

# Electronic magnetic interlock MZM 100



## Overview of the features

### Advantages

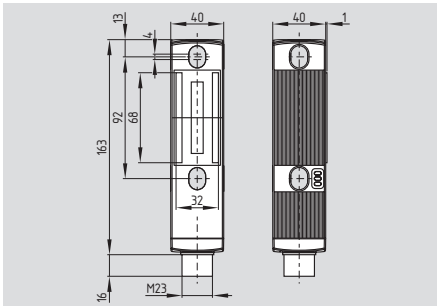
- Modern and ergonomic design
- Simple mounting, accurate adjustment through slotted holes
- Magnetic interlock (for the protection of man) with innovating and unique operating principle
- Patented
- Smooth surfaces provide for the simplicity of cleaning
- Low risk of injury
- Actuator free from play, i.e. neutralisation of undesired noises
- Automatic latching (30 N), no mechanical latching required
- Sensor technology permits an offset between actuator and interlock of  $\pm 5$  mm vertically and  $\pm 3$  mm horizontally
- Intelligent diagnostic signalling of failures
- Series-wiring (up to 31 components, without detriment to the control category)
- 3 LED's to show the operating status (refer to table in appendix)

### Classification

- Up to PL e to EN ISO 13849-1
- Control category 4 to EN 954-1 with door detection sensor T (without additional second switch)
- Up to SIL 3 applications to IEC 61508, PFH value:  $4.3 \times 10^{-9}$  / h

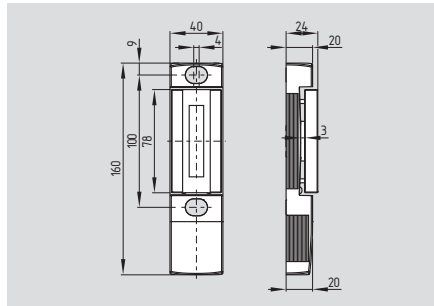
# Electronic magnetic interlock MZM 100

## MZM 100



- Modern and ergonomic design
- Simple mounting, accurate adjustment through slotted holes
- Magnetic interlock for the protection of man with innovating and unique operating principle
- Patented
- Power-to-lock principle
- Smooth surfaces provide for the simplicity of cleaning
- Low risk of injury
- Automatic latching (30 N), no mechanical latching required
- Sensor technology permits an offset between actuator and interlock of  $\pm 5$  mm vertically and  $\pm 3$  mm horizontally
- Intelligent diagnostic signalling of failures
- Series-wiring (max. 31 components), without detriment to the control category to EN 954-1
- 3 LED's to show the operating status (refer to table in appendix)

## Actuator MZM 100-B1.1

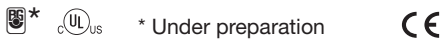


- The magnetic interlocks and the actuator unit must be ordered separately!
- Actuator free from play, i.e. neutralisation of undesired noises

## Technical data

Standards:	EN 60947-5-1, EN ISO 13849-1, EN 954-1, IEC 61508
Enclosure:	glass-fibre reinforced thermoplastic, self-extinguishing
Mechanical life:	$\geq 1$ million operations (for guards $\leq 5$ kg; actuating speed $\leq 0.5$ m/s)
$F_{max}$ :	500 N
Holding force:	typically 30 N
Protection class:	IP 67
Protection class:	II, III
Overvoltage category:	III
Degree of pollution:	3
Connection:	Connector M23
<b>Series-wiring:</b>	<b>max. 31 components</b>
Cable length:	max. 200 m (Cable length and cable section alter the voltage drop depending on the output current)
<b>Ambient conditions:</b>	
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:	$< 100$ ms
Duration of risk:	$< 100$ ms
Time to readiness:	$< 4$ s
<b>Electrical data:</b>	
Rated operating voltage $U_e$ :	24 VDC $-15\%$ / $+10\%$ (stabilised PELV)
Rated operating current $I_e$ :	1 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:	internally short-circuit proof
Device insulation:	to UL 508 $\leq 4$ A; depending on the number of components and loads (Y1, Y2 and OUT)

### Approvals



\* Under preparation

### Approvals

Approvals only in combination with switches MZM 100

## Ordering details

**MZM 100ST-①②-a** Magnetic interlock

**No. | Replace | Description**

①		<b>Outputs:</b> (1st digit = number of diagnostic outputs, 2nd digit = number of safety outputs)
	1P2P	1 diagnostic output and 2 safety outputs, all p-type
	1P2PW	As for -1P2P, combined diagnostic signal: safety guard closed <b>and</b> magnetic interlock locked
	SD2P	Serial diagnostic output and 2 safety outputs, p-type
②		Without latching
	r	With latching

## Ordering details

**MZM 100-B1.1** Actuator

## Note

The magnetic interlocks and the actuator unit must be ordered separately!

