

Visualisation; Diagnostics

Easy to Configure

Programming IEC 61131-3

Rapid Installation

PSEN ma1.3a/b-20

PILZ
THE SPIRIT OF SAFETY

► PSEN sensor technology

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SD means Secure Digital

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Introduction

Validity of documentation

This documentation is valid for the product PSEN ma1.3a/b-20. It is valid until new documentation is published.

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product.

Using the documentation

This document is intended for instruction. Only install and commission the product if you have read and understood this document. The document should be retained for future reference.

Definition of symbols

Information that is particularly important is identified as follows:



DANGER!

This warning must be heeded! It warns of a hazardous situation that poses an immediate threat of serious injury and death and indicates preventive measures that can be taken.



WARNING!

This warning must be heeded! It warns of a hazardous situation that could lead to serious injury and death and indicates preventive measures that can be taken.



CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.



NOTICE

This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

**INFORMATION**

This gives advice on applications and provides information on special features.


Safety

Intended use


The safety function of the safety switch is:

- ▶ Safe detection of the magnetic actuator within the response range

The safety switch meets the requirements in accordance with:

- ▶ EN 60947-5-3: PDDb only in connection
 - with the operator PSEN ma1.3-08 or operator PSEN ma1.3-12 and
 - the suitable evaluation devices (see [Requirements and connection to evaluation devices](#) [ 11]).

The following is deemed improper use in particular:

- ▶ Any component, technical or electrical modification to the product
- ▶ Use of the product outside the areas described in this manual
- ▶ Use of the product outside the technical details (see [Technical details](#) [ 18]).

**NOTICE****EMC-compliant electrical installation**

The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.

Safety regulations

Safety assessment

Before using a unit it is necessary to perform a safety assessment in accordance with the Machinery Directive.

Functional safety is guaranteed for the product as a single component. However, this does not guarantee the functional safety of the overall plant/machine. In order to achieve the required safety level for the overall plant/machine, define the safety requirements for the plant/machine and then define how these must be implemented from a technical and organisational standpoint.

Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by competent persons.

A competent person is someone who, because of their training, experience and current professional activity, has the specialist knowledge required to test, assess and operate the work equipment, devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.

It is the company's responsibility only to employ personnel who:

- ▶ Are familiar with the basic regulations concerning health and safety / accident prevention
- ▶ Have read and understood the information provided in this description under "Safety"
- ▶ And have a good knowledge of the generic and specialist standards applicable to the specific application.

Warranty and liability

All claims to warranty and liability will be rendered invalid if

- ▶ The product was used contrary to the purpose for which it is intended
- ▶ Damage can be attributed to not having followed the guidelines in the manual
- ▶ Operating personnel are not suitably qualified
- ▶ Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

Disposal

- ▶ In safety-related applications, please comply with the mission time T_M in the safety-related characteristic data.
- ▶ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).


For your safety




WARNING!

Loss of safety function due to manipulation of the interlocking device

Manipulation of the interlocking device may lead to serious injury and death.

- You should prevent any possibility of the interlocking device being manipulated through the use of a spare actuator.
- Keep the substitute actuator in a safe place and protect it from unauthorised access.
- If spare actuators are used, these must be installed as described in [Installation](#) [ 14].
- If the original actuators are replaced with substitute actuators, the original actuators must be destroyed before disposal.



Unit features

- ▶ The actuator PSEN ma1.3-08 or PSEN ma1.3-12 belongs to the safety switch.
- ▶ Coded actuator
- ▶ Safety switch with cable (5 m/ 10 m)
- ▶ 2 safety contacts (reed contacts - N/O)
- ▶ 1 auxiliary contact (N/O)
- ▶ Different operating distances depending on the actuator see [Technical details](#)  18]
- ▶ Design:
 - Safety switch with round design
 - Actuator with round design: PSEN ma1.3-08
 - Actuator with square design: PSEN ma1.3-12 (various directions of actuation possible)
- ▶ Operation Magnetic
- ▶ Switching voltage 24 VDC
- ▶ LED to display switch status

