connection of an AZM 200 solenoid interlock to the SRB301MC safety controller

Wiring diagram

LED

The integrated LEDs indicate the following operating states.
- Position relay K1
- Position relay K2
- Supply voltage U_B
- Internal operating voltage U_i

Note

- The wiring diagram is shown with guard doors closed and in de-energised condition.
Safety controllers

**SRB301ST V.2**

- Suitable for the signal treatment of potential-free contacts, e.g. emergency stop command devices, position switches, interlocking devices with and without interlocking function and magnetic safety switches
- Suitable for the signal treatment of potential-loaded outputs, e.g. electronic safety sensors with p-type semiconductor outputs as well as safety light grids and light curtains
- 1 or 2 channel control
- 3 safety contacts, STOP 0
- 1 signalling output (NC contact)
- Optionally with short-circuit recognition (through switch)
- With hybrid fuse
- Reset with edge detection or automatic start
- 4 LEDs to show operating conditions
- Plug-in screw terminals

### Technical data

**Standards:**
- IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508
**Start conditions:**
- Automatic or start button (monitored)
**Feedback circuit (Y/N):**
- yes
**ON delay with automatic start:**
- typ. 100 ms
**ON delay with reset button:**
- typ. 25 ms
**Drop-out delay in case of emergency stop:**
- ≤ 25 ms
**Drop-out delay on „supply failure“:**
- typ. 100 ms
**Rated operating voltage $U_e$:**
- 24 VDC –15%/+20%, residual ripple max. 10%; 24 VAC –15%/+10%
**Frequency range:**
- 50 / 60 Hz
**Fuse rating for the operating voltage:**
- Internal electronic protection, tripping current $F_1 > 500 \text{ mA}$; tripping current (S11, S21) > 50 mA; reset after disconnection of supply voltage
**Internal electronic protection (Y/N):**
- yes

**Power consumption:**
- 2.0 W; 4.9 VA
**Monitored inputs:**
- Short-circuit recognition: optional
- Wire breakage detection: yes
- Earth connection detection: yes
**Number of NC contacts:**
- 2
**Number of NO contacts:**
- 0
**Max. conduction resistance:**
- max. 40 Ω

**Outputs:**
- Number of safety contacts: 3 (13-14; 23-24; 33-34)
- Number of auxiliary contacts: 1 (41-42)
**Max. switching capacity of the auxiliary contacts:**
- 24 VDC, 2 A
**Utilisation category to IEC 60947-5-1:**
- AC-15; DC-13
**Fuse rating of the auxiliary contacts:**
- 2 A slow blow
**Mechanical life:**
- 10 million operations

**Ambient conditions:**
- Temperature range: $-25 ^\circ C$ ... $+60 ^\circ C$
- Storage and transport temperature: $-40 ^\circ C$ ... $+85 ^\circ C$
**Protection class:**
- Enclosure: IP40, Terminals: IP20, Clearance: IP54
**Mounting:**
- Snaps onto standard DIN rail to EN 60715
**Connection type:**
- Screw terminals, plug-in
- min. cable section: 0.25 mm²
- max. cable section: 2.5 mm²
**Weight:**
- 240 g
**Dimensions (Height x Width x Depth):**
- 100 x 22.5 x 121 mm

### Classification

**Safety parameters:**
- Standards:
  - ISO 13849-1, IEC 61508
- PL:
  - STOP 0: up to e
**Category:**
- STOP 0: up to 4
**PFH value:**
- STOP 0: ≤ 2.00 x 10⁻⁸/h
**SIL:**
- STOP 0: up to 3
**Mission time:**
- 20 years

The PFH value of 2.00 x 10⁻⁸/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts. Diverging applications upon request.