Accessories for series-wiring with serial diagnostic see page 31 ff.

Suitable connecting cables with mould connector can be found on page 30.

### LED functions

Green	Supply voltage on
Red	Failure
Yellow	Operating status

**The diagnostic tables for the MZM 100 can be found on page 44.**

# Electronic magnetic interlock MZM 100

## 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  $U_{e1}$ : 0 V to 4 V under  $U_e$   
 Rated operating current  $I_{e1}$ : max. 0.25 A  
 Utilisation category: DC-13  
 Leakage current  $I_l$ :  $\leq 0.5$  mA

### Diagnostic output OUT:

p-type, short-circuit proof

Rated operating voltage  $U_{e2}$ : 0 V to 4 V under  $U_e$   
 Rated operating current  $I_{e2}$ : max. 0.05 A  
 Utilisation category: DC-13  
 Wiring capacitance for -SD2P: 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

Magnet: 100% ED

### Classification: (approval under preparation)

To EN ISO 13849-1: up to PL e

To EN 954-1: up to control category 4  
 (with appropriate circuit)

To IEC/EN 61508: up to SIL 3

PFH value:  $4.3 \times 10^{-9}$  / h  
 Service life: 20 years

## Connection

### Wiring diagram for the device with integrated connector

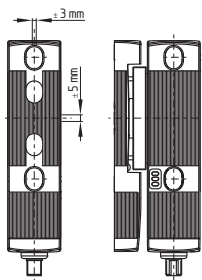
Pin configuration	Wiring of the magnetic interlock with diagnostic output	Wiring of the magnetic interlock with serial diagnostic
Pin 1	A1 Ue	A1 Ue
Pin 2	X1 Safety input 1	X1 Safety input 1
Pin 3	A2 GND	A2 GND
Pin 4	Y1 Safety output 1	Y1 Safety output 1
Pin 5	OUT Diagnostic output	SD output
Pin 6	X2 Safety input 2	X2 Safety input 2
Pin 7	Y2 Safety output 2	Y2 Safety output 2
Pin 8	IN Solenoid control	SD input
Pin 9	spare	spare

### Integrated connector M23, (8+1)-pole



## Note

### Misalignment



## Safety controller

The programme of suitable safety controllers can be found on page 49 ff.

The control category 4 to EN 954-1 and PL e to EN ISO 13849-1 achieved with these safety controllers depend on the safety controller as well as on the structure of the entire safety circuit.

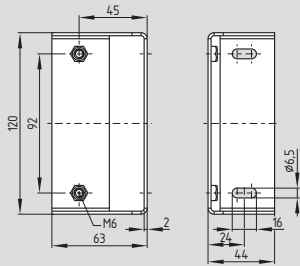
## Note

Detailed information about the use of serial diagnostic can be found in the mounting and wiring instructions of the PROFIBUS-Gateway SD-I-DP-V0-2 and in the instructions for integration of the PROFIBUS-Gateway.

A detailed description of the PROFIBUS-Gateway SD-I-DP-V0-2 can be found on page 31 of this catalogue.

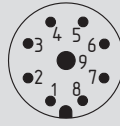
## Accessories MZM 100

### System components



Mounting kit MS MZM 100-W

### System components



Connecting cable with connector

### Ordering details

Mounting kit  
(screws included in delivery)

**MS MZM 100-W**

### Ordering details

**Connecting cable with  
mould connector (female),  
M23, (8+1)-pole,**

with soldering terminals art. n° 1187590  
with crimp connection art. n° 1190956  
with 5 m LIYY 8x0.75 mm<sup>2</sup> art. n° 1189931  
with 10 m LIYY 8x0.75 mm<sup>2</sup> art. n° 1189978

