Electronic Safety Sensors and Solenoid Interlocks

Product information | Release 09

SCHMERSAL

Safe solutions for your industry

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

www.schmersal.net

Online documentation in 13 languages

The online catalogue for our customers is permanently updated. The Main catalogue can be consulted on the Internet in 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.

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 in CAD-systems.
The Schmersal homepage furthermore contains up-to-date information on general subjects, technical articles on machine safety as well as news regarding events and trainings. To be bookmarked!

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 –
anyplace, anywhere, anytime!

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 § 5 GPSG) or other national laws.

Subject to technical modifications and errors. The data specified in this catalogue are carefully checked typical standard values.

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 of Products and Services of the Electrical Industry”.

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

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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 cross-shorts 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_d 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. While doing this, the sensor evaluates the distance with regard to the actuator as well as the coding of the actuator. 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 anti-magnetic 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 variants offer a high degree of protection against tampering.

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 energizing the solenoid. With the power-to-lock principle, the safety guard is mechanically locked by magnetic force (i.e. by energizing the solenoid) and unlocked by spring force. As the power-to-lock solenoid interlock can be unlocked in de-energised condition, 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”.

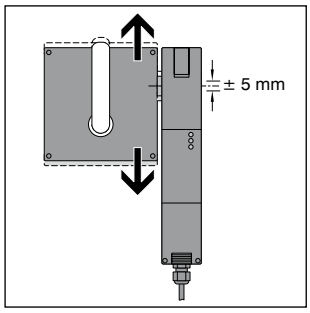
Emergency exit

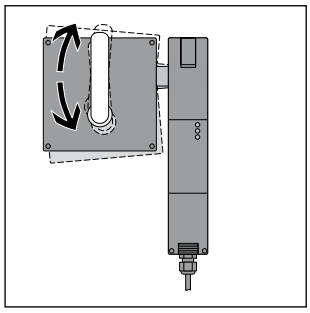
An emergency exit allows an intentional opening of the safety guard from inside the machine without tools, for example when staff are trapped inside a machine.
It enables the unlocking and opening of the safety guard with just one hand movement by simply turning the emergency handle located on the inside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

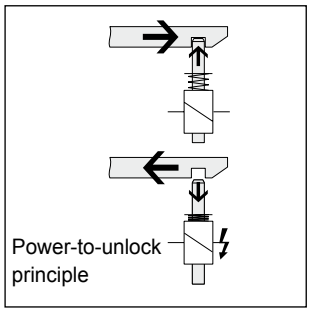
AZM 300 solenoid interlock

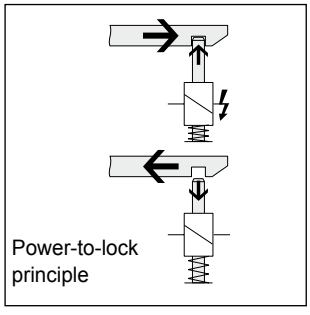
At the first glance the electronic solenoid interlock AZM 300 is already different from others available switchgears. A unique locking system based on a rotatable star handle enables that the solenoid interlock could be actuated from three sides. This provides universal applicability. Exactly the same 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.









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°.

MZM 100 electronic magnetic interlock

In this 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.

Interlocking unit

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 currentcarrying magnet.

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

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.

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

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.

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.

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.

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

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

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
- Modbus/TCP
- EtherCAT

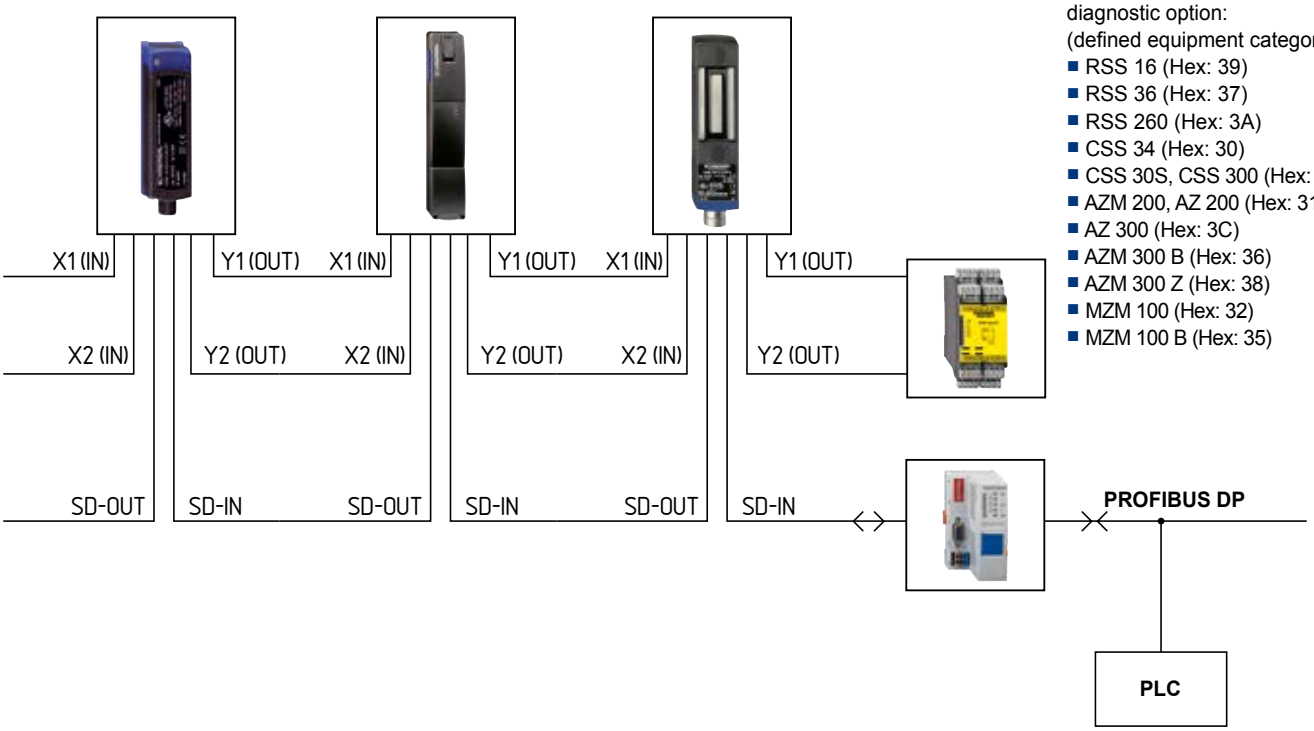
The SD Gateways are integrated as slave in the available field bus system. In this way, the diagnostic signals can be evaluated through the connected control system.

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: 38)
- MZM 100 (Hex: 32)
- MZM 100 B (Hex: 35)

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

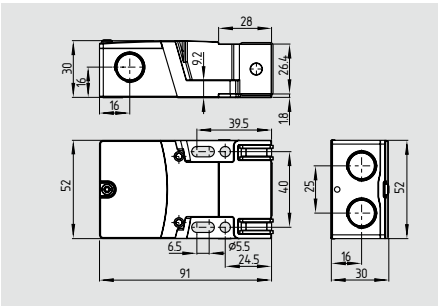
Operation advantages
- Individually coded version with Coding level „High“ according to ISO 14119
- Three types of codings for demand orientated protection against manipulation
- Three actuating directions
- Door stop with magnetic latching function
- Terminal box or plug connection

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

Electronic safety sensor RSS 16

RSS 16-..-R

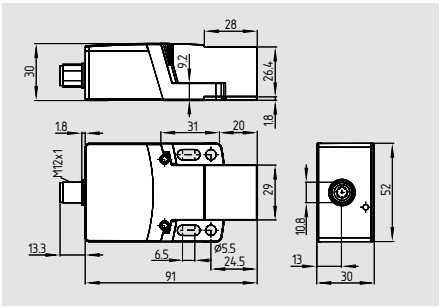


- Thermoplastic enclosure
- 2 short-circuit proof, p-type safety outputs (24 VDC per 1000 mA)
- Repeated universal or individual coding through RFID technology
- Three actuating directions
- Door stop with magnetic latching function
- Optionally with latching available
- Safety and diagnostic signals wired in series
- Series-wiring, unlimited
- Integrated cross-wire, wire breakage and external voltage monitoring of the safety cable up to the control cabinet
- LED status display
- Terminal box or plug connection
- Protection class IP65 / IP67 to IEC 60529

Approvals

TÜV cULus CE

RSS 16



- Without latching
- With screw terminals

Approvals

TÜV cULus CE

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
Coding level according to ISO 14119:	
- I1-version:	high
- I2-version:	high
- Standard coding version:	low
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_{ao}:	12 mm
- On versions with latching s_{ao}:	5 mm
Assured switch-off distance s_{ar}:	30 mm
Hysteresis:	< 2.0 mm
Repeat accuracy R:	< 0.5 mm
Ambient conditions:	
Ambient temperature Tu:	−25 °C … +70 °C
Storage and transport temperature:	−25 °C … +85 °C
Protection class:	IP65 / IP67
- 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:	1 Hz
Response time:	
- Actuator:	≤ 100 ms
- Inputs:	≤ 0.5 ms
Duration of risk:	≤ 200 ms
Time to readiness:	≤ 2 s
Minimum distance between adjacent sensors:	250 mm

Ordering details

RSS16-①-②-③-④

No.	Option	Description
①		Standard coding
	I1	Individual coding
	I2	Individual coding, re-teaching enabled
②	D	With diagnostic output
	SD	With serial diagnostic function
③		Without latching
	R	With latching, latching force 40 … 60 N
④	ST8H	With connector plug M12 in the middle
	CC	With cage clamps
	SK	With screw terminals

Note

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

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.

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_m:	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_o:	45 mA
Overvoltage category:	III
Degree of pollution:	3

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}:	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:	U_e < 1 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 DC-13: U_e/I_e: 24 VDC / 0,05 A
Voltage drop:	U_e < 2 V
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:

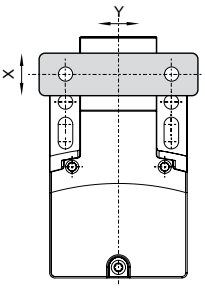
green	Supply voltage on
yellow	Actuator in the detection range
red	Fault

Classification

Standards:	ISO 13849-1, IEC 61508, IEC 62061
PL:	e
Category:	4
PFH :	6,3 x 10^{-11}/h
PFD:	1,1 x 10^{-5}
SIL:	suitable for SIL 3 applications
Mission time:	20 years

Misalignment

Lateral actuation

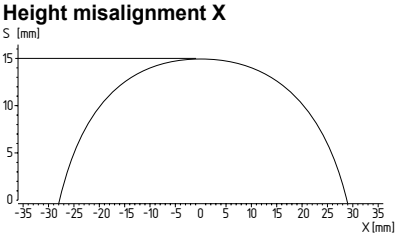


The axial misalignment (Y) is max. ± 9 mm.
The height misalignment (X) is max. ± 27 mm.

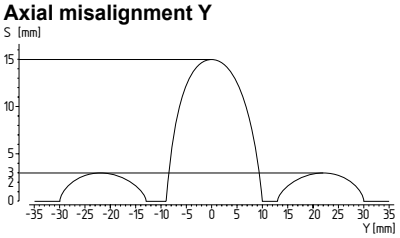
Latching versions X ± 2 mm, Y ± 2 mm.
The latching force is reduced by misalignment.

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

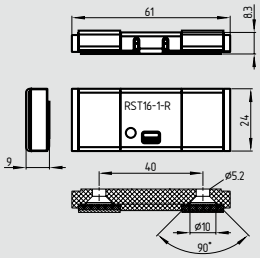


Axial misalignment Y

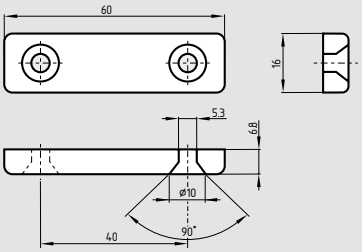


Preferred actuating directions:
From front or from the X direction.
With lateral travel in the Y direction be aware of the side lobes.

System components



Actuator RST16-1-R



Actuator RST16-1

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.

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.

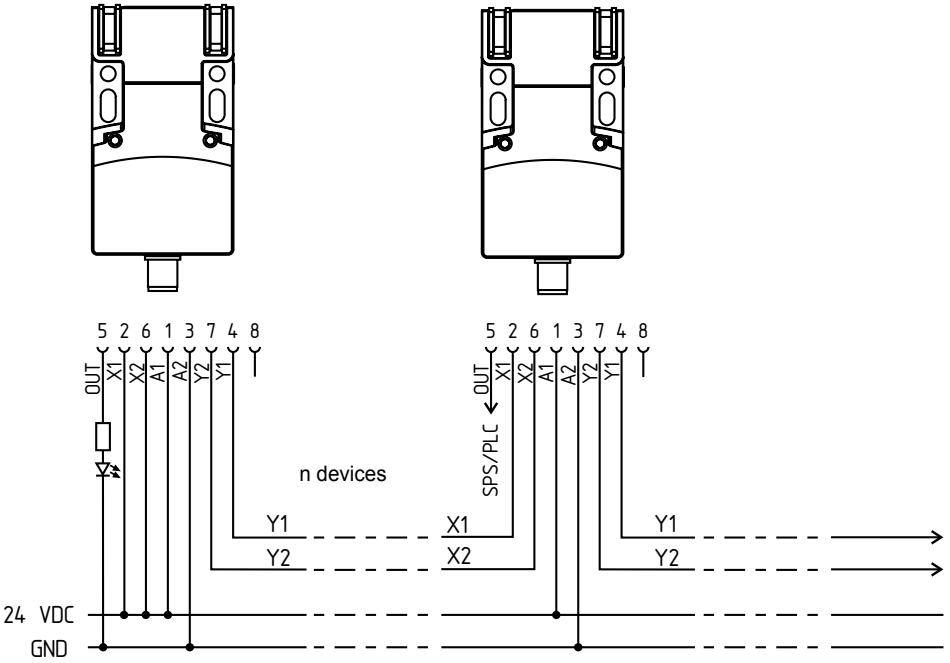
Ordering option -I2:
Teaching the individual coding of a RST actuator by a simple routine during the start-up procedure (as -I1). A protected coding process enables the teaching of a new actuator for service purposes.

Ordering details

Actuator, with latching (The latching function will be reached with the combination of RSS16-…R and RST16-1-R.)	**RST16-1-R**
Actuator, without latching	**RST16-1**

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

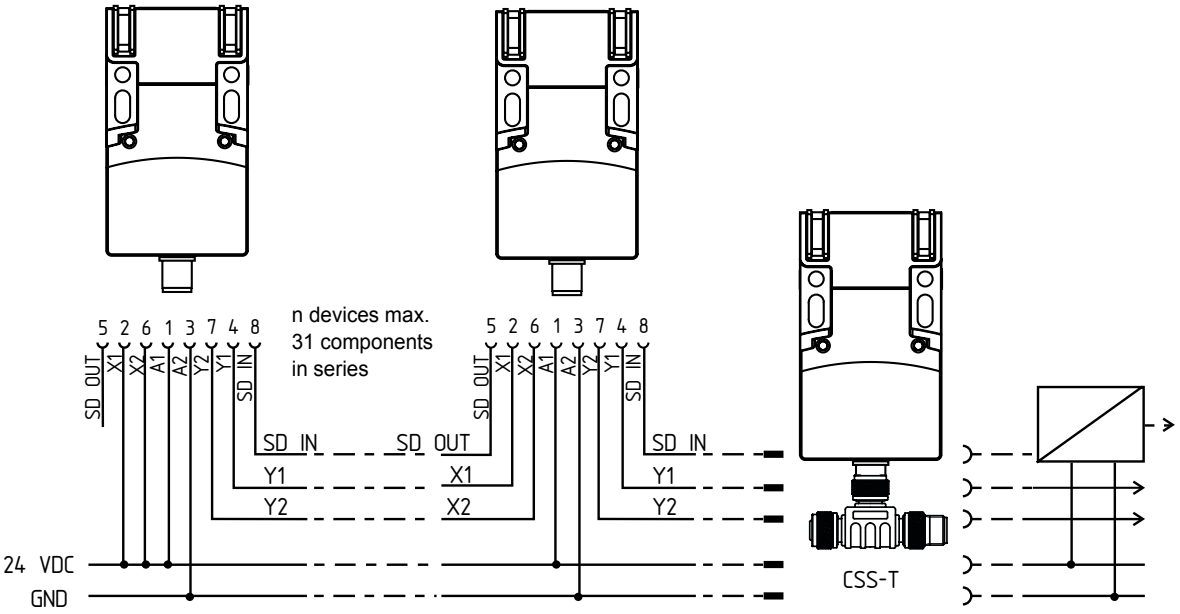
Series-wiring of the RSS 16 with conventional diagnostic output



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.

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.

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

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

Sensor function	LEDs			Diagnostic output	Safety outputs	Note
	Green	Red	Yellow		Y1, Y2	
Supply voltage	on	off	off	0 V	0 V	Voltage on, no evaluation of the voltage quality
Actuated	off	off	on	24 V	24 V	The yellow LED always signals the presence of an actuator within range
Actuated in limit area	off	off	flashes (1Hz)	24 V pulsed	24 V	The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine
Error warning, sensor actuated	off	flashes	off	0 V	24 V	After 30 minutes → error
Error	off	flashes	off	0 V	0 V	Refer to table: Flash codes
Teach actuator	off	on	flashes	0 V	0 V	Sensor in teaching mode
Protection time	flashes	off	off	0 V	0 V	10 minutes pause after re-teaching

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

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

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

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

The shown bit sequence of the diagnostic byte is an example. A different combination of theoperating 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

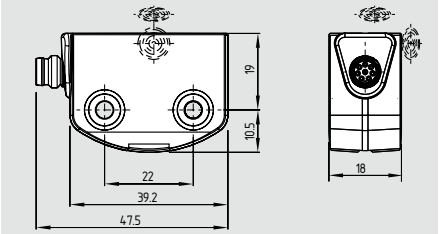
Application advantages
- Individually coded version with Coding level „High“ according to ISO 14119
- Compact form factor and subtle, elegant design
- Easy installation without additional angles
- Universal application through different actuators for typical installation situations
- Repeated universal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



active area

- 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

Approvals

TÜV cULus CE

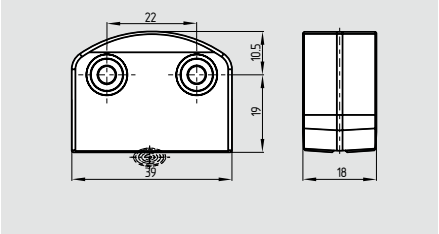
Ordering details

RSS260-①-②-ST

No.	Option	Description
①		Standard coding
	I1	Individual coding
	I2	Individual coding, re-teaching enabled
②	D	With diagnostic output
	SD	With serial diagnostic

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

RST 260-1



active area

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

Approvals

Certification in combination with safety sensor

TÜV cULus

Ordering details

Actuator **RST260-1**

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

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_{ao}:	10 mm;
- in case of lateral actuation:	6 mm
Assured switch-off distance s_{ar}:	18 mm;
- in case of lateral actuation:	15 mm
Hysteresis:	< 2.0 mm
Repeat accuracy R:	< 0.5 mm

Ambient conditions:

Ambient temperature Tu:	−25 °C … +65 °C
Storage and transport temp.:	−25 °C … +85 °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:	32 V
Rated impulse withstand voltage U_{imp}:	800 V
Residual current I_r:	< 0,5 mA
No-load current I_o:	35 mA
Overvoltage category:	III
Degree of pollution:	3

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.

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_e/I_e: 24 VDC / 0,25 A; DC-13: U_e/I_e: 24 VDC / 0,25 A
Voltage drop:	Ue < 1 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; DC-13: U_e/I_e: 24 VDC / 0,05 A
Voltage drop:	Ue < 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:

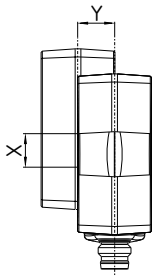
green	Supply voltage on
yellow	Actuator in the detection range
red	Fault

Classification:

Standards:	ISO 13849-1, IEC 61508, IEC 62061
PL:	e
Category:	4
PFH:	6,8 x 10^{-10} / h
PFD:	1,2 x 10^{-4}
SIL:	suitable for SIL 3 applications
Mission time:	20 years

Misalignment

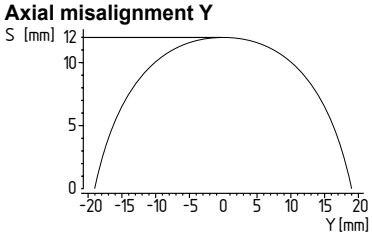
Lateral actuation



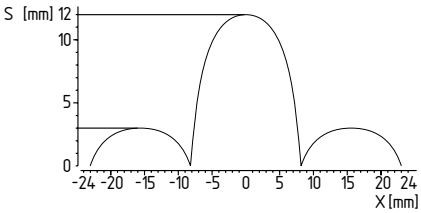
The axial misalignment (Y) is max. ± 18 mm.
The height misalignment (X) is max. ± 8 mm.

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

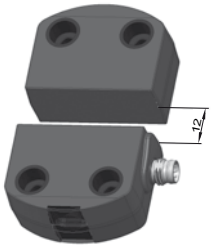


Height misalignment X

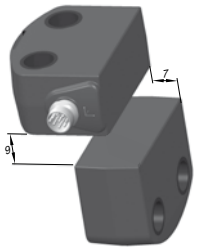


Preferred actuation directions:
From front or from side In case of a lateral actuation, the switching distances are reduced by approx. 3 mm.

Actuating directions



Actuation from front



Lateral actuation
Lateral actuation only from the shown sensor side

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.

Coding procedure

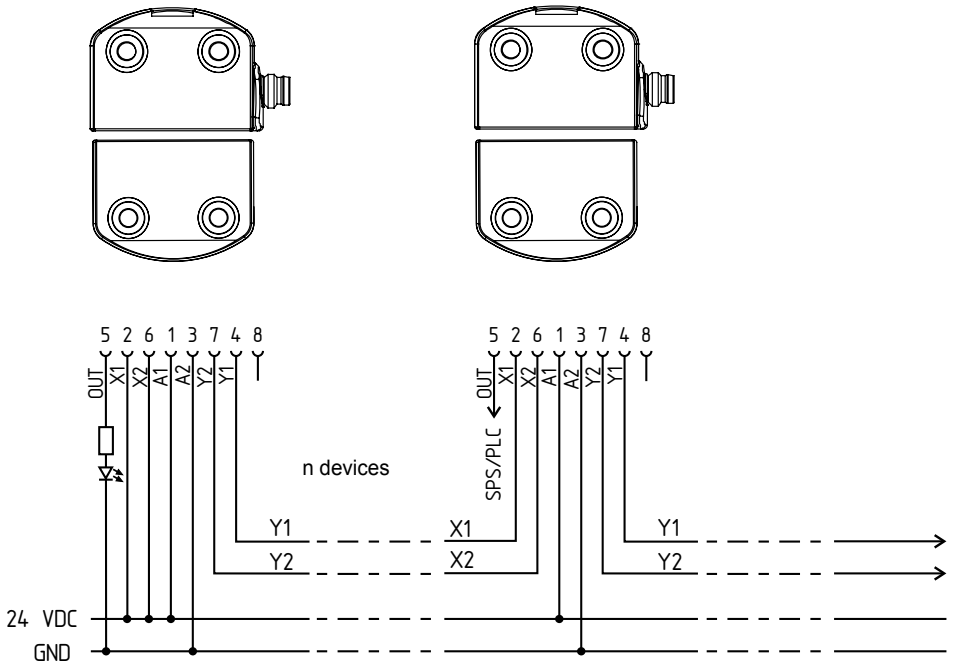
Ordering option -I1:
During the individual coding, a RST actuator is taught by a simple routine during the start-up procedure, so that every form of tampering by means of a replacement or substitute actuator is permanently excluded.

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

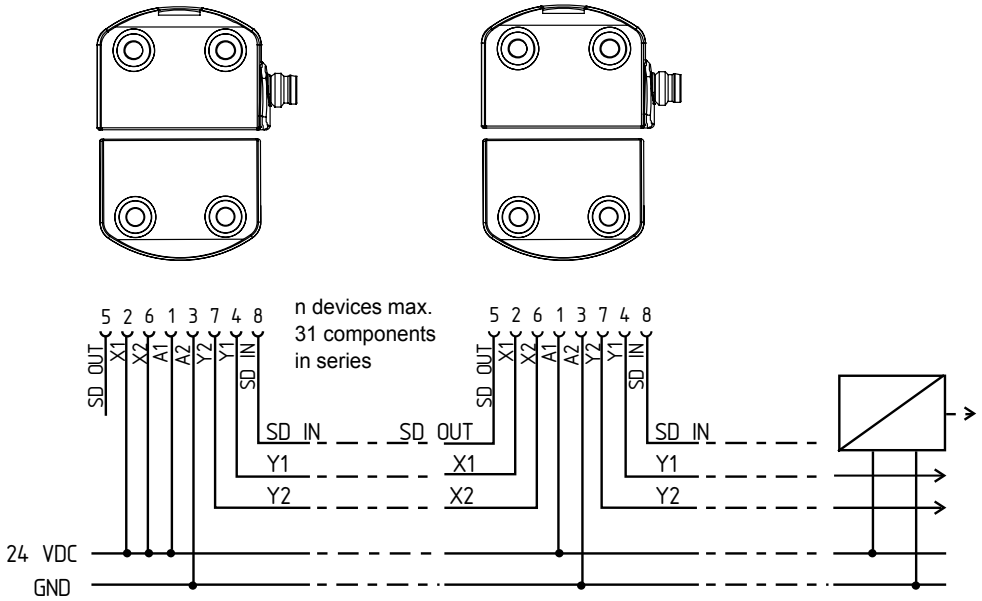
Series-wiring of the RSS 260 with conventional diagnostic output



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 260 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.

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.

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

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

Sensor function	LEDs			Diagnostic output	Safety outputs	Note
	Green	Red	Yellow		Y1, Y2	
Supply voltage	on	off	off	0 V	0 V	Voltage on, no evaluation of the voltage quality
Actuated	on	off	on	24 V	24 V	The yellow LED always signals the presence of an actuator within range
Actuated in limit area	on	off	flashes (1Hz)	24 V pulsed	24 V	The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine
Error warning, sensor actuated	off	flashes	on	0 V	24 V	After 30 minutes → error
Error	off	flashes	on	0 V	0 V	Refer to table: Flash codes
Teach actuator	off	on	flashes	0 V	0 V	Sensor in teaching mode
Protection time	flashes	off	off	0 V	0 V	10 minutes pause after re-teaching

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

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

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

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

The shown bit sequence of the diagnostic byte is an example. A different combination of theoperating 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

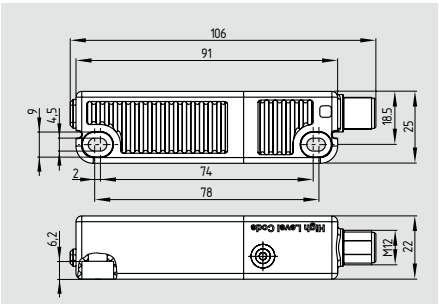
Actuation advantages
- Higher protection against tampering because of the optional individual coding of the safety sensor and the actuator
- Non-contact principle, no mechanical wear
- Optionally version with latching available
- High repeat accuracy of the switching points

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 integrated connector
- Robust due to the used cleaning agent-resistant materials and protection class up to IP69K

Approvals

TÜV cULus ECOLAB CE

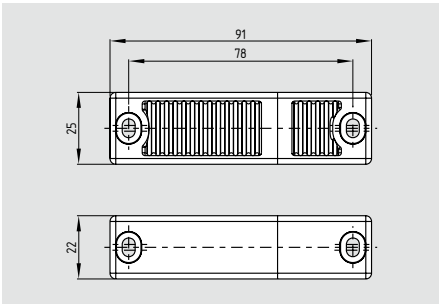
Ordering details

RSS 36 ①-②-③-ST

No.	Option	Description
①		Standard coding
	I1	Individual coding
	I2	Individual coding, unlimited
②	D	With diagnostic output
	SD	With serial diagnostic
③		Without latching
	R	with latching, latching force approx. 18 N

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

RST 36-1



- Thermoplastic enclosure
- Flexible fitting through universal mounting holes

Approvals

Certification in combination with safety sensor

TÜV cULus ECOLAB

Ordering details

Actuator **RST 36-1**
Actuator, with latching magnet **RST 36-1-R**
(The latching function is only active when RSS 36-…R is combined with RST 36-1-R.)