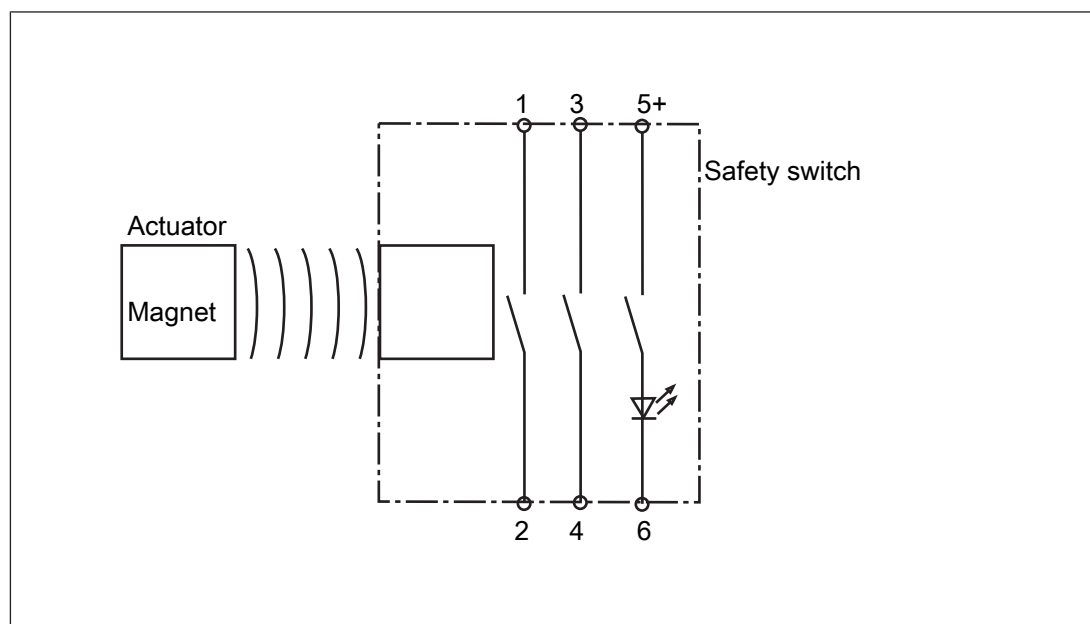
Function description

If the actuator is within the response range (safety gate closed), the safety contacts and the auxiliary contact on the safety switch will be closed and the LED will light.

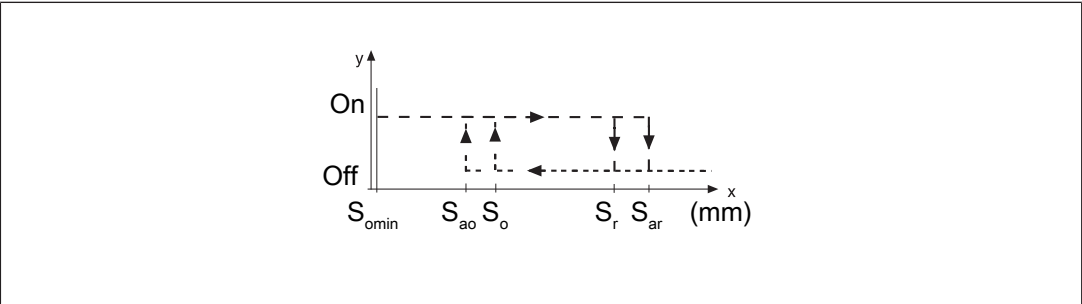
Operate the PSEN ma1.3a/b-20 in conjunction with the following components:

- ▶ Actuator PSEN ma1.3-08 or actuator PSEN ma1.3-12 (see [Order reference](#)  22]) and
- ▶ a connected evaluation device (see [Requirements and connection to evaluation devices](#)  11)).

Block diagram



Operating distances



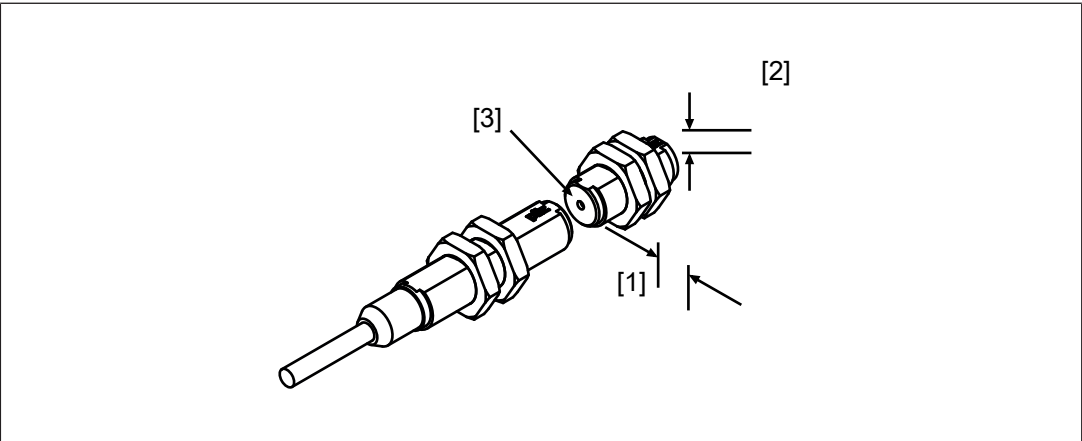
Legend

- S_{ao} Assured operating distance
- S_{omin} Min. operating distance
- S_{ar} Assured release distance

The offset-independent values for the switching distances are included in the [Technical details](#) [18].