<table>
<thead>
<tr>
<th>Contact load</th>
<th>n-op/y</th>
<th>t-cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 %</td>
<td>525,600</td>
<td>1.0 min</td>
</tr>
<tr>
<td>40 %</td>
<td>210,240</td>
<td>2.5 min</td>
</tr>
<tr>
<td>60 %</td>
<td>75,087</td>
<td>7.0 min</td>
</tr>
<tr>
<td>80 %</td>
<td>30,918</td>
<td>17.0 min</td>
</tr>
<tr>
<td>100 %</td>
<td>12,223</td>
<td>43.0 min</td>
</tr>
</tbody>
</table>

**Approvals**

**Ordering details**

**SRB301ST V.2**
Safety controllers

Note
Connection of an AZM 200 solenoid interlock to the SRB301ST V.2 safety controller

Wiring diagram

LED
The integrated LEDs indicate the following operating states.
• Position relay K1
• Position relay K2
• Supply voltage $U_B$
• Internal operating voltage $U_i$

Note
• The wiring diagram is shown with guard doors closed and in de-energised condition.
Safety controllers

SRB324ST V.3

- Suitable for the signal treatment of potential-free contacts, e.g. emergency stop command devices, position switches, interlocking devices with and without interlocking function and magnetic safety switches
- Suitable for the signal treatment of potential-loaded outputs, e.g. electronic safety sensors with p-type semiconductor outputs as well as safety light grids and light curtains
- 1 or 2 channel control
- 3 safety contacts, STOP 0; 2 safety contacts, STOP 1, adjustable 1 ... 30 s
- 4 LEDs to show operating conditions
- With hybrid fuse
- Optional: Short-circuit recognition, manual reset with edge detection in fail-safe circuit, automatic reset function

Technical data

Standards: IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508
Start conditions: Automatic or start button (monitored)
Feedback circuit (Y/N): yes
ON delay with automatic start: typ. 400 ms
ON delay with reset button: typ. 30 ms
Drop-out delay in case of emergency stop: (13-14; 23-24; 33-34): ≤ 30 ms
Drop-out delay on „supply failure“: typ. 80 ms
Rated operating voltage Ue: 24 VDC -15%/+20%, residual ripple max. 10%; 24 VAC -15%/+10%
Frequency range: 50 / 60 Hz
Fuse rating for the operating voltage: Internal electronic protection; tripping current F1: > 2.5 A, F2: > 50 mA (S11-S31), > 800 mA (X4); reset after disconnection of supply voltage

Internal electronic protection (Y/N): yes
Monitor inputs:
- Short-circuit recognition: optional
- Wire breakage detection: yes
- Earth connection detection: yes
Number of NC contacts: 2
Number of NO contacts: 0
Max. conduction resistance: max. 40 Ω
Outputs:
Stop category: 0/1
Number of safety contacts: 5 (STOP 0: 13-14; 23-24; 33-34)
(STOP 1: 47-48; 57-58)
Number of auxiliary contacts: 1 (61-62)
Number of signalling outputs: 3 (Y1-Y3)
Max. switching capacity of the safety contacts: 250 VAC, 8 A
(STOP 0: 13-14; 23-24; 33-34), 250 VAC, 6 A
(STOP 1: 47-48; 57-58), 6 A ohmic (inductive in case of appropriate protective wiring)
Max. switching capacity of the auxiliary contacts: 24 VDC, 2 A
Max. switching capacity of the signalling outputs: 24 VDC, 100 mA; residual current: 200 mA
Utilisation category to IEC 60947-5-1: AC-15; DC-13
Fuse rating of the safety contacts: 8 A slow blow
(STOP 0: 13-14; 23-24; 33-34)
(STOP 1: 47-48; 57-58): 6.3 A slow blow
Fuse rating of the auxiliary contacts: 2 A slow blow
Fuse rating of the signalling outputs: 500 mA (internal electronic protection F3)
Mechanical life: 10 million operations

Ambient conditions:
Ambient temperature: -25 °C ... +60 °C
Storage and transport temperature: -40 °C ... +85 °C
Protection class: Enclosure: IP40, Terminals: IP20, Clearance: IP54
Mounting: Snaps onto standard DIN rail to EN 60715
Connection type: Screw terminals, plug-in
Cable section: 0.25 ... 2.5 mm²
Dimensions (Height x Width x Depth): 100 x 45 x 121 mm

Approvals

Ordering details

SRB324ST-24V V.3

Classification

Safety parameters:
Standards: ISO 13849-1, IEC 61508
PL:
STOP 0: up to e; STOP 1: up to d
Category:
STOP 0: up to 4; STOP 1: up to 3
PFH value:
STOP 0: ≤ 2.00 x 10^-8/h; STOP 1: ≤ 2.00 x 10^-7/h
SIL:
STOP 0: up to 3; STOP 1: up to 2
Mission time: 20 years

The PFH values of 2.00 x 10^-8/h and 2.00 x 10^-7/h apply to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.
Diverging applications upon request.

