



**EN** Operating instructions..... pages 1 to 8  
Translation of the original operating instructions

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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 proper functionality of the entire machinery 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: [www.schmersal.net](http://www.schmersal.net).

The information contained in this operating instructions manual is provided without liability. 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 inadequate or improper use or manipulations of the safety switchgear, personal hazards or damage to machinery or plant components cannot be excluded. The relevant requirements of the standard EN 1088 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:

#### AZM 161 ① ②-AS ③④⑤⑥

No.	Option	Description
①	Z	Solenoid monitored
	B	Actuator monitored
	BZ	Combined actuator/solenoid interlock monitoring
②	ST1	Connector in the middle
	ST2	Connector at the right-hand side
③	R	Latching force 5 N
	R	Latching force 30 N
④	A	Power to unlock
	A	Power to lock
⑤	P	Magnet supply from AS-Interface
	P	Magnet supply 24 VDC (Aux.)
⑥		Manual release
	N	Emergency release
	T	Emergency exit



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 Destination and use

The AZM 161 AS is designed for use with AS-Interface Safety at Work. The different variants of the component can be used as safety switch with interlocking function or as solenoid interlock for position monitoring and locking of moveable safety guards to EN 1088.

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 the ASM safety monitor. The safety function of the AZM 161 AS 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.

The component status can be evaluated through a PLC with AS-Interface master. The safety-related functions are enabled by means of the AS-i safety monitor.



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.

For an application requiring a safe interlocking, the AZM 161 Z ST-AS or the AZM 161 BZ ST-AS variant must be selected. The AZM 161 B ST-AS is a safety switch with additional interlocking function.



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

### LED indication

The LED's have the following meaning (to EN 50295):

**Yellow LED:** Channel 1 / AS-i SaW bit 0,1

### LED green/red

AS-i duo LED: AS-Interface supply voltage AS-Interface communication error or slave address = 0 or periphery error

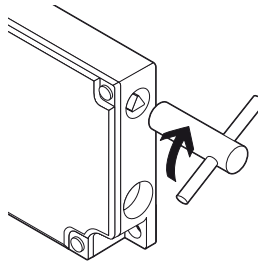
**Yellow LED:** Channel 2 / AS-i SaW bit 2,3

### Manual release

A manual release is available as a mounting tool and in the event of a power failure in case the power to unlock principle is used.

The manual release is realised by turning the triangular key by 180 degrees, so that the locking bolt is pulled into the unlocking position.

The normal locking function is only restored after the triangular key has been returned to its original position. After being put into operation, the manual release must be secured by installing the plastic cover, which is included in delivery.



### Emergency release

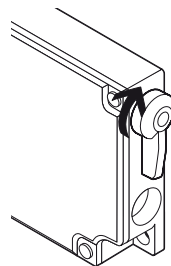
(Mounting and actuation only outside of the safety guard)

To realise an emergency release, turn the orange lever by 180 degrees in the direction shown by the arrow until it hits the end stop. In this position, the safety guard can be opened. The lever is latched and cannot be turned back. To cancel the blocked position, the central fixing screw must be unscrewed until the blocked position is neutralised. Return the lever to its original position and firmly retighten the screw.

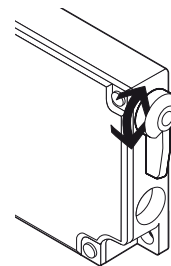
### Emergency exit

(Mounting and actuation only from within the hazardous area)

To realise an emergency exit, turn the orange lever by 180 degrees in the direction shown by the arrow until it hits the end stop. In this position, the safety guard can be opened. The blocked position is canceled by turning the lever in the opposite direction. In the unlocked condition, the safety guard is protected against unintentional closing.



Emergency release (N)



Emergency exit (T)