Lateral and vertical offset

Actuator PSEN ma1.3-08



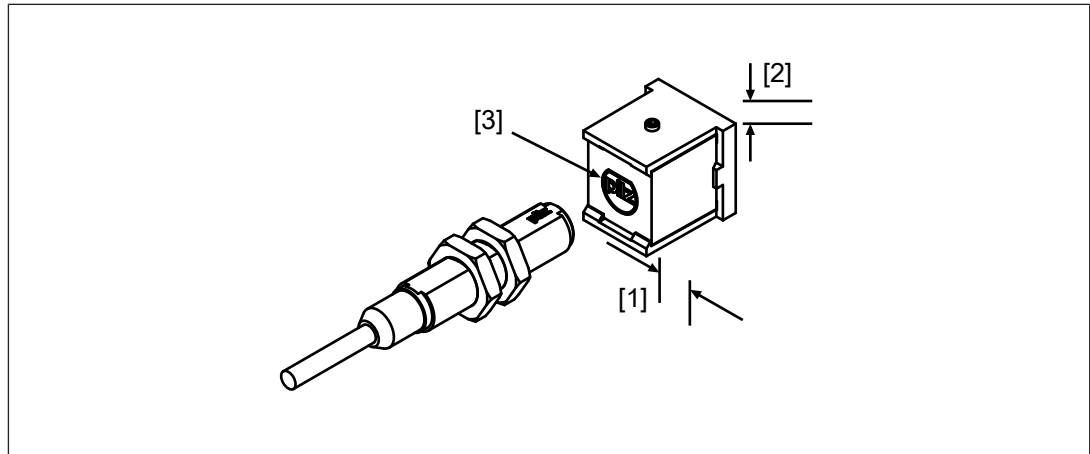
Legend

- [1] Lateral offset
- [2] Vertical offset
- [3] Sensing face

Assured operating distance S_{ao} in mm

Lateral offset	Vertical offset		
	0	2	4
0	8.0	7.0	5.5
2	7.0	6.0	4.0
4	6.0	5.0	3.0

The stated values are valid at a temperature of 20 °C.

Actuator PSEN ma1.3-12**Legend**

- [1] Lateral offset
- [2] Vertical offset
- [3] Sensing face

Assured operating distance S_{ao} in mm

Lateral offset	Vertical offset		
	0	1	2
0	12.0	10.0	8.0
2	12.0	10.0	8.0
4	11.0	9.5	7.5

The stated values are valid at a temperature of 20 °C.

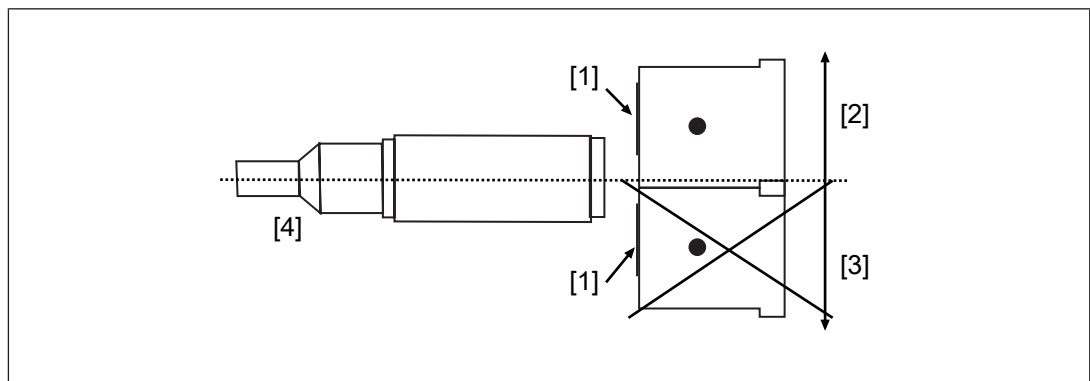
Negative vertical offset, not permitted

Fig.: Safety switch and square actuator - side view

Legend

- [1] Sensing face PSEN ma1.3-12
- [2] Positive vertical offset, permitted
- [3] Negative vertical offset, not permitted
- [4] Safety switch

Wiring

- ▶ Information given in the [Technical details](#) [18] must be followed.
- ▶ Calculation of the max. cable length l_{\max} in the input circuit:

$$l_{\max} = \frac{R_{l\max} - R_i}{R_l / \text{km}}$$

$R_{l\max}$ = Max. overall cable resistance (see evaluation device's technical details)

R_i = Internal resistance sensor (see [Technical details](#) [18])

R_l / km = Cable resistance/km of the cable (see technical details cable)

- ▶ Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- ▶ In the following cases, check the function that detects shorts across contacts prior to commissioning:
 - On evaluation devices with DC supply voltage: Overall cable resistance ≥ 15 Ohms per channel
 - On evaluation devices with AC supply voltage: Overall cable resistance ≥ 25 Ohms per channel
 - For details of how to perform the test for shorts across the contacts, please refer to the operating manual for the relevant evaluation device.

Pin assignment

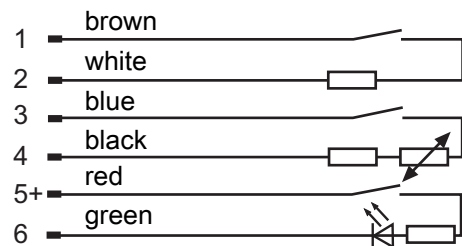


NOTICE

The colour marking for the connection lead only applies for the cable that Pilz supplies as an accessory

The safety switch is shown in an unoperated condition.