Contact load | n-op/y | t-cycle
--- | --- | ---
20 % | 525,600 | 1.0 min
40 % | 210,240 | 2.5 min
60 % | 75,087 | 7.0 min
80 % | 30,918 | 17.0 min
100 % | 12,223 | 43.0 min
Safety controllers

Note

Connection of an AZM 200 solenoid interlock to the SRB324ST V.3 safety controller

Wiring diagram

LED

The integrated LEDs indicate the following operating states.
• Position relay K1
• Position relay K2
• Position relay K3
• Position relay K4
• Supply voltage U_B
• Internal operating voltage U_I

Note

• The wiring diagram is shown with guard doors closed and in de-energised condition.
**SRB504ST**

- Suitable for signal processing of potential-free outputs, e.g. emergency stop command devices, interlocking devices, magnetic safety switches and outputs connected to potentials (AOPDs)
- 1 or 2 channel control
- 5 safety contacts, STOP 0
- 4 signalling outputs
- Switching capacity of the safety contacts 6 A
- Automatic reset, manual reset with edge detection
- 6 LEDs to show operating conditions
- Plug-in screw terminals

### Technical data

**Standards:** IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508

**Start conditions:** Automatic or start button (monitored)

**Feedback circuit (Y/N):** Yes

**ON delay with automatic start:** typ. 400 ms

**ON delay with reset button:** typ. 30 ms

**Drop-out delay in case of emergency stop:** ≤ 30 ms

**Drop-out delay on „supply failure“:** typ. 80 ms

**Rated operating voltage Ue:** 24 VDC –15%/+20%, residual ripple max. 10%;
24 VAC –15%/+10%

**Frequency range:** 50 / 60 Hz

**Fuse rating for the operating voltage:** Internal electronic protection;
tripping current F1: > 2.5 A, F2: > 50 mA (S11-S31), > 800 mA (X4)

**Internal electronic protection (Y/N):** Yes

**Power consumption:** 3.2 W; 7.1 VA, plus signalling output

**Monitored inputs:**
- Short-circuit recognition: Optional
- Wire breakage detection: Yes
- Earth connection detection: Yes
- Number of NC contacts: 2
- Number of NO contacts: 0
- Max. conduction resistance: max. 40 Ω

**Outputs:**
- Stop category: 0
- Number of safety contacts: 5 (13-14; 23-24; 33-34; 43-44; 53-54)
- Number of auxiliary contacts: 1 (61-62)
- Number of signalling outputs: 3 (Y1-Y3)

**Max. switching capacity of the safety contacts:** 250 VAC, 8 A ohmic (inductive in case of appropriate protective wiring)

**Max. switching capacity of the auxiliary contacts:** 24 VDC; 2 A

**Utilisation category to IEC 60947-5-1:** AC-15; DC-13

**Fuse rating of the safety contacts:** 8 A slow blow

**Fuse rating of the auxiliary contacts:** 2 A slow blow

**Fuse rating of the signalling outputs:** 100 mA slow blow

**Mechanical life:** 10 million operations

**Ambient conditions:**
- Ambient temperature: −25 °C ... +60 °C
- Storage and transport temperature: −40 °C ... +85 °C
- Protection class: Enclosure: IP40, Terminals: IP20, Clearance: IP54
- Mounting: Snaps onto standard DIN rail to EN 60715
- Connection type: Screw terminals, plug-in
- min. cable section: 0.25 mm²
- max. cable section: 2.5 mm²
- Weight: 420 g
- Dimensions (Height x Width x Depth): 100 x 45 x 121 mm

### Classification

**Safety parameters:**

**Standards:** ISO 13849-1, IEC 61508

**PL:** STOP 0: up to e

**Category:** STOP 0: up to 4

**PFH value:** STOP 0: ≤ 2.00 x 10⁻⁸/h

**SIL:** STOP 0: up to 3

**Mission time:** 20 years

The PFH value of 2.00 x 10⁻⁸/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.