**M12x1, 8-pole,**

2.5 m long, 8x0.23 mm<sup>2</sup> art. n° 1193608  
5.0 m long, 8x0.23 mm<sup>2</sup> art. n° 1193609  
10 m long, 8x0.23 mm<sup>2</sup> art. n° 1193610

## SD-Gateway for PROFIBUS SD-I-DP-V0-2

For the conversion of serial diagnostic signals to the PROFIBUS DP Protocol



### Overview of the features

#### Advantages of the serial diagnostic

- Diagnostic cables of max. 31 safety components can be wired in series
- Series-wiring of different components possible (CSS 34, AZ 200, AZM 200 and MZM 100)
- The diagnostic cable is suitable for series-wiring or daisy-chaining, thus reducing the cabling costs
- Bidirectional communication, i.e. reading of the operational data and unlocking of a solenoid interlock in the chain

#### Advantages of the integration into the PROFIBUS system

- Default PROFIBUS configuration
- PROFIBUS DP slave
- GSD file for system configuration

#### Advantages for the communication set-up

- Automatic addressing of the safety components through the serial input
- Automatic and continuous transmission of the operating data of each participating in the diagnostic chain

#### Advantages of the diagnostic in the PLC

- Mapping of the operating data of the series-wired safety sensors and solenoid interlocks
- Control commands for unlocking all connected solenoid interlocks
- Fast and accurate error messages with detailed information about the failure/malfunction
- Increased availability: pre-signalling of failures during machine operation, e.g. sagging of the safety guard

# SD-Gateway for PROFIBUS SD-I-DP-V0-2

## SD-I-DP-V0-2

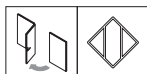


- PROFIBUS-Gateway SD-I-DP-V0-2 for converting serial diagnostic signals to the PROFIBUS DP protocol
- PROFIBUS-Gateway SD-I-DP-V0-2 is a slave in the PROFIBUS system
- Protection class IP 10 device for control cabinet mounting, for standard DIN rails

## Technical data

PROFIBUS interface:	9-pole D-SUB connector Default 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-circuiting device:	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 $U_g$ :	24 VDC, -15 % / +20 %
Rated operating current $I_g$ :	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:	IP 10
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 dBV/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 24 VDC supply, approx. 300 mA, PELV power supply

## Approvals



## Ordering details

**SD-I-DP-V0-2** SD Gateway for PROFIBUS

## LED signals

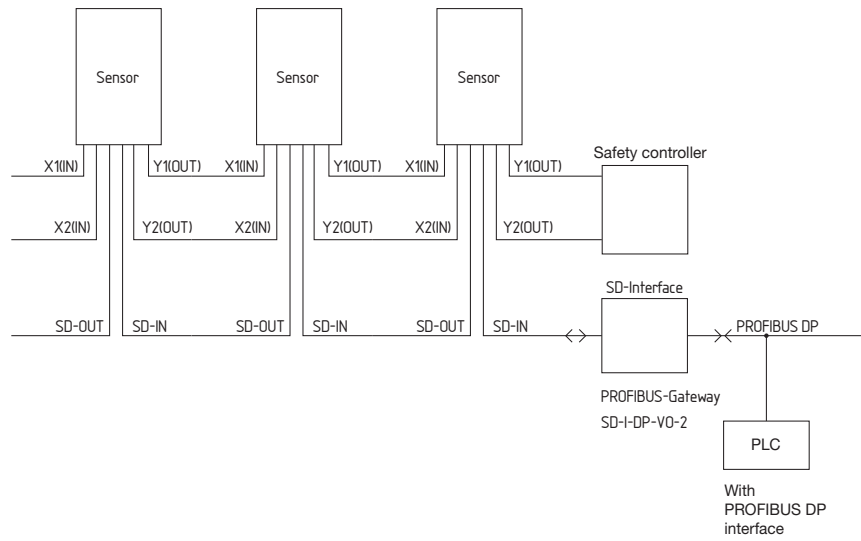
"PB"	Continuous red Flashing signal	Profibus error Profibus initialisation
"SD"	Continuous red Flashing signal	SD Gateway error SD Gateway initialisation
"T"	Continuous yellow Flashing signal	SD initialisation error or 'teach' switch active Initialisation error SD participant addresses, teaching required
"ON"	Continuous green	Supply voltage on

# SD-Gateway for PROFIBUS SD-I-DP-V0-2

## Note

- Serial diagnostic of series-wired safety sensors/solenoid interlocks
- Components with serial diagnostic option:  
 AZ 200  
 AZM 200  
 CSS 34  
 MZM 100

## Wiring example



## Note

Accessories for series-wiring with serial diagnostic see page 35 ff.

