



**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](http://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 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:

#### AZ 200<sup>①</sup>-T-<sup>②</sup>

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

Actuator	suitable for
AZ/AZM 200-B1-...	Sliding safety guards
AZ/AZM 200-B30-...	Hinged safety guards



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 Comprehensive quality insurance to 2006/42/EC

Schmersal is a certified company to appendix X of the Machinery Directive. As a result, Schmersal is entitled to autonomously conduct the conformity assessment procedure for the products listed in Appendix IV of the MD without involving a notified body. The prototype test certificates are available upon request or can be downloaded from the Internet at [products.schmersal.com](http://products.schmersal.com).

### 2.4 Purpose

The non-contact, electronic safety switchgear is designed for application in safety circuits and is used for monitoring the position of movable safety guards. The integrated door detection sensor monitors the closed condition of the safety guard, the sensor of the actuator monitors the actuator position.

The safety function consists of safely switching off the safety outputs when the safety guard is opened and maintaining the safe switched off condition of the safety outputs for as long as the safety guard is open. The opening of the safety guard is detected by the safety sensors.



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

### Series-wiring

Series-wiring can be set up for devices AZ 200...-1P2P. Response and risk times remain unchanged by series-wiring. The number of components is only limited by the external cable protection according to the technical data and the line loss. Series-wiring of up to 31 AZ200...-SD components with serial diagnostics is possible. In devices with the serial diagnostics function (ordering suffix -SD), the serial diagnostics connections are wired in series and connected to a SD-Gateway for evaluation purposes. Wiring examples for series-wiring, refer to appendix



The user must evaluate and design the safety chain in accordance with the relevant standards and the required safety level. If multiple safety switchgears are involved in the same safety function, the PFH values of the individual components must be added.



The entire concept of the control system, in which the safety component is integrated, must be validated to the relevant standards.

### 2.5 Technical data

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

Enclosure:	glass-fibre reinforced thermoplastic, self-extinguishing
Working principle:	inductive
Coding level according to ISO 14119:	low
Mechanical life:	≥ 1 million operations
Latching force:	30 N
Protection class:	IP66, IP67 gemäß EN 60529
Insulation protection class:	II, <input checked="" type="checkbox"/>
Overvoltage category:	III
Degree of pollution:	3
Realisation of the electrical connection:	Screw terminals or cage clamps, M12 or M23 connector
Cable section:	min. 0.25 mm <sup>2</sup> , max. 1.5 mm <sup>2</sup> (including conductor ferrules)
Tightening torque for the cover screws:	0.7 ... 1 Nm (Torx T10)
Cable entry:	M20 x 1.5
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
<b>Switching distances to EN 60947-5-3:</b>	
Rated operating distance $S_n$ :	6.5 mm
Assured switching distance $S_{so}$ :	4 mm
Assured switch-off distance $S_{ar}$ :	30 mm
Hysteresis:	max: 1.5 mm
Repeat accuracy:	< 0.5 mm
<b>Ambient conditions:</b>	
Ambient temperature:	-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
Switching frequency:	≤ 1 Hz
Response time:	< 60 ms
Duration of risk:	< 120 ms
Time to readiness:	< 4,000 ms
Actuating speed:	≤ 0.2 m/s
<b>Electrical data:</b>	
Rated operating voltage $U_e$ :	24 VDC -15% / +10% (stabilised PELV)
Rated operating current $I_e$ :	0.7 A
No-load current $I_o$ :	max. 0.1 A

Rated impulse withstand voltage $U_{imp}$ :	0.8 kV
Rated insulation voltage $U_i$ :	32 VDC
Device fuse rating:	internal short-circuit proof
- Screw terminals or cage clamps:	$\leq 4$ A when used to UL 508
- Connector M12:	$\leq 2$ A
- Connector M23:	$\leq 4$ A
EMC rating:	to EN 61000-6-2
<b>Safety inputs X1 and X2:</b>	(-1P2P and -SD2P)
Rated operating voltage $U_e$ :	- 3 V ... 5 V (Low) 15 V ... 30 V ( High)
Rated operating current $I_e$ :	typically 2 mA at 24 V
Accepted test pulse duration on input signal:	$\leq 1.0$ ms
- With test pulse interval of:	$\geq 100$ ms
Classification:	ZVEI CB24I
<b>Sink:</b>	C1
<b>Source:</b>	C1 C2 C3