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<td>17.0 min</td>
</tr>
<tr>
<td>100%</td>
<td>12,223</td>
<td>43.0 min</td>
</tr>
</tbody>
</table>

24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.

Diverging applications upon request.
Safety controllers

Note

• 2 channel control shown for a guard-door monitor with two contacts, of which at least one contact has positive break, with external reset button ○.
• Relay outputs: Suitable for 2 channel control, for increase in capacity or number of contacts by means of contactors or relays with positive-guided contacts.
• ○ = Feedback circuit
• The control recognises cross-short, cable break and earth leakages in the monitoring circuit.
• Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

Wiring diagram

LED

The integrated LEDs indicate the following operating states.
• Position relay K1
• Position relay K2
• Position relay K3
• Position relay K4
• Supply voltage $U_B$
• Internal operating voltage $U_I$

Note

• The wiring diagram is shown with guard doors closed and in de-energised condition.

SCHMERSAL
### Safety controllers

**PROTECT-PE**

- Possibility to connect up to 4 sensors per interface, e.g. safety magnetic switches of the BNS type, emergency stop control devices, interlocking devices, etc.
- Wiring of up to 4 sensors per interface with signals connected to the potential possible, e.g. CSS products from Schmersal and AOPD’s only PROTECT-PE-02.
- Current and voltage limitation of the input circuits
- Connection of sensors with 2 NC contacts (PROTECT-PE-02) or of sensors with NC/NO contacts (PROTECT-PE-11)
- Cross-wire monitoring of the input circuits (only PROTECT-PE-02)
- Signalling output for each sensor (monitoring of both circuits of one sensor) and of all sensors (Y5, summation signal)
- Signalling output 32-33, 33-34
- Cascading possible for the connection of up to 80 sensors
- Width 65.5 mm
- 6 LED to show operating conditions
- Cage clamps or plug-in screw terminals (ordering suffix -SK)
- With antivalent output contacts, ordering suffix -AN

### Technical data

**Standards:** IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508

#### Start conditions:
- automatic
- no

#### Feedback circuit (Y/N):
- no

#### ON delay with automatic start:
- typ. 10 ms

#### Drop-out delay in case of emergency stop:
- ≤ 10 ms

#### Drop-out delay on „supply failure“:
- ≤ 60 ms

#### Rated operating voltage $U_{op}$:
- 24 VDC –15%/+20%, residual ripple max. 10%

#### Fuse rating for the operating voltage:
- Internal electronic trip, tripping current > 300 mA
- yes

#### Internal electronic protection (Y/N):
- yes

#### Power consumption:
- max. 1.7 W; plus signalling outputs

#### Monitored inputs:
- Short-circuit recognition: PROTECT-PE-11: option; PROTECT-PE-02: yes
- Wire breakage detection: yes
- Earth connection detection: yes

#### Number of NC contacts:
- PROTECT-PE-11: 1; PROTECT-PE-02: 2

#### Number of NO contacts:
- PROTECT-PE-11: 1; PROTECT-PE-02: 0

#### Outputs:
- Stop category: 0
- Number of auxiliary contacts: 2 (13-14, 23-24)
- Number of signalling outputs: 7 (Y1-Y5, 32-33, 33-34)
- Max. switching capacity of the safety contacts:
  - V, 2 A ohmic (inductive in case of appropriate protective wiring)
- Max. switching capacity of signalling outputs:
  - 24 VDC, 100 mA
- Utilisation category to IEC 60947-5-1: DC-13
- Fuse rating of the safety contacts:
  - 2 A slow blow
- Fuse rating of the signalling outputs:
  - Internal electronic trip, tripping current > 750 mA
- Mechanical life: 10 million operations