## Note

Detailed functions, refer to the programming and configuration manual of the SD Gateway

# Up to Date



## Produkte | Neuheiten

Ergonomische Bedienung, kompaktere Bauformen, höheres Sicherheitsniveau, Einklang von Produktivität und Sicherheit, Integration von Funktionen: Das sind nur einige von vielen Eigenschaften, auf die unsere Entwickler Wert legen, wenn sie - in Kooperation mit dem Produktmanagement - die Pflichtenhefte für neue Produkte und Produktfamilien schreiben. Hier sehen Sie die Ergebnisse: Die Neuheiten der Schmersal Gruppe. Immer aktuell!

- 01.09.2003 **ESALAN-Safety Controller**  
Sichere Bewegungen im Raum [PDF \[115kb\]](#)
- 11.08.2003 **Programmerweiterung bei der Baureihe AZM 161**  
Erhöhte Flexibilität für Sicherheitszuhaltungen. [PDF \[69kb\]](#)
- 04.04.2003 **Sicherheits-Lichtvorhänge und -Lichtgitter mit integrierter Muting-Funktion**  
Für die Absicherung von Gefahrenbereichen.



Die neuen Sicherheits-Lichtvorhänge und -Lichtgitter der Baureihen SLC/SLG 415, die Schmersal EOT auf der Hannover Messe vorstellt, ergänzen das bestehende Programm und zeichnen sich durch Integration der Muting-Funktion aus.

Muting bedeutet, dass optoelektronische Schutzeinrichtungen mit Hilfe von zusätzlichen Sensoren in der Lage sind, zwischen Mensch und Material zu

Up-to-date product information and innovations at:  
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## Accessories for series-wiring with serial diagnostic



### Overview of the features

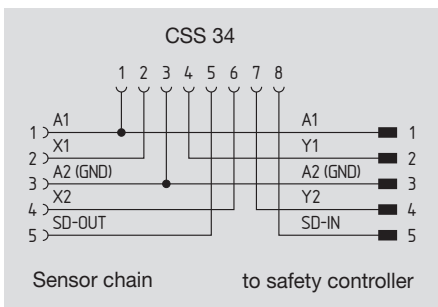
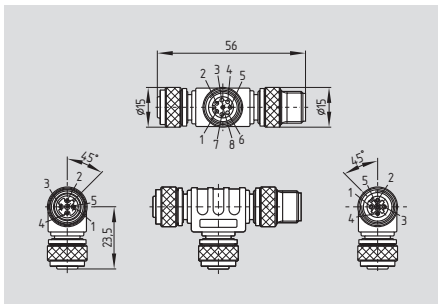
Wiring tools enabling a fast and smooth series-wiring of electronic sensors and solenoid interlocks of the CSS, AZ/AZM 200 and MZM family

- T-adapter CSS-T  
CSS 34 sensors with serial diagnostic can be daisy-chained by means of T-adapters and conventional cables with 5/8-pole connectors and sockets.  
The number of participants is limited by the 2 A-fuse.
- SD junction box  
To be used preferably for the series-wiring of MZM and AZM components with high power demand  
IP 65 enclosure or open IP 00 design for control cabinet mounting

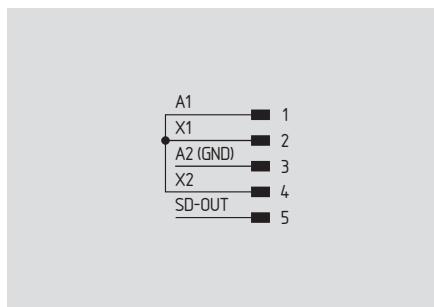
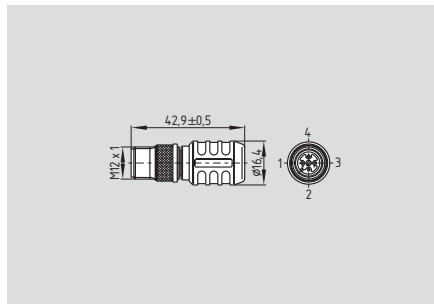
The SD junction box and the T-adapter are suitable for the series-wiring of components with serial diagnostic. When components with conventional diagnostic output are daisy-chained, only the safety channels are wired in series.