<b>Safety outputs Y1 and Y2:</b>	p-type, short-circuit proof
Rated operating voltage $U_e$ :	0 V ... 4 V under $U_e$
Rated operating current $I_e$ :	max. depending 0.25 A
Utilisation category:	DC-13
Leakage current $I_r$ :	$\leq 0.5$ mA
Test pulse duration:	$\leq 1.0$ ms
Test pulse interval:	1,000 ms
Classification:	ZVEI CB24I
<b>Source:</b>	C1
<b>Sink:</b>	C1

<b>Diagnostic output OUT:</b>	short-circuit proof, p-type
Rated operating voltage $U_e$ :	0 V ... 4 V under $U_e$
Rated operating current $I_e$ :	0.05 A
Utilisation category:	DC-13
Wiring capacitance for serial diagnostics:	max. 50 nF
<b>LED switching conditions display:</b>	
green LED:	Supply voltage
yellow LED:	Operating condition
red LED:	Internal device error



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.

### 2.6 Safety classification

Standards:	EN ISO 13849-1, EN 61508
PL:	up to e
Control category:	4
PFH:	$4 \times 10^{-9}$ / h
SIL:	suitable for SIL 3 applications
Mission time:	20 years

## 3. Mounting

### 3.1 General mounting instructions

For fitting the safety switch and the actuator, two mounting holes for M6 screws with washers (washers included in delivery) are provided. The safety switch must not be used as end stop. Any mounting position. The mounting position however must be chosen so that the ingress of dirt and soiling in the used opening is avoided. The unused actuator opening must be sealed by means of the dust-proof flap (included in delivery).

**Minimum distance between two safety switches: 100 mm**



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

### Mounting of the actuators

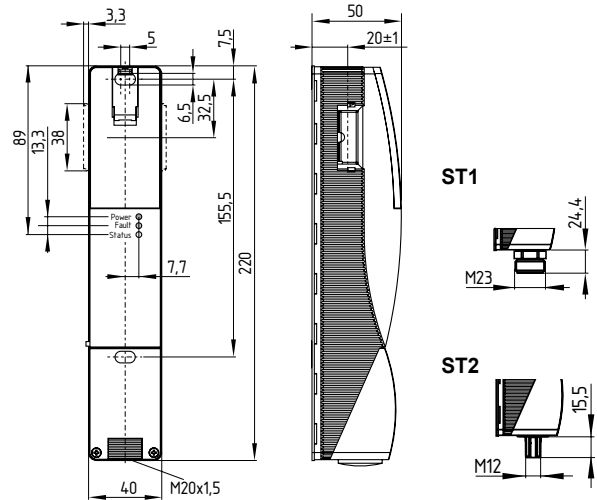
Refer to the mounting instructions manual for the corresponding actuator.



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

### Dimensions

All measurements in mm.



## 4. Electrical connection

### 4.1 General information for electrical connection



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

The power supply for the safety switch must provide protection against permanent overvoltage. To that effect, stabilised PELV supply units must be used. The safety outputs can be directly integrated in the safety circuit of the control system. For applications up to PL e / control category 4 in accordance with EN ISO 13849-1, the safety outputs of the safety switch must have an assessment with the same category (refer to wiring examples). Inductive loads (e.g. contactors, relays, etc.) are to be provided with suitable interference suppression circuitry.

### Requirements for the connected safety-monitoring module:

- Dual-channel safety input, suitable for 2 p-type semi-conductor outputs



### Configuration of the safety controller

If the safety switchgear is connected to electronic safety-monitoring modules, we recommend that you set a discrepancy time of 100 ms. The safety inputs of the safety-monitoring module must be able to blank a test impulse of approx. 1 ms. The safety-monitoring module does not need to have a cross-wire short monitoring function, if necessary, the cross-wire short monitoring function must be disabled.



Information for the selection of suitable safety-monitoring modules can be found in the Schmersal catalogues or in the online catalogue on the Internet: [products.schmersal.com](http://products.schmersal.com).