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

Technical data

Standards:	IEC 60947-5-3, IEC 61508, ISO 13849-1
Enclosure:	glass-fibre reinforced thermoplastic
Mode of operation:	RFID
Coding level according to ISO 14119:	
- I1-version:	high
- I2-version:	high
- Standard coding version:	low
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, 8-pole, A-coded
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 Tu:	−25 °C … +70 °C
Storage and transport temperature:	−25 °C … +85 °C
Protection class:	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)

Note

Wiring and connectors
refer to page 108

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

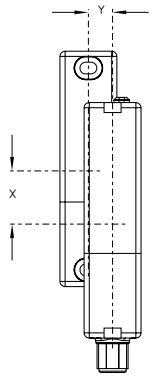
Electronic safety sensor RSS 36

Technical data

Rated operating current I_e:	0.6 A
Lowest operating current I_m:	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_0:	35 mA
Protection class:	II
Overvoltage category:	III
Degree of pollution:	3
Safety inputs X1/X2:	
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
	DC-13: U_e/I_e: 24 VDC/0.25 A
Voltage drop:	< 1 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
	DC-13: U_e/I_e: 24 VDC/0.05 A
Voltage drop:	< 2 V
Serial diagnostic:	short-circuit proof
Operating current:	150 mA
Wiring capacitance for serial diagnostic:	max. 50 nF
External cable protection:	Fuse 2.0 A
	Please observe the cable section of the lead-on cable
LED functions:	
Green	Supply voltage on
Yellow	Operating status
Red	Error
Classification:	
Standards:	ISO 13849-1, IEC 61508, IEC 62061
PL:	e
Category:	4
PFH :	2.7 x 10^{-10}/h
PFD:	2.1 x 10^{-5}
SIL:	suitable for SIL 3 applications
Mission time:	20 years

Misalignment

Lateral actuation

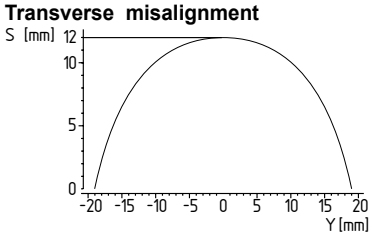


The axial misalignment (Y) is max. ± 18 mm.
The height misalignment (X) is max. ± 8 mm.

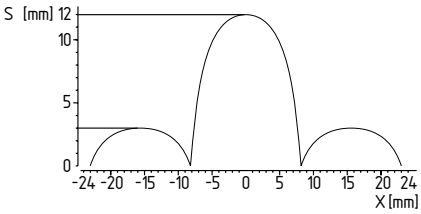
Latching versions X ± 5 mm, Y ± 3 mm.
The latching force is reduced by misalignment.

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.

Transverse misalignment



Height misalignment



Preferred actuating directions:
from front or from side

System components

Sealing kit

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.

Coding procedure

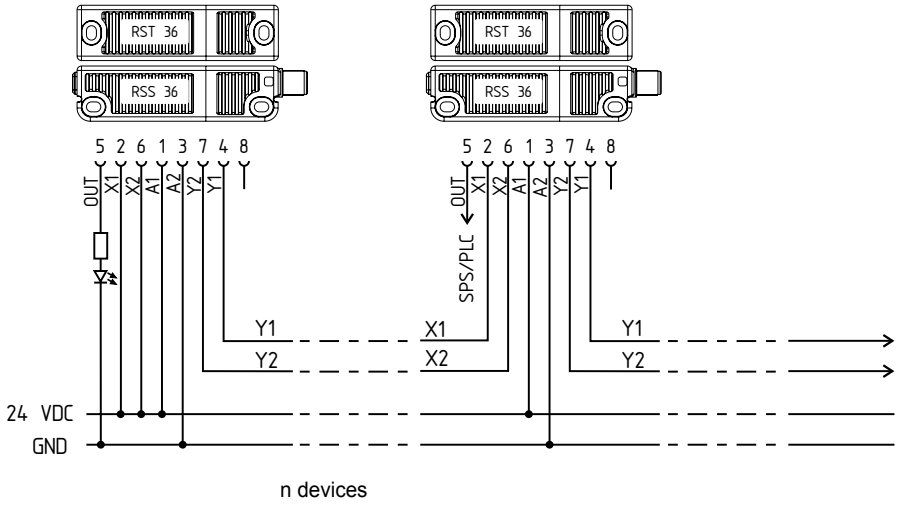
Ordering option -I1:
During the individual coding, a RST actuator is taught by a simple routine during the start-up procedure, so that every form of tampering by means of a replacement or substitute actuator is permanently excluded.

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.

Ordering details

Sealing kit ACC RSS 36-SK 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)	**101215048**
Tamperproof screws (not displayed)	
NRS-M4X25-FHS-4PCS	**101217746**
NRS-M4X30-FHS-4PCS	**101217747**

Series-wiring of the RSS 36 with conventional diagnostic output

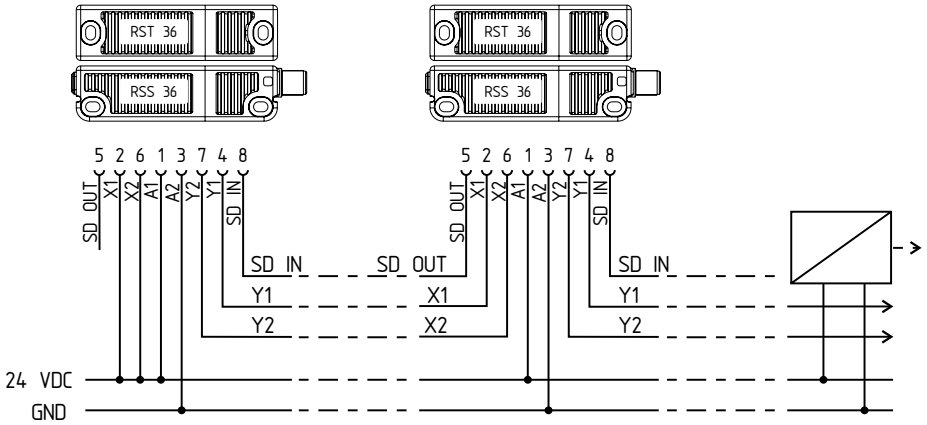


n devices

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



n devices max.
31 components
in series

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.

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.

LED (red)	Flash codes	Cause
1 flash pulse		Error output Y1
2 flash pulses		Error output Y2
3 flash pulses		Cross-wire Y1/Y2
4 flash pulses		Ambient temperature too high
5 flash pulses		Incorrect or defective actuator
Continuous red		Internal device error

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

Sensor function	LEDs			Diagnostic output	Safety outputs	Note
	Green	Red	Yellow		Y1, Y2	
Supply voltage	on	off	off	0 V	0 V	Voltage on, no evaluation of the voltage quality
Actuated	off	off	on	24 V	24 V	The yellow LED always signals the presence of an actuator within range
Actuated in limit area	off	off	flashes (1Hz)	24 V pulsed	24 V	The sensor must be adjusted before the distance to the actuator increases and before the safety outputs are disabled, thus stopping the machine
Error warning, sensor actuated	off	flashes	off	0 V	24 V	After 30 minutes → error
Error	off	flashes	off	0 V	0 V	Refer to table with flash codes

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 responseand diagnostic data is automatically andpermanently written in an input byte of the PLC for each safety sensor in the series-wiredchain. The request data for each safety sensorare transmitted to the component through anoutput 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 theimmediate deactivation of the safety outputs.The failure is reset when the failure cause iseliminated and bit 7 of the request bytechanges from 1 to 0 or when the safetyguard is opened.Failures at the safety outputs will only bedeleted upon the next release, as theneutralisation of the failure cannot bedetected 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

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

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

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

The shown bit sequence of the diagnostic byte is an example. A different combination of theoperating 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 61502
- PFH: 2,5 x 10^{-9} / h

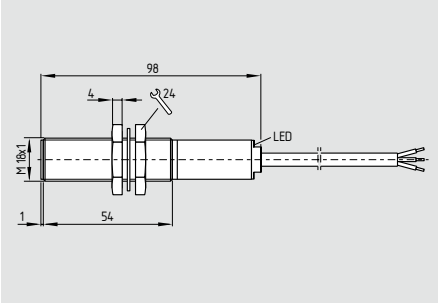
Actuation advantages
- Non-contact principle, no mechanical wear
- Suitable for flush mounting
- Rated switching distance 8 mm
- Misaligned actuation possible
- High repeat accuracy of the switching points

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

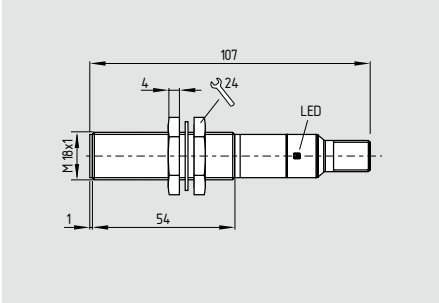
Electronic safety sensor CSS 180

CSS 180



- **Connecting cable or connecting cable and connector**
- Thermoplastic enclosure
- Electronic, non-contact, coded system
- Large switching distance
- Misaligned actuation possible
- High repeat accuracy of the switching points
- Self-monitored series-wiring of max. 16 sensors
- Max. length of the sensor chain 200 m
- Comfortable diagnose through sensor LED and diagnostic output
- 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
Coding level according to ISO 14119:	low
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_n:	8 mm
Assured switch-on distance S_{ao}:	7 mm
Assured switch-off distance S_{ar}:	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_u:	
- For max. output current	
≤ 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
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:	3 Hz
Response time:	< 30 ms
Duration of risk:	≤ 30 ms

Electrical data:

Rated operating voltage U_e:	24 VDC −15% / +10% (stabilised PELV)
Rated operating current I_e:	1 A
Minimum operating current I_m:	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_0:	0.05 A
Leakage current I_r:	≤ 0.5 mA

Approvals

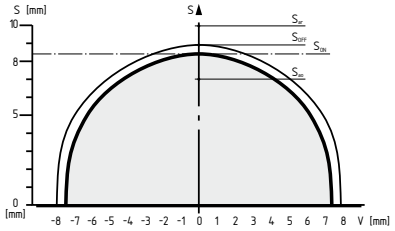
Ordering details

CSS 8-180-①-②-③

No.	Option	Description
①	2P	2 p-type safety outputs
	2P+D	2 p-type safety outputs and 1 p-type signal contact (diagnostic)
②	E	End or single device
	Y	Device for series-wiring
	M	Multifunction device
③	L	Connecting cable
	LST	Connecting cable and connector
	ST	Integrated connector

Sensor and actuator must be ordered separately.

Note

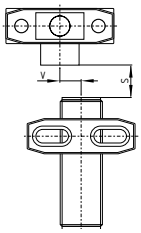


Legend

S	Switching distance
V	Misalignment
S_{on}	Switch-on distance
S_{off}	Switch-off distance
S_h	Hysteresis area $s_h = s_{on} - s_{off}$
S_{ao}	Assured switch-on distance
S_{ar}	Assured switch-off distance

Note

Misalignment



Electronic safety sensor CSS 180

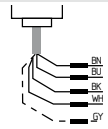
Technical data

Protection class:	II
Overvoltage category:	III
Degree of pollution:	3
Safety inputs X1/X2:	
Rated operating voltage U_e:	24 VDC −15% / +10% PELV to IEC 60204-1
Rated operating current I_e:	1 A
Safety outputs Y1/Y2:	p-type, short-circuit proof
Rated operating current I_{e1}:	max. 0.5 A, ambient temperature-dependent
Utilisation category:	DC-12 U_e/I_e 24 VDC/0.5 A DC-13 U_e/I_e 24 VDC/0.5 A
Voltage drop:	0.5 V
Diagnostic output:	p-type, short-circuit proof
Rated operating voltage U_{e2}:	min. U_e - 4 V
Rated operating current I_{e2}:	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/0.05 A
External short-circuit protection:	fuse
- for output current ≤ 200 mA:	1.0 A
- for output current > 200 mA:	1.6 A
Classification:	
Standards:	ISO 13849-1, IEC 61508
PL:	e
Category:	4
PFH:	2,5 x 10^{-9} / h
SIL:	suitable for SIL 3 applications
Mission time:	20 years

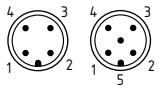
Connection

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



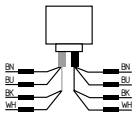
Connecting cable (2 m) with connector male:
M12, 4-pole
M12, 5-pole



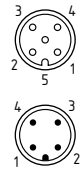
Colour of the connecting cable	Wiring	Pin configuration
BN (brown)	A1 U_e	Pin 1
BU (blue)	A2 GND	Pin 3
BK (black)	Y1 Safety output 1	Pin 4
WH (white)	Y2 Safety output 2	Pin 2
GY (grey)	Only 5-pole version: diagnostic output (option)	Pin 5

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



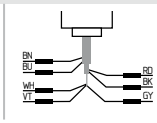
Inputs (IN): (0.25 m)
Connecting cable with connector female M12, 5-pole
Outputs (OUT):(2 m)
Connecting cable with connector male M12, 4-pole



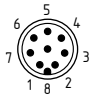
Colour of the connecting cable	Wiring grey cable (IN)	black cable (OUT)	Pin configuration
BN (brown)	A1 U_e	A1 U_e	Pin 1
BU (blue)	A2 GND	A2 GND	Pin 3
BK (black)	X1 Safety input 1	Y1 Safety output 1	Pin 4
WH (white)	X2 Safety input 2	Y2 Safety output 2	Pin 2

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

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



Connecting cable (2 m) with connector male M12, 8-pole or integrated connector male M12, 8-pole



Colour of the connecting cable	Wiring	Pin configuration
BN (brown)	A1 U_e	Pin 1
BU (blue)	A2 GND	Pin 3
VT (violet)	X1 Safety input 1	Pin 6
WH (white)	X2 Safety input 2	Pin 2
BK (black)	Y1 Safety output 1	Pin 4
RD (red)	Y2 Safety output 2	Pin 7
GY (grey)	Diagnostic output	Pin 5
–	Spare	Pin 8

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

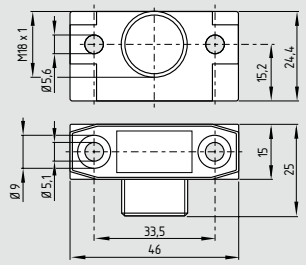
The safety switchgears are classified according to ISO 14119 as type 4 switching devices.

Note

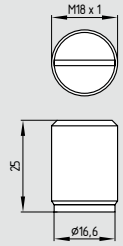
- Series-wiring of sensors:
  A chain of 16 self-monitored CSS 180 safety sensors can be wired in series without loss of PL e and category 4 to ISO 13849-1. In this configuration, the redundant output of the first sensor is wired into the input of the next sensor.
- The voltage drop over a long sensor 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.

Electronic safety sensor CSS 180

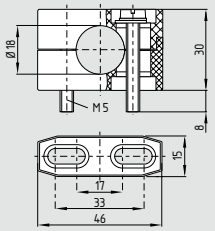
System components



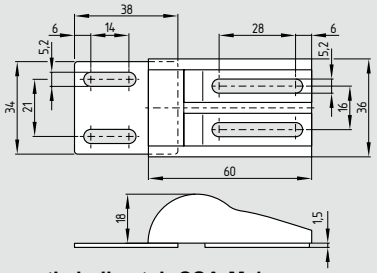
Actuator CST 180-1



Actuator CST 180-2



Terminal mounting H 18



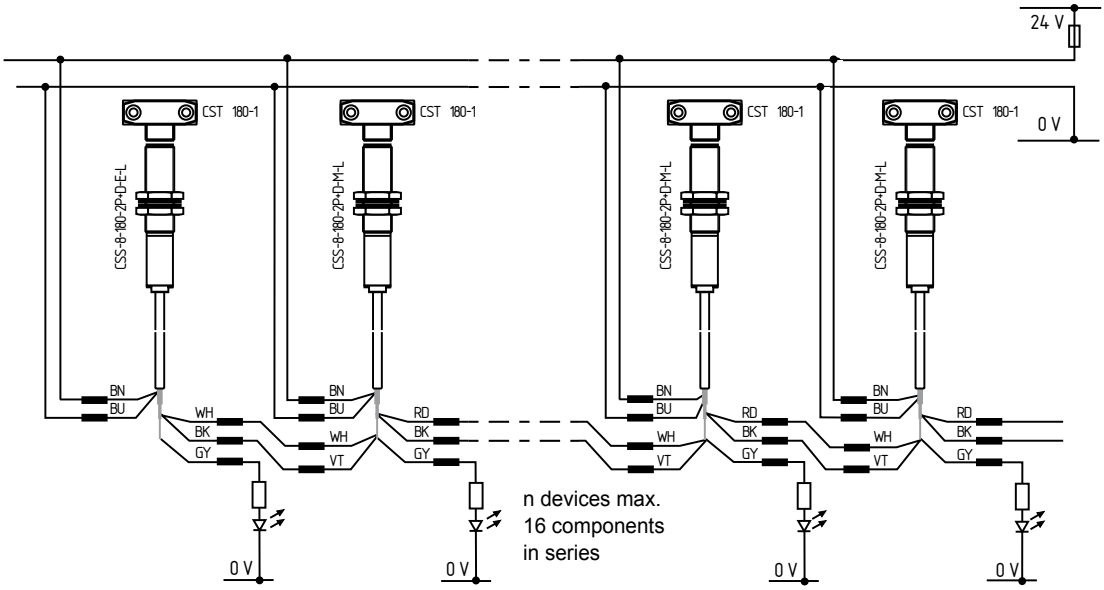
Magnetic ball catch CSA-M-1

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.

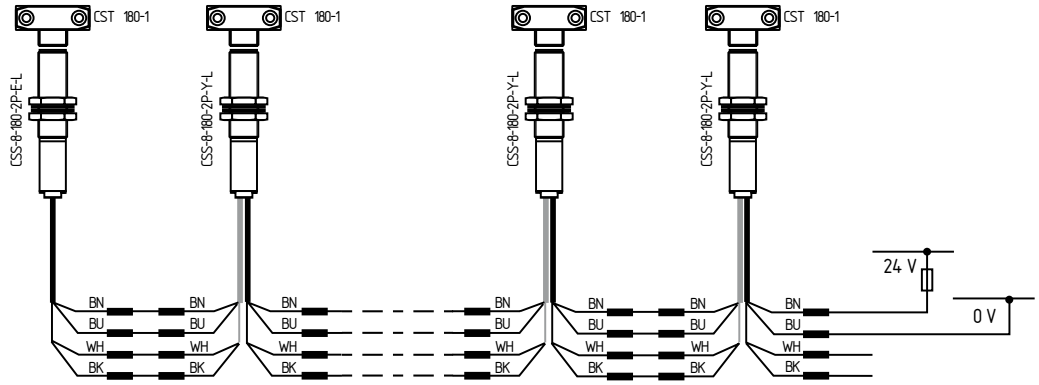
Series-wiring of the CSS 180 with common cable for safety inputs and outputs



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.

Diagnostic function of the CSS 180

The operating condition of the sensor as wellas 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.

LED (red)	Flash codes	Cause
1 flash pulse		Error output Y1
2 flash pulses		Error output Y2
3 flash pulses		Cross-wire, error safety outputs 1 and 2
4 flash pulses		Ambient temperature too high
5 flash pulses		Actuator error, coding error

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

Sensor condition	LEDs	Diagnostic output	Safety output	Note
Not actuated	Green	0V	0 V	Supply voltage on, no evaluation of the voltage quality
Actuated	Yellow	24 V	24 V	The yellow LED always signals the presence of an actuator within range
Actuated in limit range	Flashes yellow	24 V 2 Hz pulsed	24 V	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.
Failure warning, sensor actuated	Flashes red	10 s delayed 24 V → 0 V	1 min delayed 24 V → 0 V	After 1 minute -> failure
Failure	Red	10 s delayed 24 V → 0 V	not delayed 24 V → 0 V	–

Electronic safety sensor CSS 30

Classification:
- PL e / category 4 to ISO 13849-1
- Up to SIL 3 to IEC 61508
- PFH: 2,5 x 10^{-9} / h

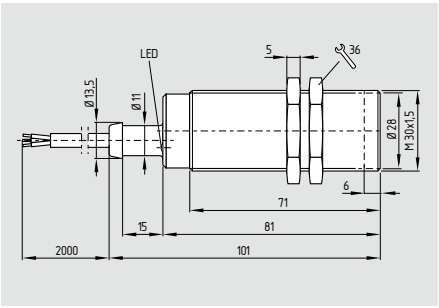
Actuation advantages
- Non-contact principle, no mechanical wear
- Suitable for flush mounting
- Rated switching distance 15 mm
- Misaligned actuation possible
- High repeat accuracy of the switching points

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

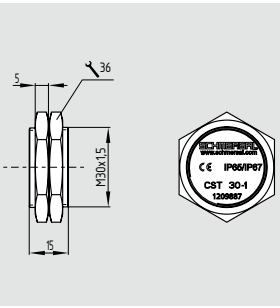
CSS 30



- 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

Approvals

CST 30-1



- Thermoplastic enclosure

Approvals

Certification in combination with safety sensor

Technical data

Standards:	IEC 60947-5-3; ISO 13849-1; IEC 61508
Enclosure:	nickel-plated brass
Mode of operation:	inductive
Coding level according to ISO 14119:	low
Actuator:	CST 30-1, CST 34-S-3
Switching distances to IEC 60947-5-3:	
Rates switching distance S_n:	
- CST 30-1:	15 mm
- CST 34-S-3:	12 mm
Assured switch-on distance S_{ao}:	
CST 30-1:	12 mm (s_{ao} min: 1 mm)
CST 34-S-3:	10 mm
Assured switch-off distance S_{ar}:	
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)
Cable:	PVC / LIYY / 7 x 0.25 mm² / UL-Style 2464 / AWG 24 / 2 m
Ambient conditions:	
Ambient temperature T_u:	
- for output current	
≤ 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 vibration:	10 … 55 Hz, amplitude 1 mm
Resistance to shock:	30 g / 11 ms
Protection class:	IP65 / IP67
Electrical data:	
Rated operating voltage U_e:	24 VDC −15% / +10% (stabilised PELV)
Rated operating current I_e:	1.1 A
Required rated short-circuit current:	100 A
Short-circuit protection:	external fuse
- for output current ≤ 200 mA:	1.0 A
- for output current > 200 mA:	1.6 A

Ordering details

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

Sensor and actuator must be ordered separately.

Ordering details

Actuator	**CST 30-1**

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

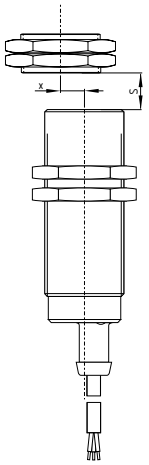
Technical data

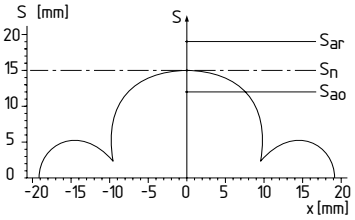
Rated insulation voltage U_i:	32 V
Rated impulse withstand voltage U_{imp}:	800 V
No-load current I_0:	0.05 A
Response time:	< 30 ms
Duration of risk:	≤ 30 ms
Protection class:	II
Overvoltage category:	III
Degree of pollution:	3
Safety inputs X1/X2:	
Rated operating voltage U_e:	24 VDC -15% / +10% (PELV to IEC 60204-1)
Rated operating current I_e:	1 A
Safety outputs Y1/Y2:	NO function, 2-channel, p-type, short-circuit proof
Voltage drop:	0.5 V
Rated operating voltage U_{e1}:	min. U_e - 0.5 V
Leakage current I_r:	≤ 0.5 mA
Rated operating current I_e:	max. 0.5 A ambient temperature-dependent
Minimum operating current I_m:	0.5 mA
Utilisation category:	DC-12 U_e/I_e 24 VDC/0.5 A DC-13 U_e/I_e 24 VDC/0.5 A
Diagnostic output:	p-type, short-circuit proof
U_{e2}:	min. U_e - 4 V
Rated operating current I_{e2}:	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/0.05 A
Classification:	
Standards:	ISO 13849-1, IEC 61508
PL:	e
Category:	4
PFH:	2.5 x 10^{-9}/h
SIL:	suitable for SIL 3 applications
Mission time:	20 years

Misalignment

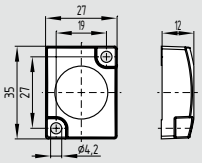
The actuating curves represent the switch-on and switch-off distances of the CSS 30 safety sensor by the approach of the CST 30-1 actuator.

In case of concealed mounting, the switching distance varies.

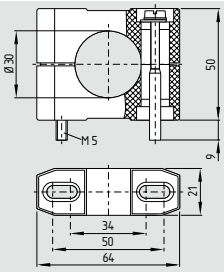




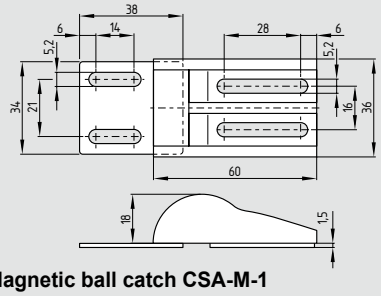
System components



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.

Note

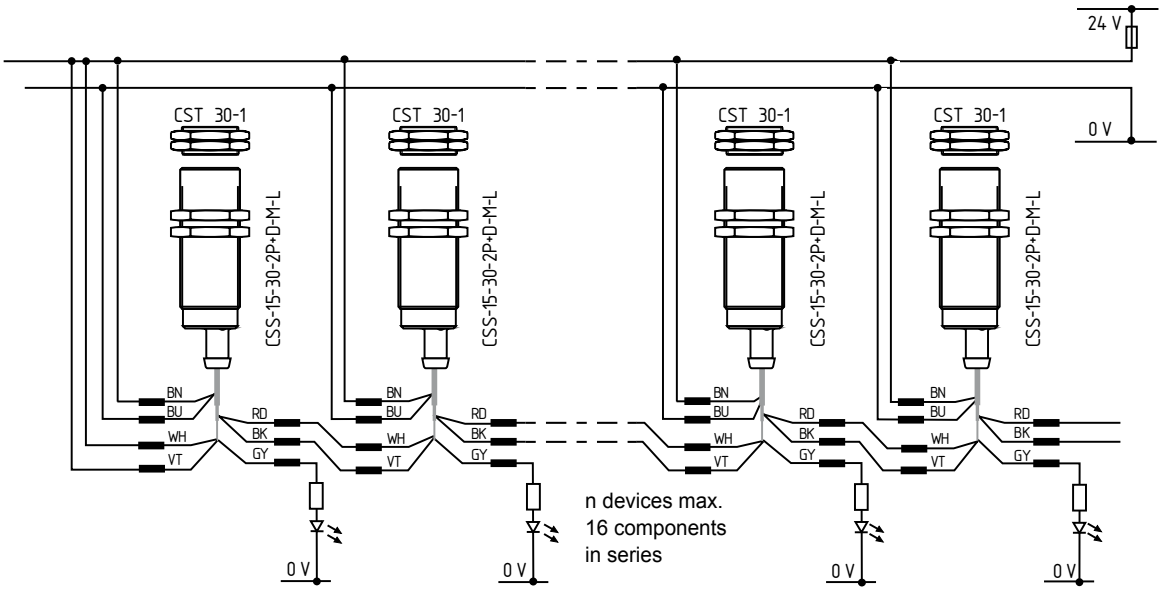
Legend

S	Switching distance
x	Misalignment
S_n	Switching distance
S_{ao}	Assured switch-on distance
S_{ar}	Assured switch-off distance

Ordering details

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

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



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

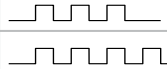
For the last safety sensor in a series-wiring, the positive operating voltage must be supplied to both safety inputs.
A series-wiring of multiple safety sensors is realised by wiring in the control cabinet either in junction boxes on site.

Diagnostic function of the CSS 30

The operating condition of the sensor as wellas 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.