# Accessories for series-wiring with serial diagnostic

## T-adapter CSS-T



## Terminal connector CSS-T-A



## Technical data

Rated operating voltage of the CSS 34 sensors to be connected:	24 V (-15%/+10%)
Rated operating current of the CSS 34 sensors to be connected:	0.6 A
Fuse of the connecting cables (circuit breaker):	2 A
Ambient temperature $T_U$ :	- 25 °C ... + 70 °C

- Enables the series-wiring of CSS 34 sensors. To this end, both the safety channels and the serial diagnostic cable are wired in series.
- Supplies the safety channels with operating voltage

Approvals



Approvals



## Ordering details

CSS-T T-adapter

## Ordering details

CSS-T-A Terminal connector

## Accessories for series-wiring with serial diagnostic

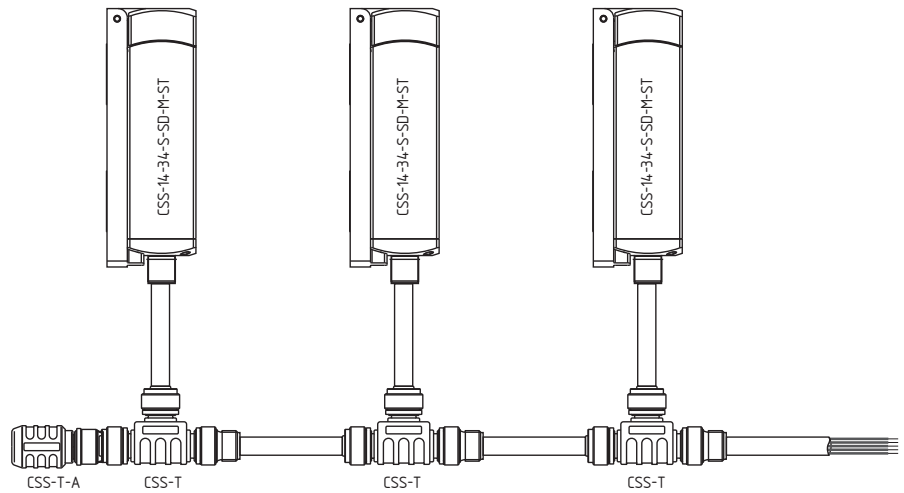
### CSS-T and CSS-T-A

With the **CSS-T T-adapter**, CSS 34 sensors can be daisy-chained. To this end, both the safety channels and the serial diagnostic cables are wired in series.

Sensors with conventional diagnostic output can also be wired in series, though in this configuration, the diagnostic outputs are not evaluated.

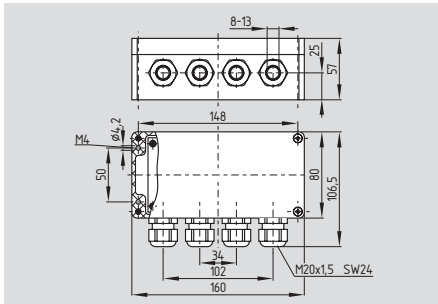
The **CSS-T-A connector** supplies the safety channels with operating voltage. For the wiring, M12x1 cable extensions can be used. The voltage drop (due to the cable length, cable section, voltage drop per sensor) should be taken into account, as it reduces the maximum number of CSS 34 sensors that can be wired in series.

### Wiring example



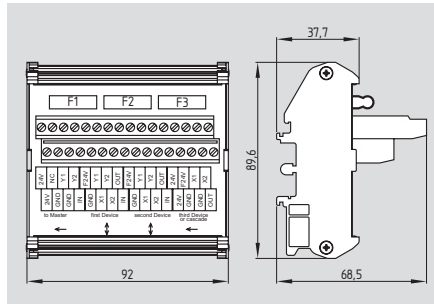
# Accessories for series-wiring with serial diagnostic