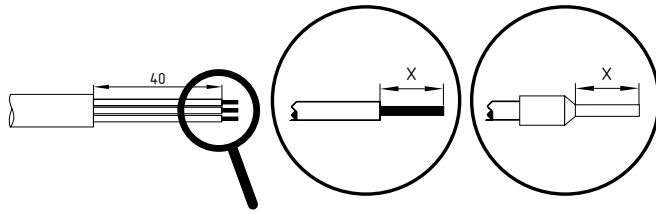
If the safety component is wired to relays or to non-safety relevant control components, a new risk analysis must be carried out.

### Cable

The cable entry is realised by a metric M20 x 1.5 gland. This gland must be dimensioned by the user so that it is suitable for the cable used. A cable gland with strain relief and suitable IP protection class must be used.

**Settle length x of the cable at terminals of type s, r or f:**

Cage clamps (CC):	7.5 mm
Screw terminals (SK):	8.0 mm



The maximum cable length is 200 m (for ST2 M12 connectors approx. 20 m depending on the cable section used for an operating current of 0.5 A). The maximum cable section is 1.5 mm<sup>2</sup>, incl. conductor ferrules. Prior to the connection, the cable must be stripped by 40+5 mm and insulated by 5 mm. The fitted 24V, X1, X2 bridge is included in the delivery of ...-1P2P and ...-SD2P.

## 5. Operating principle and diagnostic functions

### 5.1 Mode of operation of the safety outputs

The opening of the safety guard causes the safety outputs to be disabled within the risk time.

### 5.2 Diagnostic-LEDs

The safety switchgear signals the operational state as well as errors through three coloured LEDs installed on the front side of the device.

<b>green</b>	(Power)	Supply voltage on
<b>yellow</b>	(Status)	switching condition
<b>red</b>	(Fault)	Fault (refer to table 2)

### 5.3 Operating principle of the electronic diagnostic output

The short-circuit proof diagnostic output can be used for central visualisation or control functions, e.g. in a PLC. The closed condition of the safety guard and the inserted condition of the actuator is indicated by means of a 24V signal.

**The diagnostic output is not a safety-related output.**

### Error

Errors, which no longer guarantee the function of the AZ 200 T (internal errors) cause the safety outputs to be disabled. Any error that does not immediately affect the safe functionality of a safety switch will lead to a delayed shut-down (refer to table 2).

After fault rectification (fault at output Y1 or Y2, temperature fault), the fault is acknowledged by opening and relocking the relevant guard door. The safety outputs enable and allow a restart.



Automatic, electronic locking takes place if more than one fault is detected at the safety outputs or a cross circuit is detected between Y1 and Y2. This means that normal fault acknowledgement is no longer possible. To reset this type of interlocking, the safety switch must be isolated from the power supply after elimination of the error causes.

**Table 1: The diagnostic function of the safety switchgear**

System condition	LED			Safety outputs Y1, Y2	Diagnostic output -1P2P OUT
	green	red	yellow		
Guard open	On	Off	Off	0 V	0 V
Door closed, <b>actuator not inserted</b>	On	Off	Off	0 V	0 V
Door closed, <b>actuator inserted</b>	On	Off	On	24 V (if X1 = X2 = 24 V)	24 V
Error warning <sup>1)</sup> , actuator inserted, shut-down approaching	On	Flashes <sup>2)</sup>	On	24 V (if X1 = X2 = 24 V)	0 V
<b>Error</b>	On	Flashes	Off	0 V	0 V

<sup>1)</sup>after 30 min: shut-down due to error

<sup>2)</sup>see flash code

**Table 2: Error messages / flash codes red diagnostic LED**

Flash codes	Designation	Autonomous switch-off after	Error cause
1 flash pulse	Error (warning) at output Y1	30 min	Fault in output test or voltage at output Y1, although the output is disabled.
2 flash pulses	Error (warning) at output Y2	30 min	Fault in output test or voltage at output Y2, although the output is disabled.
3 flash pulses	Error (warning) cross-wire short	30 min	Cross-wire short between the output cables or fault at both outputs
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 fault	0 min	Incorrect or defective actuator
6 flash pulses	Error actuator combination	0 min	An invalid combination of actuators were detected (blocking bolt detection or tamper attempt).
Continuous red	internal error	0 min	Device defective

**5.4 Safety switch with serial diagnostic function SD**

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 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 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 are 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 interlocking device is maintained.

**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.



Automatic, electronic locking takes place if more than one fault is detected at the safety outputs or a cross circuit is detected between Y1 and Y2. This means that normal fault acknowledgement is no longer possible. To reset this type of interlocking, the safety switch must be isolated from the power supply after elimination of the error causes.