Layout of the 6-core cable



NOTICE

The auxiliary contact with LED

- may only be operated with a supply voltage of up to 24 VDC
- cannot be connected in series
- may **not** be used for safety circuits

Requirements and connection to evaluation devices

For use of PSEN ma1.3a/b-20 in accordance with DIN EN 60947-5-3 an evaluation device must be connected.

Connect the PSEN ma1.3a/b-20

- ▶ **either** with a certified Pilz evaluation device
- ▶ **or** with an evaluation device with defined properties

Certified Pilz evaluation devices are, for example:

- ▶ PNOZelog for safety gate monitoring
 - PNOZ e1p, PNOZ e1.1p, PNOZ e1vp
 - PNOZ e5.11p
 - PNOZ e6vp, PNOZ e6.1p
- ▶ PNOZpower for safety gate monitoring
 - PNOZ p1p, PNOZ p1vp
- ▶ PNOZsigma for safety gate monitoring:
 - PNOZ s3
 - PNOZ s4
 - PNOZ s5
- ▶ PNOZ X for safety gate monitoring
 - PNOZ X2, PNOZ X2.5P, PNOZ X2.7P, PNOZ X2.8P, PNOZ X2.9P, PNOZ X2C,
 - PNOZ X3, PNOZ X3.1, PNOZ X3P, PNOZ X3.10P
 - PNOZ X4
 - PNOZ X5, PNOZ X5J
 - PNOZ Ex
- ▶ PNOZmulti for safety gate monitoring

Configure the switch in the PNOZmulti Configurator with switch type 3.
- ▶ PSS for safety gate monitoring with standard function block SB064, SB066 or FS_Safety Gate
- ▶ PSSuniversal PLC for safety gate monitoring with function block FS_SafetyGate

A full list of the certified Pilz evaluation devices (type examination certificate) is available in the download area (<http://www.pilz.com/support/downloads>).

The correct connection to the respective evaluation device is described in the operating manual for the evaluation device. Make sure that the connection is made in accordance with the specifications in the operating manual for the selected evaluation device.

Defined properties of evaluation devices:

- ▶ 2-channel with feasibility monitoring
- ▶ Open circuit monitoring of the safety switch is performed
- ▶ The inputs and outputs of the evaluation device must fulfil the requirements of IEC 61131

- ▶ Technical data of the evaluation device must fulfil the requirements in the [Technical details \[18\]](#) of PSEN ma1.3a/b-20
 - Always comply with the max. switching current safety contacts of PSEN ma1.3a/b-20.
- ▶ Outputs at the evaluation device must only be switched on again when both reed contacts at the safety switch have been opened and closed (partial operation lock)



INFORMATION

Risk time in accordance with DIN EN 60947-5-3

The risk time is made up of the reaction time of the sensor (see [Technical details \[18\]](#)) and the processing and delay times of the evaluation device (s. operating manual for the relevant evaluation device).

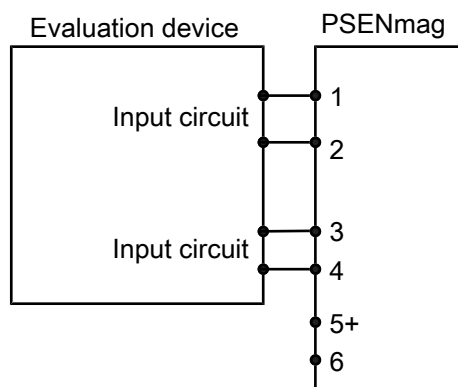
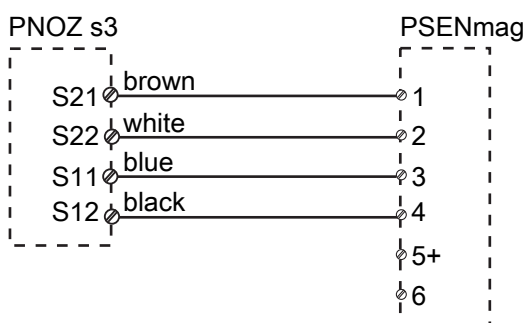
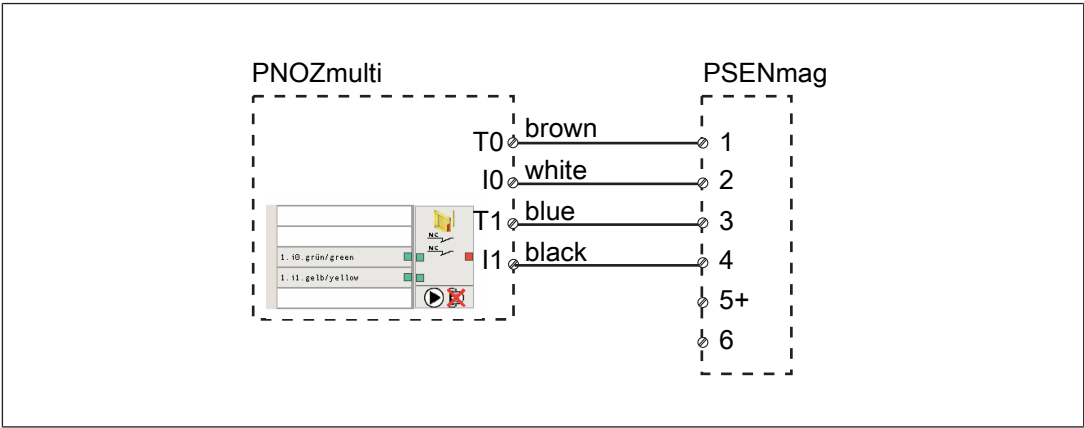


