



EN Operating instructions.pages 1 to 8
Original

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1. About this document

1.1 Function

This operating instructions manual provides all the information you need for the mounting, set-up and commissioning to ensure the safe operation and disassembly of the safety switchgear. The operating instructions must be available in a legible condition and a complete version in the vicinity of the device.


1.2 Target group: authorised qualified personnel


All operations described in this operating instructions manual must be carried out by trained specialist personnel, authorised by the plant operator only.

Please make sure that you have read and understood these operating instructions and that you know all applicable legislations regarding occupational safety and accident prevention prior to installation and putting the component into operation.

The machine builder must carefully select the harmonised standards to be complied with as well as other technical specifications for the selection, mounting and integration of the components.

1.3 Explanation of the symbols used

 **Information, hint, note:**
This symbol is used for identifying useful additional information.

 **Caution:** Failure to comply with this warning notice could lead to failures or malfunctions.
Warning: Failure to comply with this warning notice could lead to physical injury and/or damage to the machine.

1.4 Appropriate use

The products described in these operating instructions are developed to execute safety-related functions as part of an entire plant or machine. It is the responsibility of the manufacturer of a machine or plant to ensure the correct functionality of the entire machine or plant.

The safety switchgear must be exclusively used in accordance with the versions listed below or for the applications authorised by the manufacturer. Detailed information regarding the range of applications can be found in the chapter "Product description".

1.5 General safety instructions

The user must observe the safety instructions in this operating instructions manual, the country specific installation standards as well as all prevailing safety regulations and accident prevention rules.



Further technical information can be found in the Schmersal catalogues or in the online catalogue on the Internet: products.schmersal.com.

The information contained in this operating instructions manual is provided without liability and is subject to technical modifications.

There are no residual risks, provided that the safety instructions as well as the instructions regarding mounting, commissioning, operation and maintenance are observed.

1.6 Warning about misuse



In case of improper use or manipulation of the safety switchgear, personal hazards or damages to machinery or plant components cannot be excluded. The relevant requirements of the standard EN ISO 14119 must be observed.

1.7 Exclusion of liability

We shall accept no liability for damages and malfunctions resulting from defective mounting or failure to comply with this operating instructions manual. The manufacturer shall accept no liability for damages resulting from the use of unauthorised spare parts or accessories.

For safety reasons, invasive work on the device as well as arbitrary repairs, conversions and modifications to the device are strictly forbidden, the manufacturer shall accept no liability for damages resulting from such invasive work, arbitrary repairs, conversions and/or modifications to the device.

2. Product description

2.1 Ordering code

This operating instructions manual applies to the following types:

MZM 100 ① ST-AS ②③AP

No.	Option	Description
①		Solenoid interlock monitored
	B	Actuator monitored
②		without electrical latching (only for variant "Solenoid interlock monitored")
	RE	Latching force, adjustable, approx. 30 N ... 100 N without Permanent magnet
③	M	With Permanent magnet approx. 15 N
	A	Power to lock
	P	Device supplied through auxiliary voltage

MZM 100-B1.1 actuator



Only if the information described in this operating instructions manual are realised correctly, the safety function and therefore the compliance with the Machinery Directive is maintained.

2.2 Special versions

For special versions, which are not listed in the order code below 2.1, these specifications apply accordingly, provided that they correspond to the standard version.

2.3 Purpose



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

The MZM 100 AS is designed for application with AS-Interface Safety at Work and is used for monitoring the position of movable separating safety guards. A door detection sensor monitors the closed condition of the safety guard.

The optional variable latching force is activated by the detection of the actuator when the safety guard is closed. The latching force exercised by the permanent magnet keeps the safety guard closed, also in de-energised condition (approx. 15 N).

The latching force F of the MZM 100 AS solenoid interlock is permanently measured and checked.

A safe magnetic force monitoring detects when the latching force drops below a defined latching force. In this way, soiling of the solenoid interlock can be detected. If the latching force drops below 500 N, the AS-i Safety codes are not enabled.

The different variants can be used as safety switch with interlocking function either as solenoid interlock.



If the risk analysis indicates the use of a monitored interlock then a variant with the monitored interlock is to be used, marked with the symbol in the ordering code. The actuator monitoring variant (B) is a safety switch with an interlock function for process protection.

The safety function of MZM 100 variant "Solenoid interlock monitored" consists of safely monitoring a magnetic interlocking force for a safety guard, safely switching off the code transmission when the magnetic force drops below a defined magnetic force and maintaining the safe switched off condition for as long as the safety guard is open or unlocked.