## 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: IP 65 SD-2V-S-SK: IP 00 to IEC/EN 60529
Insulation protection class:	SD-2V-F-SK: II, III 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 mm <sup>2</sup> max. 2.50 mm <sup>2</sup> (incl. conductor ferrules)
Cable entry:	SD-2V-F-SK: 4 x M20x1.5, 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 <sub>e</sub> :	24 VDC -15% / +10% (stabilised PELV)
Rated operating current I <sub>e</sub> :	16 A
Rated impulse withstand voltage U <sub>imp</sub> :	800 V
Rated insulation voltage U <sub>i</sub> :	32 VDC
Fuse rating:	16 A

### Approvals



### Ordering details

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

### Approvals



### Ordering details

**SD-2V-S-SK** SD junction box for control cabinet mounting

## Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors



Diagnostic of the AZ 200 safety switch . . . . .	Page 40
Diagnostic of the AZM 200 solenoid interlock . . . . .	Page 42
Diagnostic of the MZM 100 magnetic interlock . . . . .	Page 44
Diagnostic of the CSS 34 safety sensor . . . . .	Page 46
Diagnostic of the CSS 180 safety sensor . . . . .	Page 48

# Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors

## Diagnostic of AZ 200 safety switch with diagnostic output

Diagnostic outputs	Flash codes (red)	Meaning	Autonomous switch-off after	Cause
<p>The <b>AZ 200 -1P2P</b> safety switch has one diagnostic output: OUT</p> <p>OUT Safety guard closed, actuator inserted and no failure detected</p>	1 flash pulse	Failure (warning) output Y1	30 min	Error in output test or voltage at output Y1 although the output is switched off
<p>The <b>AZ 200 -3P2P</b> safety switch has three diagnostic outputs: OUT, OUT2, OUT3</p> <p>OUT Safety guard closed, actuator inserted</p> <p>OUT2 Failure warning</p> <p>OUT3 Safety guard detected</p>	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
<p>The diagnostic outputs are protected against short-circuits by means of a common current-limiting circuit.</p> <p>Therefore: <math>I_{OUT} + I_{OUT2} + I_{OUT3} \leq I_{e2}</math></p>	4 flash pulses	Failure (warning) ambient temperature too high	30 min	Temperature measurement indicates too high an inner temperature
<p><b>Failure</b></p> <p>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.</p> <p>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 (see table).</p>	5 flash pulses	Error target	0 min	The coding (frequency) of the detected actuator does not match the required value, incorrect or defective actuator
	6 flash pulses	Error target combination	0 min	An invalid combination of targets was detected at the 4 coils of the AZ 200 safety switch. (Current setting: latching bolt detected & door target not detected =>latch breakage or tampering attempt)
<p>After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard.</p> <p>The safety outputs are enabled and allow a restart of the machine.</p>	Continuous red	Internal failure	0 min	-

### 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

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

System condition	LED			Safety outputs Y1, Y2	Diagnostic outputs			
	Green	Red	Yellow		-1P2P OUT	-3P2P OUT	OUT2	OUT3
Safety guard open	On	Off	Off	0 V	0 V	0 V	0 V	0 V
Safety guard closed, actuator not inserted	On	Off	Off	0 V	0 V	0 V	0 V	0 V
Safety guard closed, actuator inserted	On	Off	On	24 V (when X1 = X2 = 24 V)	24 V	24 V	0 V	0 V
Failure warning <sup>1)</sup> , actuator inserted, switch-off approaching	On	Flashes <sup>2)</sup>	On	24 V (when X1 = X2 = 24 V)	0 V	24 V	24 V	0 V
Failure	On	Flashes	Off	0 V	0 V	24V/0V	24 V	0 V

<sup>1)</sup> after 30 min -> 0 V

<sup>2)</sup> refer to flash codes

# Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors

## Diagnostic of the AZ 200 safety switch with serial diagnostic cable

### Safety switch with serial diagnostic cable

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 (i.e. wired in series), the diagnostic input and output data are transmitted through this series-wiring.

Up to 31 safety switches can be wired in series. For the evaluation of the serial diagnostic cable, the PROFIBUS-Gateway SD-I-DP-V0-2 is used. This serial diagnostic interface is integrated as slave in an available PROFIBUS DP network, thus allowing for an evaluation of the diagnostic signals 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 PROFIBUS-Gateway and the safety switch, the switching condition of the safety outputs of the safety switch is maintained.