**2.4 Technical data**

Standards:	EN 50295, IEC 60947-5-1, EN ISO 13849-1, IEC/EN 61508
Enclosure:	glass-fibre reinforced thermoplastic, self-extinguishing
Actuator and locking bolt:	stainless steel 1.4301
Mechanical life:	> 1 million operations
Holding force $F_{max}$ :	2000 N
Latching force:	30 N, only for option R
Protection class:	IP 67 to IEC/EN 60529
Insulation protection class:	II, $\square$
Overvoltage category:	III
Degree of pollution:	3
Termination:	M12 x 1 connector, 4-pole
Electrical data	
AS-Interface:	
Operating voltage range:	26.5...31.6 VDC, through AS-Interface, reverse polarity-proof
AS-interface power consumption:	max. 0.25 A, ordering suffix "P" max. 0.1 A
Rated insulation voltage $U_{i1}$ :	32 VDC
Rated impulse withstand voltage $U_{imp1}$ :	800 V
Device fuse rating:	internally short-circuit proof
Specification (V 2.1):	AS-i slave profile: S-7 .B.E, IO-Code: 0x7, ID-Code: 0xB, ID-Code1: 0xF, ID-Code2: 0xE
AS-interface inputs:	Databits D0...D3: condition static 0 or dynamic code transmission SaW
AS-interface outputs:	Bit 0: magnet control solenoid interlock Bit 1...bit 3: no function
Parameter port:	P0: actuator detected P1: solenoid interlock locked P2: magnet voltage in tolerance range P3: error message "locking/unlocking of the solenoid interlock blocked"
Diagnostic information:	LED yellow: channel 1 / AS-i SaW bit 0,1 LED green / red (AS-i duo LED): AS-Interface supply voltage / AS-Interface communication error or slave address = 0 or periphery error LED yellow: channel 2 / AS-i SaW bit 2,3
Input module address:	preset to address 0, can be changed through AS-interface bus master or hand-held programming device
Auxiliary voltage magnet:	only ordering suffix "P"
Operating voltage range:	24 VDC -15% / +10% (stabilised PELV)
Power consumption AUX:	max. 0.5 A
Rated insulation voltage $U_{i2}$ :	32 VDC
Rated impulse withstand voltage $U_{imp2}$ :	800 V
Device fuse rating:	$\leq 4$ A when used to UL 508
Magnet:	100% ED
Ambient conditions:	
Ambient temperature:	-25 °C ... +60 °C
Storage and transport temperature:	-25 °C ... +85 °C
Relative humidity:	30...95%, no condensation
Resistance to vibration:	10 ... 150 Hz, amplitude 0.35 mm
Resistance to shock:	30 g / 11 ms
Switching frequency f:	$\leq 1$ Hz
Switch-off delay:	< 100 ms
Actuating speed:	$\leq 2$ m/s

**2.5 Safety classification (approval under preparation)**

Standards:	EN ISO 13849-1, IEC 61508
If a fault exclusion of a hazardous damage to the 1-channel mechanics is authorised and sufficient protection against tampering is ensured	
PL:	up to d
Control category:	up to 3
PFH value:	$1.01 \times 10^{-7}$ / h for $\leq 100,000$ operations / year
SIL:	up to 2
Service life:	20 years
Basically suitable up to:	
PL:	up to c
Control category:	up to 1
PFH value:	$1.14 \times 10^{-6}$ / h for $\leq 100,000$ operations / year
SIL:	up to 1
Service life:	20 years

**3 Mounting**

**3.1 General mounting instructions**

Three mounting holes are provided for fixing the enclosure. The solenoid interlock is double insulated. The use of a protective ground wire therefore is not authorised. The solenoid interlock must not be used as an end stop. The solenoid interlock can be fitted in any mounting position. The mounting position however must be chosen so that the ingress of dirt and soiling in the used opening is avoided. Unused actuator openings must be sealed with slot sealing plugs.



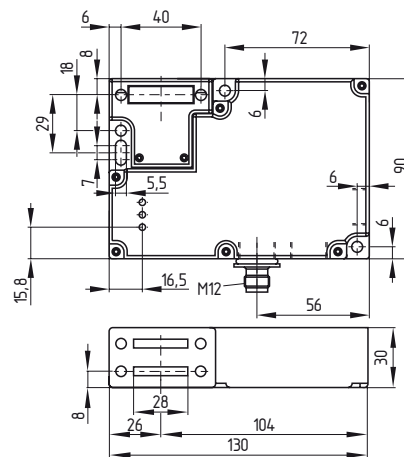
Please observe the remarks of the standards EN ISO 12100, EN 953 and EN 1088.

**Mounting of the actuator**

See mounting instructions actuators.

**3.2 Dimensions**

All measurements in mm.



**4 Electrical connection**

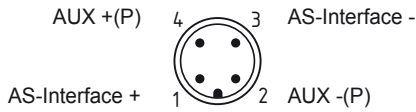
**4.1 General information for electrical connection**



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

The AZM 161 AS is supplied from the AS-Interface cable. The energy for the locking magnets is either supplied separately (Aux) (ordering suffix P) or through the AS-Interface cable. Both voltage supplies of the solenoid interlock 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 50295):



## 5 Functions and configuration

### 5.1 Mode of operation of the safety outputs

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

- the actuator is inserted
- the solenoid interlock is locked

#### AZM 161 B ST-AS

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

- the actuator is inserted

#### AZM 161 BZ ST-AS

The safety outputs of the AS-i safety monitor are only activated, when both AS-i half-codes are enabled.