LED (red)	Flash codes	Cause
1 flash pulse		Error output Y1
2 flash pulses		Error output Y2
3 flash pulses		Cross-wire, error safety outputs 1 and 2
4 flash pulses		Ambient temperature too high
5 flash pulses		Actuator error, coding error

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

Sensor condition	LEDs	Diagnostic output	Safety output	Note
Not actuated	Green	0V	0 V	Supply voltage on, no evaluation of the voltage quality
Actuated	Yellow	24 V	24 V	The yellow LED always signals the presence of an actuator within range
Actuated in limit range	Flashes yellow	24 V 2 Hz pulsed	24 V	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.
Failure warning, sensor actuated	Flashes red	10 s delayed 24 V → 0 V	1 min delayed 24 V → 0 V	After 1 minute -> failure
Failure	Red	10 s delayed 24 V → 0 V	not delayed 24 V → 0 V	–

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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 x 10^{-9} / h

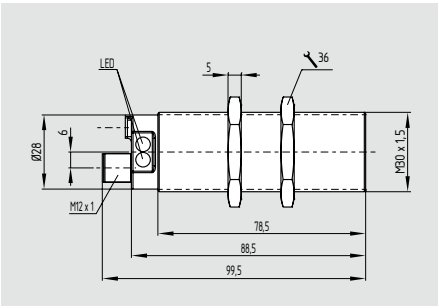
Actuation advantages
- Non-contact principle, no mechanical wear
- Robust enclosure in 1.4404 (V4A) to EN 10088
- Hygiene-compliant design with IP69K protection class
- Sensor can also be fitted under V4A covers
- Suitable for flush mounting
- Misaligned actuation possible

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

CSS 30S



- 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

Approvals

TÜV cULus CE

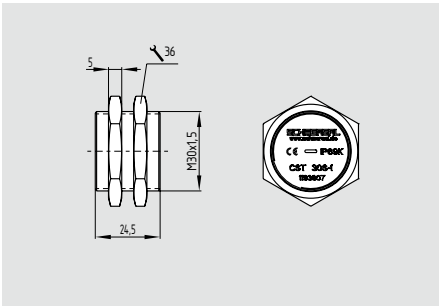
Ordering details

CSS 11-30S-①-M-ST

No.	Option	Description
①	D	with diagnostic output
	SD	with serial diagnostic function

Sensor and actuator must be ordered separately.

CST 30S-1



- Stainless steel enclosure M30

Approvals

TÜV cULus

Certification in combination with safety sensor

Ordering details

Actuator	**CST 30S-1**

Technical data

Standards:	IEC 60947-5-3, ISO 13849-1, IEC 61508
Enclosure:	stainless steel, 1.4404 to EN 10088
Mode of operation:	inductive
Coding level according to ISO 14119:	low
Switching distances to IEC 60947-5-3:	
Rates switching distance S_n:	11 mm
Assured switch-on distance S_{ao}:	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_u:	−25 °C … +65 °C
Storage and transport temperature:	−25 °C … +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_e:	1 A

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 30S

Technical data

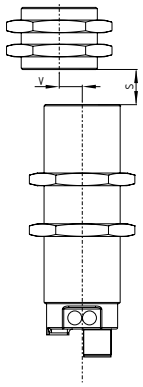
Safety outputs Y1/Y2:

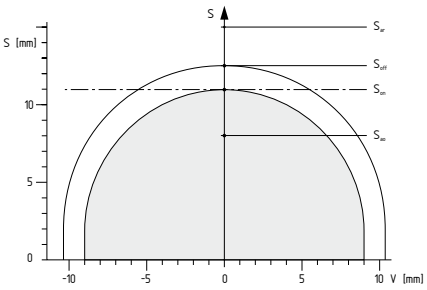
	NO function, 2-channel, p-type, short-circuit proof
Rated operating voltage U_{e1}:	24 VDC −15% / +10%
Voltage drop:	< 1 V
Leakage current I_r:	< 0.5 mA
Rated operating current I_{e1}:	max. 0.25 A
Minimum operating current I_m:	0.5 mA
Utilisation category:	DC-12, DC-13: U_{e1}/I_{e1}: 24 VDC/0.25 A
Required rated short-circuit current:	100 A
Diagnostic output:	p-type, short-circuit proof
Rated operating voltage U_{e2}:	24 VDC −15% / +10%
Voltage drop:	< 5 V
Rated operating current I_{e2}:	max. 0.05 A
Utilisation category:	DC-12, DC-13: U_{e2}/I_{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 x 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.

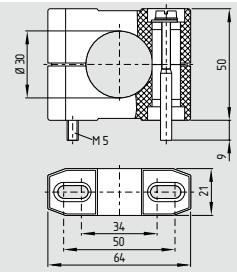




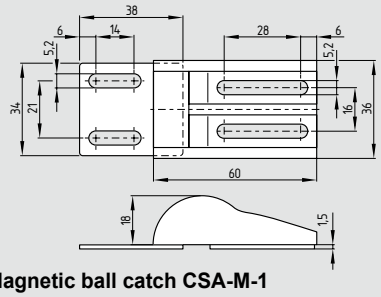
Legend

S	Switching distance
V	Misalignment
S_{on}	Switch-on distance
S_{off}	Switch-off distance **($S_{on} < S_h < S_{off}$)**
S_h	Hysteresis area
S_{ao}	Assured switch-on distance
S_{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.

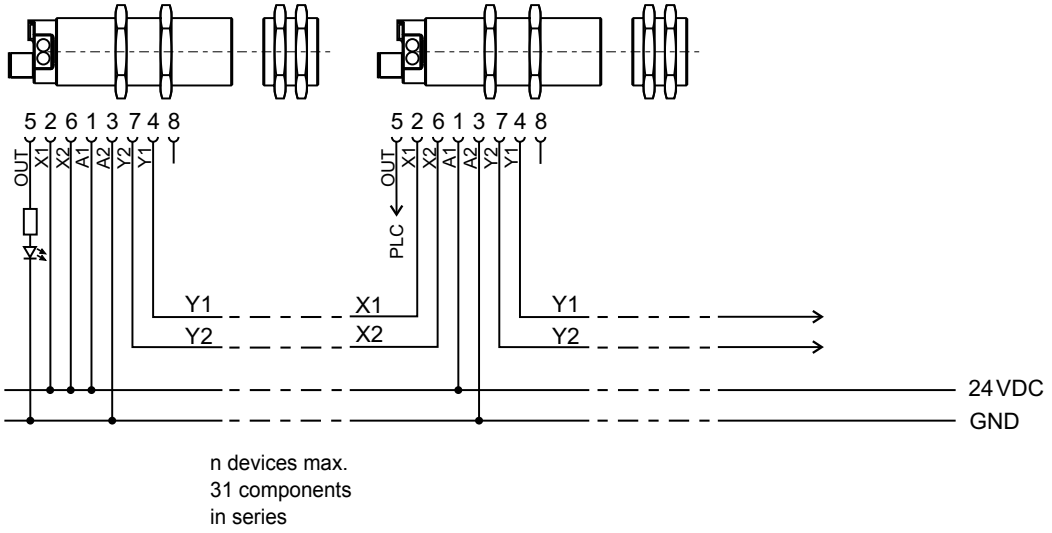
Note

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the 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	**H 30**
Magnetic ball catch	**CSA-M-1**

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

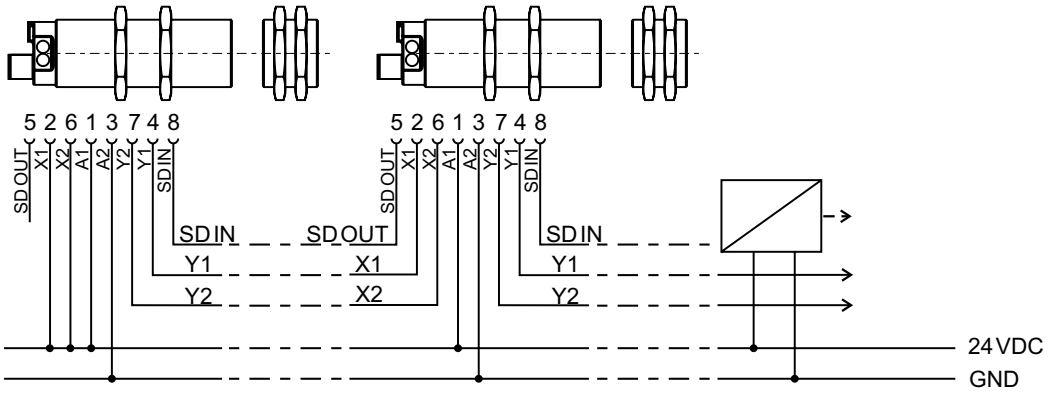


n devices max.
31 components
in series

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



n devices max.
31 components
in series

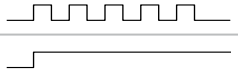
Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus

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.

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.

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

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

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

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

Bit n°	Request byte	Response byte	Diagnostic Failure warning	Diagnostic Failure
Bit 0:	---	Safety output enabled	Error output Y1	Error output Y1
Bit 1:	---	Actuator detected	Error output Y2	Error output Y2
Bit 2:	---	---	Cross-wire	Cross-wire
Bit 3:	---	---	Ambient temperature too high	Ambient temperature too high
Bit 4:	---	Input condition X1 and X2	---	Actuator error,coding error
Bit 5:	---	Actuated in limit area	Internal error	Internal error
Bit 6:	---	Failure warning	Communication error between fieldbus gateway and safety sensor	---
Bit 7:	Failure reset	Failure (enabling path switched off)	---	---

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

System condition	Duo-LED		LED	Safety outputs	Response byte n°							
	green	red	yellow	Y1, Y2	7	6	5	4	3	2	1	0
Supply voltage on, not actuated	On	Off	Off	0 V	0	0	0	0	0	0	0	0
Actuated, safety outputs released	On	Off	On	24 V	0	0	0	1	0	0	1	1
Actuated in limit area	On	Off	Flashes	24 V	0	0	1	1	0	0	1	1
Actuated, failure warning	Off	Flashes	On	24 V	0	1	0	1	0	0	1	1
Actuated, failure	Off	Flashes	On	0 V	1	0	0	1	0	0	1	0

The shown bit sequence of the diagnostic byte is an example. A different combination of theoperating 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 x 10^{-9} / h

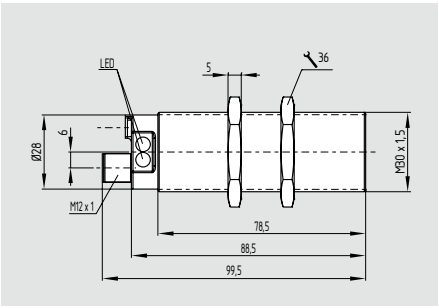
Actuation advantages
- Non-contact principle, no mechanical wear
- Suitable for concealed mounting behind stainless steel
- Suitable for flush mounting
- High repeat accuracy of the switching points

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

Approvals

TÜV cULus CE

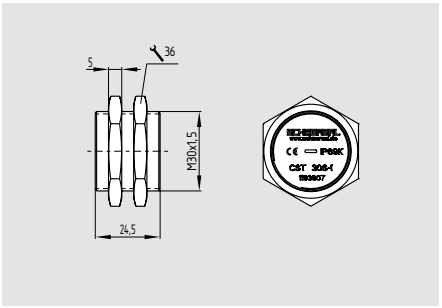
Ordering details

CSS 11-300-①-M-ST

No.	Option	Description
①	D	with diagnostic output
	SD	with serial diagnostic function

Sensor and actuator must be ordered separately.

CST 30S-1



- Stainless steel enclosure
- Ø M30

Approvals

TÜV cULus

Certification in combination with safety sensor

Ordering details

Actuator	**CST 30S-1**

Technical data

Standards:	IEC 60947-5-3, ISO 13849-1, IEC 61508
Enclosure:	thermoplastic
Mode of operation:	inductive
Coding level according to ISO 14119:	low
Switching distances to IEC 60947-5-3:	
Rates switching distance S_n:	11 mm
Assured switch-on point S_{ao}:	8 mm
Assured switch-off point S_{ar}:	15 mm
Hysteresis:	< 2 mm
Repeat accuracy:	< 1 mm
Switching frequency f:	3 Hz
Integrated connector:	M12, 8-pole
Series-wiring:	max. 31 components
Fuse:	external, 2 A
Cable length:	max. 200 m
Ambient conditions:	
Ambient temperature T_u:	−25 °C … +60 °C
Storage and transport temperature:	−25 °C … +85 °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 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_e:	1 A

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

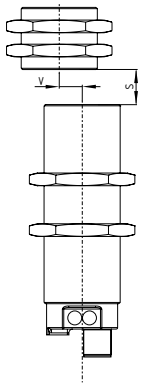
Safety outputs Y1/Y2:

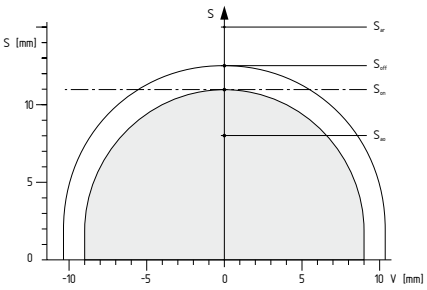
	NO function, 2-channel, p-type, short-circuit proof
Rated operating voltage U_{e1}:	24 VDC −15% / +10%
Voltage drop:	< 1 V
Leakage current I_r:	< 0.5 mA
Rated operating current I_{e1}:	max. 0.25 A
Minimum operating current I_m:	0.5 mA
Utilisation category:	DC-12, DC-13: U_{e1}/I_{e1}: 24 VDC/0.25 A
Required rated short-circuit current:	100 A
Diagnostic output:	p-type, short-circuit proof
Rated operating voltage U_{e2}:	24 VDC −15% / +10%
Voltage drop:	< 5 V
Rated operating current I_{e2}:	max. 0.05 A
Utilisation category:	DC-12, DC-13: U_{e2}/I_{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 x 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.

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

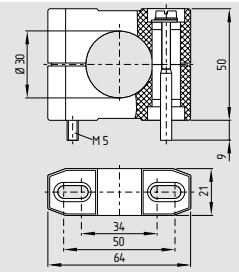




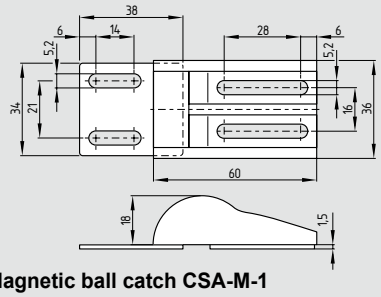
Legend

S	Switching distance
V	Misalignment
S_{on}	Switch-on distance
S_{off}	Switch-off distance
S_h	Hysteresis area $s_h = s_{on} - s_{off}$
S_{ao}	Assured switch-on distance
S_{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.

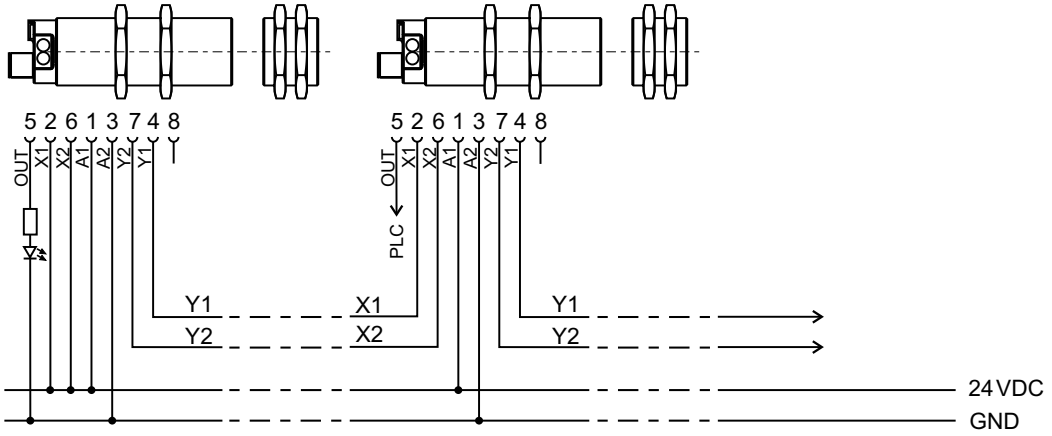
Note

Detailed information about the use of the serial diagnostics can be found in the operating instructions of the 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	**H 30**
Magnetic ball catch	**CSA-M-1**

Series-wiring of the CSS 300 with conventional diagnostic output

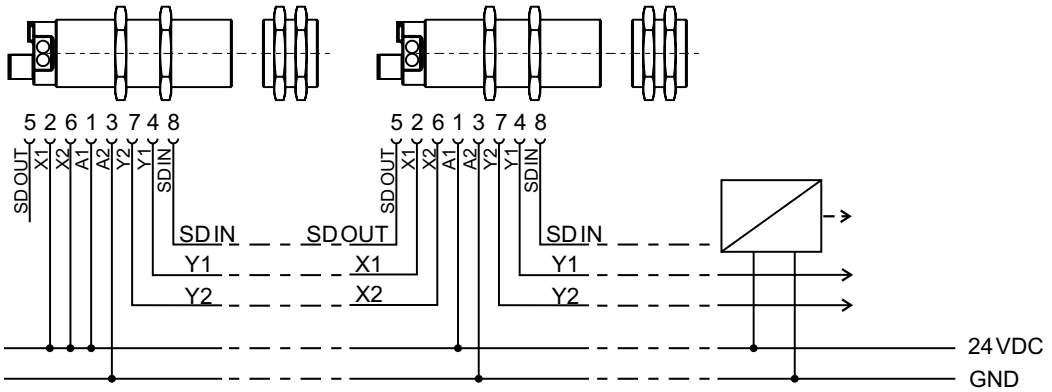


n devices max.
31 components
in series

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



n devices max.
31 components
in series

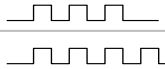
Y1 and Y2 = Safety outputs → Safety controller
SD-IN → Gateway → Field bus

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.

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.

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

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

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

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

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

Bit n°	Request byte	Response byte	Diagnostic Failure warning	Diagnostic Failure
Bit 0:	---	Safety output enabled	Error output Y1	Error output Y1
Bit 1:	---	Actuator detected	Error output Y2	Error output Y2
Bit 2:	---	---	Cross-wire	Cross-wire
Bit 3:	---	---	Ambient temperature too high	Ambient temperature too high
Bit 4:	---	Input condition X1 and X2	---	Actuator error,coding error
Bit 5:	---	Actuated in limit area	Internal error	Internal error
Bit 6:	---	Failure warning	Communication error between fieldbus gateway and safety sensor	---
Bit 7:	Failure reset	Failure (enabling path switched off)	---	---

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

System condition	Duo-LED		LED	Safety outputs	Response byte n°							
	green	red	yellow	Y1, Y2	7	6	5	4	3	2	1	0
Supply voltage on, not actuated	On	Off	Off	0 V	0	0	0	0	0	0	0	0
Actuated, safety outputs released	On	Off	On	24 V	0	0	0	1	0	0	1	1
Actuated in limit area	On	Off	Flashes	24 V	0	0	1	1	0	0	1	1
Actuated, failure warning	Off	Flashes	On	24 V	0	1	0	1	0	0	1	1
Actuated, failure	Off	Flashes	On	0 V	1	0	0	1	0	0	1	0

The shown bit sequence of the diagnostic byte is an example. A different combination of theoperating 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

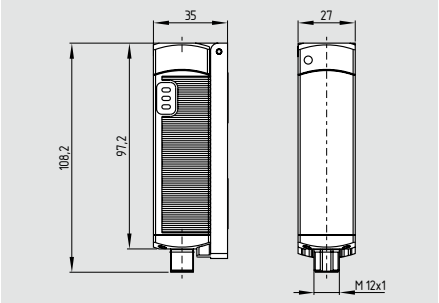
Actuation advantages
- Non-contact principle, no mechanical wear
- 4 actuating directions
- Side faces can be rotated in 3 positions
- Many actuator designs
- Sensor functioning with max. 53 mm misalignment with regard to the actuator
- High repeat accuracy of the switching points

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

Approvals

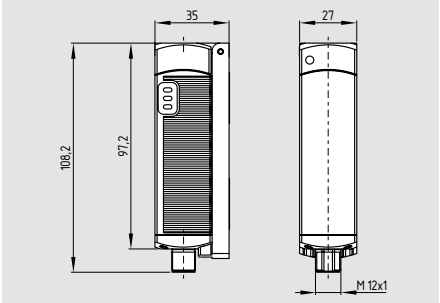
Ordering details

CSS ①-34-②-③-M-④

No.	Option	Description
①	12	Head actuation
	14	Sideways actuation
②	S	Lateral actuating surface
	V	Frontal actuating surface
③	D	With diagnostic output
	SD	With serial diagnostic function
④	L	With connecting cable
	ST	With integrated connector

Sensor and actuator must be ordered separately.

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

Approvals

Ordering details

CSS ①-34②-③-D-M-ST

No.	Option	Description
①	12	Head actuation
	14	Sideways actuation
②		Standard version
	F0	Input for enabling button, suitable for automatic start
	F1	Input for reset button, with edge monitoring
③	S	Lateral actuating surface
	V	Frontal actuating surface

Sensor and actuator must be ordered separately.

Technical data

Standards:	IEC 60947-5-3, ISO 13849-1; IEC 61508
Enclosure:	glass-fibre reinforced thermoplastic
Mode of operation:	inductive
Coding level according to ISO 14119:	low
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 in the enclosure
Ambient conditions:	
Ambient temperature T_u:	
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 … +85 °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 U_e:	24 VDC −15% / +10% (stabilised PELV)
Rated operating current I_e:	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.

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.

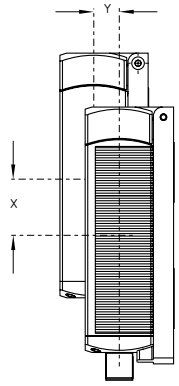
Electronic safety sensor CSS 34

Technical data

Rated insulation voltage U_i:	32 V
Rated impulse withstand voltage U_{imp}:	800 V
No-load current I_0:	0.1 A
Response time:	< 30 ms
Duration of risk:	< 60 ms
Protection class:	II
Overvoltage category:	III
Degree of pollution:	3
Safety inputs X1/X2:	
Rated operating voltage U_e:	24 VDC −15% / +10% PELV to IEC 60204-1
Rated operating current I_e:	1 A
Safety outputs Y1/Y2:	NO function, 2-channel, p-type, short-circuit proof
Voltage drop:	< 1 V
Rated operating voltage U_{e1}:	min. (U_e −1 V)
Leakage current I_r:	< 0.5 mA
Rated operating current I_{e1}:	max. 0.25 A, ambient temperature-dependent
Minimum operating current I_m:	0.5 mA
Utilisation category:	DC-12, DC-13: U_{e1}/I_{e1}: 24 VDC/0.25A
Diagnostic output:	p-type, short-circuit proof
Voltage drop:	< 5 V
Rated operating voltage U_{e2}:	min. (U_e −5 V)
Rated operating current I_{e2}:	max. 0.05 A
Utilisation category:	DC-12, DC-13: U_{e2}/I_{e2}: 24 VDC/0.05A
Wiring capacitance for serial diagnostic:	max. 50 nF
Classification:	
Standards:	ISO 13849-1, IEC 61508
PL:	e
Category:	4
PFH:	1,3 x 10^{-10} /h
SIL:	suitable for SIL 3 applications
Mission time:	20 years

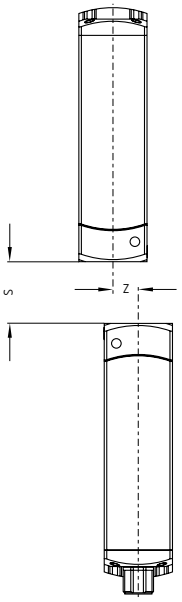
Misalignment

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.

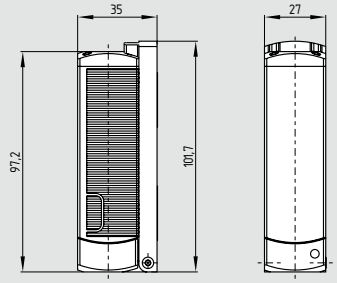
Note

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

Actuator CST-34-.-1 and CST-34-S-2*



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

Approvals

Certification in combination with safety sensor

Ordering details

CST 34-①-1

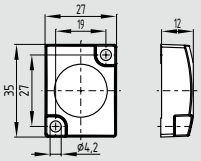
No.	Option	Description
①	V	Frontal actuating surface
	S	Lateral actuating surface

Actuator with double solenoid, for increased misalignment, lateral actuating surface **CST 34-S-2***

Sensor and actuator must be ordered separately.

Actuator

Actuator CST-34-S-3*



- Small design
- Front and lateral actuation of the sensor possible

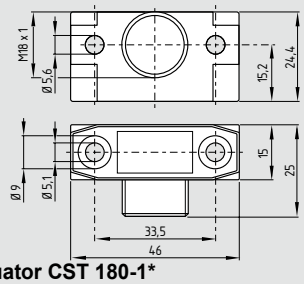
Approvals

Certification in combination with safety sensor

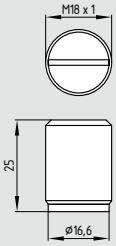
Ordering details

Small actuator (enables lateral and frontal actuation of the sensor) **CST-34-S-3***

Actuator



Actuator CST 180-1*



Actuator CST 180-2*

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

Approvals

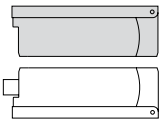
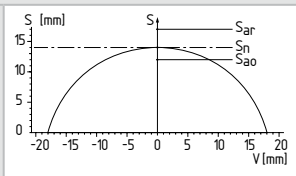
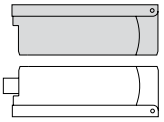
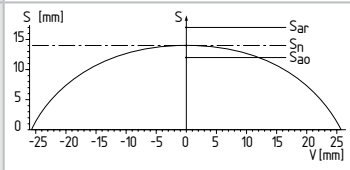
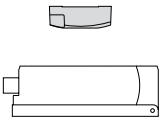
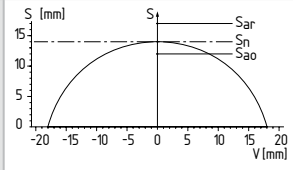
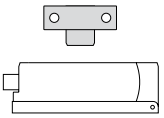
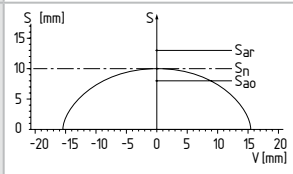
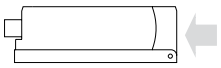
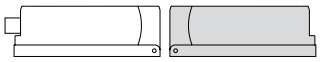
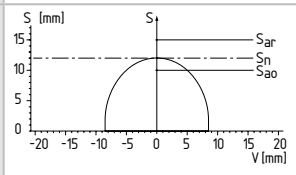
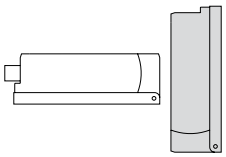
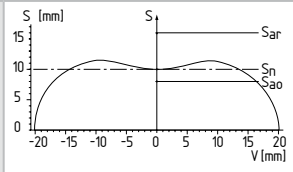
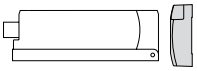
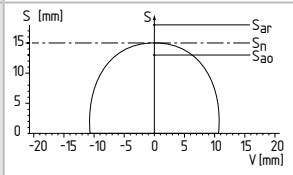
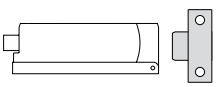
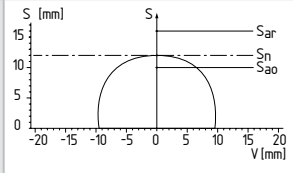
Certification in combination with safety sensor

Ordering details

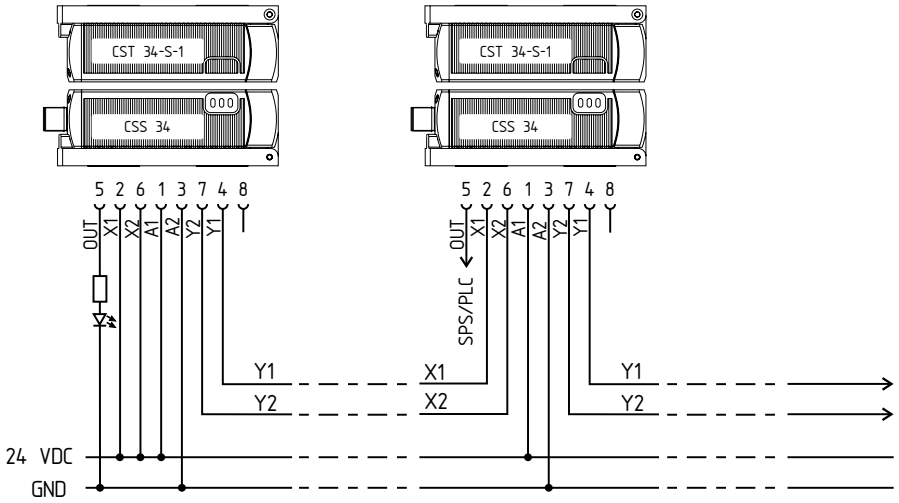
Also suitable:
Actuator CSS 180
with terminal mounting **CST 180-1***
without terminal mounting **CST 180-2***

* Certification in combination with safety sensor under preparation

Selection table: Actuator

Safety sensor	Actuator	Actuation	Switching distances to IEC 60947-5-3		
Lateral actuation  CSS 14-34-S …	**CST 34-S-1** 		S_n S_{ao} S_{ar}	14 mm 12 mm 17 mm	
	CST 34-S-2 		S_n S_{ao} S_{ar}	14 mm 12 mm 17 mm	
	CST 34-S-3 		S_n S_{ao} S_{ar}	14 mm 12 mm 17 mm	
	CST 180-1 / CST 180-2 		S_n S_{ao} S_{ar}	10 mm 8 mm 13 mm	
Frontal actuation  CSS 12-34-V …	**CST 34-V-1** 		S_n S_{ao} S_{ar}	12 mm 10 mm 15 mm	
	CST 34-S-2 		S_n S_{ao} S_{ar}	10 mm 8 mm 16 mm	
	CST 34-S-3 		S_n S_{ao} S_{ar}	15 mm 13 mm 18 mm	
	CST 180-1 / CST 180-2 		S_n S_{ao} S_{ar}	12 mm 10 mm 16 mm	

Series-wiring of the CSS 34 with conventional diagnostic output

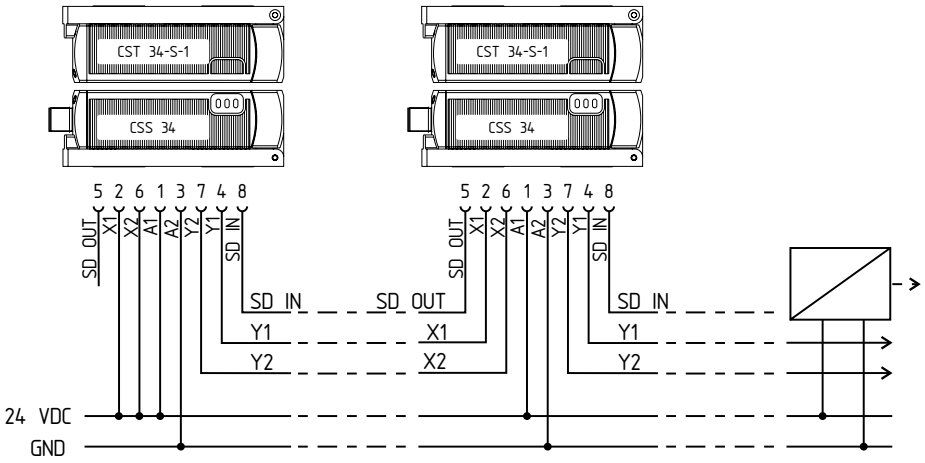


n devices max.
31 components
in series

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



n devices max.
31 components
in series

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.