Fig.: Dual-channel connection PSEN ma1.3a/b-20 to the input circuits of an evaluation device

Examples for connection to Pilz evaluation devices:





Auxiliary contact with LED

The auxiliary contact and the LED indicate the status of the safety contacts.

Actuator in the response range	Safety contacts and auxiliary contact	LED	
Yes	Closed		lights
No	Open	•	Off

<p>PSENmag</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>24 V — 5+</p> <p>GND — 6</p>		<p>PSENmag</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>24 V — 5+</p> <p>PLC — 6</p>	
Connecting the auxiliary contact to an evaluation device		Connecting the auxiliary contact to a PLC	

Installation

- ▶ The unit can be installed in any position. Safety switches and actuators must be installed so that the bevelled surface on the safety switch and the bevelled surface of the actuator face each other precisely.
- ▶ The safety switch and actuator should only be secured using screws and nuts made of non-magnetic material (e.g. brass).
- ▶ If possible, do not install the safety switch and actuator on to ferromagnetic material. Changes to the operating distances are to be expected.

**CAUTION!**

Potential loss of safety function due to changed device properties

The unit's properties may be affected if installed in an environment containing electrically or magnetically conductive material.

- Please check the operating distances and the assured release distance.

**CAUTION!**

Possible loss of the safety function by changing the release distance S_{ar} with non-flush installation

Installing the safety switch non-flush within electrically or magnetically conductive material, the value for the assured release distance S_{ar} can change.

- Check the assured release distance S_{ar} .

- ▶ Safety switches and actuators must be positioned so that they are secured against a change of position.
- ▶ Avoid the risk of damages from foreseeable external influences by attaching the safety switch and actuator. If necessary, safety switch and actuator have to be protected.

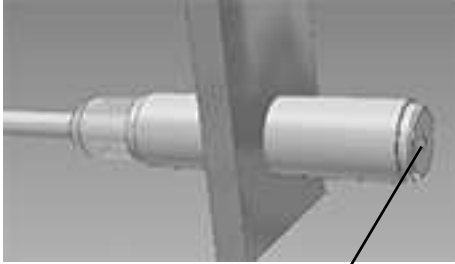
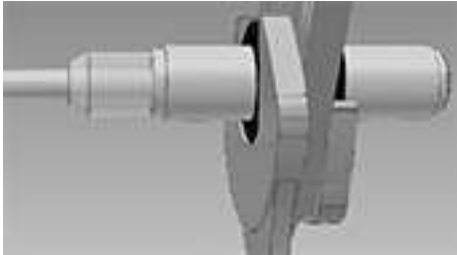
**INFORMATION**

The actuator should be protected from unauthorised removal and from contamination.


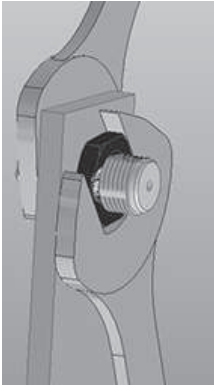
- ▶ Prevent self-loosening of the fastening elements of safety switch and actuator.
- ▶ The fastening of safety switch and actuator has to be sufficiently stable to ensure the proper operation of the safety switch and the actuator.
- ▶ The distance between two safety switches must be maintained (see [Technical details](#) [18]).
- ▶ Safety switches and actuators
 - Should be kept away from iron swarf
 - Should not be exposed to strong magnetic fields
 - Should be used for fixed wiring only
- ▶ Prevent the safety switch and actuator being exposed to heavy shock or vibration
- ▶ Make sure that the safety switch and actuator cannot be used as an end stop.
- ▶ Circumvention of the safety switch in a reasonably foreseeable manner must be prevented.
- ▶ Please note the installation measures in accordance with EN ISO 14119 for a proximity switch design 4 and with level of coding Low
- ▶ Alignment errors of the guard must not adversely affect the safety function of the guard.

- ▶ The assured operating distance S_{ao} and the assured release distance S_{ar} must be tested under real conditions.