**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 cause of error is eliminated.

**Diagnostic error (warning)**

If an error (warning) is signalled in the response byte, detailed fault information can be read out.



**Accessories SD interface**

For ease of wiring and series-wiring of SD devices, considerable accessories are available. Detailed information is available on the Internet, [products.schmersal.com](http://products.schmersal.com).



On wiring SD devices, please pay attention to the voltage drop on the cables and the current carrying capacity of the individual components.

**Table 3: I/O data and diagnostic data**

The described condition is reached, when Bit = 1

Bit n°	Request byte	Response byte	Diagnostic error warning	Diagnostic error
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 short	Cross-wire short
Bit 3:	---	---	Temperature too high	Temperature too high
Bit 4:	---	Input condition X1 and X2	---	Incorrect or defective actuator
Bit 5:	---	Guard door detected	Internal device error	Internal device error
Bit 6:	---	Error warning <sup>1)</sup>	Communication error between the field bus Gateway and the safety switch	---
Bit 7:	Error reset	Error (enabling path switched off)	---	---

<sup>1)</sup> after 30 min: disabling due to fault

### 6. Set-up and maintenance

#### 6.1 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 fixation of the safety switch and the actuator
3. Check the integrity of the cable entry and connections
4. Check the switch enclosure for damage

#### 6.2 Maintenance

A regular visual inspection and functional test, including the following steps, is recommended:

1. Check max. axial misalignment of actuator and safety switchgear
2. Check fixation of the safety switch and the actuator
3. Remove particles of dust and soiling
4. Check cable entry and connections



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.**

### 7. Disassembly and disposal

#### 7.1 Disassembly

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

#### 7.2 Disposal

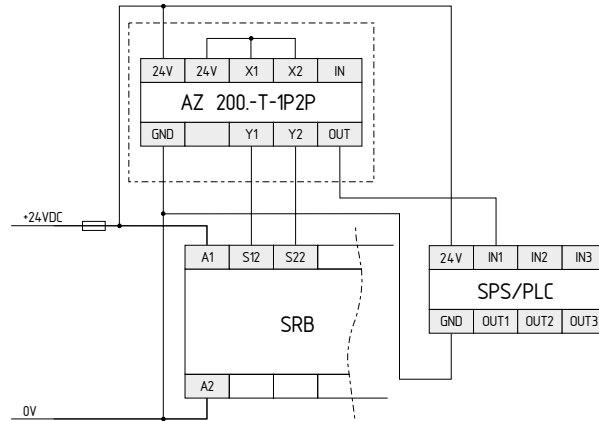
The safety switchgear must be disposed of in an appropriate manner in accordance with the national prescriptions and legislations.

### 8. Appendix

#### 8.1 Wiring examples

The application examples shown are suggestions. They however do not release the user from carefully checking whether the switchgear and its set-up are suitable for the individual application.

##### Wiring example 1: AZ 200.-T-1P2P.

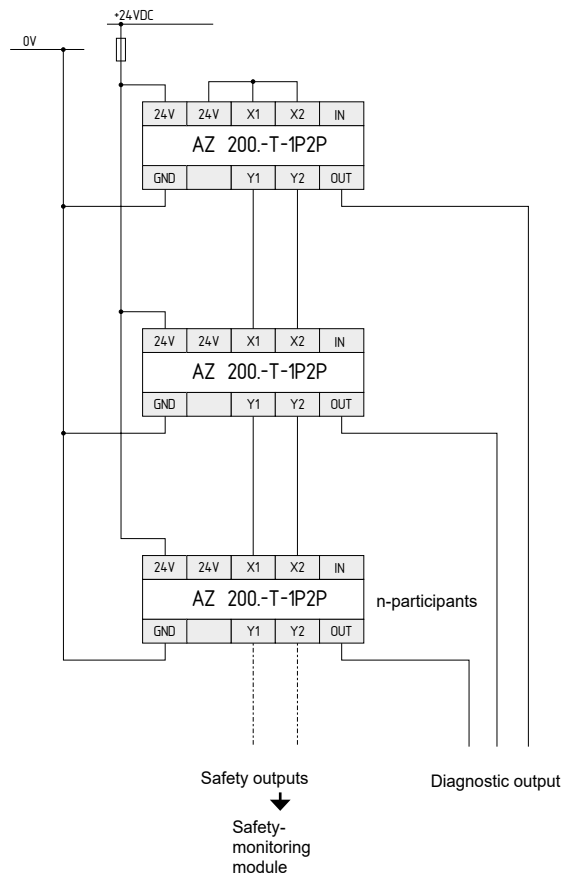


##### Wiring example 2: series-wiring of the AZ 200.-T-1P2P.

The series-wiring of multiple AZM 200 solenoid interlocks is realised by wiring in the control cabinet or in on-site junction boxes.