The safety function of MZM 100 B variant "Actuator monitored" consists in safely switching off the code transmission when the safety guard is opened and maintaining the safe switched off condition for as long as the safety guard is open.



Interlocks with power to lock principle may only be used in special cases after a thorough evaluation of the accident risk, since the safety guard can be opened immediately on failure of the power supply or upon activation of the main switch.

An AS-Interface Safety at Work component functions on the basis of an individual code generator (8 x 4 bit). This safety code is cyclically transmitted over the AS-i network and monitored by a safety monitor.



The user must evaluate and design the safety chain in accordance with the relevant standards and the required safety level.

2.4 Technical data

Standards:	EN 60947-5-3, EN ISO 14119, EN 62026-2, EN ISO 13849-1, IEC 61508
Enclosure:	Plastic, glass-fibre, reinforced thermoplastic, self-extinguishing
Working principle:	inductive
Coding level according to EN ISO 14119:	low
Response time:	< 150 ms
Duration of risk:	< 150 ms
Time to readiness:	< 4 s

Mechanical data

Execution of the electrical connection:	M12 connector plug, 4 poles
Mechanical life:	> 1,000,000 operations (for safety guards ≤ 5 kg, actuating speed: ≤ 0.5 m/s)
Holding force F_{max} typically:	750 N
Holding force F guaranteed:	500 N
Electrically adjustable latching force:	approx. 30 ... 100 N
Permanent magnet (M), typically:	approx. 15 N
Tightening torque for device fixation:	max. 8 Nm

Ambient conditions

Ambient temperature:	-25 °C ... +55 °C
Storage and transport temperature:	-25 °C ... +70 °C
Relative humidity:	30 % ... 95 %, no condensation, no icing
Resistance to shock:	30 g / 11 ms
Resistance to vibration:	10 Hz ... 150 Hz (0.35 mm / 5 g)
Degree of protection:	IP65 / IP67 to EN 60529
Installation altitude above sea level:	≤ 2,000 m
Protection class:	III

Insulation values to EN 60664-1:

- Rated impulse withstand voltage U_{imp} :	0.8 kV
- Rated insulation voltage U_i :	32 VDC
- Overvoltage category:	III
- Degree of pollution:	3

Electrical data – AS-Interface

AS-i supply voltage:	26.5 ... 31.6 VDC, protection against polarity reversal
AS-i power consumption:	≤ 100 mA
AS-i device insulation:	internal short-circuit proof
AS-i specification:	
- Version:	V 2.1
- Profile:	S-7 B.F.E
AS-i inputs:	
- Channel 1:	Data bits DI 0/DI 1
- Channel 2:	Data bits DI 2/DI 3
	Databits condition static 0 or dynamic code transmission

AS-i outputs:	
- DO 0:	Magnet control
- DO 1 ... DO 3:	Latching force adjustment in 10 N steps

AS-i Parameter bits:	
- P0:	Actuator in
- P1:	Solenoid interlock locked
- P2:	Auxiliary voltage in
- P3:	Internal device error
Parameter request:	default value parameter request "1111" (0xF)
AS-i Input module address:	0
- preset to address 0, can be changed through AS-interface bus master or hand-held programming device	

Electrical data - auxiliary voltage (AUX)

Supply voltage U_B :	24 VDC (-15 % / +10 %), protection against polarity reversal, stabilised PELV units
Power consumption AUX:	≤ 600 mA
Magnet switch-on time:	100 %
Device fuse rating AUX:	4 A gG when used to UL 508

LED switching conditions display

Green/red (AS-i duo LED):	Supply voltage / communication error / slave address = 0 / periphery error detected
Red LED:	Internal device error
Yellow LED:	Device condition (Enabling status)

⚠ If the cable and connector assembly is not listed for Type 12 or higher, then the device MZM 100 ... shall be used in a Type 1 environment only.

Use isolated power supply only.

For use in NFPA 79 Applications only.

Adapters providing field wiring means are available from the manufacturer. Refer to manufacturers information.

2.5 Safety classification

Standards:	EN ISO 13849-1, IEC 61508
PL:	up to e
Control Category:	4
PFH:	≤ 5.0 x 10 ⁻⁹ / h
SIL:	suitable for SIL 3 applications
Mission time:	20 years

3. Mounting

3.1 General mounting instructions



Please observe the remarks of the standards EN ISO 12100, EN ISO 14119 and EN ISO 14120.