#### Ambient conditions:
- Ambient temperature: −25 °C … +55 °C
- Storage and transport temperature: −25 °C … +70 °C
- Protection class: Enclosure: IP20, Terminals: IP20, Clearance: IP20
- Mounting: Snaps onto standard DIN rail to EN 60715
- Connection type: Cage clamps or ordering suffix -SK: plug-in screw terminals
- - min. cable section: Cage clamps: 0.08 mm²; Plug-in screw terminals: 0.14 mm²
- - max. cable section: Cage clamps: 2.5 mm²; Plug-in screw terminals: 1.5 mm²
- Weight: 160 g
- Dimensions (Height x Width x Depth): 126 x 48 x 43 mm

#### Classification

**Safety parameters:**

**Standards:** ISO 13849-1, IEC 61508

**PL:**
- STOP 0: up to d
- STOP 0: up to 3

**SIL:**
- STOP 0: 2.00 x 10^−7/h
- STOP 0: up to 2

**Mission time:**
- 20 years

The PFH value of 2.00 x 10^−7/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.

<table>
<thead>
<tr>
<th>Contact load</th>
<th>n-op/y</th>
<th>t-cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 %</td>
<td>525,600</td>
<td>1.0 min</td>
</tr>
<tr>
<td>40 %</td>
<td>210,240</td>
<td>2.5 min</td>
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<tr>
<td>60 %</td>
<td>75,087</td>
<td>7.0 min</td>
</tr>
<tr>
<td>80 %</td>
<td>30,918</td>
<td>17.0 min</td>
</tr>
<tr>
<td>100 %</td>
<td>12,223</td>
<td>43.0 min</td>
</tr>
</tbody>
</table>

The above-mentioned switching cycle times (t-cycles) for the relay contacts.

Diverging applications upon request.

---

**Approvals**

**Ordering details**

**PROTECT-PE-02**

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td></td>
<td>Connection of sensors with 2 NC contacts</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Connection of sensors with NC/NO contacts</td>
</tr>
<tr>
<td>11-AN</td>
<td></td>
<td>Connection of sensors with NC/NO contacts and antivalent output contacts</td>
</tr>
<tr>
<td>SK</td>
<td></td>
<td>Cage clamps</td>
</tr>
</tbody>
</table>

**Classification**

**PL:**
- STOP 0: up to d
- STOP 0: up to 3

**SIL:**
- STOP 0: 2.00 x 10^−7/h
- STOP 0: up to 2

**Mission time:**
- 20 years
Safety controllers

**Note**

- **Start level**: Depends on the wiring of the safety relay module.
- **Sensor level**: Dual-channel control of magnetic safety switches according to IEC 60947-5-3.
- **Output level**: Dual-channel control of a downstream safety relay module.
- **Cross-shorts, wire breakage and earth leakage in the control circuits are detected.**
- **If the inputs S1, S3, S5 and S7 are not used, they have to be bridged to plus.**
- **If the inputs S2, S4, S6 and S8 are not used, they have to be bridged to minus.**
- **The safety relay modules must be suitable for single or dual-channel floating NC-contacts.**
- **Start and actuator configuration has to be effected in accordance with the data sheet.**
- **The obtainable performance level and category according to ISO 13849-1 depends on type and wiring of the used safety relay module.**

---

**LED**

- **LED's or signalling outputs signalise an opened protective device or emergency stops.**
- **Monitoring effected on both contact circuits of the sensor.**
- **When the protective device or the emergency stop circuit is opened a signal of 24 V will be wired the regarding output (Y1…Y5) and the dedicated LED lights.**

The integrated LEDs indicate the following operating states.

- Position relay K1
- Position relay K2
- Position relay K3
- Position relay K4
- Internal operating voltage U_i

---

**Wiring diagram**

The wiring diagram is shown with guard doors closed and in de-energised condition. Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.
Up-to-date without fail.
The online product catalogue

For detailed information, check out www.schmersal.net
The compact safety controller PROTECT-SELECT offers engineers high flexibility for configuring safety devices and for integrating safety devices into machine functions.