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 failure	Internal failure
Bit 6:	---	Failure warning <sup>1)</sup>	Communication error between PROFIBUS-Gateway and safety switch	---
Bit 7:	Failure reset	Failure (enabling path switched off)	Operating voltage too low	---

### 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.

The described condition is obtained, when bit = 1 <sup>1)</sup> after 30 min -> failure

# Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors

## Diagnostic of the AZM 200 solenoid interlock with diagnostic output

Operating principle of the diagnostic output	Flash codes (red)	Meaning	Autonomous switch-off after	Cause
The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC. <b>The diagnostic output is not a safety-relevant output!</b>	1 flash pulse	Failure (warning) output Y1	30 min	Error in output test or voltage at output Y1 although the output is switched off
Depending on the component variant, the following diagnostic signals are transmitted: <b>1P2P-Variant:</b> OUT Safety guard closed	2 flash pulses	Failure (warning) output Y2	30 min	Error in output test or voltage at output Y2 although the output is switched off
<b>1P2PW-Variant:</b> OUT Combined diagnostic signal: safety guard closed <b>and</b> solenoid interlock locked	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
<b>Failure</b> 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.	5 flash pulses	Error target	0 min	The coding (frequency) of the detected actuator does not match the required value, incorrect or defective actuator
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.	6 flash pulses	Error target combination	0 min	An invalid combination of targets was detected at the 4 coils of the AZM 200 solenoid interlock. (Current setting: latching bolt detected & door target not detected =>latch breakage or tampering attempt)
	Continuous red	Internal failure	0 min	-

### 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.

### The diagnostic function of the AZM 200 solenoid interlock

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

System condition	Solenoid control IN		LED			Safety outputs Y1, Y2		Diagnostic outputs OUT	
	Power-to-unlock	Power-to-lock	Green	Red	Yellow	AZM 200...	AZM 200 B...	-1P2P	-1P2PW
Safety guard open	24 V (0 V)	0 V (24 V)	On	Off	Off	0 V	0 V	0 V	0 V
Safety guard closed, <b>actuator not inserted</b>	24 V	0 V	On	Off	Off	0 V	0 V	0 V	0 V
Safety guard closed, actuator inserted, <b>not locked</b>	24 V	0 V	On	Off	Flashes	0 V	24 V	24 V	24 V
Safety guard closed, actuator inserted, <b>locking impossible</b>	0 V	24 V	On	Off	Flashes	0 V	24 V	24 V	0 V
<b>Safety guard closed, actuator inserted and locked</b>	0 V	24 V	On	Off	On	24 V	24 V	24 V	24 V
<b>Failure warning<sup>1)</sup>, Solenoid interlock locked</b>	0 V	24 V	On	Flashes <sup>2)</sup>	On	24 V <sup>1)</sup>	24 V <sup>1)</sup>	0 V	0 V
<b>Failure</b>	0 V (24 V)	24 V (0 V)	On	Flashes <sup>2)</sup>	Off	0 V	0 V	0 V	0 V

<sup>1)</sup> after 30 min -> failure

<sup>2)</sup> refer to flash codes

# Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors

## Diagnostic of the AZM 200 solenoid interlock with serial diagnostic cable

### Solenoid interlock with serial diagnostic cable

Solenoid 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 and output data are transmitted through this series-wiring.

Up to 31 solenoid interlocks can be wired in series. For the evaluation of the serial diagnostic cable, the PROFIBUS-Gateway SD-I-DP-V0-2 is used. This serial diagnostic interface is integrated as slave in an available PROFIBUS DP network, thus allowing for an evaluation of the diagnostic signals 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 PROFIBUS-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.

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	---	Target error, coding error or false target combination
Bit 5:	---	Safety guard detected	Internal failure	Internal failure
Bit 6:	---	Failure warning <sup>1)</sup>	Communication error between PROFIBUS-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 <sup>1)</sup> after 30 min -> failure

### Functional example of the diagnostic LED's, the serial status signals and the safety outputs

System condition	LED's			Safety outputs Y1, Y2	Response byte Bit n°							
	Green	Red	yellow		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 <sup>1)</sup> , 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