The safety switchgear must be used as end stop.

Any mounting position. The system must only be operated with an angle of ≤ 2° between the solenoid interlock and the actuator. For fitting the MZM 100 AS and the actuator, two mounting holes for M6 screws with washers (washers included in delivery) are provided. After fitting, the mounting holes can be sealed by means of the supplied plugs. The plugs serve as a means of sealing the assembly openings and are also suitable to prevent against tampering with the screw connection. If necessary, these plugs can be removed from the actuator by exercising pressure on the top side (in case of fitting with connector downwards) or on the right-hand side on the plugs of the anchor plate.

Minimum distance between two devices: 100 mm



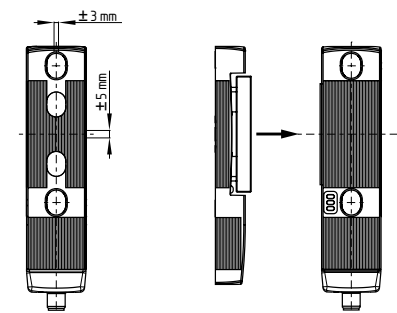
The actuator must be permanently fitted to the safety guards and protected against displacement by suitable measures (e.g. tamperproof screws, gluing, drilling of the screw heads).



At an ambient temperature of ≥ 50 °C, the safety component must be fitted so that it is protected against unintentional contact with persons.



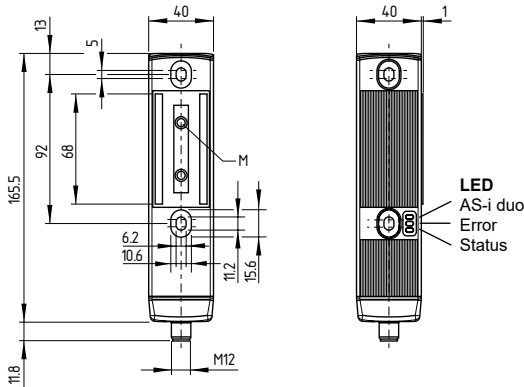
The safety component must be operated in the operating direction of the latching force (refer to image).



3.2 Dimensions

All measurements in mm.

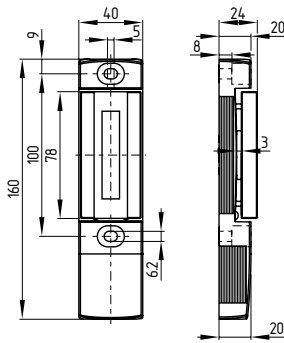
Safety switchgear



Key

M Permanent magnet

Actuator



4. Electrical connection

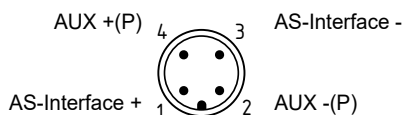
4.1 General information for electrical connection



The electrical connection may only be carried out by authorised personnel in a de-energised condition.

The MZM 100 AS safety switchgear and the interlocking solenoid are supplied from the auxiliary energy. The AS-Interface mode is supplied from AS-i. Both voltage supplies of the safety switchgear must be equipped with a protection against permanent overvoltage. To that effect, stabilised PELV supply units must be used.

The connection to the AS-Interface system is realised through an M12 connector. The M12 connector is A-coded. The wiring configuration of the M12 connector is defined as follows (to EN 62026-2):



5. Functions and configuration

5.1 Mode of operation of the safety outputs

MZM 100 ST-AS ...

The safety outputs of the AS-i safety monitor are enabled, when the following conditions are met:

- the actuator has been detected
- the interlock is locked, the magnetic force is > 500 N

MZM 100 B ST-AS ...

The safety outputs of the AS-i safety monitor are enabled, when the following conditions are met:

- the actuator has been detected, the latching force is active
- locking with magnetic force > 500 N possible

5.2 Magnet control

The control system with the AS-Interface Master can lock and unlock the solenoid interlock through the output bit 0 of the addressed AS-i slave. To lock the interlock, output bit DO 0 of the MZM 100 AS must be set to "1" by the control.

5.3 Description of the latching and the latching force adjustment

The latching force exercised by the permanent magnet (M) keeps the safety guard closed, also in de-energised condition (approx. 15 N). The electrical latching is activated by the detection of the actuator when the safety guard is closed.