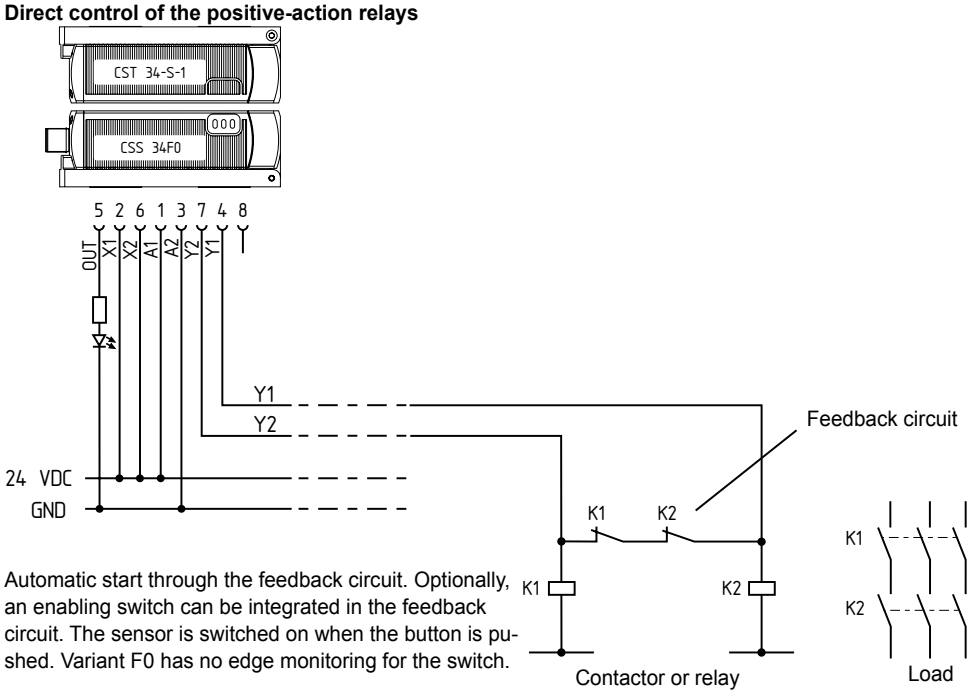
Single device CSS 34F0 with conventional diagnostic output

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.

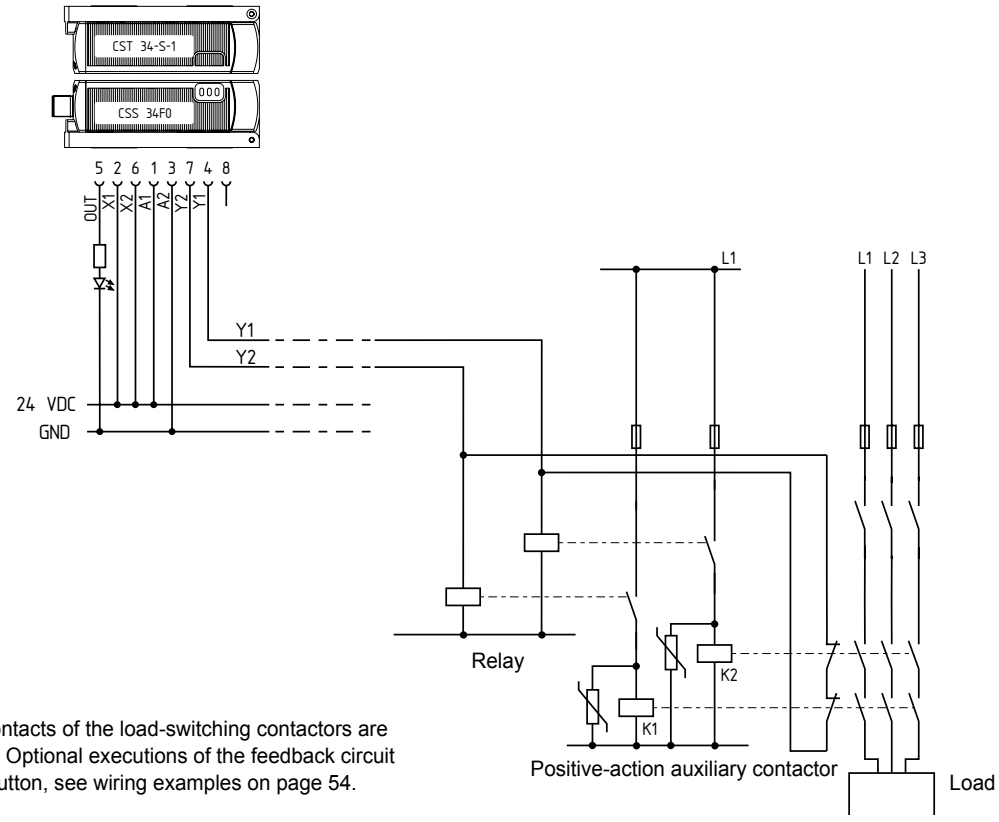
In this example, the CSS 34F0 safety sensor is connected as single device. To this effect, the safety inputs are connected to 24 VDC.

Direct control of the positive-action relays



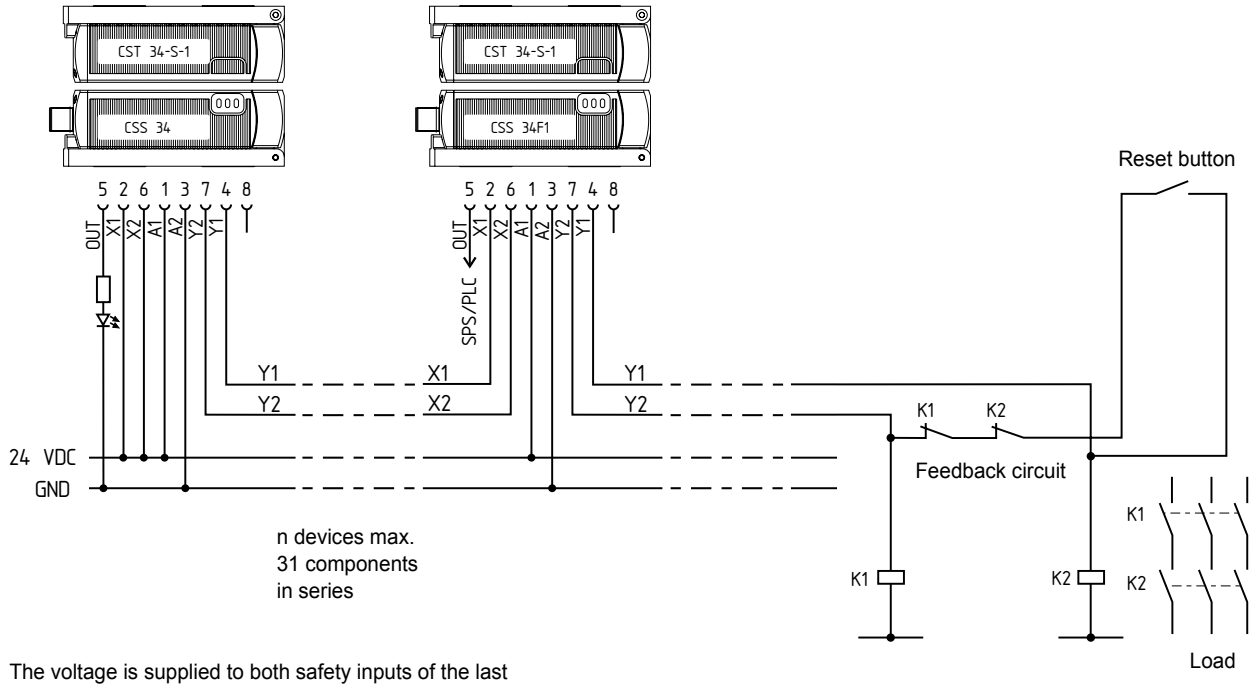
Automatic start through the feedback circuit. Optionally, an enabling switch can be integrated in the feedback circuit. The sensor is switched on when the button is pushed. Variant F0 has no edge monitoring for the switch.

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.

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

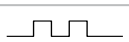


The voltage is supplied to both safety inputs of the last sensor of the chain (starting from the safety controller). The safety outputs of the first sensor control and monitor contactor K1/K2. The safety outputs of the CSS 34F1 are enabled after the reset button has been actuated.

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.

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

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

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

* only for CSS 34F0/F1 with feedback circuit

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 responseand diagnostic data is automatically andpermanently written in an input byte of the PLC for each safety sensor in the series-wiredchain. The request data for each safety sensorare transmitted to the component through anoutput 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 theimmediate deactivation of the safety outputs.The failure is reset when the failure cause iseliminated and bit 7 of the request bytechanges from 1 to 0 or when the safetyguard is opened.Failures at the safety outputs will only bedeleted upon the next release, as theneutralisation of the failure cannot bedetected 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

Bit n°	Request byte	Response byte	Warning or failure byte	
			Failure warnings	Failure messages
Bit 0:	Failure reset	Safety output enabled	Error output Y1	Error output Y1
Bit 1:	---	Actuator detected	Error output Y2	Error output Y2
Bit 2:	---	---	Cross-wire	Cross-wire
Bit 3:	---	Start function is missing / Feedback circuit opened (only CSS 34F.)	Ambient temperature too high	Ambient temperature too high
Bit 4:	---	Input condition X1 and X2	---	Incorrect or defective actuator
Bit 5:	---	Actuated in limit area	Internal error	Internal error
Bit 6:	---	Failure warning	Internal error error between fieldbus gateway and safety sensor	---
Bit 7:	Failure reset	Failure (enabling path switched off)	Operating voltage too low	---

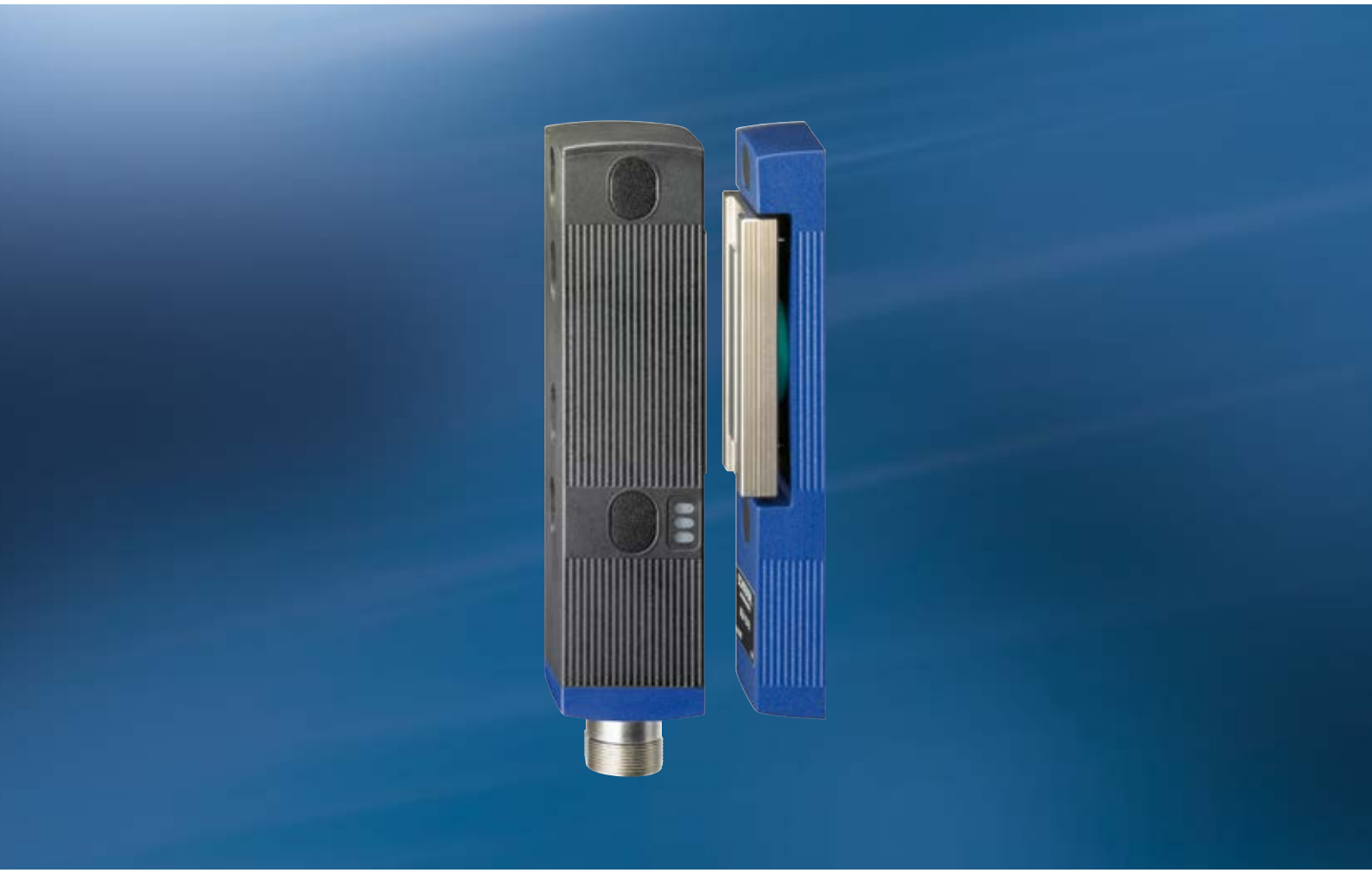
The described condition is obtained, when bit = 1

Function of the diagnostic LEDs, the serial status signals and the safety outputs
Flash code as in previous version

System condition	LEDs			Safety outputs Y1, Y2	Status signalsserial diagnostic byte Bit n°							
	green	red	yellow		7	6	5	4	3	2	1	0
Supply voltage on, not actuated	On	Off	Off	0 V	0	0	0	0	0	0	0	0
Actuated, feedback circuit open / not actuated (only CSS 34F.)	On	Off	Flashes (5 Hz)	0 V	0	0	0	1	1	0	1	0
Actuated, safety outputs released	On	Off	On	24 V	0	0	0	1	0	0	1	1
Actuated in limit area	On	Off	Flashes (1 Hz)	24 V	0	0	1	1	0	0	1	1
Actuated, failure warning	On	On/Flashes	On	24 V	0	1	0	1	0	0	1	1
Actuated, failure	On	On/Flashes	On	0 V	1	1	0	1	0	1	1	0

The shown bit sequence of the diagnostic byte is an example. A different combination of theoperating 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

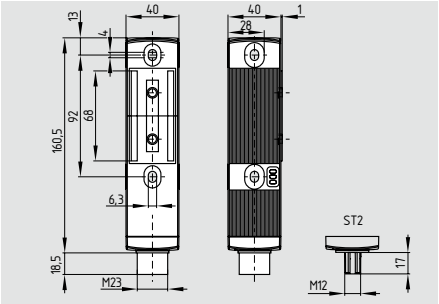
Actuation advantages
- Patented operating principle for solenoid interlocks (for personal protection applications)
- The safety switchgear must be used as end stop
- Variably adjustable latching
- Latching force generated through permanent magnet, approx. 30 N, also in de-energised condition
- Accurate 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

Electronic solenoid interlock and safety switch MZM 100 (B)

MZM 100



Solenoid interlock
(Solenoid 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

Approvals

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 ajdustable latching force (RE):	30 N … 100 N
Permanent magnet (M):	30 N
Holding force F_{max} typically:	750 N
Holding force F guaranteed:	500 N
Coding level according to ISO 14119:	low
Protection class:	IP65 / IP67
Protection class:	II, ⧈
Overvoltage category:	III
Degree of pollution:	3
Connection:	connector M12 or M23
Series-wiring:	**max. 31 components**
Cable length:	max. 200 m (Cable length and cable section alter 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_e:	24 VDC −15% / +10% (stabilised PELV)
Operating current:	max. 0.6 A plus current through the safety outputs
Rated operating current I_e:	1 A
Rated impulse withstand voltage U_{imp}:	800 V
Rated insulation voltage U_i:	32 VDC
Device insulation:	≤ 2 A to UL 508; depending on the number of components and loads (Y1, Y2 and OUT)

Technical data

Safety inputs X1 and X2:

Voltage range – 3V … 5V:	Low
Voltage range 15V … 30V:	High, typically 4 mA at 24 V
Safety outputs Y1 and Y2:	p-type, short-circuit proof
Rated operating voltage U_{e1}:	24 V
Rated operating current I_{e1}:	0.25 A
Voltage drop:	< 1 V
Utilisation category:	DC-13
Leakage current I_r:	≤ 0.5 mA
Diagnostic output OUT:	p-type, short-circuit proof
Rated operating voltage U_{e2}:	0 V up to 4 V under U_e
Rated operating current I_{e2}:	max. 0.05A
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^{-9} / h
SIL:	suitable for SIL 3 applications
Mission time:	20 years

The latching force of the MZM 100 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.

Ordering details

MZM 100 ①-②③④-A

No.	Option	Description
①	ST	Connector M23, (8+1)-pole
	ST2	Connector M12, 8-pole
②	1P2PW	1 diagnostic output and 2 safety outputs, all p-type with combined diagnostic signal: safety guard closed and magnetic interlock locked
	SD2P	Serial diagnostic output and 2 safety outputs, p-type

Ordering details

MZM 100 ①-②③④-A

No.	Option	Description
③		Without latching
	RE	Adjustable latching force approx. 30 … 100 N
④	M	Permanent magnet approx. 30 N

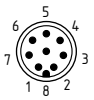
The solenoid interlock, the actuating unit and the adjustment target must be ordered separately.

Connection

Integrated connectors

M23, (8+1)-pole (Suffix -ST)

M12, 8-pole (Suffix -ST2)



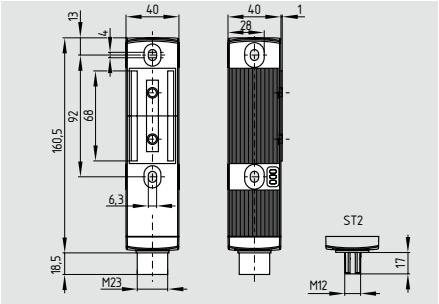
Actuators and accessories refer to page 67

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)

MZM 100 B



Safety sensor with interlocking function (Actuator monitoring)

- Innovating and unique operating principle
- Accurate adjustment through slotted holes
- Power to lock principle
- Safety sensor 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 sensor 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

Approvals

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 ajdustable latching force (RE):	30 N … 100 N
Permanent magnet (M):	30 N
Holding force F_{max} typically:	750 N
Holding force F guaranteed:	500 N
Coding level according to ISO 14119:	low
Protection class:	IP65 / IP67
Protection class:	II, ⧈
Overvoltage category:	III
Degree of pollution:	3
Connection:	connector M12 or M23
Switching distances to IEC 60947-5-3:	
- assured switching distance s_{ao}:	0 mm
- assured switch-off distance s_{ar}:	1 mm
Series-wiring:	**max. 31 components**
Cable length:	max. 200 m (Cable length and cable section alter the voltage drop depending on the output current)

Ambient conditions:

Ambient temperature:	−25 °C … +55 °C
Storage and transport temp.:	−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_e:	24 VDC −15% / +10% (stabilised PELV)
Operating current:	max. 0.6 A plus current through the safety outputs
Rated operating current I_e:	1 A
Rated impulse withstand voltage U_{imp}:	800 V
Rated insulation voltage U_i:	32 VDC
Device insulation:	≤ 2 A to UL 508; depending on the number of components and loads (Y1, Y2 and OUT)

Technical data

Safety inputs X1 and X2:

Voltage range – 3V … 5V:	Low
Voltage range 15V … 30V:	High, typically 4 mA at 24 V
Safety outputs Y1 and Y2:	p-type, short-circuit proof
Rated operating voltage U_{e1}:	24 V
Rated operating current I_{e1}:	0.25 A
Voltage drop:	< 1 V
Utilisation category:	DC-13
Leakage current I_r:	≤ 0.5 mA
Diagnostic output OUT:	p-type, short-circuit proof
Rated operating voltage U_{e2}:	0 V up to 4 V under U_e
Rated operating current I_{e2}:	max. 0.05A
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^{-9} / 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.

Ordering details

MZM 100 B ①-②RE③-A

No.	Option	Description
①	ST	Connector M23, (8+1)-pole
	ST2	Connector M12, 8-pole
②	1P2PW2	1 diagnostic output and 2 safety outputs, all p-type with combined diagnostic signal: safety guard closed **and** can be locked
	SD2P	Serial diagnostic output and 2 safety outputs, p-type
③	M	Permanent magnet approx. 30 N

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

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.

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

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.

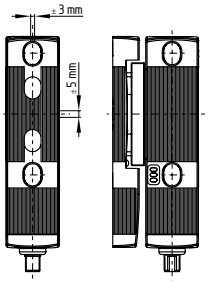
The diagnostic output is not a safety-relevant output.

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.

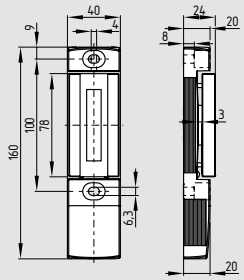
Misalignment

Misalignment



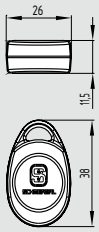
Electronic solenoid interlock and safety switch MZM 100 (B)

MZM 100-B1.1



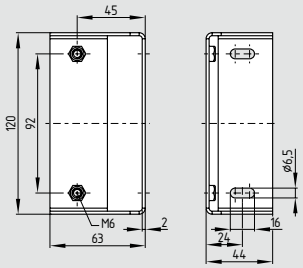
- The magnetic interlocks and the actuator unit must be ordered separately.
- Actuator free from play, i.e. neutralisation of undesired noises

MZM 100 TARGET



- 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

System components



Mounting kit MS MZM 100-W

Approvals

Approvals only in combination with switches MZM 100

Ordering details

Actuator **MZM 100-B1.1**

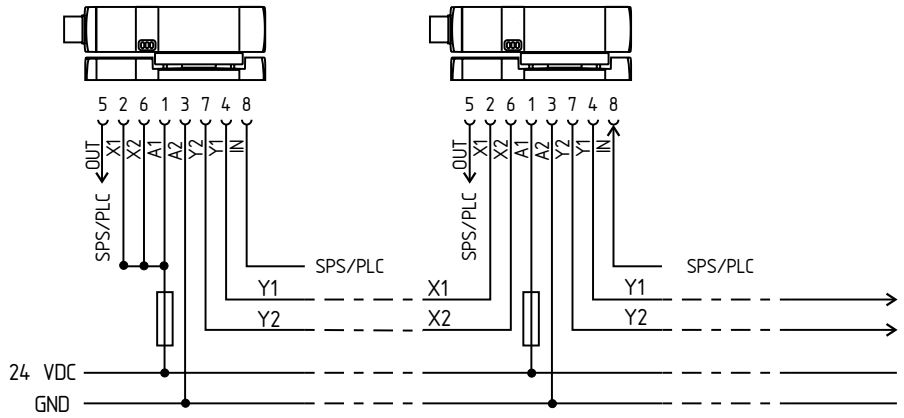
Ordering details

Adjustment target **MZM 100 TARGET**

Ordering details

Mounting kit **MS MZM 100-W**
(screws included in delivery)

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

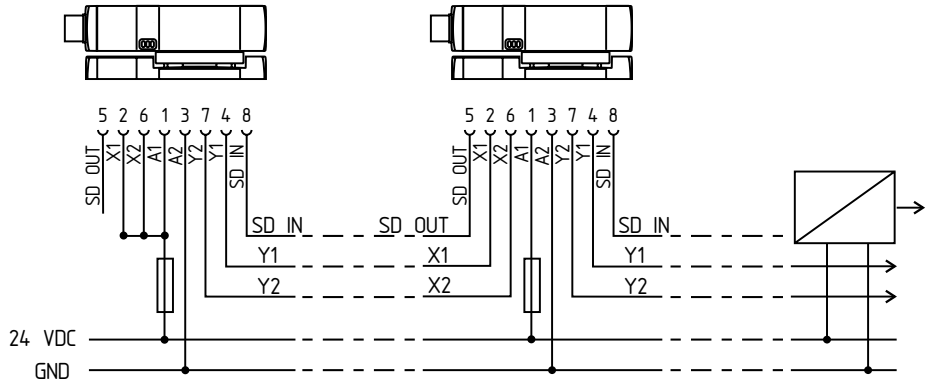


n devices max.
31 components
in series

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



n devices max.
31 components
in series

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.

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

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

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, thefollowing 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.

System condition	Solenoid control	LED			Safety outputs	Diagnostic output
	IN	green	red	yellow	Y1, Y2	OUT
Safety guard open	0 V	On	Off	Off	0 V	0 V
Safety guard closed, actuator in	0 V	On	Off	Flashes	0 V	24 V
Safety guard closed and locked	24 V	On	Off	On	24 V	24 V
Safety guard closed, holding force too low	24 V	On	Off	Flashes	0 V	0 V
Failure warning[1)], safety guard locked	24 V	On	Flashes [2)]	On	24 V	0 V
Failure	0 V/24 V	On	Flashes [2)]	Off	0 V	0 V
Unauthorized violent separation of solenoid interlock and actuator	24 V	On	Flashes [2)]	Flashes [2)]	0 V	0 V

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

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

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

The described condition is obtained, when bit = 1

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

System condition	LEDs			Safety outputs	Response byte Bit n°							
	green	red	yellow	Y1, Y2	7	6	5	4	3	2	1	0
Safety guard open	On	Off	Off	0 V	0	0	0	X	0	0	0	0
Safety guard closed, actuator present	On	Off	Flashes	0 V	0	0	0	X	0	0	1	0
Safety guard closed and locked	On	Off	On	24 V	0	0	0	1	0	1	1	1
Solenoid interlock cannot be locked. Safety guard not correctly closed or magnet soiled	On	Off	Flashes	0 V	0	0	0	1	0	0	1	0
Failure warning [1], safety guard locked	On	Flashes[2]	On	24 V	0	1	0	1	0	1	1	1
Failure	On	Flashes[2]	Off	0 V	1	0	0	X	0	X	X	0

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

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

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

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 asafety-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, t he 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

System condition	Solenoid control	LED			Safety outputs	Diagnostic output
	IN	green	red	yellow	Y1, Y2	OUT
Safety guard open	0 V	On	Off	Off	0 V	0 V
Safety guard closed, actuator in	0 V	On	Off	Flashes	24 V	24 V
Safety guard closed and locked	24 V	On	Off	On	24 V	24 V
Solenoid interlock cannot be locked. Safety guard not correctly closed or magnet soiled	24 V	On	Off	Off	0 V	0 V
Failure warning[1)], actuator in	0 V/24 V	On	Flashes [2)]	Flashes/ On	24 V	0 V
Failure	0 V/24 V	On	Flashes [2)]	Off	0 V	0 V

[1)] s. refer to flash codes
[2)] after 30 minutes -> failure

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 anoutput 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).