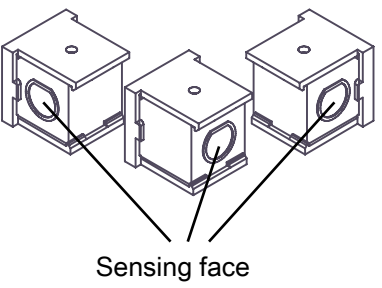


Installation of safety switch

 <p>Sensing face</p>	<p>Slide the switch through the hole in the mounting surface with the sensing face towards the actuator.</p>
	<p>Attach the switch using 2 M12 hexagonal nuts.</p> <p>Also note the max. torque setting (see Technical details [18]).</p>




Installation with actuator PSEN ma1.3-08

 <p>Sensing face</p>	<p>Slide the actuator through the hole in the mounting surface with the sensing face towards the safety switch.</p>
	<p>Attach the actuator using 2 M12 hexagonal nuts.</p> <p>Also note the max. torque setting (see Technical details [18]).</p>

Installation with actuator PSEN ma1.3-12

	<p>Attach the bracket using countersunk screws (M4).</p>
 <p>Sensing face</p>	<p>The sensing face at the actuator is marked by a circle with a bevelled surface in the shape of the safety switch. The sensing face can be aligned in 3 directions depending on the direction of actuation. Slide the actuator on to the bracket in the required direction of actuation until the actuator clicks into place.</p>
	<p>The actuator should be secured using a set screw M3 x 6 mm DIN 319 (supplied with the device).</p> <p>Also note the low max. torque setting (see Technical details  18]).</p>

Adjustment

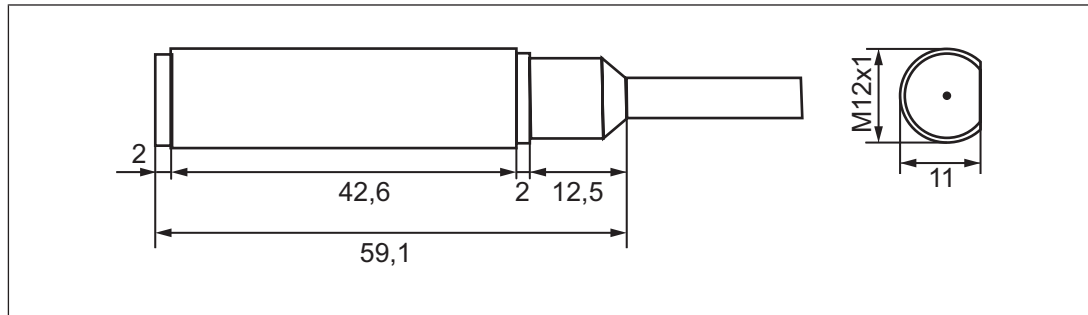
- ▶ The safety switch may only be used with the corresponding actuator PSEN ma1.3-08 or PSEN ma1.3-12.
- ▶ Always test the function with a connected evaluation device.
- ▶ The stated operating distances (see [Technical details](#)  18]) only apply when the safety switch and actuator are installed according to the specifications [Installation](#)  14]. Operating distances may deviate if other arrangements are used. Note the maximum permitted lateral and vertical offset (see [Operating distances and Lateral and vertical offset](#)  8]).

Periodic test

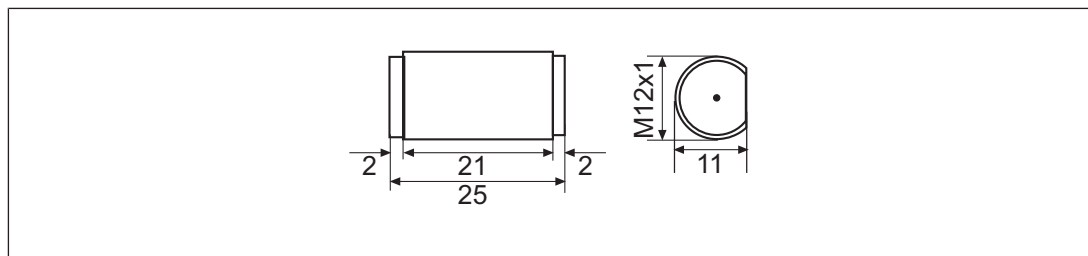
- ▶ Carry out a monthly function test on the safety switch and actuator.
- ▶ Always test the function with a connected evaluation device.
- ▶ The safety function may only be checked by qualified personnel.