Four different basic programs are available. Each program can easily be adapted to the respective application via menu navigation and cleartext messages. Programming skills are not required. Thus e.g. the drop-out delay and debouncing times can be set individually and numerous parameters such as cross-circuit monitoring can be configured according to the requirements – a clear advantage compared to safety control modules.

All of the four programs offer numerous functions, including the following:

- Connection of up to 6 dual-channel safety switching devices (with or without potential) up to PL e/ SIL 3
- Safety semi-conductor and relay outputs with Stop 0 or Stop 1 (adjustable)
- Safe analog monitoring of temperature and other process variables
- Free assignment of feedback circuit, start-up tests, periodic tests, auto start, manual start
- Cross-circuit detection via clock outputs
- Display of cleartext messages during troubleshooting
- Input filter for safety devices with contact bounce
Compact safety controller

PROTECT-SELECT

- Suitable for signal processing of potential-free outputs, e.g. emergency stop command devices, position switches, solenoid interlocks with and without interlocking function and magnetic safety switches
- Suitable for the signal treatment of potential-loaded outputs, e.g. electronic safety sensors with p-type semi-conductor outputs as well as safety light grids and light curtains
- 1 or 2 channel control
- Safety outputs with Stop 0/1 function and free adjustable fail-safe timer
- Automatic or manual reset function
- Optionally with short-circuit recognition
- Input filter for safety devices with contact bounce
- LEDs to show operating conditions

Technical data

Standards: ISO 13849-1; IEC 61508; IEC 62061; IEC 60204-1; IEC 60947-5-1
Start conditions: Automatic or manual (adjustable)
Feedback circuit (Y/N): adjustable
Rated operating voltage Ue: 24 VDC ±10%
Fuse rating for the operating voltage: 3 A slow blow, external
Internal electronic protection (Y/N): yes

Digital safety inputs:
- Short-circuit recognition: optional
- Wire breakage detection: yes
- Earth connection detection: yes
Number of NC contacts, 2 channel: application dependent, max. 6
Number of NC/NO contacts: application dependent, max. 6
Max. conduction resistance: max. 300 Ω

Safe analogue inputs:

Measurement range: 0...10 VDC
Accuracy: typ. 3 % (max. cable length < 30 m)
Resolution: 12 Bit

Safety semi-conductor outputs:
Stop category: 0 or 1 (adjustable)
Number (p-n-type): 1
Number (p-type): 2
Max. switching capacity: 24 VDC at 0.7 A; ohmic load, short-circuit proof

Safety relay outputs:
Number: 2 (common access)
Contact load capacity:
- AC-1: 250 V / 4 A;
- AC-15: 230 V / 3 A;
- DC-1: 24 V / 4 A;
- DC-13: 24 V / 4 A / 0.1 Hz

Signalling outputs:
Number: optional 4
Max. switching capacity: 24 VDC at 0.1 A; ohmic load, short-circuit proof

Clock outputs:
Number: 3
Max. current at: 24 VDC at 0.1 A; ohmic load, short-circuit proof
Switch-off test pulse: < 1.5 ms

Ambient conditions:
Ambient temperature: -25 °C ... +55 °C
Storage and transport temperature: -40 °C ... +85 °C
Installation: vertical, no condensation
Installation compartment: Earthen, lockable switch cabinet with class of protection IP54
Protection class: IP20
Mounting: Snaps onto standard DIN rail to EN 60715
Connection type:
- min. cable section: 0.25 mm²
- max. cable section: 2.5 mm²
Weight: 300 g
Dimensions (Height x Width x Depth): 100 x 52.5 x 118 mm

Approvals

Ordering details

PROTECT-SELECT

<table>
<thead>
<tr>
<th>No.</th>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK</td>
<td></td>
<td>Screw terminals</td>
</tr>
<tr>
<td>CC</td>
<td></td>
<td>Cage clamps</td>
</tr>
</tbody>
</table>

Classification

Safety parameters:

Standards: ISO 13849-1; IEC 61508; IEC 62061;
PL: up to e
Category: up to 4
DC: high
CCF: > 65 points
SIL CL: up to 3
SFF: > 99%
PFHd: 1.6 x 10^-8/h (Valid for dual channel and 60% relay load)
Mission time: 20 years
Hardware fault tolerance: 1
Request rate: High and continuous
MTTFd (inputs+logic + semi-conductor outputs): >100 years
B10d Value (for one channel of the relay output):
- Small load range: 20%: 10,000,000
  40%: 7,500,000
  60%: 2,500,000
  80%: 1,000,000
- Maximum load: 100%: 400,000
Compact safety controller

Application program 1

One safety area with operating mode switch / enabling switch

The program 1 allows to connect up to four dual-channel safety switching devices, each of which can be bridged by means of operating mode switches and enabling switches. The program is ideally suited for hazardous areas where additional operating modes such as “setting-up mode” and “process monitoring” are facilitating tasks like setting up a machine or troubleshooting.

- Up to 4 safety switching devices can be bridged in conformance with standards
- Additional emergency stop function
- Direct control of a solenoid interlock (lock/unlock)

Clear view onto process
Additional operating modes can be useful e.g. when a machine needs to be set-up or adjusted after a tool change.

Setting-up mode and process monitoring
Operating modes such as the setting-up mode and process monitoring can be realised with PROTECT-SELECT and application program 1.

Application program 2

Two safety areas

It is often useful to provide two separate safety areas for the particular workplaces on machines. Program 2 has been developed for this application. Here is an example from the packaging machine industry: The upper part of the machine is the work area, where packaging units are fed and packaged.

The lower part of the machine houses the material feed mechanism and the drive units. It must only be accessed for maintenance purposes, but must still be monitored with a safety switching devices. This functionality can be achieved with application program 2 of PROTECT-SELECT.

- For up to 2 or 3 safety switching devices per safety area
- Start/reset function for each safety area
- Feedback circuits for each safety area
- Prioritised emergency stop with independent reset function

Work area
The work area can be protected by up to 3 safety switching devices which can be configured individually.

Service / material supply
The area below (or above) the work area is considered to be an independent safety area and is thus configured separately.
Compact safety controller

Application program 3

One safety area with up to six safety switching devices

Program 3 can be used for processing signals of up to 6 safety switching devices. The application program allows to assign a separate reset function to one of the safety switching devices. This way even the most complex safety areas which are monitored by several safety switching devices can be conveniently configured.

- For up to 6 safety switching devices
- Direct control of a solenoid interlock (lock / unlock)
- Prioritised emergency stop with independent reset function

Many switching devices – one evaluation

PROTECT-SELECT operating in program 3 replaces up to 6 safety control modules and thus helps saving money and space in the control cabinet.

Multi-purpose use

Program 3 is e.g. ideally suited for safety areas which are monitored by several safety switching devices.

Application program 4

One safety area with safe bridging (muting)

In order to ensure a material transport into and out of a safety area without provoking a machine stop, an optoelectronic safety device which is bridged automatically and for a limited amount of time should be used.

Usually a safety light-grid with integrated muting function is required for this purpose. When PROTECT-SELECT is used, the muting function can be monitored directly via standard safety light-grids and sensors. In addition, signals from 2 other safety switching devices can be processed. This enables the user to realise a complete muting application with e.g. an additional guard door and an emergency stop function.

- Muting function with standard optoelectronic safety devices
- Flexible muting time parameterization
- Connection of additional emergency stop and safety switching device
- Direct control of a solenoid interlock (lock / unlock)

Muting boosts productivity

The muting function enables safe monitoring of the access to the hazardous area without interruptions of the material flow or the work flow.