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

The described condition is obtained, when bit = 1

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

System condition	LEDs			Safety outputs	Response byte Bit n°							
	green	red	yellow	Y1, Y2	7	6	5	4	3	2	1	0
Safety guard open	On	Off	Off	0 V	0	0	0	X	0	0	0	0
Safety guard closed, actuator present	On	Off	Flashes	24 V	0	0	0	1	0	0	1	0
Safety guard closed and locked	On	Off	On	24 V	0	0	0	1	0	1	1	1
Solenoid interlock cannot be locked. Safety guard not correctly closed or magnet soiled	On	Off	Flashes	0 V	0	0	0	1	0	0	0	0
Failure warning[1)], actuator present	On	Flashes[2)]	On	24 V	0	1	0	1	0	X	1	1
Failure	On	Flashes[2)]	Off	0 V	1	0	0	X	0	X	X	0

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

Electronic solenoid interlock AZM 300 and safety switch with separate actuator AZ 300

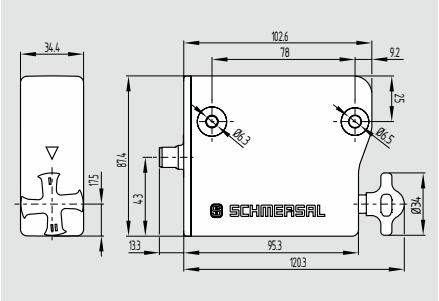
Actuation advantages
- Symmetrical mounting for right- and left-hinged doors
- Only one version for hinged and sliding doors
- Can be used as end stop
- Individually coded version with Coding level „High“ according to ISO 14119
- With manual release, emergency exit or emergency release

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

Electronic solenoid interlock and safety switch AZ/AZM 300

AZM 300



- 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
- Manual release, emergency exit or emergency release
- Easily mounted to standard extrusion guards

Approvals

TÜV cULus ECOLAB CE

Technical data

Standards:	IEC 60947-5-1, IEC 60947-5-3, ISO 14119, ISO 13849-1, IEC 61508, IEC 62061
Enclosure:	glass-fibre reinforced thermo-plastic, self-extinguishing
Operating principle:	RFID
Holding force F:	1,000 N
Latching force:	25 N / 50 N
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 sn:	2 mm
Assured switching distance s_{ao}:	1 mm
Assured switch-off distance s_{ar}:	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
Tightening torque of the fixing screws:	5 … 6 Nm
Ambient conditions	
Ambient temperature:	0°C ... +60°C
Storage and transport temp.:	−10°C ... +90°C
Protection class:	IP66, IP67, IP69 to IEC 60529
Protection class:	II
Resistance to shock:	30 g / 11 ms
Resistance to vibration:	10 … 150 Hz, amplitude 0.35 mm

Technical data

Insulation values to IEC 60664-1:	
- Rated insulation voltage U_i:	32 VDC
- Rated impulse withstand voltage U_{imp}:	0.8 kV
- Over-voltage category:	III
- Degree of pollution:	3
Electrical data	
Operating voltage U_B:	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 inputs	
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 - Safety outputs	
Safety outputs:	Y1 and Y2
Switching elements:	p-type, short-circuit proof
Utilisation category:	DC-12, DC-13
Rated operating voltage U_e:	0 V ... 4 V under supply voltage UB
Rated operating current I_e:	0,25 A
Residual current I_r:	≤ 0,5 mA
Test impulse width:	< 0,5 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_e:	0 V ... 4 V under supply voltage UB
Rated operating current I_e:	0,05 A

Ordering details

AZM300①-②-ST-③-④-⑤

No.	Option	Description
①	Z	Solenoid interlock monitored
	B	Actuator monitored
②		Standard coding
	I1	Individual coding
	I2	Individual coding, re-teaching enabled
③	1P2P	1 p-type diagnostic output and 2 p-type safety outputs
	SD2P	Serial diagnostic output and 2 p-type safety outputs
④		Power to unlock

Ordering details

No.	Option	Description
⑤	A	Power to lock
		Manual release
	N	Emergency release
	T	Emergency exit
	T8	Emergency exit, distance 8.5 mm

Note

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

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

Electronic solenoid interlock and safety switch AZ/AZM 300

Technical data

Electrical data - Magnet control:

Solenoid input:	IN
Switching thresholds:	− 3 V … 5 V (Low), 15 V … 30 V (High)
Power consumption::	10 mA / 24 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:

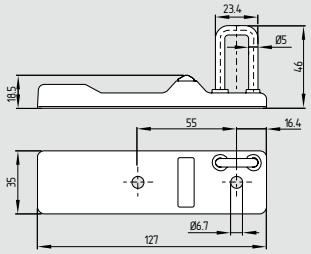
Standards:	ISO 13849-1, IEC 61508 , IEC 62061
PL:	e
Category:	4
PFH:	5.2 x 10^{-10} / h
PFD:	4.5 x 10^{-5}
SIL:	suitable for SIL 3 applications
Mission time:	20 years

- of the guard locking function*:

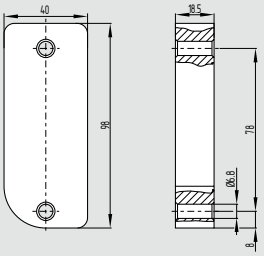
Standards:	ISO 13849-1, IEC 61508 , IEC 62061
PL:	d
Category:	2
PFH:	2.0 x 10^{-9} / h
PFD:	1.8 x 10^{-4}
SIL:	suitable for SIL 2 applications
Mission time:	20 years

* The safety classification of the guard locking function only applies for standard devices with monitored solenoid interlock AZM300Z-…-1P2P-… (see ordering code and notes at the operating instructions).

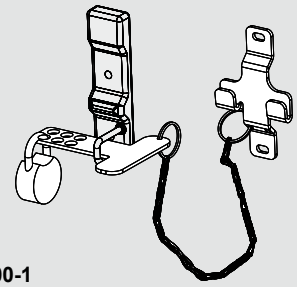
System components



AZ/AZM300-B1



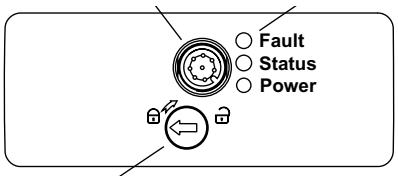
MP-AZ/AZM300-1



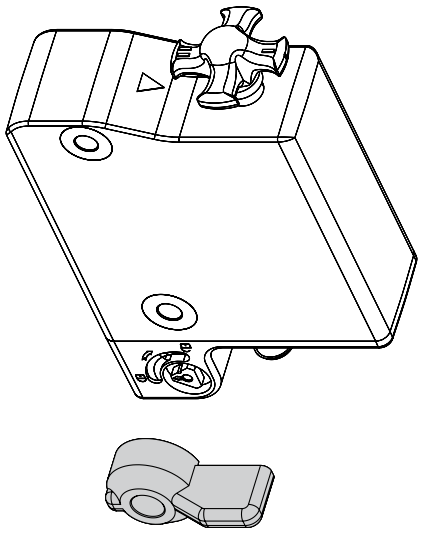
SZ 200-1

Connecting cables

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**

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 with female connector M12, 8-pole - 8 x 0,21 mm²

Cable length 5.0 m	**101210560**
Cable length 5.0 m (angled)	**101210561**

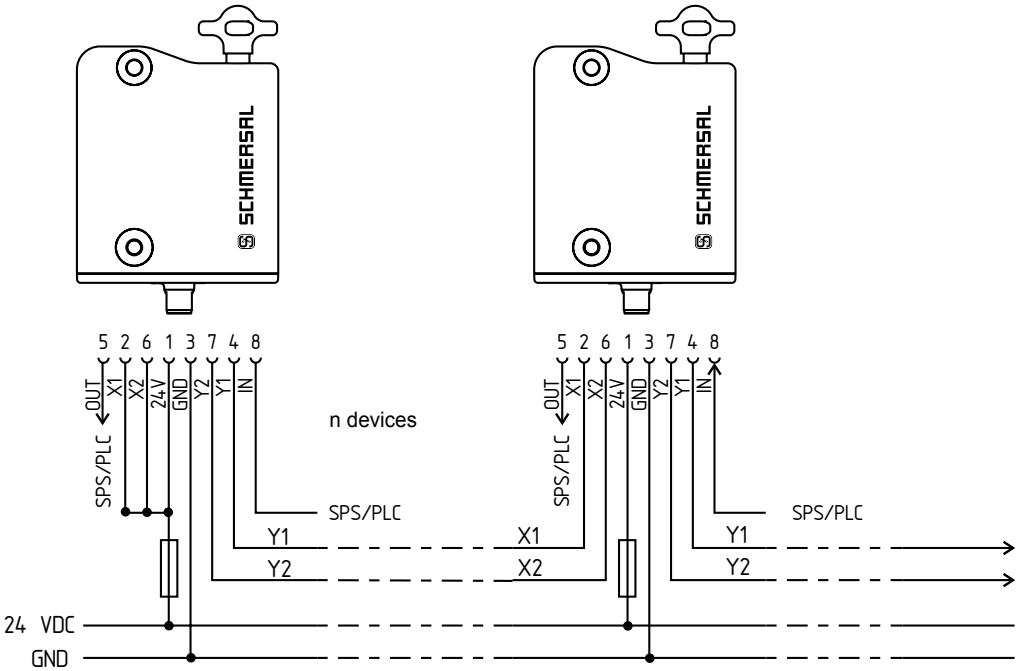
Diagnostic

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.

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

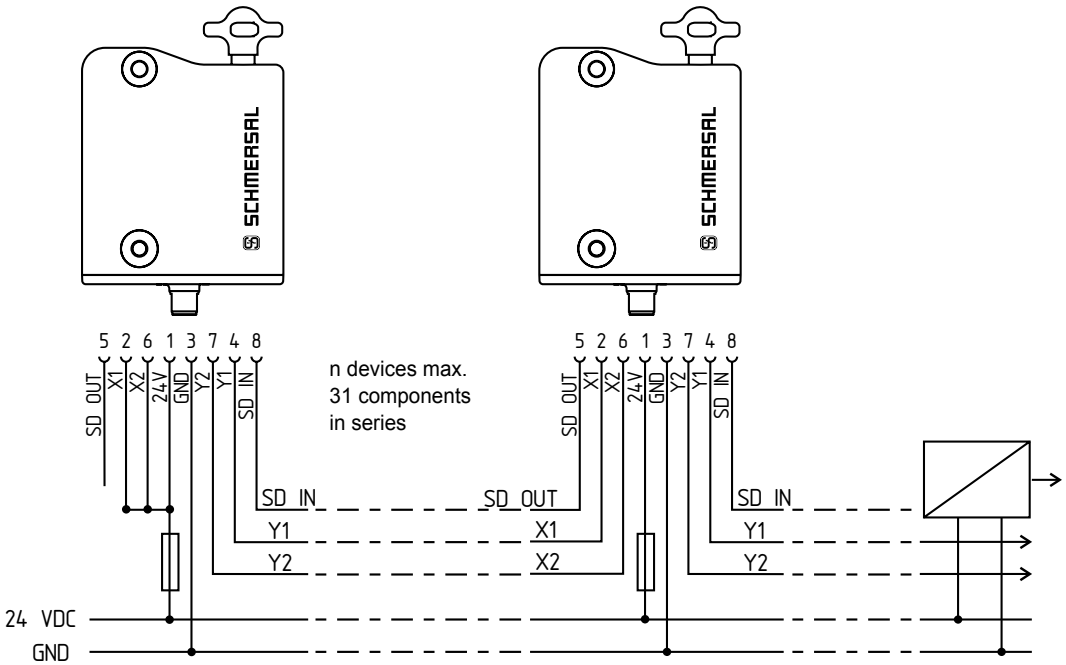


Y1 and Y2 = Safety outputs → Safety monitoring module

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.

Series-wiring of the AZM 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.

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

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, thefollowing 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.

System condition	Solenoid control IN		LED			Safety outputs Y1, Y2		Diagnostic output OUT
	Power to unlock	Power to lock	green	red	yellow	AZM 300Z	AZM 300B	
Safety guard open	24 V (0 V)	0 V (24 V)	On	Off	Off	0 V	0 V	0 V
Door closed, not locked	24 V	0 V	On	Off	Flashes	0 V	24 V	24 V
Door closed, locking impossible	0 V	24 V	On	Off	Flashes	0 V	24 V	0 V
Door closed and locked	0 V	24 V	On	Off	On	24 V	24 V	24 V
Error warning [1]	0 V	24 V	On	Flashes[2]	Off	24 V[1]	24 V[1]	0 V
Error	0 V (24 V)	24 V (0 V)	On	Flashes[2]	Off	0 V	0 V	0 V
Additionally for variant I1/I2:								
Teach-in procedure actuator started			Off	On	Flashes	0 V	0 V	0 V
Only I2: teach-in procedure actuator (release block)			Flashes	Off	Off	0 V	0 V	0 V

[1] after 30 min: disabling due to fault
[2] refer to flash codes

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 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).

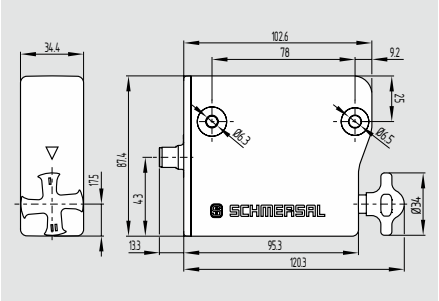
Bit n°	Request byte	Response byte	Diagnostic Failure warning	Diagnostic Failure
Bit 0:	Magnet in, independent of power-to-lock or power-to-unlock principle	Safety output enabled	Error output Y1	Error output Y1
Bit 1:	---	Actuator detected	Error output Y2	Error output Y2
Bit 2:	---	Actuator detected and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

[1)] after 30 min -> fault

The described condition is obtained, when bit = 1

Electronic solenoid interlock and safety switch AZ/AZM 300

AZ 300



- 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
- 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
- Hygiene-compliant design
- Protection class IP69
- Easily mounted to standard extrusion guards

Technical data

Standards:	IEC 60947-5-1, IEC 60947-5-3, ISO 14119, ISO 13849-1, IEC 61508, IEC 62061
Enclosure:	glass-fibre reinforced thermo-plastic, self-extinguishing
Operating principle:	RFID
Latching force:	25 N / 50 N
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 sn:	2 mm
Assured switching distance s_{ao}:	1 mm
Assured switch-off distance s_{ar}:	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
Tightening torque of the fixing screws:	5 … 6 Nm
Ambient conditions	
Ambient temperature:	0°C ... +60°C
Storage and transport temp.:	−10°C ... +90°C
Protection class:	IP66, IP67, IP69 to IEC 60529
Protection class:	II
Resistance to shock:	30 g / 11 ms
Resistance to vibration:	10 … 150 Hz, amplitude 0.35 mm

Technical data

Insulation values to IEC 60664-1:	
- Rated insulation voltage U_i:	32 VDC
- Rated impulse withstand voltage U_{imp}:	0.8 kV
- Over-voltage category:	III
- Degree of pollution:	3
Electrical data	
Operating voltage U_B:	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)
Electrical data - Safety inputs	
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 - Safety outputs	
Safety outputs:	Y1 and Y2
Switching elements:	p-type, short-circuit proof
Utilisation category:	DC-12, DC-13
Rated operating voltage U_e:	0 V ... 4 V under supply voltage UB
Rated operating current I_e:	0,25 A
Residual current I_r:	≤ 0,5 mA
Test impulse width:	< 0,5 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_e:	0 V ... 4 V under supply voltage UB
Rated operating current I_e:	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

Approvals

TÜV cULus ECOLAB CE

Ordering details

AZ300①-②-③

No.	Option	Description
①	Z	Solenoid interlock monitored
	B	Actuator monitored
②		Standard coding
	I1	Individual coding
	I2	Individual coding, re-teaching enabled
③	1P2P	1 p-type diagnostic output and 2 p-type safety outputs
	SD2P	Serial diagnostic output and 2 p-type safety outputs

Note

The safety switch and the actuator unit must be ordered separately.

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

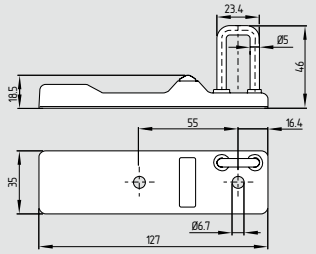
Note

Wiring and connectors
refer to page 106

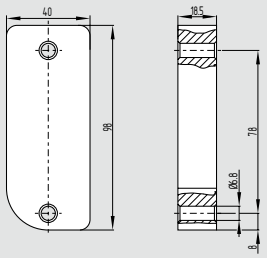
Wiring examples refer to page 76
Diagnostic functions refer to page 81

Electronic solenoid interlock and safety switch AZ/AZM 300

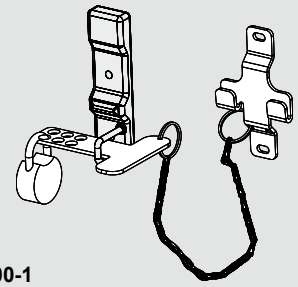
System components



AZ/AZM300-B1



MP-AZ/AZM300-1



SZ 200-1

Connecting cables

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

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 with female connector M12, 8-pole - 8 x 0,21 mm²

Cable length 5.0 m	**101210560**
Cable length 5.0 m (angled)	**101210561**

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.

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

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, thefollowing 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.

System condition	LED			Safety outputs Y1, Y2	Diagnostic output OUT
	green	red	yellow		
Safety guard open	On	Off	Off	0 V	0 V
Safety guard closed	On	Off	On	24 V	24 V
Error warning [1]	On	Flashes[2]	Off	24 V[1]	0 V
Error	On	Flashes[2]	Off	0 V	0 V
Additionally for variant I1/I2:					
Teach-in procedure actuator started	Off	On	Flashes	0 V	0 V
Only I2: 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

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).

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

[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

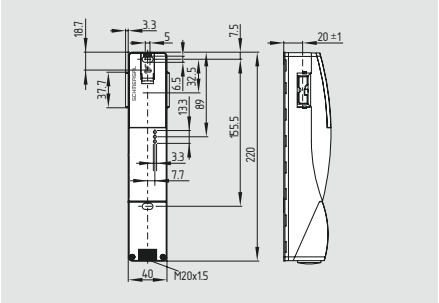
Actuation advantages
- Integrated door detection sensor
- Sensor technology permits an offset of ± 5 mm between actuator and interlock
- 3 LEDs to show the operating status
- Accurate adjustment through slotted holes

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

Electronic solenoid interlock and safety switch AZ/AZM 200

AZM 200



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
- Holding force 2,000 N
- 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

TÜV cULus CE

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
Holding force F:	2,000 N
Latching force:	30 N
Coding level according to ISO 14119:	low
Protection class:	IP67 to IEC 60529
Protection class:	II, ⧈
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**
Cable length:	max. 200m (Cable length and cable section alter the voltage drop depending on the output current)
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 ms
Time to readiness:	< 4 s
Actuating 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:	
- Screw terminals or cage clamps:	≤ 4 A when used to UL 508;
- Connector M12 or M23:	≤ 2 A

Technical data

Safety inputs X1 and X2:	
$U_{e3/Low}$:	−3 V … 5 V
$U_{e3/High}$:	15 V … 30 V
I_{e3}:	typically 2 mA at 24 V
Safety outputs Y1 and Y2:	p-type, short-circuit proof
U_{e1}:	0 V up to 4 V under U_e
I_{e1}:	max. je 0.25 A
Utilisation category:	DC-13
Leakage current I_r:	≤ 0.5 mA
Diagnostic output OUT:	p-type, short-circuit proof
U_{e2}:	0 V up to 4 V under U_e
I_{e2}:	max. 0.05 A
Utilisation category:	DC-13
Wiring capacitance for serial diagnostic:	max. 50 nF
Solenoid control IN:	
$U_{e4/Low}$:	−3 V … 5 V
$U_{e4/High}$:	15 V … 30 V
I_{e4}:	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	
- 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

* The safety classification of the guard locking function only applies for standard devices with monitored solenoid interlock AZM 200...-1P2P(W)-... (see ordering code and notes at the operating instructions).

Ordering details

AZM 200①-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		Power to unlock
	A	Power to lock

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

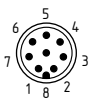
The safety switchgears are classified according to ISO 14119 as type 4 interlocking devices.

Connection

Integrated connectors

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

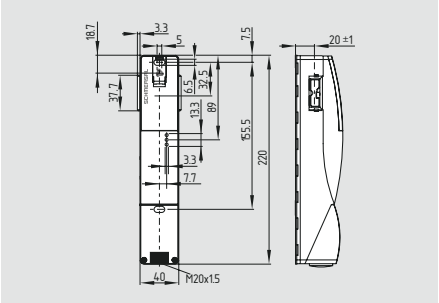
M12, 8-pole (Suffix -ST2)



Wiring and connectors
refer to page 110

Electronic solenoid interlock and safety switch AZ/AZM 200

AZM 200 B



Safety switch with interlocking function (Actuator 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
- Holding force 2,000 N
- 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

TÜV cULus CE

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
Holding force F:	2,000 N
Latching force:	30 N
Coding level according to ISO 14119:	low
Protection class:	IP67 to IEC 60529
Protection class:	II, ⧈
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**
Cable length:	max. 200m (Cable length and cable section alter the voltage drop depending on the output current)

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 ms
Time to readiness:	< 4 s
Actuating 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:	
- Screw terminals or cage clamps:	≤ 4 A when used to UL 508;
- Connector M12 or M23:	≤ 2 A

Technical data

Safety inputs X1 and X2:

$U_{e3/Low}$:	−3 V … 5 V
$U_{e3/High}$:	15 V … 30 V
I_{e3}:	typically 2 mA at 24 V

Safety outputs Y1 and Y2:

	p-type, short-circuit proof
U_{e1}:	0 V up to 4 V under U_e
I_{e1}:	max. je 0.25 A
Utilisation category:	DC-13
Leakage current I_r:	≤ 0.5 mA

Diagnostic output OUT:

	p-type, short-circuit proof
U_{e2}:	0 V up to 4 V under U_e
I_{e2}:	max. 0.05 A
Utilisation category:	DC-13
Wiring capacitance for serial diagnostic:	max. 50 nF

Solenoid control IN:

$U_{e4/Low}$:	−3 V … 5 V
$U_{e4/High}$:	15 V … 30 V
I_{e4}:	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

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		Power to unlock
	A	Power to lock

Note

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

Actuators and accessories refer to page 104

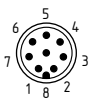
The safety switchgears are classified according to ISO 14119 as type 4 interlocking devices.

Connection

Integrated connectors

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

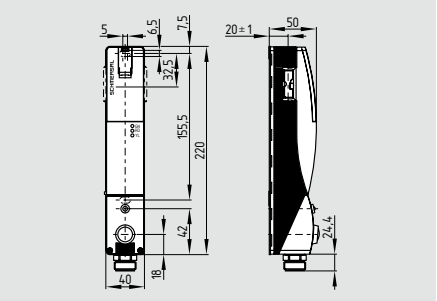
M12, 8-pole (Suffix -ST2)



Wiring and connectors

refer to page 110

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 detriment to the category

Approvals

TÜV cULus CE

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
Holding force F:	2,000 N
Latching force:	30 N
Coding level according to ISO 14119:	low
Protection class:	IP65 to IEC 60529
- Button:	IP65, 24 VDC
- LED:	IP65, white, 24 VDC
Protection class:	II, ⧈
Overvoltage category:	III
Degree of pollution:	3
Connection:	connector M23, 12-pole
Series-wiring:	**max. 31 components**
Cable length:	max. 200m (Cable length and cable section alter the voltage drop depending on the output current)
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 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 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

Technical data

Safety inputs X1 and X2:	
$U_{e3/Low}$:	−3 V … 5 V
$U_{e3/High}$:	15 V … 30 V
I_{e3}:	> 2 mA at 24 V
Safety outputs Y1 and Y2:	p-type, short-circuit proof
U_{e1}:	0 V up to 4 V under U_e
I_{e1}:	max. je 0.25 A
Utilisation category:	DC-13
Leakage current I_r:	≤ 0.5 mA
Diagnostic output OUT:	p-type, short-circuit proof
U_{e2}:	0 V up to 4 V under U_e
I_{e2}:	max. 0.05 A
Utilisation category:	DC-13
Wiring capacitance for serial diagnostic:	max. 50 nF
Solenoid control IN:	
$U_{e4/Low}$:	−3 V … 5 V
$U_{e4/High}$:	15 V … 30 V
I_{e4}:	typically 10 mA at 24 V, dynamically 20 mA
Solenoid:	100% ED
LED functions:	
Green	Supply voltage on
Yellow	Operating status
Red	Error
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

* The safety classification of the guard locking function only applies for standard devices with monitored solenoid interlock AZM 200...-1P2P(W)-... (see ordering code and notes at the operating instructions).

Ordering details

MS-AZM 200ST-T-1P2PW-①-2568

No.	Option	Description
①		Power to unlock
	A	Power to lock

Note

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

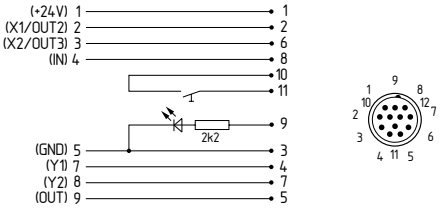
As long as the actuator unit is inserted in the solenoid interlock, the unlocked safety guard can be relocked. In this case, the safety outputs are re-enabled; **opening the safety guard is not required.**

Actuators and accessories refer to page 104

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

Ordering details

Integrated connectors
M23, 12-pole



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

Wiring and connectors
refer to page 110

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:

1P2PW-Variant:

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

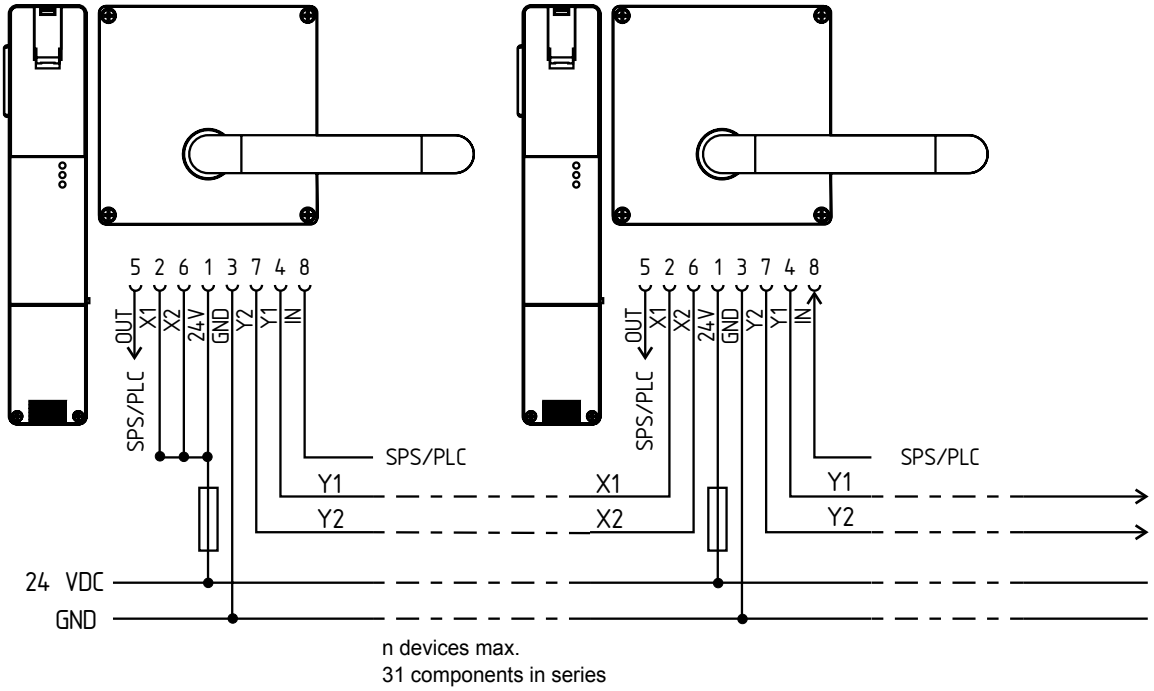
Serial diagnostic

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.