Dimensions in mm

Safety switch



Actuator PSEN ma1.3-08



Actuator PSEN ma1.3-12

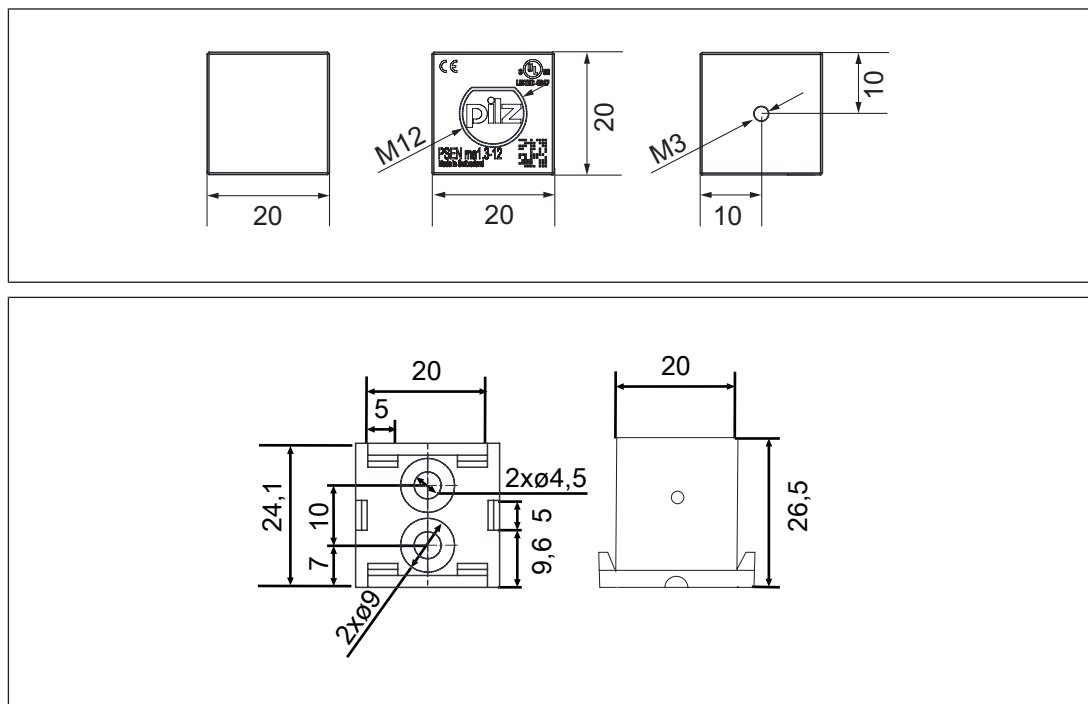


Fig.: Actuator holder

Technical details order no. 506220, 506230

General	506220	506230
Approvals	CE, EAC (Eurasian), ECOLAB, TÜV, cULus Listed	CE, EAC (Eurasian), ECOLAB, TÜV, UL/cUL, cULus Listed
Sensor's mode of operation	Magnetic	Magnetic
Coding level in accordance with EN ISO 14119	Low	Low
Design in accordance with EN ISO 14119	4	4
Classification in accordance with EN 60947-5-3	PDDb	PDDb
Electrical data	506220	506230
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Supply voltage		
Max. current	150 mA	150 mA
Max. switching frequency	1 Hz	1 Hz
Switching voltage	24 V	24 V
Internal resistance	10 Ohm	10 Ohm
Max. switching current, safety contacts	0,2 A	0,2 A
Max. breaking capacity, safety contacts	5 W	5 W
Max. switching current, auxiliary contacts	10 mA	10 mA
Semiconductor outputs	506220	506230
Lowest operating current	1 mA	1 mA
Times	506220	506230
Reaction time (actuator removed)	2 ms	2 ms
Environmental data	506220	506230
Ambient temperature		
Temperature range	-25 - 70 °C	-25 - 70 °C
Climatic suitability		
In accordance with the standard	IEC 60068-2-30	IEC 60068-2-30
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Max. operating height above sea level	2000 m	2000 m
EMC	EN 60947-5-3	EN 60947-5-3
Vibration		
In accordance with the standard	EN 60947-5-2	EN 60947-5-2
Frequency	10 - 55 Hz	10 - 55 Hz
Amplitude	1 mm	1 mm

Environmental data	506220	506230
Shock stress		
Acceleration	30g	30g
Duration	11 ms	11 ms
Airgap creepage		
Pollution degree	3	3
Rated insulation voltage	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV
Protection type		
Housing	IP67	IP67
Mechanical data	506220	506230
Actuator 1	PSEN ma1.3-08	PSEN ma1.3-12
Typ. Hysteresis	2 mm	2,5 mm
Operating distances		
Assured operating distance Sao	8 mm	12 mm
Min. operating distance Somin	0,5 mm	0,5 mm
Typical operating distance So	10 mm	14 mm
Assured release distance Sar	15 mm	25 mm
Typical release distance Sr	12 mm	16 mm
Repetition accuracy switching distances	5 %	5 %
Min. distance between safety switches	25 mm	35 mm
Sensor flush installation in accordance with EN 60947-5-2	Yes, follow installation guidelines	Yes, follow installation guidelines
Connection type	5 m cable	5 m cable
Cable	LiY11Y 6 x 0,25 mm²	LiY11Y 6 x 0,25 mm²
Material		
Top	PBT	PBT
Max. torque setting		
Safety switch	3 Nm	3 Nm
Actuator 1	3 Nm	0,1 Nm
Dimensions		
Height	11 mm	11 mm
Width	12 mm	12 mm
Depth	59,1 mm	59,1 mm
Actuator dimensions		
Height	11 mm	20 mm
Width	12 mm	20 mm
Depth	25 mm	20 mm
Weight of safety switch	185 g	185 g
Weight of actuator	11 g	26 g
Weight	196 g	211 g

Where standards are undated, the 2015-09 latest editions shall apply.