The latching force (RE) can be set in 8 steps through the control system using the output bits DO 1 ... DO 3 of the addressed AS-i slave MZM 100 AS.

DO	3	2	1	Latching force RE	Latching force REM
	0	0	0	approx. 30 N	approx. 45 N
	0	0	1	approx. 40 N	approx. 55 N
	0	1	0	approx. 50 N	approx. 65 N
	0	1	1	approx. 60 N	approx. 75 N
	1	0	0	approx. 70 N	approx. 85 N
	1	0	1	approx. 80 N	approx. 95 N
	1	1	0	approx. 90 N	approx. 105 N
	1	1	1	approx. 100 N	approx. 115 N



The actual latching forces may deviate from the specified values owing to the different influences (e.g. angled position of actuator, contamination or damage to metal surface, etc.).



When the guard system is opened for the first time from the locked status, higher latching forces may be experienced on account of residual magnetism.

5.4 Programming the slave address

The slave address is programmed through the M12 connector. Any address from 1 to 31 can be set by means of the AS-i bus master or a hand-held programming device.

5.5 Configuration of the safety monitor

The MZM 100 AS can be configured in the ASIMON configuration software with the following monitoring devices (also refer to the ASIMON manual). (also refer to the ASIMON manual)

Double channel dependent

- Synchronisation time: 0.1 s
- Optionally with startup test
- Optional with local acknowledge



The configuration of the safety monitor must be tested and confirmed by a qualified and authorised safety expert/safety engineer.

5.6 Status signal "safety release"

The "safety release" status signal from a Safety at Work slave can be cyclically queried by the control system through the AS-i master. To this effect, the 4 input bits with the varying SaW code of a Safety at Work slave are evaluated through an OR operation with 4 inputs in the control system.

5.7 Violent separation of solenoid interlock and actuator (only in connection with "Solenoid interlock monitored")



The solenoid interlock has a latching force F of 500 N. When the actuator and the interlock are separated in an unauthorized and violent way, the safety guard is opened and the safety outputs are switched off within 150 ms. This is signalled through the yellow and red LED blinking alternatively.

To bring the system back to an operational condition, proceed in the following way:

- Close the safety guard
- Switch off the solenoid control once and then switch it back on (the yellow and red LED now flash simultaneously)
- Now wait for the 10-minute tampering protection time to expire with the safety guard closed, until the LEDs go out
- Switch the solenoid control once more off and on

The device now is ready for operation again.

6. Diagnostic

6.1 LED indications

The LEDs have the following meaning (in accordance with EN 62026-2):

LED green-red (AS-i Duo LED):	AS-Interface supply voltage/ AS-Interface communication error or slave address = 0 or periphery error
Red LED:	Device error
Yellow LED:	Device Status

6.2 Error

Errors, which no longer guarantee the safe functioning of the MZM 100 AS electromagnetic interlock, cause the safety outputs to be switched off and are signaled through a flashing pattern of the red LED (see table 2).

After fault rectification, the error message can be reset by opening and closing the relevant guard door. The safety outputs of the safety monitor can be switched back on, thus enabling the machine.

6.3 Locking of the solenoid interlock blocked

When the interlocking function of the solenoid interlock is blocked and no latching force of at least 500 N could be generated, the MZM 100 AS will emit a warning message. This is signaled by the alternating red/green flashing of the AS-i duo LED on the device.

Possible causes for the blocked interlocking function:

- Solenoid soiled
- Guard incorrectly closed
- Too large a misalignment between the solenoid interlock and the actuator

6.4 Diagnostic information

Table 1: Diagnostic information of the MZM 100 AS safety switchgear

The safety switch signals the operational state as well as errors through three coloured LED's installed on both sides of the device.

System condition	Solenoid control AS-i DO 0	LED			Condition AS-i SaW-Code (DI 0 ... DI 3)	
		green-red AS-i duo-LED	red Error	yellow Status		
Guard open	0	green	Off	Off	static 0	
Safety guard closed, actuator in	0	green	Off	Flashes	static 0 MZM 100 ST-AS dynamic MZM 100 B ST-AS	
Safety guard closed and locked	1	green	Off	On	dynamically	
Solenoid interlock cannot be locked, safety guard not correctly closed or solenoid soiled	1 0	red-green flashing red-green flashing	Off Off	Flashes Off	static 0 MZM 100 ST-AS static 0 MZM 100 B ST-AS	
Device error	0/1	red-green flashing	Flashes ¹⁾	Off	static 0	
Violent separation of solenoid interlock and actuator (description, see 5.7)	0/1	red-green flashing	Flashes	Flashes	static 0 Only MZM 100 ST-AS	
AS-i error: slave address = 0 or communication error	0/1	red	depending on the condition		static 0	
Periphery error signaled through AS-i duo LED	0/1	red-green flashing	depending on the condition		static 0	