Note

For manual release the triangular key is included in delivery.

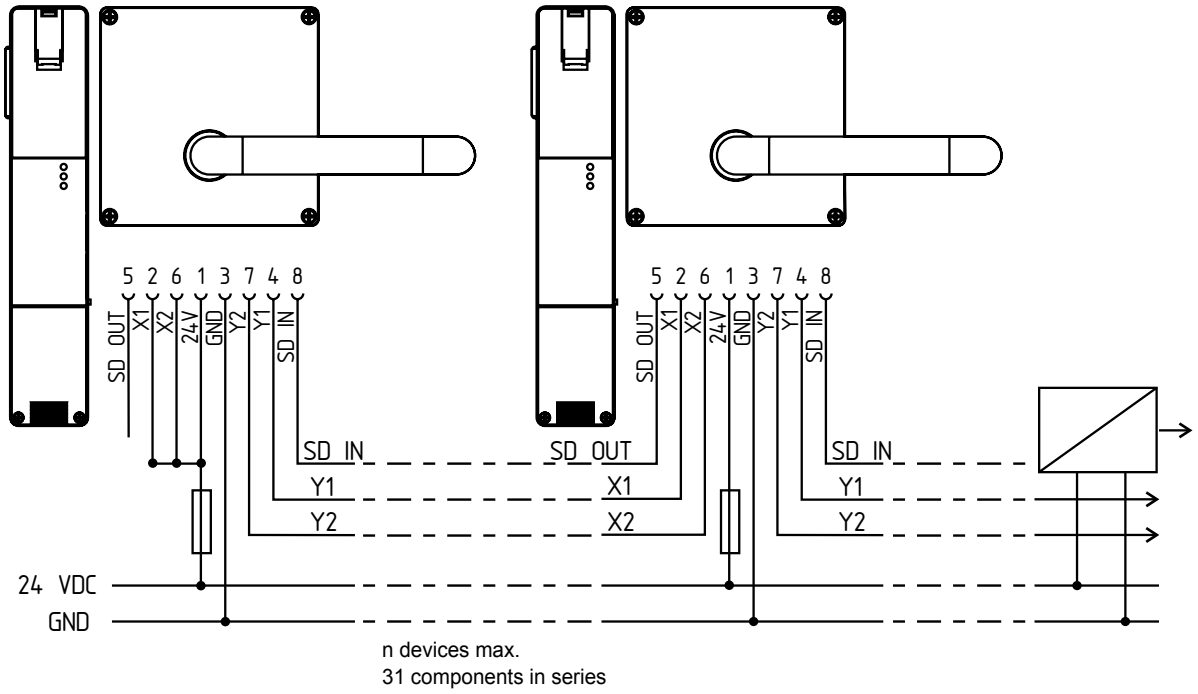
Series-wiring of the AZM 200 (B) with conventional diagnostic output



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.

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

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

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.

System condition	Solenoid control IN		LED			Safety outputs Y1, Y2		Diagnostic output
	Power-to-unlock	Power-to-lock	green	red	yellow	AZM 200...	AZM 200 B...	OUT
Safety guard open	24 V (0 V)	0 V (24 V)	On	Off	Off	0 V	0 V	0 V
Safety guard closed, actuator not inserted	24 V	0 V	On	Off	Off	0 V	0 V	0 V
Safety guard closed, actuator inserted, not locked	24 V	0 V	On	Off	Flashes	0 V	24 V	24 V
Safety guard closed, actuator inserted, locking impossible	0 V	24 V	On	Off	Flashes	0 V	24 V	0 V
Safety guard closed, actuator inserted and locked	0 V	24 V	On	Off	On	24 V	24 V	24 V
Failure warning[1], Solenoid interlock locked	0 V	24 V	On	Flashes[2]	On	24 V [1]	24 V [1]	0 V
Failure	0 V (24 V)	24 V (0 V)	On	Flashes[2]	Off	0 V	0 V	0 V

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

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).

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

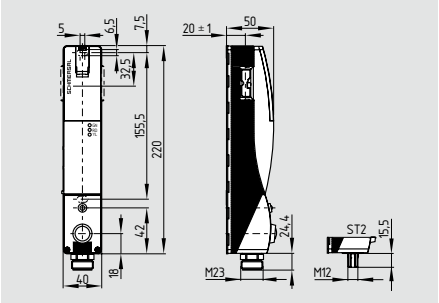
The described condition is obtained, when bit = 1

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

System condition	LEDs			Safety outputs	Response byte Bit n°.							
	green	red	yellow	Y1, Y2	7	6	5	4	3	2	1	0
Supply voltage on, safety guard open	On	Off	Off	0 V	0	0	0	X	0	0	0	0
Safety guard closed, actuator present	On	Off	Flashes	0 V	0	0	0	X	0	0	1	0
Safety guard closed and locked	On	Off	On	24 V	0	0	0	1	0	1	1	1
Failure warning [1)], safety guard locked	On	Flashes	On	24 V	0	1	0	1	0	1	1	1
Failure	On	Flashes	Off	0V	1	0	0	X	0	X	X	0

[1)] after 30 minutes -> Failure

AZM 200 D



Solenoid interlock with
two dual-channel enabling paths

- 2 safety outputs for door closed, 2 safety outputs for door locked
- 1 diagnostic output
- Optionally with potential-free button and LED
- Sensor technology permits an offset of ± 5 mm between actuator and interlock
- Accurate adjustment through slotted holes
- 3 LEDs to show the operating status
- Manual release
- Holding force 2,000 N
- Latching force 30 N

- **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

Approvals

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
Holding force F:	2,000 N
Latching force:	30 N
Coding level according to ISO 14119:	low
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
Protection class:	II, ⧈
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
Cable length:	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 s_{ao}:	14 mm
Assured switch-off distance s_{ar}:	22 mm
Switching frequency f:	1 Hz

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

Electrical data:

Rated operating voltage U_e:	24 VDC -15% / +10% (stabilised PELV)
Rated operating current I_e:	1,2 A
Required rated short-circuit current:	100 A

Technical data

No-load current I_0:	max. 0,5 A
Rated impulse withstand voltage U_{imp}:	0,8 kV
Rated insulation voltage U_i:	32 VDC
Fuse rating:	
- Screw terminals or cage clamps:	≤ 4 A bei when used to UL 508;
- Connector M12 or M23:	≤ 2 A

Safety inputs X1 and X2:

- $U_{e3/Low}$:	−3 V … 5 V
- $U_{e3/High}$:	15 V … 30 V
I_{e3}:	typically 2 mA at 24 V

Safety outputs Y1 … Y4:

	p-type, short-circuit proof
U_{e1}:	0 V up to 4 V under U_e
I_{e1}:	
- Y1 and Y2:	max. per 0,25 A
- Y3 and Y4:	max. 0,1 A*
Utilisation category:	DC-13
Residual current I_r:	≤ 0,5 mA

Diagnostic output OUT:

	p-type, short-circuit proof
U_{e2}:	0 V up to 4 V under U_e
I_{e2}:	max. 0,1 A*
Utilisation category:	DC-13

*** Residual current through outputs Y3, Y4, OUT:** $I_{Y3} + I_{Y4} + I_{OUT} \leq 0,1$ A

Solenoid control IN:

- $U_{e4/Low}$:	−3 V … 5 V
- $U_{e4/High}$:	15 V … 30 V
I_{e4}:	typically 10 mA at 24 V, dynamically 20 mA
Solenoid:	100% ED

LED functions:

Green	Supply voltage on
Yellow	Operating status
Red	Error

Ordering details

AZM 200 D ①-T-1P2P2P-②

No.	Option	Description
①	SK	Screw terminals
	CC	Cage clamps
	ST1	Connector M23, (8+1)-pole
	ST2	Connector M12, 8-pole
	ST3	Connector M23, 12-pole only for -2568
②		Power to unlock
	A	Power to lock
③		Without
	2568	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.

Actuators and accessories refer to page 104

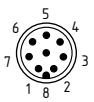
The safety switchgears are classified according to ISO 14119 as type 4 interlocking devices.

Connection

Integrated connectors

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

M12, 8-pole (Suffix -ST2)



Wiring and connectors refer to page 110

Electronic solenoid interlock and safety switch AZ/AZM 200

Technical data

Classification:

- Safety guard monitoring, Y1 and Y2:

Standards:	ISO 13849-1, IEC 61508
PL:	e
Control category:	4
PFH:	4 x 10^{-9} / h
SIL:	suitable for SIL 3 applications
Service life:	20 years

- Locking monitoring, Y3 and Y4:

Standards:	ISO 13849-1, IEC 61508
PL:	d
Control category:	3
PFH:	1 x 10^{-7} / h
SIL:	suitable for SIL 2 applications
Service life:	20 years

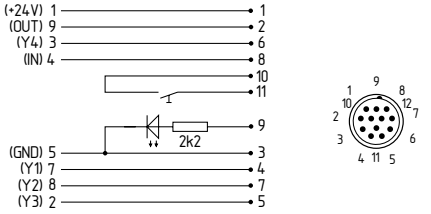
Note

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)



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.

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

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

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, tem perature error, short-circuit + 24 VDC at safety output), will result in a delayed switch-off (see table). After elimina tion 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.

System condition	Solenoid control IN		LED			Safety outputs				Diagnostic output
	Power-to-unlock	Power-to-lock	green	red	yellow	Y1	Y2	Y3	Y4	OUT
Safety guard open	24 V (0 V)	0 V (24 V)	On	Off	Off	0 V	0 V	0 V	24 V	0 V
Safety guard closed, actuator not inserted	24 V	0 V	On	Off	Flashes 3 Hz	24 V	24 V	0 V	24 V	0 V
Safety guard closed, actuator inserted, not locked	24 V	0 V	On	Off	Flashes	24 V	24 V	0 V	24 V	24 V
Safety guard closed, actuator inserted, locking impossible	0 V	24 V	On	Off	Flashes	24 V	24 V	0 V	24 V	24 V
Safety guard closed, actuator inserted and locked	0 V	24 V	On	Off	On	24 V	24 V	24 V	0 V	24 V
Failure warning[1], Solenoid interlock locked	0 V	24 V	On	Flashes[2]	On	24 V[1]	24 V[1]	24 V	0 V	0 V
Failure	0 V (24 V)	24 V (0 V)	On	Flashes[2]	Off	0 V	0 V	24 V	0 V	0 V

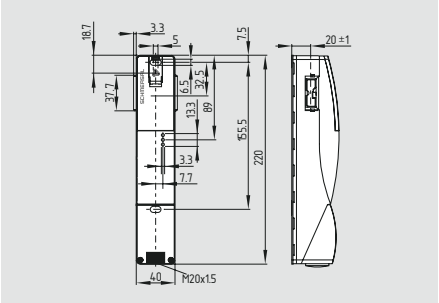
[1] after 30 minutes -> failure
[2] refer to flash codes

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

AZ 200



Safety switch
- Thermoplastic enclosure
- Sensor technology permits an offset of ± 5 mm between actuator and safety switch
- Intelligent diagnostic
- Accurate adjustment through slotted holes
- 3 LEDs to show the operating status (refer to table)
- 2 safety outputs, 1 diagnostic output
- Holding 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

TÜV cULus CE

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
Coding level according to ISO 14119:	low
Holding force:	30 N
Protection class:	IP67 to IEC 60529
Protection class:	II, ⧈
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**
Cable length:	max. 200m (Cable length and cable section alter the voltage drop depending on the output current)
Switching distances to EN 60947-5-3:	
S_n:	6.5 mm
S_{ao}:	4.0 mm
S_{ar}:	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

Technical data

Actuating speed:	≤ 0.2 m/s
Electrical data:	
Rated operating voltage U_e:	24 VDC −15%/+10% (stabilised PELV)
Rated operating current I_e:	0.7 A
No-load current I_0:	max. 0.1 A
Rated impulse withstand voltage U_{imp}:	800 V
Rated insulation voltage U_i:	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
$U_{e3/Low}$:	− 3 V … 5 V
$U_{e3/High}$:	15 V … 30 V
I_{e3}:	typically 2 mA at 24 V
Safety outputs Y1 and Y2:	p-type, short-circuit proof
U_{e1}:	0 V up to 4 V under U_e
I_{e1}:	max. je 0.25 A
Utilisation category:	DC-13
Leakage current Ir:	≤ 0.5 mA
Diagnostic output OUT:	p-type, short-circuit proof
U_{e2}:	0 V up to 4 V under U_e
I_{e2}:	max. 0.05 A
Utilisation category:	DC-13
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

Ordering details

AZ 200①-T-②

No.	Option	Description
①	SK	Screw terminals
	CC	Cage clamps
	ST1	Connector M23, (8+1)-pole
	ST2	Connector M12, 8-pole
②	1P2P	1 diagnostic output and 2 safety outputs, all p-type
	SD2P	serial diagnostic output and 2 safety outputs, p-type

Note

The safety switch and theactuator unit must be ordered separately.

Actuators and accessories refer to page 104

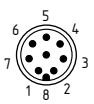
The safety switchgears are classified according to ISO 14119 as type 4 interlocking devices.

Connector

Integrated connector

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

M12, 8-pole (Suffix -ST2)



Wiring and connectors refer to page 110

Diagnostic

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.

Note

The wiring examples of the AZ 200 are identical to those of the AZM 200 series (refer to page 82).
Derogation: IN not assigned in the version with conventional diagnostic output.

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

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

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

System condition	LED			Safety outputs	Diagnostic output
	green	red	yellow	Y1, Y2	OUT
Safety guard open	On	Off	Off	0 V	0 V
Safety guard closed, actuator not inserted	On	Off	Off	0 V	0 V
Safety guard closed, actuator inserted	On	Off	On	24 V (when X1 = X2 = 24 V)	24 V
Failure warning[1], actuator inserted, switch-off approaching	On	Flashes[2]	On	24 V (when X1 = X2 = 24 V)	0 V
Failure	On	Flashes	Off	0 V	0 V

[1] after 30 minutes -> 0 V
[2] refer to flash codes

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.

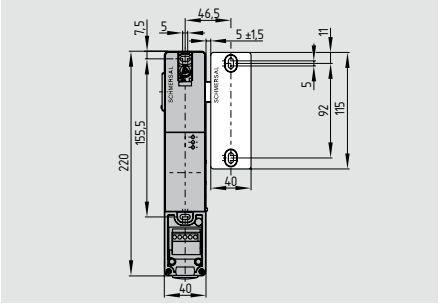
Diagnostic failure (warning)
If an failure (warning) is signalled in an answer byte, detailed information can be read out about this failure (warning).

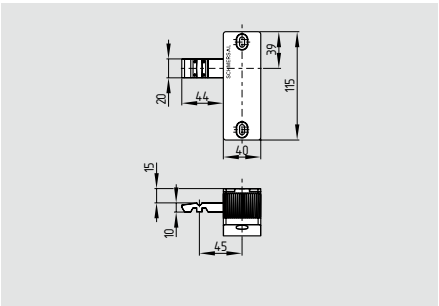
Bit n°	Request byte	Response byte	Diagnostic Failure warning	Diagnostic Failure
Bit 0:	---	Safety output enabled	Error output Y1	Error output Y1
Bit 1:	---	Actuator detected	Error output Y2	Error output Y2
Bit 2:	---	---	Cross-wire	Cross-wire
Bit 3:	---	---	Ambient temperature too high	Ambient temperature too high
Bit 4:	---	Input condition X1 and X2	---	Target error, coding error or false target combination
Bit 5:	---	Safety guard detected	Internal error	Internal error
Bit 6:	---	Failure warning	Communication error between fieldbus gateway and safety switch	---
Bit 7:	Failure reset	Failure (enabling path switched off)	Operating voltage too low	---

The described condition is obtained, when bit = 1

Electronic solenoid interlock and safety switch AZ/AZM 200

AZ/AZM 200-B1-…





- **Actuator for sliding guards**
- Actuator with return spring
- Tolerates overtravel of up to max. 5 mm
- With door detection sensor T
- Available with or without emergency exit (P0)

Approvals

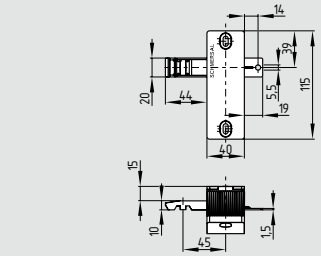
Approvals only in combination with switches AZ/AZM 200

Technical data

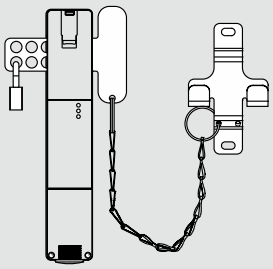
Material:

B1-housing:	Grivory
Actuator:	zinc die-cast
Mechanical life:	≥ 1 million operations
Holding force F for AZM 200:	2,000 N

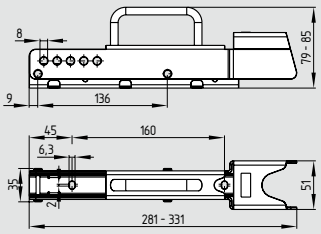
System components



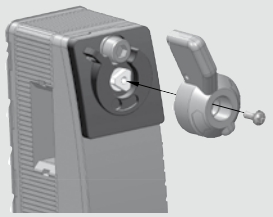
Actuator B1 with emergency exit P0



Lockout tag SZ 200-1



Lockout tag SZ 200



RF-AZM200-N/-T

Ordering details

AZ/AZM 200-B1-①T②

No.	Option	Description
①	L	Actuating direction left
	R	Actuating direction right
②		Without emergency exit
	P0	With emergency exit

Note

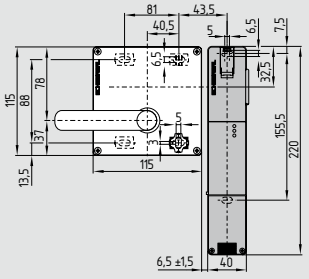
The safety switches/solenoid interlocks and the actuator unit must be ordered separately.

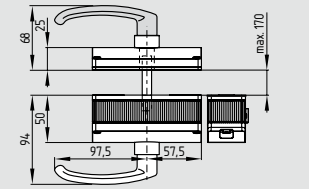
Ordering details

Actuator B1 with emergency exit	**AZ/AZM 200-B1-..-P0**
Lockout tag	**SZ 200-1**
Lockout tag	**SZ 200**
Retrofit kit	**RF-AZM200-N** **RF-AZM200-T**

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

Approvals

Approvals only in combination with switches AZ/AZM 200

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

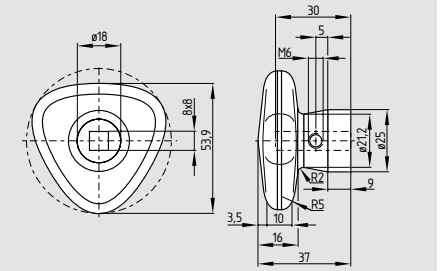
Door handle G1, G2:
plastic coated aluminium

Panic handle P1, P20, P25:
plastic coated aluminium

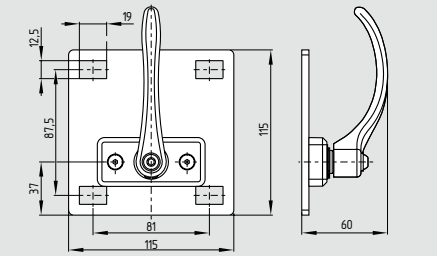
Actuator:
zinc die-cast

Mechanical life:	≥ 1 million operations
Holding force F for AZM 200:	
- mounting outside:	2.000 N
- mounting inside:	1.000 N

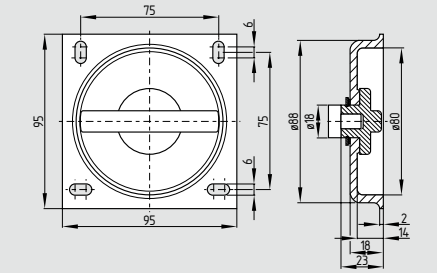
System components



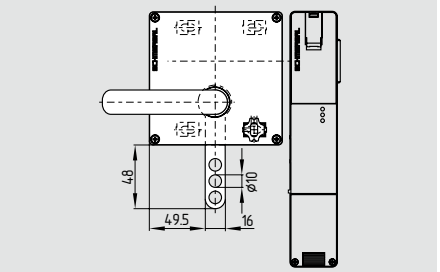
Rotary button



Emergency exit metal



Inset handle



Actuator B30 with lockout tag SZ

Ordering details

AZ/AZM 200-B30-①TA②③④-⑤

No.	Option	Description
①	L	Door hinge on left-hand side
	R	Door hinge on right-hand side
②	A	For mounting outside
	I	For mounting inside
③	G1	With doorhandle
	G2	With rotating knob
④	P1	With emergency exit
	P20	With emergency exit metal *
	P25	With emergency exit inset handle *
⑤		Without lockout tag
	SZ	With lockout tag *

* Only for mounting outside

Note

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

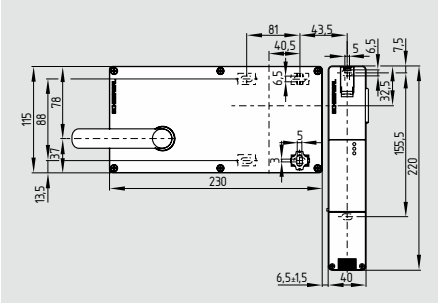
The actuator can be combined with a three-point locking rod to increase the stability of large and especially double-leaf safety guards.

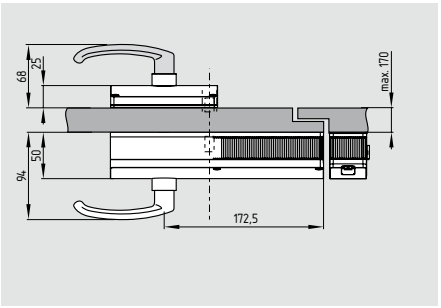
Ordering details

Actuator with rotary button	**AZ/AZM 200-…-G2**
Emergency exit metal	**AZ/AZM 200-…-P20**
with inset handle	**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

Approvals

Approvals only in combination with switches AZ/AZM 200

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

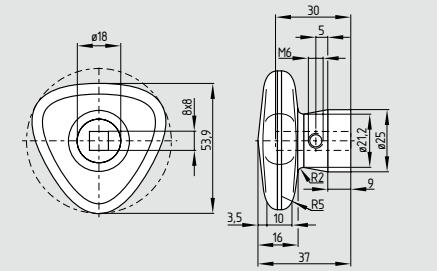
Door handle G1, G2:
plastic coated aluminium

Panic handle P1, P20, P25:
plastic coated aluminium

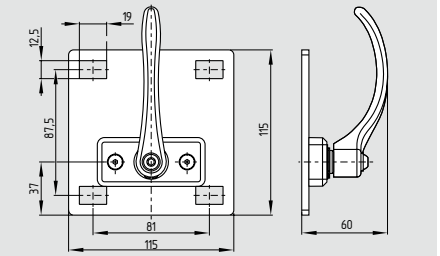
Actuator:
zinc die-cast

Mechanical life:	≥ 1 million operations
Holding force F for AZM 200:	2.000 N

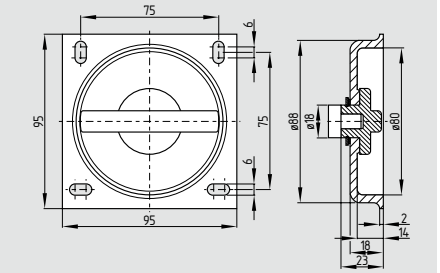
System components



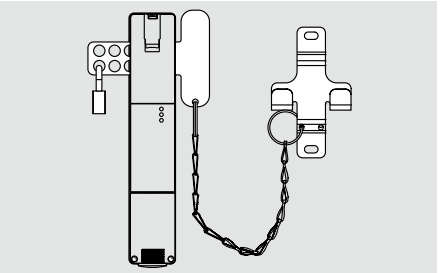
Rotary button



Emergency exit metal



Inset handle



Lockout tag SZ 200-1

Ordering details

AZ/AZM 200-B40-①TA②③

No.	Option	Description
①	L	Door hinge on left-hand side
	R	Door hinge on right-hand side
②	G1	With door handle
	G2	With rotary button
③	P1	With emergency exit
	P20	With emergency exit metal
	P25	With emergency exit with inset handle

Note

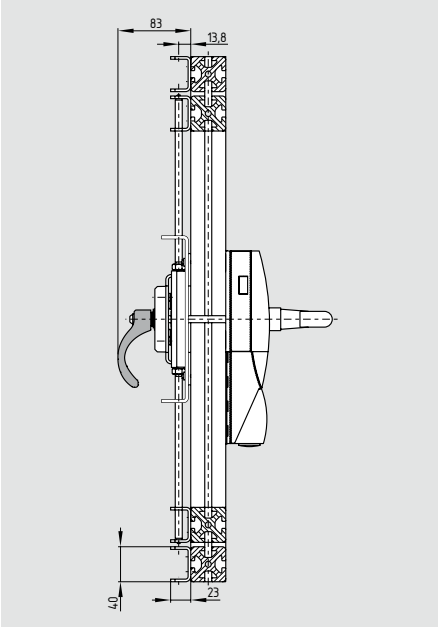
The safety switches/solenoid interlocks and the actuator unit must be ordered separately.

Ordering details

Actuator with rotary button	**AZ/AZM 200-…-G2**
Emergency exit metal	**AZ/AZM 200-…-P20**
with inset handle	**AZ/AZM 200-…-P25**
Lockout tag	**SZ 200-1**

Electronic solenoid interlock and safety switch AZ/AZM 200

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
- No supplementary door handles required
- Does not protrude into the door opening
- Various handles available
- Can be fitted with or without emergency exit

Approvals

Approvals only in combination with switches 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

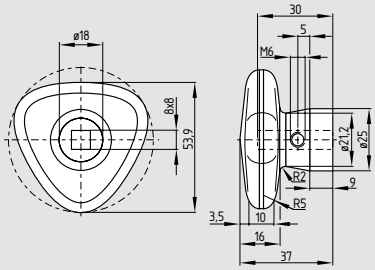
Door handle G1, G2:
plastic coated aluminium

Panic handle:
plastic coated aluminium

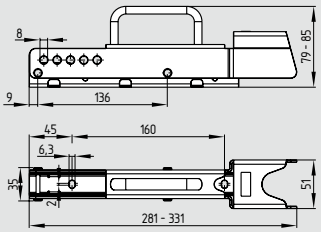
Actuator:
zinc die-cast

Mechanical life:	≥ 1 million operations
Holding force F for AZM 200:	2.000 N

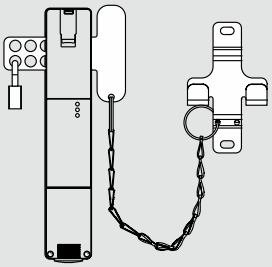
System components



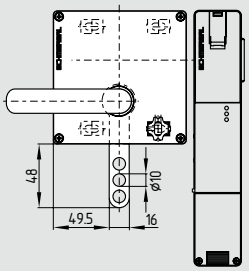
Rotary button



Lockout tag SZ 200



Lockout tag SZ 200-1



Actuator B30 with lockout tag SZ

Ordering details

AZ/AZM 200-B30-①-②TA③-④

No.	Option	Description
①	L	Door hinge on left-hand side
	R	Door hinge on right-hand side
②	G1	With door handle
	G2	With rotary button
③	P30	Without emergency exit
	P31	With emergency exit
④		Without lockout tag
	SZ	With lockout tag

Note

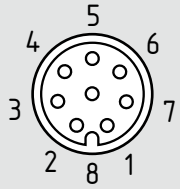
The safety switches/solenoid interlocks and the actuator unit must be ordered separately.