<sup>1)</sup> after 30 min -> failure

# Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors

## Diagnostic of the MZM 100 magnetic interlock with diagnostic output

Operating principle of the diagnostic output	Flash codes (red)	Meaning	Autonomous switch-off after	Cause
<p>The short-circuit proof diagnostic output OUT can be used for central indicating or control functions, for instance in a PLC.</p> <p><b>The diagnostic output is not a safety-relevant output!</b></p> <p>Depending on the component variant, the following diagnostic signals are transmitted:</p> <p><b>1P2P-Variant:</b> OUT Safety guard closed</p> <p><b>1P2PW-Variant:</b> OUT Combined diagnostic signal: safety guard closed <b>and</b> magnetic interlock locked</p> <p><b>Failure</b> Failures, which no longer guarantee the proper functioning of the MZM 100 magnetic interlock (internal failures), will result in the deactivation of the safety outputs for as long as the risk persists.</p> <p>Failures, which do not immediately affect the safety function of the MZM 100 magnetic interlock (cross-wire, temperature error, short-circuit + 24 VDC at safety output), will result in a delayed switch-off (see table).</p> <p>After elimination of the failure, the failure message is reset by opening and closing the relevant safety guard.</p> <p>When the safety guard is relocked, the safety outputs are enabled.</p>	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	The coding of the detected target does not match the required value
	6 flash pulses	Holding force error	0 min	The required holding force is not obtained (misalignment/soiling). The holding force is < 500 N
	10 flash pulses	Magnet temperature too high	0 min	The magnet is too hot: T > 70°C
	Continuous red	Internal failure	0 min	–

### The diagnostic function of the MZM 100 magnetic interlock

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

System condition	Magnet control IN	LED's			Safety outputs Y1, Y2	Diagnostic output OUT	
		green	red	yellow		-1P2P	-1P2PW
Guard open	0 V	on	off	off	0 V	0 V	0 V
Guard closed, actuator in	0 V	on	off	flashes	0 V	24 V <sup>3)</sup>	24 V
Guard closed, holding force too low	24 V	on	off	flashes	0 V	24 V <sup>3)</sup>	0 V
Guard closed and locked	24 V	on	off	on	24 V	24 V	24 V
Error warning, door locked	24 V	on	flashes <sup>2)</sup>	on	24 V <sup>1)</sup>	0 V	0 V
Error	0V/24V	on	flashes <sup>2)</sup>	off	0V	0V	0 V
Unauthorized violent separation of magnetic interlock and actuator	0V/24V	on	flashes	flashes	0V	0V	0 V

<sup>1)</sup> after 30 min -> error

<sup>2)</sup> refer to flash codes

<sup>3)</sup> version -1P2PV: 0 V

# Diagnostic tables of the electronic safety switches, solenoid interlocks and safety sensors

## Diagnostic of the MZM 100 magnetic interlock with serial diagnostic cable

### Magnetic interlock with serial diagnostic cable

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

Up to 31 magnetic interlocks can be wired in series. For the evaluation of the serial diagnostic cable, the PROFIBUS-Gateway SD-I-DP-V0-2 is used. This serial diagnostic interface is integrated as slave in an available PROFIBUS DP network, thus allowing for an evaluation of the diagnostic signals 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 magnetic 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 PROFIBUS-Gateway and the magnetic interlock, the switching condition of the magnetic 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.

Bit n°	Request byte	Response byte	Diagnostic failure warning	Diagnostic failure
Bit 0:	Magnet in, failure reset	Safety output enabled	Error output Y1	Error output Y1
Bit 1:	---	Actuator detected	Error output Y2	Error output Y2
Bit 2:	---	Magnet activated	Cross-wire	Cross-wire
Bit 3:	---	---	Magnet temperature too high	Magnet temperature too high
Bit 4:	---	Input condition X1 and X2	---	Actuator error, coding error
Bit 5:	---	---	Internal failure	Internal failure
Bit 6:	---	Failure warning <sup>1)</sup>	Communication error between PROFIBUS-Gateway and magnetic interlock	Unauthorised violent separation of magnetic interlock and actuator
Bit 7:	Failure reset	Failure (enabling path switched off)	Operating voltage too low	---

The described condition is obtained, when bit = 1 <sup>1)</sup> after 30 min -> failure

### Functional example of the diagnostic LED's, the serial status signals and the safety outputs

System condition	LED's			Safety outputs Y1, Y2	Response byte Bit n°							
	Green	Red	yellow		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 <sup>1)</sup> , 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

<sup>1)</sup> after 30 min -> failure