Half-code 1 (AS-i SaW bit 0,1) is enabled, when:

- the actuator is inserted

The solenoid interlock now can be locked.

Half-code 2 (AS-i SaW bit 2,3) is enabled, when:

- the solenoid interlock is additionally locked.

### 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 AZM 161 AS. In the power to lock variant of the AZM 161 AS, the functional set of output bit 0 will cause the solenoid interlock to be locked. In the power to unlock variant of the AZM 161 AS, the functional set of output bit 0 will cause the solenoid interlock to be unlocked.

### 5.3 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.

### 5.4 Configuration of the safety monitor

Depending on the component used, the AZM 161 AS can be configured in the ASIMON configuration software with the following safety monitors (also refer to the ASIMON manual).

#### Dual-channel dependent with filtering

Suitable for: AZM 161 B ST-AS

The use of this safety-monitoring module is especially advantageous on safety guards bouncing or vibration against the mechanical stop upon closing.

- Optionally with start-up test
- Stabilisation time typically 0.5 up to 1.0 s
- Synchronisation time typically 5.0 up to 10 s

The safety-monitoring module is only released after expiration of the stabilising time; the synchronization time always must exceed the stabilising time.

#### Double channel conditionally dependent

Suitable for: AZM 161 BZ ST-AS

- Independent: In - 1

As long as the actuator remains inserted, the safety guard can be relocked at any time, in which case the safety outputs are reactivated. The safety guard must not be opened.



The redundancy and the "Safety guard closed" signal are not tested in this configuration. To test these conditions, additional measures must be taken beyond the safety monitor.

#### Dual-channel dependent

Suitable for: AZM 161 Z ST-AS, AZM 161 B ST-AS, AZM 161 BZ ST-AS

- Synchronisation time typically: 0.1 s; for AZM 161 BZ ST-AS infinite (∞)
- Optionally with start-up test
- Optionally with local acknowledge

When the AZM 161 BZ ST-AS is used together with this safety-monitoring module for conducting the start-up test prior to every restart, the safety guard must be opened.



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

### 5.5 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 that 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.

### 5.6 Read-out of the parameter port

The parameter port P0 to P3 of a solenoid interlock 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.

Parameter bit	Condition = 1	Condition = 0
0	Actuator inserted. The actuator can now be locked.	No actuator detected
1	Actuator inserted and locked	Actuator not locked
2	Magnet voltage available	Magnet voltage not available
3	Locking/unlocking of the solenoid interlock blocked	Locking/unlocking of the solenoid interlock not blocked

#### Error message "locking/unlocking of the solenoid interlock blocked"

This error is transmitted, when the solenoid interlock no longer can be correctly locked or unlocked. The causes for this error can be: the safety guard is not correctly closed, the actuator is deformed, the manual release is not correctly reset or the auxiliary voltage is missing. This error is transmitted as "periphery error" to the control system through the AS-i Master. A "periphery error" is shown on the AS-i device by the alternating red/green flashing of the AS-i Duo LED.

**AZM 161 Z ST-AS .A.** Z-variant, power to lock (magnet-operated locking)

System condition	Magnet input AS-i D Out: 0	Channel 1 Yellow LED	Channel 2 Yellow LED	SaW code Authorized operation	AS-i FID Red LED	Parameter port			
						P0	P1	P2	P3
Safety guard open	0	---	---	0 0 0 0	---	0	0	1	0
Safety guard closed	0	---	---	0 0 0 0	---	1	0	1	0
Safety guard locked	1	ON	ON	SaW code	---	1	1	1	0
Locking blocked	1	---	---	0 0 0 0	Flashes	1	0	1	1
Unlocking blocked	0	ON	ON	SaW code	Flashes	1	1	1	1

**AZM 161 B ST-AS .A.** B-variant, power to lock (magnet-operated locking)

System condition	Magnet input AS-i D Out: 0	Channel 1 Yellow LED	Channel 2 Yellow LED	SaW code Authorized operation	AS-i FID Red LED	Parameter port			
						P0	P1	P2	P3
Safety guard open	0	---	---	0 0 0 0	---	0	0	1	0
Safety guard closed	0	ON	ON	SaW code	---	1	0	1	0
Safety guard locked	1	ON	ON	SaW code	---	1	1	1	0
Locking blocked	1	ON	ON	SaW code	Flashes	1	0	1	1
Unlocking blocked	0	ON	ON	SaW code	Flashes	1	1	1	1