All functions combined in one module

All safety functions for safety areas with muting are controlled via one PROTECT-SELECT unit – including e.g. a solenoid interlock and an emergency stop function.
Humanity first and foremost.
Safety Consulting

For detailed information, check out
www.schmersal.com
### Wuppertal

**K.A. Schmersal GmbH & Co. KG**
- Founded in 1945
- Around 600 employees

**Focal points**
- Headquarters of the Schmersal Group
- Development and manufacture of switchgears and switching systems for safety, automation and lift engineering
- Accredited test laboratory
- Central research and development
- Logistics centre for European markets

### Wettenberg

**K.A. Schmersal GmbH & Co. KG**
- Founded in 1952 (1997)
- Around 150 employees

**Focal points**
- Development and manufacture of switchgears for operation and monitoring, safety-related relay modules and controls as well as switchgears for explosion protection

### Mühldorf / Inn

**Safety Control GmbH**
- Around 30 employees

**Focal points**
- Development and manufacture of optical electronic components for safety and automation engineering

### Bergisch Gladbach

**Böhnke + Partner Steuerungssysteme GmbH**
- Around 70 employees

**Focal points**
- Development and manufacture of components, controls and remote diagnostic systems for the lift industry

( ) = inclusion in the Schmersal Group
Schmersal Worldwide
International Offices

Boituva / Brazil

ACE Schmersal
- Founded in 1974
- Around 350 employees

Focal points
- Manufacture of electromechanical and electronic switchgears
- Customer-specific control systems for the North and South American market

Shanghai / China

Schmersal Industrial Switchgear Co. Ltd
- Founded in 1999
- Around 165 employees

Focal points
- Development and manufacture of switchgears for safety, automation and lift engineering for the Asian market

Pune / India

Schmersal India Private Limited
- Founded in 2013
- Around 54 employees

Focal points
- Development and manufacture of switchgears for safety, automation and lift engineering for the Indian market
The privately owned Schmersal Group has been developing and manufacturing products to enhance the safety at work for decades. The company was founded in 1945 and is represented by seven manufacturing sites on three continents with its own companies and sales partners in more than 60 nations. In the demanding field of machine safety the Schmersal Group is one of the international market and component leaders. On the basis of a comprehensive product portfolio, the company’s approximate 2000 employees develop and design complete solutions for the safety of man and machine.

Customers of the Schmersal Group include „Global Players“ from mechanical engineering and plant manufacturing and operators of machinery. They benefit from the comprehensive know-how of the company when it comes to the standard-compliant integration of safety technology in the production processes. Furthermore, Schmersal has special sector expertise in the application fields that demand high quality requirements and special characteristics from safety switching systems. This includes the foodstuff production, packaging industry, machine tool industry, lift switchgear, heavy industry and the automobile industry.

Against this background of growing standards and directives on machine safety, the tec.nicum offers a comprehensive range of Safety Services as part of the Schmersal Group services division: Certified functional safety engineers advise customers in creating suitable safety concepts keeping in mind the legitimate requirements, and this is done on a worldwide scale.

<table>
<thead>
<tr>
<th>Product ranges</th>
<th>Industries</th>
<th>Services</th>
<th>Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe switching and monitoring</td>
<td>Elevators and Escalators</td>
<td>Application support</td>
<td>Machine safety</td>
</tr>
<tr>
<td></td>
<td>Commanding devices</td>
<td>CE conformity assessment</td>
<td>Automation</td>
</tr>
<tr>
<td></td>
<td>Safety devices</td>
<td>Risk assessment</td>
<td>Explosion protection</td>
</tr>
<tr>
<td></td>
<td>Tactile safety devices</td>
<td>Hazard assessment</td>
<td>Hygienic Design</td>
</tr>
<tr>
<td></td>
<td>Optoelectronic safety devices</td>
<td>Upgrading / Retrofit</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technical planning and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>implementation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trainings</td>
<td></td>
</tr>
<tr>
<td>Safe signal processing</td>
<td>Packaging</td>
<td>C Landshut</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Food</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Machine tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heavy industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automation</td>
<td>Safety monitoring modules</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety controllers</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety bus systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automation</td>
<td>Position detection</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Command and signalling devices</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Precautions have been taken to assure accuracy of the information in this catalogue. Typographic or pictorial errors that are brought to our attention will be corrected in subsequent issues.

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