Retrofitting kit (only for AZ/AZM 200-B30-… **-P1 with emergency exit**) on request

Ordering details

Actuator with rotary button	**AZ/AZM 200-…-G2**
Lockout tag	**SZ 200**
Lockout tag	**SZ 200-1**
Actuator B30 with lockout tag SZ	**AZ/AZM 200-B30-.-SZ**

Connectors M12, 8-pole for CSS 34, CSS 30S, CSS 300, RSS 36, RSS 16



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

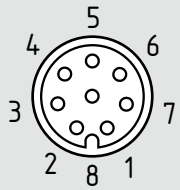
Cable length 5 m	**101210560**
Cable length 5 m, angled	**101210561**

Function of the safety switchgear			Pin configuration of the integrated connector	Colour code of the Schmersal connectors or of the integrated cable	Possible coulour codes of other customary connector	
	with conventional diagnostic output	with serial diagnostics			according to EN 60947-5-2: 2008	to DIN 47100
A1	U_e		1	BN	BN	WH
X1	Safety input 1		2	WH	WH	BN
A2	GND		3	BU	BU	GN
Y1	Safety output 1		4	BK	BK	YE
OUT	Diagnostic output	SD output	5	GY	GY	GY
X2	Safety input 2		6	VT	PK	PK
Y2	Safety output 2		7	RD	VT	BU
IN	CSS 34F2: On-site acknowledgment; others: without function	SD input	8	PK	OR	RD

Legend: Colour code

Code	Colour	Code	Colour	Code	Colour	Code	Colour
BK	black	GN	green	PK	pink	WH	white
BN	brown	GY	grey	RD	red	YE	yellow
BU	blue	OR	orange	VT	purple		

Connectors M12, 8-pole for CSS 16, CSS 30, CSS 180



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**

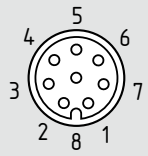
Function of the safety switchgear			Pin configuration of the integrated connector	Colour code of the Schmersal connectors or of the integrated cable	Possible coulour codes of other customary connector	
	with conventional diagnostic output	with serial diagnostics			according to EN 60947-5-2: 2008	to DIN 47100
A1	U_e		1	BN	BN	WH
X1	Safety input 1		2	WH	WH	BN
A2	GND		3	BU	BU	GN
Y1	Safety output 1		4	BK	BK	YE
OUT	Diagnostic output		5	GY	GY	GY
X2	Safety input 2		6	VT	PK	PK
Y2	Safety output 2		7	RD	VT	BU
IN	without function		8	PK / -	OR	RD

[1] integrated cable of CSS 16 and CSS 180: 7-wire

Legend: Colour code

Code	Colour	Code	Colour	Code	Colour	Code	Colour
BK	black	GN	green	PK	pink	WH	white
BN	brown	GY	grey	RD	red	YE	yellow
BU	blue	OR	orange	VT	purple		

Connectors M8, 8-pole for RSS 260



Function of the safety switchgear			Pin configuration of the integrated connector	Colour code of the Schmersal connectors according to DIN 47100	Possible coulour codes of other customary connector according to IEC 60947-5-2: 2007
	with conventional diagnostic output	with serial diagnostics			
A1	U_e		1	WH	BN
X1	Safety input 1		2	BN	WH
A2	GND		3	GN	BU
Y1	Safety output 1		4	YE	BK
OUT	Diagnostic output	SD output	5	GY	GY
X2	Safety input 2		6	PK	PK
Y2	Safety output 2		7	BU	VT
IN	without function	SD input	8	RD	OR

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

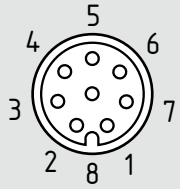
Connection adapter M8 coupling M12 connector, IP 67, 8-pole - 8 x 0,14 mm²

Cable length 0,3 m	103009832
Cable length 2 m	103003645

Legend: Colour code

Code	Colour	Code	Colour	Code	Colour	Code	Colour
BK	black	GN	green	PK	pink	WH	white
BN	brown	GY	grey	RD	red	YE	yellow
BU	blue	OR	orange	VT	purple		

Connectors M12, 8-pole for AZ/AZM 200, AZ/AZM 300, MZM 100



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

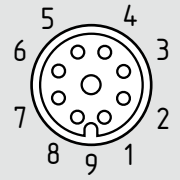
Cable length 5 m	**101210560**
Cable length 5 m, angled	**101210561**

Function of the safety switchgear			Pin configuration of the integrated connector	Colour code of the Schmersal connectors	Possible coulour codes of other customary connector	
	with conventional diagnostic output	with serial diagnostics			according to EN 60947-5-2: 2007	to DIN 47100
A1	U_e		1	BN	BN	WH
X1	Safety input 1		2	WH	WH	BN
A2	GND		3	BU	BU	GN
Y1	Safety output 1		4	BK	BK	YE
OUT	Diagnostic output	SD output	5	GY	GY	GY
X2	Safety input 2		6	VT	PK	PK
Y2	Safety output 2		7	RD	VT	BU
IN	Solenoid control	SD input	8	PK	OR	RD

Legend: Colour code

Code	Colour	Code	Colour	Code	Colour	Code	Colour
BK	black	GN	green	PK	pink	WH	white
BN	brown	GY	grey	RD	red	YE	yellow
BU	blue	OR	orange	VT	purple		

Connectors M23, (8+1)-pole for AZ/AZM 200, AZ/AZM 300, MZM 100



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**

Function of the safety switchgear			Pin configuration of the integrated connector	Wire number of the Schmersal connectors	Possible coulour codes of other customary connector	
	with conventional diagnostic output	with serial diagnostics			according to EN 60947-5-2: 2007	to DIN 47100
A1	U_e		1	1	BN	WH
X1	Safety input 1		2	2	WH	BN
A2	GND		3	3	BU	GN
Y1	Safety output 1		4	4	BK	YE
OUT	Diagnostic output	SD output	5	5	GY	GY
X2	Safety input 2		6	6	PK	PK
Y2	Safety output 2		7	7	VT	BU
IN	Solenoid control	SD input	8	8	OR	RD
-	without function		9			

Legend: Colour code

Code	Colour	Code	Colour	Code	Colour	Code	Colour
BK	black	GN	green	PK	pink	WH	white
BN	brown	GY	grey	RD	red	YE	yellow
BU	blue	OR	orange	VT	purple		

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.

SD-I-DP-V0-2

- **PROFIBUS-Gateway** for the series-wiring of the diagnostic signals of safety switchgear with integrated SD interface. The status and diagnostic information of the SD devices is transmitted to the control system through the PROFIBUS DP-V0 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
- IP10 component for quick-fix mounting onto standard DIN rails in the control cabinet

Approvals

CE

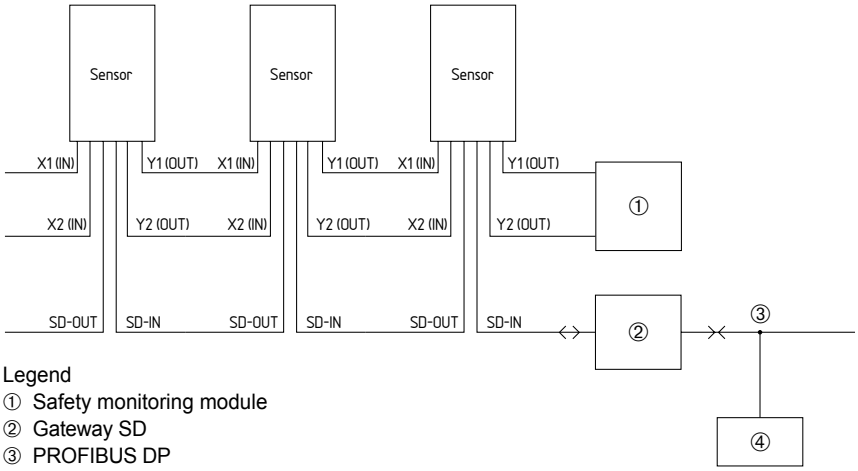
Technical data

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_e:	24 VDC, –15 % / +20 %
Rated operating current I_e:	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:	2
Storage temperature range:	−25 °C … +85 °C, non-condensing
Operating temperature range:	−5 °C … +55 °C, non-condensing
Relative humidity:	5% - 95%, non-condensing
Protection class:	IP10
Resistance to vibration:	5 … 9 Hz / 3.5 mm (to IEC 60068-2-6) 9 … 150 Hz / 1 g
Resistance to shock:	15 g / 11 ms (to IEC 60068-2-27)
EMC rating:	to EN 61000-6-2 (2002)
to EN 61000-4-2 (ESD):	4 kV / 8 kV
to EN 61000-4-3:	10 V/m / 80% AM
to EN 61000-4-4 (burst):	2 kV DC supply / 1 kV PROFIBUS & SD-Interface
to EN 61000-4-5 (surge):	500 V DC supply / 1 kV PROFIBUS & SD-Interface
to EN 61000-4-6:	10 V / 80 % AM
EMC interfering radiation:	to EN 61000-6-4 (2002)
Industrial interfering radiation:	37 dBÌV/m
Electrical connection:	
- SD:	connection for max. 31 devices in the serial diagnostic
- 24 V:	+ 24 VDC voltage supply
- 0 V:	GND of the voltage supply and GND of the diagnostic cable and 24 VDC supply, approx. 300 mA, PELV power supply
LED signals:	
“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	SD initialisation error or ‘teach’ switch active
“T” Flashing signal	Initialisation error SD participant addresses, teaching required
“ON“ Continuous green	Supply voltage on

Ordering details

SD-I-DP-V0-2

Wiring diagram



Legend
① Safety monitoring module
② Gateway SD
③ PROFIBUS DP
④ PLC with PROFIBUS DP interface

Serial diagnostic - UNIVERSAL-Gateway for SD-Interface

SD-I-U- …

- **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: to IEC 60068-2-6	if fitted between two lateral clamping blocks on the rail 10 … 57 Hz / 0.35 mm and 57 … 150 Hz / 5 g
Restistance to shock 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 (Burst)	±1 kV all connections
to EN 61000-4-5 (Surge)	±1 kV all connections
to EN 61000-4-6 (HF cables)	10 V all connections
EMC interfering radiation: to EN 61000-6-4 (2002)	industrial interfering radiation
Rated insulation voltage U_i:	32 V
Rated impulse withstand voltage U_{imp}:	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

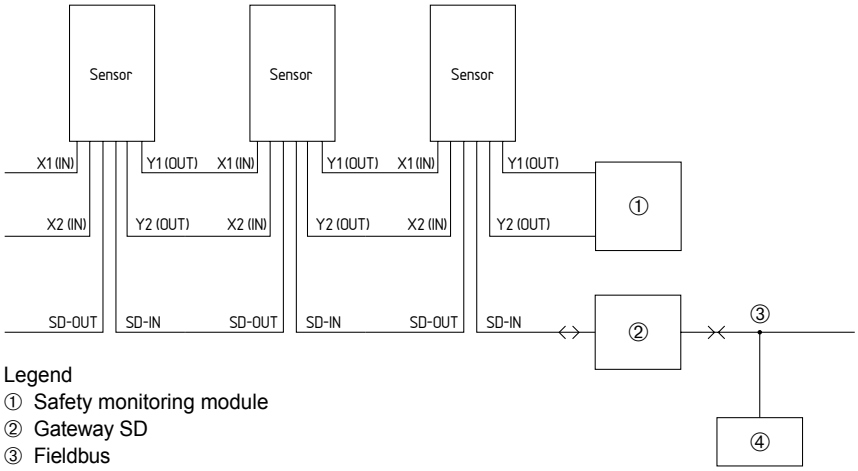
CE

Ordering details

SD-I-U-①

No.	Option	Description
①	PN	PROFINET IO
	EIP	EtherNet IP
	DN	DeviceNet
	CCL	CC-Link
	CAN	CANopen
	MT	Modbus/TCP

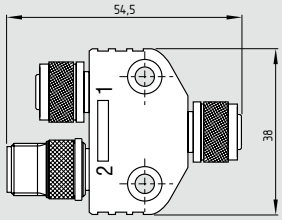
Wiring diagram

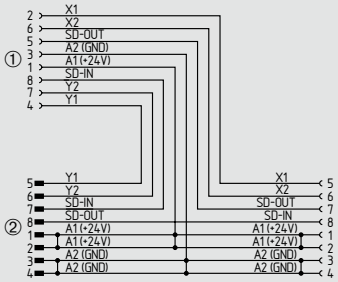


Legend
① Safety monitoring module
② Gateway SD
③ Fieldbus
④ PLC with fieldbus interface

Accessories for series-wiring with serial diagnostic - Y-adapter

Y-adapter CSS-Y-8P





- 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.

Approvals

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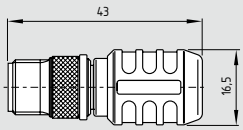
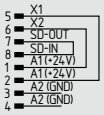
Ordering details

Y-adapter	**CSS-Y-8P**
	CSS-Y-8P-VA

Terminating plug





- 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.

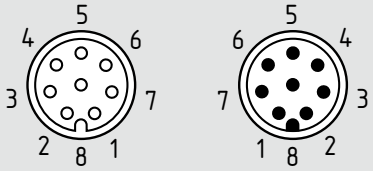
Approvals

CE

Ordering details

Terminating plug	**CSS-Y-A-8P**
	CSS-Y-A-8P-VA

Accessories



Cable Y-adapter
IP69K, M12, 8-pole, 8 x 0,23 mm²

Cable length 0,5 m	**101217786**
Cable length 1,0 m	**101217787**
Cable length 1,5 m	**101217788**
Cable length 2,5 m	**101217789**
Cable length 5,0 m	**101217790**

IP69K, M12, 8-pole, 8 x 0,23 mm²
with stainless steel hex nut

Cable length 0,5 m	**103008416**
Cable length 1,0 m	**103008417**
Cable length 1,5 m	**103008418**
Cable length 2,0 m	**103008419**
Cable length 2,5 m	**103008420**
Cable length 3,0 m	**103008980**
Cable length 5,0 m	**103008981**

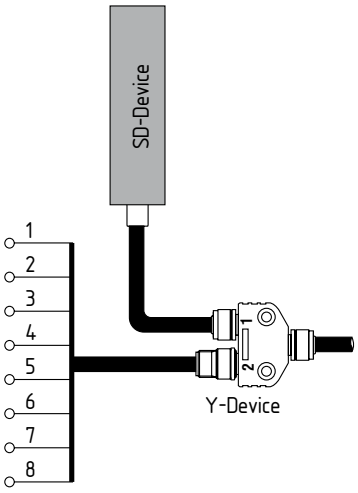
Technical data

Operating voltage SD devices:	24 VDC (−15%/+10%)
Max. operating current device connection:	1 A
Max. fuse rating of power supply (cable protection):	4 A
Ambient temperature T_u:	−25 °C … +75 °C
Protection class:	IP67

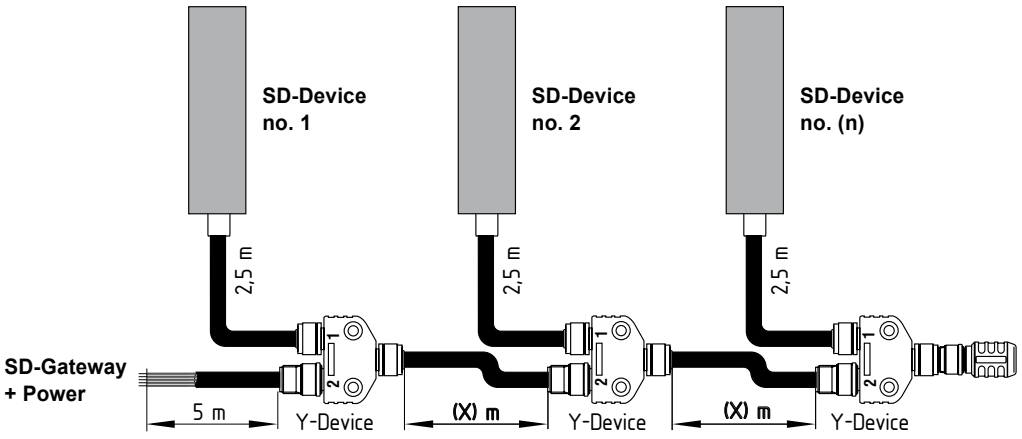
Accessories for series-wiring with serial diagnostic - Y-adapter

Wiring

Signal	PIN	Connector (2)	Color of wire		
			SCHMERSAL cable	Cable to IEC 60947-5-2	Cable to DIN 47100
A1	1	Ue	BN	BN	WH
A1	2	Ue	WH	WH	BN
A2	3	GND	BU	BU	GN
A2	4	GND	BK	BK	YE
Y1	5	Safety output 1	GY	GY	GY
Y2	6	Safety output 2	VT	PK	PK
IN	7	SD input	RD	VT	BU
OUT	8	SD output	PK	OR	RD



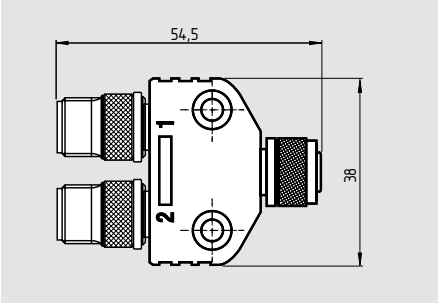
Technical engineering of SD line

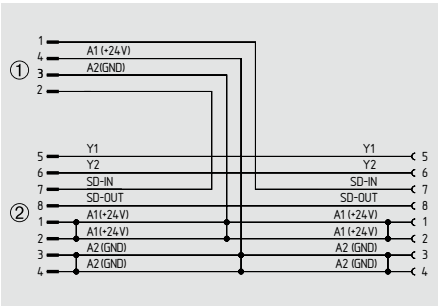


Engineering table with 24,0 VDC power supply without Y-Power adapter		
Device type	max. numbers (n) of SD devices	max. distance (X) between the SD-Y adapter
AZM 300	8	up to 3 m
MZM 100	6	up to 3 m
AZM 200	5	up to 3 m
RSS / CSS	14	up to 3 m

Accessories for series-wiring with serial diagnostic - SD-Y-POWER adapter

SD-Y-POWER adapter





- 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.

Approvals

CE

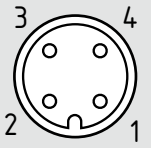
Ordering details

Y-Power adapter	**SD-Y-POWER** **SD-Y-POWER-VA**

Technical data

Operating voltage SD devices:	24 VDC (–15%/+10%)
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**

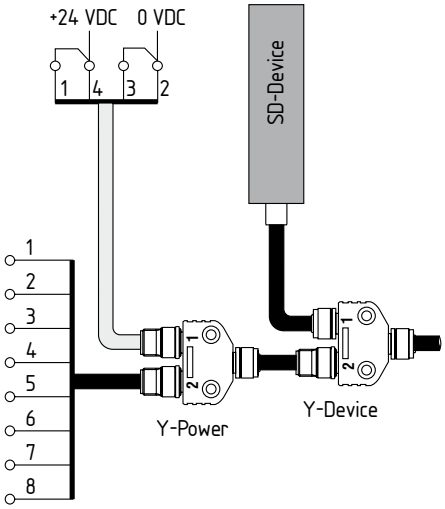
IP67, M12, 4-pole, 4 x 0,75 mm²
with stainless steel hex nut

Cable length 2,5 m	**103009366**
Cable length 5,0 m	**103009367**
Cable length 10 m	**103009368**

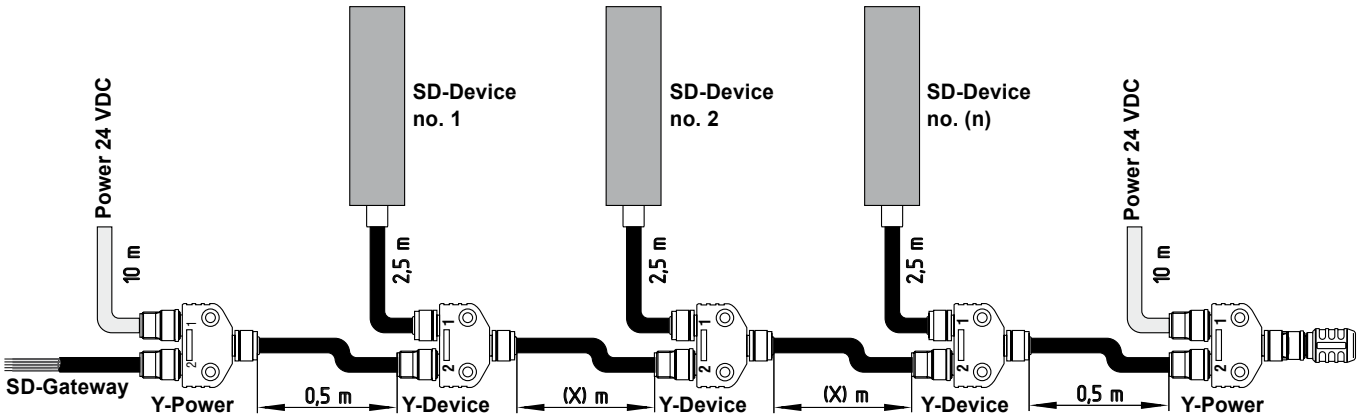
Accessories for series-wiring with serial diagnostic - SD-Y-POWER adapter

Wiring

Signal	PIN	Connector (2)	Color of wire		
			SCHMERSAL cable	Cable to IEC 60947-5-2	Cable to DIN 47100
A1	1	Ue	BN	BN	WH
A1	2	Ue	WH	WH	BN
A2	3	GND	BU	BU	GN
A2	4	GND	BK	BK	YE
Y1	5	Safety output 1	GY	GY	GY
Y2	6	Safety output 2	VT	PK	PK
IN	7	SD input	RD	VT	BU
OUT	8	SD output	PK	OR	RD



Technical engineering of SD line

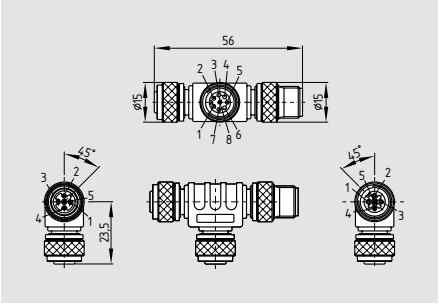


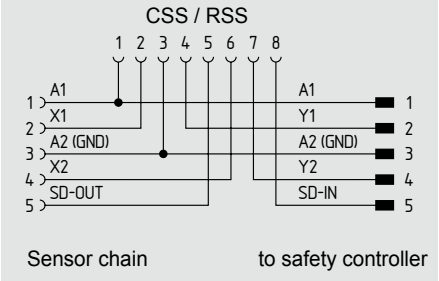
Engineering table with 24 VDC power supply and two Y-Power adapters		
Device type	max. numbers (n) of SD devices	max. distance (X) between the SD-Y adapter
AZM 300	18	up to 3 m
	14	up to 5 m
MZM 100	12	up to 3 m
	10	up to 5 m
AZM 200	10	up to 3 m
	8	up to 5 m
RSS / CSS	28	up to 3 m
	20	up to 5 m

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.

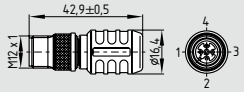
Approvals

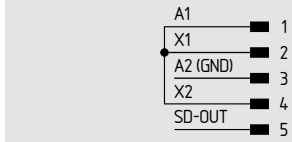
CE

Ordering details

T-adapter **CSS-T**

Terminal connector





- Supplies the safety channels with operating voltage

Approvals

CE

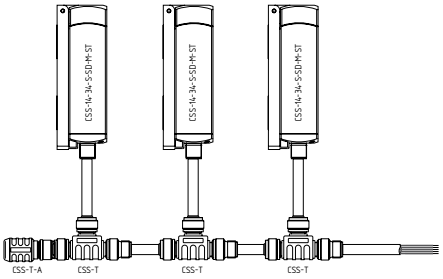
Ordering details

Terminal connector **CSS-T-A**

Technical data

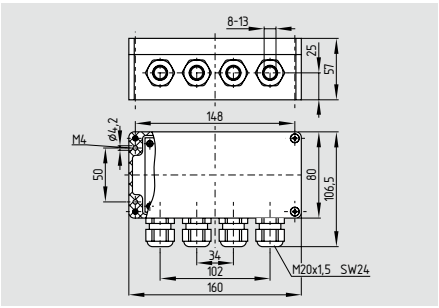
Rated operating voltage of the SD devices to be connected:	24 V (–15%/+10%)
Rated operating current of the SD devices to be connected:	0.6 A
Fuse of the connecting cables (circuit breaker):	2 A
Ambient temperature T_u:	−25 °C … +70 °C

Wiring diagram



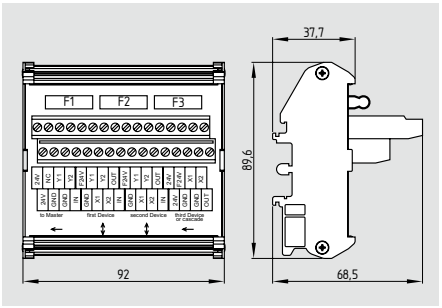
Accessories for series-wiring with serial diagnostic - SD junction box

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

CE

Ordering details

SD junction box for field applications **SD-2V-F-SK**

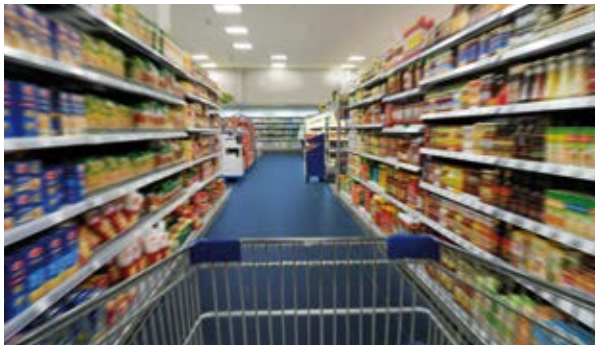
Approvals

CE

Ordering details

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

Safety controllers for electronic safety switches, interlocks and sensors

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.

Type	Operating voltage	ISO 13849-1	Sensor inputs	Safety release	Diagnostic contacts	Diagnostic outputs	Reset options	Refer to page
SRB031MC	24 VAC/DC	Cat. 4 / PL e	2P	3 x Stop 1	1x 2A	–	• Manual **without** edge detection • Automatic	120
SRB201LC	24 VAC/DC	Cat. 4 / PL e	2P	2 x Stop 0	–	1 x 100 mA	• Manual **without** edge detection • Automatic	122
SRB211ST V.2	24 VAC/DC	Cat. 4 / PL e	2P	2 x Stop 0 1 x Stop 1 0,1…30 s dropout delay	–	1 x 100 mA	• Manual **with** edge detection • Automatic	124
SRB301MA	24 VAC/DC	Cat. 4 / PL e	2P	3 x Stop 0	1x 2A	–	• Manual **with** edge detection	126
SRB301MC	24 VAC/DC	Cat. 4 / PL e	2P	3 x Stop 0	1x 2A	–	• Manual **without** edge detection • Automatic	128
SRB301ST V.2	24 VAC/DC	Cat. 4 / PL e	2P	3 x Stop 0	1x 2A	–	• Manual **with** edge detection • Automatic	130
SRB324ST V.3	24 VAC/DC	Cat. 4 / PL e	2P	3 x Stop 0 2 x Stop 1 0,1…30 s dropout delay	1x 2A	3 x 100 mA	• Manual **with** edge detection • Automatic	132
SRB504ST	24 VAC/DC	Cat. 4 / PL e	2P	5 x Stop 0	1x 2A	3 x 100 mA	• Manual **with** edge detection • Automatic	134
PROTECT-PE	24 VAC/DC	Cat. 3 / PL d	4P	Refer to data sheet	2x 2A	5 x 100 mA	• Input expanders only with downstream safety-monitoring module	136

Further details about suitable safety controllers can be found at www.schmersal.net.

The safety outputs Y1/Y2 must be connected to the safety controller in the following way.