Technical details order no. 506222, 506232

General	506222	506232
Approvals	CE, EAC (Eurasian), ECOLAB, TÜV, cULus Listed	CE, EAC (Eurasian), ECOLAB, TÜV, UL/cUL, cULus Listed
Sensor's mode of operation	Magnetic	Magnetic
Coding level in accordance with EN ISO 14119	Low	Low
Design in accordance with EN ISO 14119	4	4
Classification in accordance with EN 60947-5-3	PDDb	PDDb
Electrical data	506222	506232
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Supply voltage		
Max. current	150 mA	150 mA
Max. switching frequency	1 Hz	1 Hz
Switching voltage	24 V	24 V
Internal resistance	10 Ohm	10 Ohm
Max. switching current, safety contacts	0,2 A	0,2 A
Max. breaking capacity, safety contacts	5 W	5 W
Max. switching current, auxiliary contacts	10 mA	10 mA
Semiconductor outputs	506222	506232
Lowest operating current	1 mA	1 mA
Times	506222	506232
Reaction time (actuator removed)	2 ms	2 ms
Environmental data	506222	506232
Ambient temperature		
Temperature range	-25 - 70 °C	-25 - 70 °C
Climatic suitability		
In accordance with the standard	IEC 60068-2-30	IEC 60068-2-30
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Max. operating height above sea level	2000 m	2000 m
EMC	EN 60947-5-3	EN 60947-5-3
Vibration		
In accordance with the standard	EN 60947-5-2	EN 60947-5-2
Frequency	10 - 55 Hz	10 - 55 Hz
Amplitude	1 mm	1 mm

Environmental data	506222	506232
Shock stress		
Acceleration	30g	30g
Duration	11 ms	11 ms
Airgap creepage		
Pollution degree	3	3
Rated insulation voltage	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV
Protection type		
Housing	IP67	IP67
Mechanical data	506222	506232
Actuator 1	PSEN ma1.3-08	PSEN ma1.3-12
Typ. Hysteresis	2 mm	2,5 mm
Operating distances		
Assured operating distance Sao	8 mm	12 mm
Min. operating distance Somin	0,5 mm	0,5 mm
Typical operating distance So	10 mm	14 mm
Assured release distance Sar	15 mm	25 mm
Typical release distance Sr	12 mm	16 mm
Repetition accuracy switching distances	5 %	5 %
Min. distance between safety switches	25 mm	35 mm
Sensor flush installation in accordance with EN 60947-5-2	Yes, follow installation guidelines	Yes, follow installation guidelines
Connection type	10 m cable	10 m cable
Cable	LiY11Y 6 x 0,25 mm²	LiY11Y 6 x 0,25 mm²
Material		
Top	PBT	PBT
Max. torque setting		
Safety switch	3 Nm	3 Nm
Actuator 1	3 Nm	0,1 Nm
Dimensions		
Height	11 mm	11 mm
Width	12 mm	12 mm
Depth	59,1 mm	59,1 mm
Actuator dimensions		
Height	11 mm	20 mm
Width	12 mm	20 mm
Depth	25 mm	20 mm
Weight of safety switch	360 g	360 g
Weight of actuator	11 g	26 g
Weight	371 g	386 g

Where standards are undated, the 2015-09 latest editions shall apply.

Safety characteristic data



NOTICE

You must comply with the safety-related characteristic data in order to achieve the required safety level for your plant/machine.

Safety characteristic data

B10d in accordance with EN ISO 13849-1: 2015 and EN 62061	7.300.000
TM [year] in accordance with EN ISO 13849-1:2015	20

Order reference

System

Product type	Features	Connection type	Order no.
PSEN ma1.3a-20/ PSEN ma1.3-08/8mm/1 unit	Magnetic safety switch, actuator with assured operating distance 8 mm	Cable, 5 m	506 220
PSEN ma1.3a-20/ PSEN ma1.3-12/12mm/ 1unit	Magnetic safety switch, actuator with assured operating distance 12 mm	Cable, 5 m	506 230
PSEN ma1.3b-20/ PSEN ma1.3-08/8mm/1 unit	Magnetic safety switch, actuator with assured operating distance 8 mm	Cable, 10 m	506 222
PSEN ma1.3b-20/ PSEN ma1.3-12/12mm/1unit	Magnetic safety switch, actuator with assured operating distance 12 mm	Cable, 10 m	506 232
PSEN ma1.3a-20/1switch	Magnetic safety switch	Cable, 5 m	526 120
PSEN ma1.3b-20/1switch	Magnetic safety switch	Cable, 10 m	526 122
PSEN ma1.3-08/1actu- ator	Actuator with assured operating distance 8 mm		516 120
PSEN ma1.3-12/1actu- ator	Actuator with assured operating distance 12 mm		516 130

Accessories

Product type	Features	Order no.
PSEN/PDP67 M12-8sm screw terminals	8-pin M12 connector with screw terminals	540 334

EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC for machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

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