1) refer to flash code

Table 2: Error messages / flash codes red LED

Flash codes (red)	Designation	Autonomous switch-off after	Error cause
5 flash pulses	Actuator fault	0 min	Incorrect or defective actuator
6 flash pulses	Latching force fault	0 min	Latching force has dropped below > 500 N (e.g. actuator misalignment)
10 flash pulses	Magnet temperature too high	0 min	The magnet is too hot: $T > 70 \text{ }^\circ\text{C}$.
Continuous red signal	Internal error	0 min	Device defective

6.5 Diagnostic signal periphery error

All warnings or error messages of the MZM 100 AS are transmitted as "periphery error" to the control system through the AS-i master. The signal "periphery error" is a centralised alarm signal from warnings or error messages. The periphery error (FID input of the AS-i chip) is controlled together with parameter port P3. A "periphery error" is signaled by the alternating red and green flashing of the AS-i duo LED on the device.

6.6 Read-out of the parameter port

The parameter port P0 to P3 of an AS-i slave can be read out through the control interface of the AS-i master (see component description) by means of the "Write parameter" instruction (with hexadecimal value F). This (non-safe) diagnostic information from the reflected parameters or the answer to a "Write parameter instruction" can be used by the user for diagnostic purposes or for the control programme.

Table 3: diagnostic information (P0...P3)

Parameter bits	Condition = 1	Condition = 0
0	Actuator in, the solenoid interlock can be locked	Actuator not in
1	Solenoid interlock is locked	Solenoid interlock is not locked
2	Auxiliary voltage in	No auxiliary voltage
3	Warning or error detected	No error detected

7. Set-up and maintenance

7.1 Functional testing

The safety function of the safety components must be tested. The following conditions must be previously checked and met:

1. Check max. axial misalignment of actuator and safety switchgear
2. Check max. angular misalignment (see "Mounting" part)
3. Check the switch enclosure for damage
4. Remove particles of dust and soiling

7.2 Maintenance

We recommend a regular maintenance, including the following steps:

- Check the fixing of the safety switch and the actuator
- Check max. axial misalignment of actuator and safety switch
- Check max. angular misalignment (see "Mounting" part)
- Check the switch enclosure for damages
- Remove soiling



Adequate measures must be taken to ensure protection against tampering either to prevent tampering of the safety guard, for instance by means of replacement actuators.

Damaged or defective components must be replaced.

8. Disassembly and disposal

8.1 Disassembly

The safety switchgear must be disassembled in a de-energised condition only.

8.2 Disposal

The safety switchgear must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.

9. EU Declaration of conformity

EU Declaration of conformity



Original
K.A. Schmersal GmbH & Co. KG
Möddinghofe 30
42279 Wuppertal
Germany
Internet: www.schmersal.com

We hereby certify that the hereafter described components both in their basic design and construction conform to the applicable European Directives.

Name of the component: MZM 100 AS

Type: See ordering code

Description of the component: Interlocking device with electromagnetic interlock for safety functions with integrated AS-i Safety at Work

Relevant Directives:
2006/42/EC Machinery Directive
2014/30/EU EMC-Directive
2011/65/EU RoHS-Directive

Applied standards:
EN 60947-5-3:2013
EN ISO 14119:2013
EN ISO 13849-1:2015
IEC 61508 parts 1-7:2010

Notified body for the prototype test: TÜV Rheinland Industrie Service GmbH
Am Grauen Stein, 51105 Köln
ID n°: 0035

EC-prototype test certificate: 01/205/5778.00/20

Person authorised for the compilation of the technical documentation: Oliver Wacker
Möddinghofe 30
42279 Wuppertal

Place and date of issue: Wuppertal, November 18, 2020

MZM100AS-D-DE

Authorised signature
Philip Schmersal
Managing Director



The currently valid declaration of conformity can be downloaded from the internet at products.schmersal.com.



K.A. Schmersal GmbH & Co. KG
Möddinghofe 30, 42279 Wuppertal
Germany
Phone: +49 202 6474-0
Telefax: +49 202 6474-100
E-Mail: info@schmersal.com
Internet: www.schmersal.com