Sensors/Solenoid interlocks	Safety output 1	Safety output 2
CSS 30/30S/300	Y1	Y2
CSS 34	Y1	Y2
CSS 180	Y1	Y2
RSS 16	Y1	Y2
RSS 260	Y1	Y2
RSS 36	Y1	Y2
AZ/AZM 200	Y1	Y2
AZ/AZM 300	Y1	Y2
MZM 100	Y1	Y2

to be connected to

Safety controller	Safety channel 1	Safety channel 2	Feedback/Start contact connection	Start contact	Notes bridge	Refer to page
SRB031MC	S 12	S 22	X1 - X2	X1 - X2	–	120
SRB201LC	S 12	S 22	X1 - X2	X1 - X2	–	122
SRB211ST V.2	S 12	S 22	X1 - X2/X3	X1 - X2/X3	–	124
SRB301MA	S 12	S 22	X1 - X2	X1 - X2	–	126
SRB301MC	S 12	S 22	X1 - X2	X1 - X2	–	128
SRB301ST V.2	S 12	S 22	S12 - X2/X3	S12 - X2/X3	–	130
SRB324ST V.3	S 12	S 32	X1 - X2	X3 - X4	S22 - S21	132
SRB504ST	S 12	S 32	X1 - X2	X3 - X4	S22 - S21	134
PROTECT-PE	S 1, S 3, S 5, S 7	S 2, S 4, S 6, S 8	realised by the downstream safety-monitoring module			136

Note:
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.

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

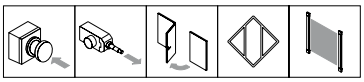
Standards:	IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508
Start conditions:	Automatic or start button
Feedback circuit (Y/N):	yes
ON delay with automatic start:	typ. 100 ms
Drop-out delay in case of emergency stop:	Drop-out delay time ± 30% for 24 VDC and duty cycle > 3.5 s
Drop-out delay on „supply failure“:	Drop-out delay time ± 30% for 24 VDC and duty cycle > 3.5 s
Rated operating voltage 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 > 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-①

No.	Option	Description
①		Time delay:
	0,4S	0.4 seconds
	0,7S	0.7 seconds
	1,1S	1.1 seconds
	1,5S	1.5 seconds



Classification

Safety parameters:

Standards:	ISO 13849-1, IEC 61508
PL:	STOP 1: up to d
Category:	STOP 1: up to 3
PFH value:	STOP 1: ≤ 2.00 x 10^{-7}/h
SIL:	STOP 1: up to 2
Mission time:	20 years

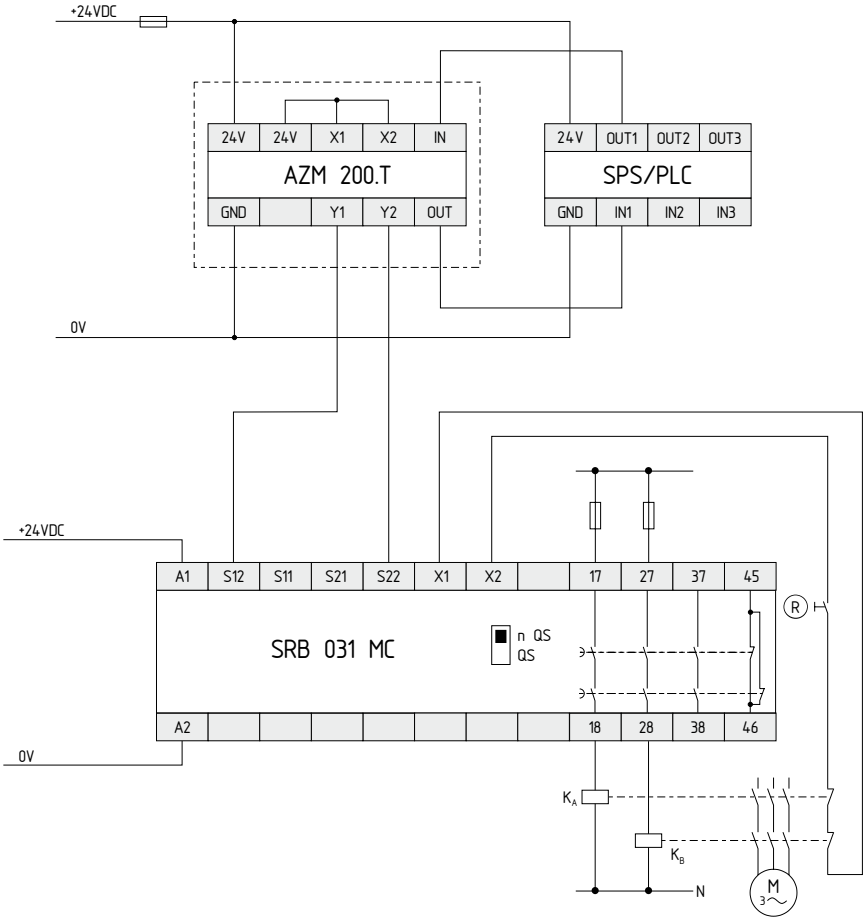
The PFH value of 2.00 x 10^{-7}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) 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

Note

Connection of an AZM 200 solenoid interlock to the SRB031MC 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.

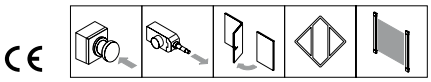
SRB201LC

- 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
Start conditions:	Automatic or start button
Feedback circuit (Y/N):	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 U_e:	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
Power consumption:	max. 2.0 W / 5.2 VA
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 (I_k = 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:	Screw terminals
- 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

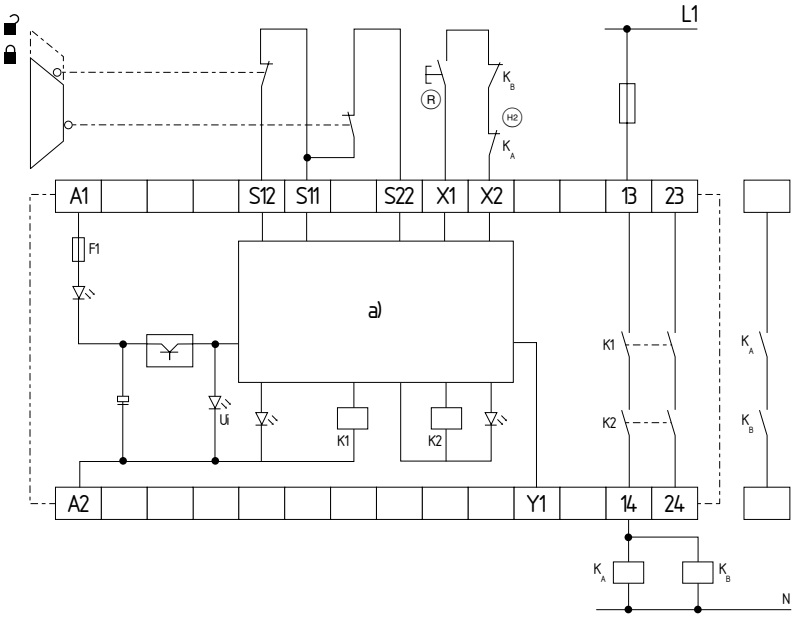
The PFH value of 2.00 x 10^{-8}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) 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

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 Ⓡ; cross-wire monitoring and feedback circuit Ⓗ2.
- 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

Wiring diagram



LED

The integrated LEDs indicate the following operating states.

- Position relay K1
- Position relay K2
- Internal operating voltage U_i

Note

- The wiring diagram is shown with guard doors closed and in de-energised condition.

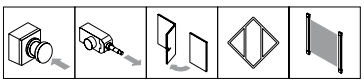
SRB211ST V.2

- 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

Approvals

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. 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



Ordering details

SRB211ST V.2

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

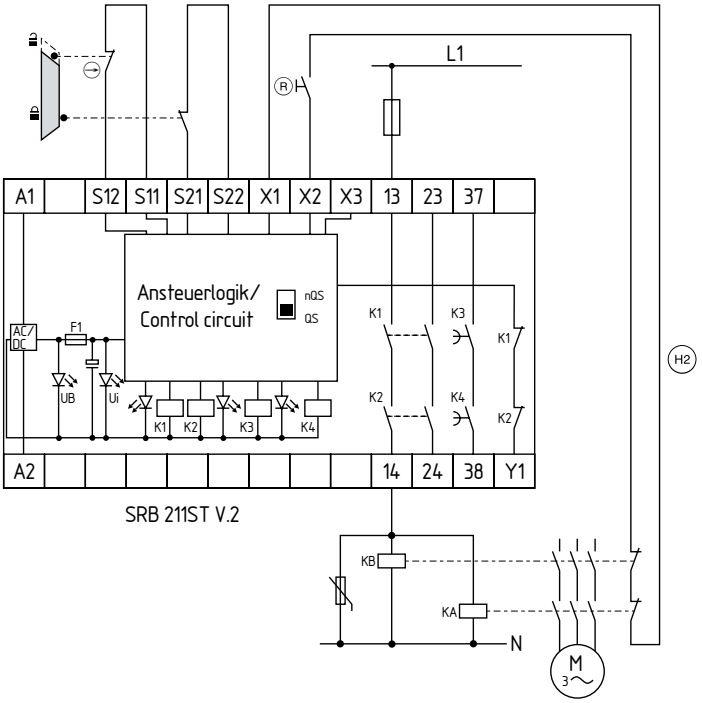
The PFH values of 2.00 x 10^{-8}/h and 2.00 x 10^{-7}/h applie to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.
At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching 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

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 Ⓗ2.
- 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 intructions).
- 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.

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.
- Inductive loads (e.g. contactors, relays, etc.) are to be suppressed by means of a suitable circuit.

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 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
- Reset function with trailing edge
- Optionally with short-circuit recognition (through switch)
- 4 LEDs to show operating conditions

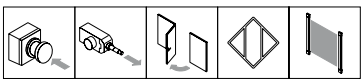
Technical data

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 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 > 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

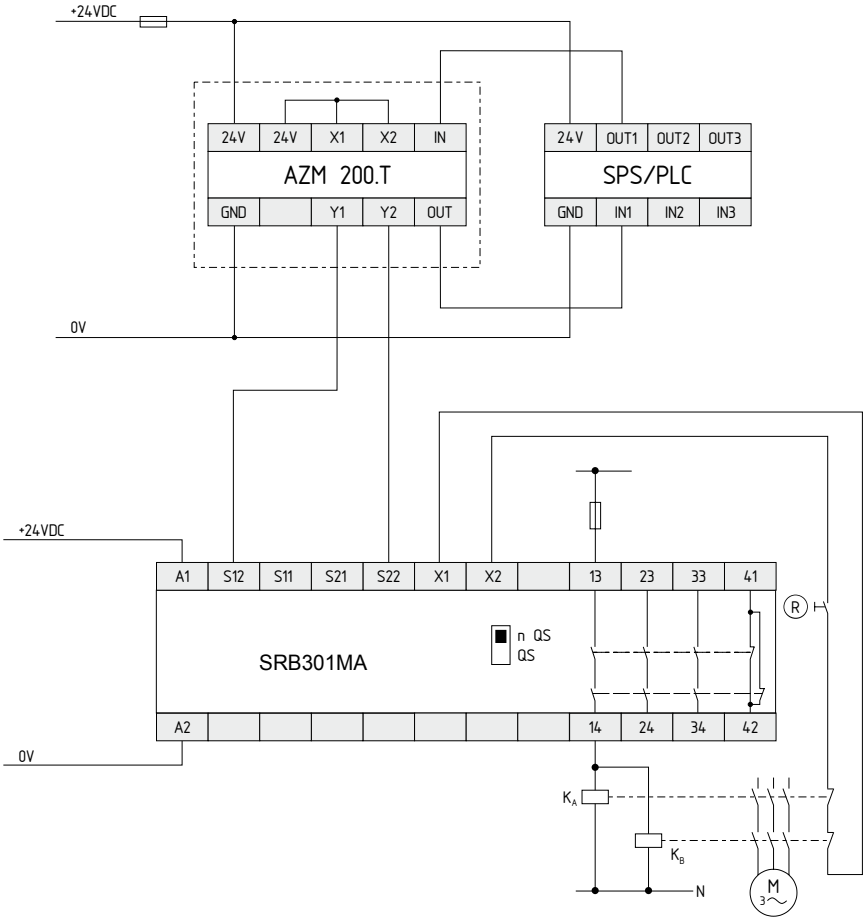
The PFH value of 2.00 x 10^{-8}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) 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

Note

Connection of an AZM 200 solenoid interlock to the SRB301MA 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.

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

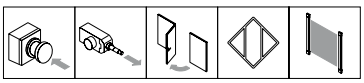
Technical data

Standards:	IEC 60204-1; IEC 60947-5-1; ISO 13849-1; IEC 61508
Start conditions:	Automatic or start button
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 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 > 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
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

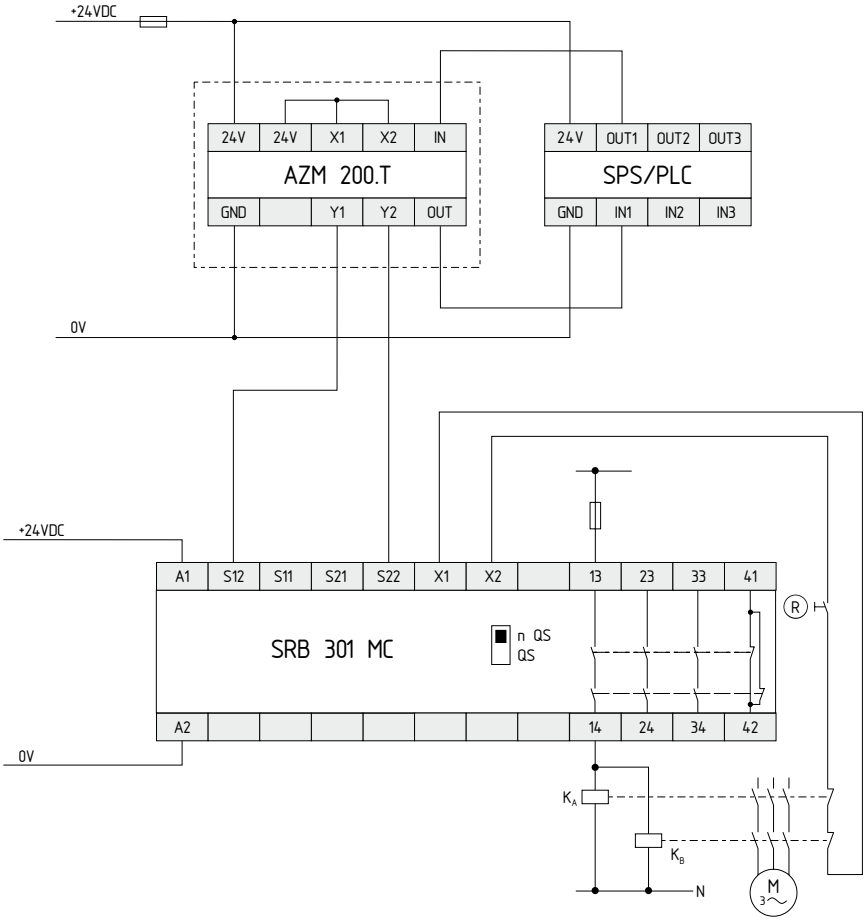
The PFH value of 2.00 x 10^{-8}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.
Diverging applications upon request.

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

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.

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 semi-conductor 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

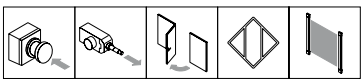
Technical data

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 F1 > 500 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:	
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:	250 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; DC-13
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, 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

Approvals

Ordering details

SRB301ST V.2



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

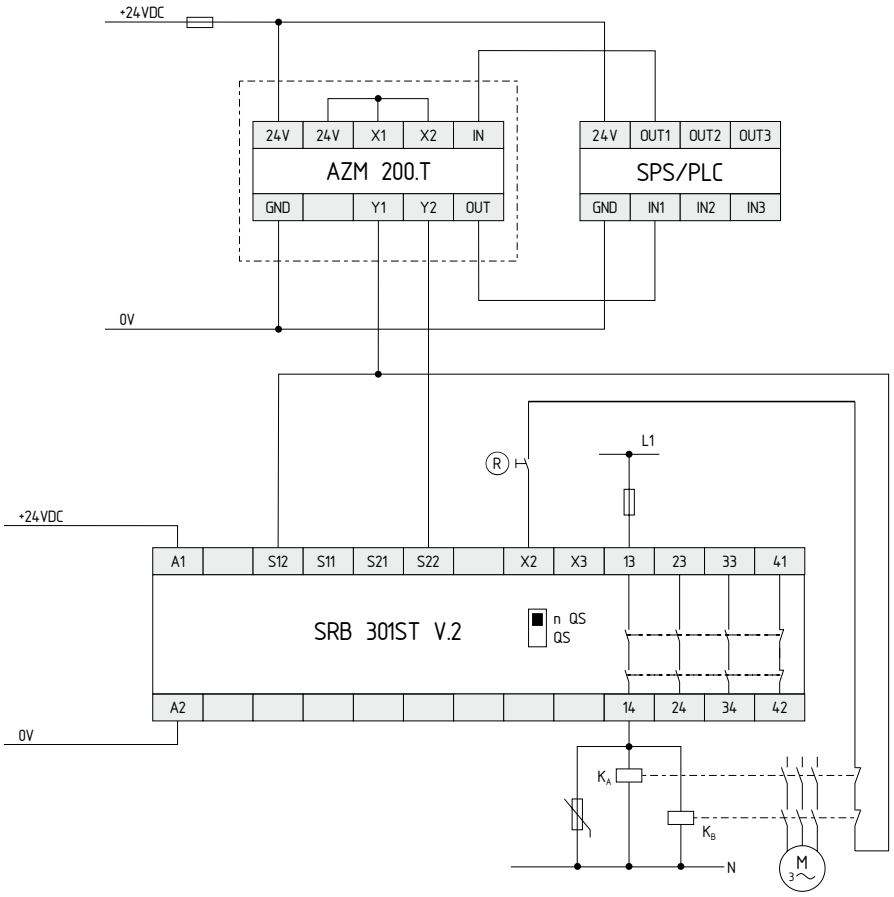
The PFH value of 2.00 x 10^{-8}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.
Diverging applications upon request.

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

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.

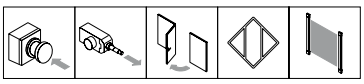
SRB324ST V.3

- 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 semi-conductor 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 signalling outputs
- 6 LEDs to show operating conditions
- With hybrid fuse
- Optional: Short-circuit recognition, manual reset with edge detection in fail-safe circuit, automatic reset function

Approvals

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 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: > 2.5 A, F2: > 50 mA (S11-S31), > 800 mA (X4); reset after disconnection of supply voltage
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:	0/1
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:	(STOP 0: 13-14; 23-24; 33-34): 250 VAC, 8 A (STOP 1: 47-48; 57-58): 250 VAC, 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:	(STOP 0: 13-14; 23-24; 33-34): 8 A slow blow (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



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

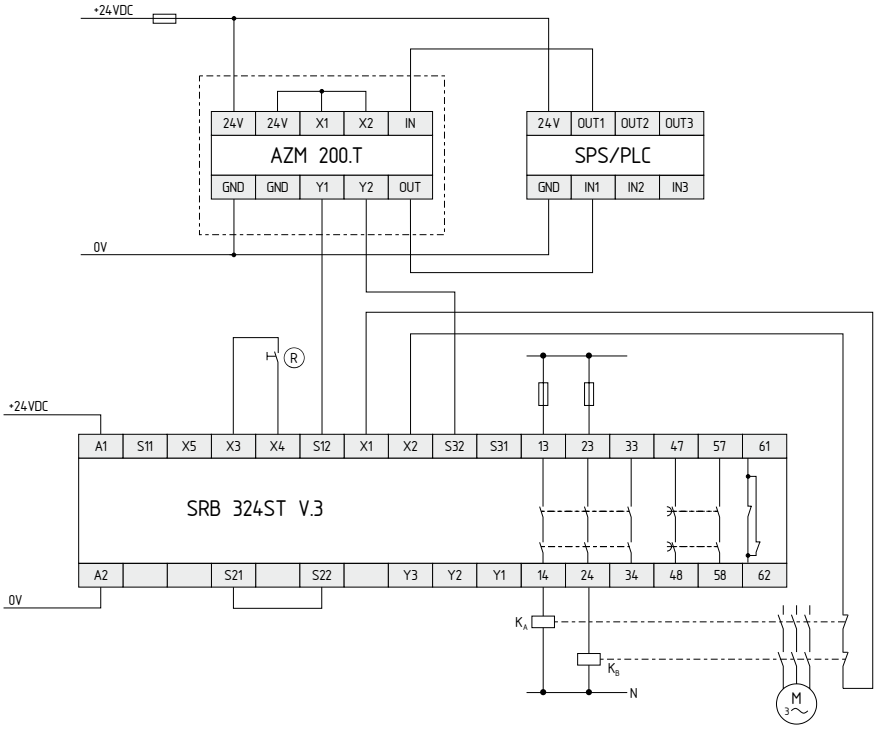
The PFH values of 2.00 x 10^{-8}/h and 2.00 x 10^{-7}/h applie to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below.
At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching 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

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

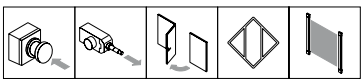
Technical data

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
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
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

Approvals

Ordering details

SRB504ST-24V



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

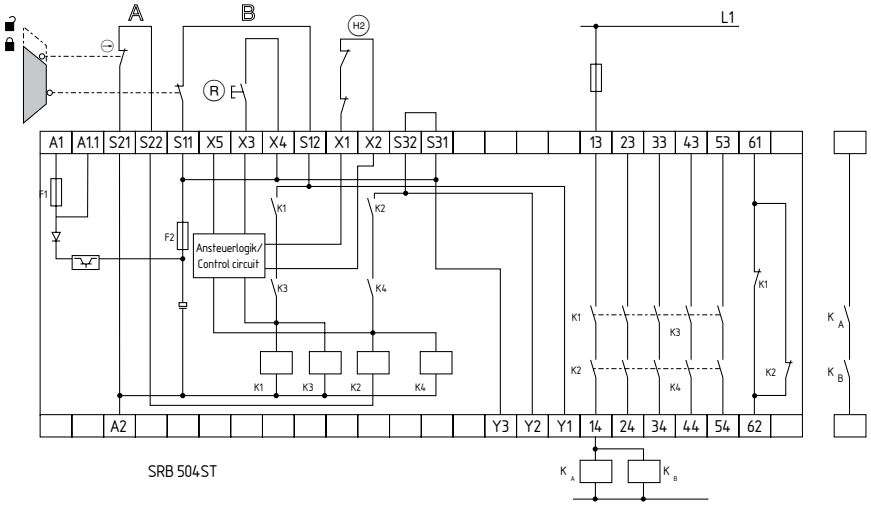
The PFH value of 2.00 x 10^{-8}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) for the relay contacts.
Diverging applications upon request.

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

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.
- Ⓗ2 = 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.

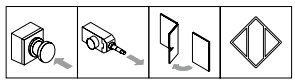
PROTECT-PE

- 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
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_e:	24 VDC –15%/+20%, residual ripple max. 10%
Fuse rating for the operating voltage:	Internal electronic trip, tripping current > 300 mA
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:	24 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

Approvals



Ordering details

PROTECT-PE-①-②

No.	Option	Description
①	02	Connection of sensors with 2 NC contacts
	11	Connection of sensors with NC/NO contacts
	11-AN	Connection of sensors with NC/NO contacts and antivalent output contacts
②		Cage clamps
	SK	Plug-in screw terminals

Classification

Safety parameters:

Standards:	ISO 13849-1, IEC 61508
PL:	STOP 0: up to d
Category:	STOP 0: up to 3
PFH value:	STOP 0: 2.00 x 10^{-7}/h
SIL:	STOP 0: up to 2
Mission time:	20 years

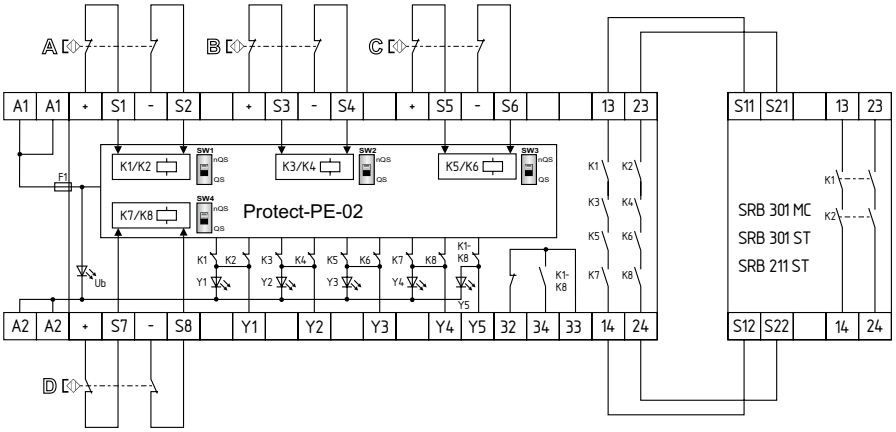
The PFH value of 2.00 x 10^{-7}/h applies to the combinations of contact load (current through enabling contacts) and number of switching cycles (n-op/y) mentioned in the table below. At 365 operating days per year and a 24-hours operation, this results in the below-mentioned switching cycle times (t-cycle) 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

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 signal processing 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.

Wiring diagram



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

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.

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The online product catalogue

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PROTECT-SELECT
Compact safety controller

■ PROTECT-SELECT _____ Page 140

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 cleattext messages during troubleshooting
- Input filter for safety devices with contact bounce

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

Approvals

CE

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 U_e:	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:	
Number:	2
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:	Earthed, lockable switch cabinet with class of protection IP54
Protection class:	IP20
Mounting:	Snaps onto standard DIN rail to EN 60715
Connection type:	Cage clamps or screw terminals
- 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

Ordering details

PROTECT-SELECT-①

No.	Option	Description
①	SK	Screw terminals
	CC	Cage clamps

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:	> 90%
PFH_d:	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
$MTTF_d$ (inputs+logic + semi-conductor outputs):	>100 years
B_{10d} 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

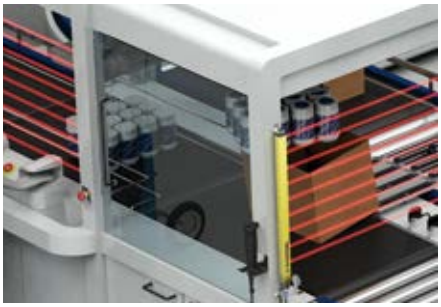
Application program 1

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.

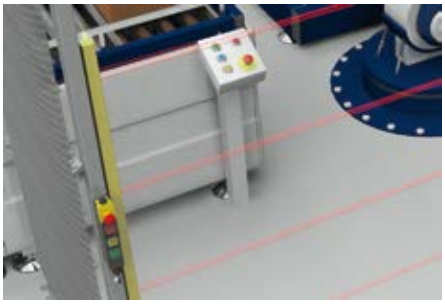
Application program 3

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

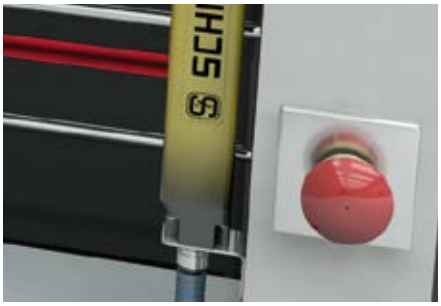
One safety area with safe bridging (muting)

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.

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Safety Consulting

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- Around 700 employees

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- Accredited test laboratory
- Central research and development
- Logistics centre for European markets

Wettenberg

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- Founded in 1952 (1997)
- Around 180 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

- Founded in 1994 (2008)
- Around 30 employees

Focal points
- Development and manufacture of optical electronic components for safety and automation engineering

Bergisch Gladbach

Böhnke + Partner GmbH Steuerungssysteme

- Founded in 1991 (2013)
- 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 400 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 60 employees

Focal points
- Development and manufacture of switchgears for safety, automation and lift engineering for the Indian market

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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 and 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 competence leaders. Based on a comprehensive product range, the company's approximately 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 machine users. 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 and special characteristics from safety switching systems. These include food production, the packaging industry, machine tool construction, lift engineering, heavy industry and the automotive industry.

Against the backdrop of increasing numbers of standards and directives, tec.nicum offers a comprehensive range of safety services as part of the Schmersal Group services division: Certified functional safety engineers advise customers on selecting suitable safety equipment, CE compliance assessments and risk assessment, on a word-wide basis.

Product ranges

Safe switching and monitoring
- Guard door monitoring (Safety switches)
- Command devices with safety function
- Tactile safety devices
- Optoelectronic safety devices

Safe signal processing
- Safety relay components
- Safety controllers
- Safety bus systems

Automation
- Position detection
- Command and signalling devices

Industries

- Elevators and Escalators
- Packaging
- Food
- Automotive
- Machine tools
- Heavy industry

Services

- Application support
- CE conformity assessment
- Risk assessment
- Upgrading / Retrofit
- Technical planning and implementation
- Training courses

Competences

- Machine safety
- Automation
- Explosion protection
- Hygienic design

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