**AZM 161 BZ ST-AS .A.** BZ-variant, power to lock (magnet-operated locking)

System condition	Magnet input AS-i D Out: 0	Channel 1 Yellow LED	Channel 2 Yellow LED	SaW code Authorized operation	AS-i FID Red LED	Parameter port			
						P0	P1	P2	P3
Safety guard open	0	---	---	0 0 0 0	---	0	0	1	0
Safety guard closed	0	ON	---	HC1* 0 0	---	1	0	1	0
Safety guard locked	1	ON	ON	SaW code	---	1	1	1	0
Locking blocked	1	ON	---	HC1* 0 0	Flashes	1	0	1	1
Unlocking blocked	0	ON	ON	SaW code	Flashes	1	1	1	1

HC1\* AS-i half code 1 (AS-i SaW bit 0.1)

**AZM 161 Z ST-AS** Z-variant, power to unlock (spring-operated locking)

System condition	Magnet input AS-i D Out: 0	Channel 1 Yellow LED	Channel 2 Yellow LED	SaW code Authorized operation	AS-i FID Red LED	Parameter port			
						P0	P1	P2	P3
Safety guard open	1	---	---	0 0 0 0	---	0	0	1	0
Safety guard closed	1	---	---	0 0 0 0	---	1	0	1	0
Safety guard locked	0	ON	ON	SaW code	---	1	1	1	0
Locking blocked	0	---	---	0 0 0 0	Flashes	1	0	1	1
Unlocking blocked	1	ON	ON	SaW code	Flashes	1	1	1	1

**AZM 161 B ST-AS** B-variant, power to unlock (spring-operated locking)

System condition	Magnet input AS-i D Out: 0	Channel 1 Yellow LED	Channel 2 Yellow LED	SaW code Authorized operation	AS-i FID Red LED	Parameter port			
						P0	P1	P2	P3
Safety guard open	1	---	---	0 0 0 0	---	0	0	1	0
Safety guard closed	1	ON	ON	SaW code	---	1	0	1	0
Safety guard locked	0	ON	ON	SaW code	---	1	1	1	0
Locking blocked	0	ON	ON	SaW code	Flashes	1	0	1	1
Unlocking blocked	1	ON	ON	SaW code	Flashes	1	1	1	1

**AZM 161 BZ ST-AS** BZ-variant, power to unlock (spring-operated locking)

System condition	Magnet input AS-i D Out: 0	Channel 1 Yellow LED	Channel 2 Yellow LED	SaW code Authorized operation	AS-i FID Red LED	Parameter port			
						P0	P1	P2	P3
Safety guard open	1	---	---	0 0 0 0	---	0	0	1	0
Safety guard closed	1	ON	---	HC1* 0 0	---	1	0	1	0
Safety guard locked	0	ON	ON	SaW code	---	1	1	1	0
Locking blocked	0	ON	---	HC1* 0 0	Flashes	1	0	1	1
Unlocking blocked	1	ON	ON	SaW code	Flashes	1	1	1	1

HC1\* AS-i half code 1 (AS-i SaW bit 0.1)

**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 the switch enclosure for damage
2. Check for a secure installation of the actuator and the switch
3. Check the integrity of the cable entry and connections

**6.2 Maintenance**

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

1. Check for a secure installation of the actuator and the switch
2. Remove particles of dust and soiling
- 3 Check cable entry and connections

**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.

8.1 EC Declaration of conformity

	
<h2>EC Declaration of conformity</h2>	
Translation of the original declaration of conformity valid as of December 29, 2009	K.A. Schmersal GmbH Industrielle Sicherheitssysteme Mödinghofe 30, D - 42279 Wuppertal Germany Internet: www.schmersal.com
We hereby certify that the hereafter described safety components both in its basic design and construction conforms to the applicable European Directives.	
<b>Name of the safety component:</b>	AZM 161 AS
<b>Description of the safety component:</b>	Interlocking device with electromagnetic interlock for safety functions with integrated AS-i Safety at Work
<b>Harmonised EC-Directives:</b>	2006/42/EC EC-Machinery Directive 2004/108/ EC EMC-Directive
<b>Person authorized for the compilation of the technical documentation:</b>	Ulrich Loss Mödinghofe 30 42279 Wuppertal
<b>Place and date of issue:</b>	Wuppertal, October 22, 2009
AZM 161 AS-B-EN	
	Authorised signature Heinz Schmersal Managing Director



**Note**

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





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