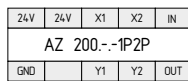
In the example, 3 AZ 200.-T-1P2P safety switches are wired in series. The diagnostic output ("OUT") are separately wired to a conventional PLC for evaluation or control. The maximum cable length of the safety circuits must not exceed 200 m.

In the series-wiring, the 24V-X1-X2 bridge must be removed from all components up to the last component (refer to wiring example).

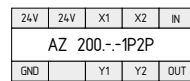


**8.2 Wiring configuration and connector accessories**

	Safety switch function		Pin configuration of the connector		Colour code of the Schmersal connector to DIN 47100	Possible colour code of other commercially available connectors according to EN 60947-5-2
	1 diagnostic output 1P2P	with serial diagnostic function SD2P	Connector plug ST1 M23, (8+1)-pole	Connector plug ST2 M12, 8-pole		
<b>24V</b>	U <sub>e</sub>		1	1	WH	BN
<b>X1</b>	Safety input 1		2	2	BN	WH
<b>GND</b>	GND		3	3	GN	BU
<b>Y1</b>	Safety output 1		4	4	YE	BK
<b>OUT</b>	Diagnostic output	SD output	5	5	GY	GY
<b>X2</b>	Safety output 2		6	6	PK	PK
<b>Y2</b>	Safety output 2		7	7	BU	VT
<b>IN</b>	without function	SD input	8	8	RD	OR
	without function		9	-		



**Terminal block  
-SK or -CC**



**Terminal block  
-SK or -CC**

**Connector accessories**

**Connecting cables with coupling (female)**  
**IP67, M23, (8+1)-pole – 8 x 0.75 mm**

Cable length	Ordering code
5.0 m	101209959
10.0 m	101209958

**Connecting cables with coupling (female)**  
**IP67 / IP69, M12, 8-pole – 8 x 0.25 mm<sup>2</sup>**  
**to DIN 47100**


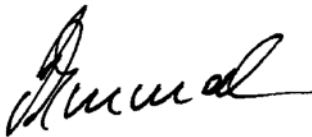
Cable length	Ordering code
2.5 m	103011415
5.0 m	103007358
10.0 m	103007359

**Connector with female plug**  
**IP67, M23, (8+1)-pole – 8 x 0.75 mm<sup>2</sup>**

Versions	Ordering code
with soldering terminals	101209970
with crimp terminals	101209994

Further versions in other lengths and with angled cable exit are available upon request.

9. EU Declaration of conformity

<b>EU Declaration of conformity</b>		
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.		
<b>Name of the component:</b>	AZ 200	
<b>Type:</b>	See ordering code	
<b>Description of the component:</b>	Safety Switch for safety functions	
<b>Relevant Directives:</b>	2006/42/EC    Machinery Directive 2014/30/EU    EMC-Directive 2011/65/EU    RoHS-Directive	
<b>Applied standards:</b>	EN 60947-5-3:2013 ISO 14119: 2013 EN ISO 13849-1:2015 EN 61508 parts 1-7:2010 EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	
<b>Notified body for the prototype test:</b>	TÜV Rheinland Industrie Service GmbH Am Grauen Stein, 51105 Köln ID n°: 0035	
<b>EC-prototype test certificate:</b>	01/205/5122.02/20	
<b>Person authorised for the compilation of the technical documentation:</b>	Oliver Wacker Möddinghofe 30 42279 Wuppertal	
<b>Place and date of issue:</b>	Wuppertal, 26. February, 2020	
		
	Authorised signature <b>Philip Schmersal</b> Managing Director	

AZ 200-D-DE



The currently valid declaration of conformity can be downloaded from the internet at [products.schmersal.com](http://products.schmersal.com).

