

► PSEN ma1.3n-20

PILZ

THE SPIRIT OF SAFETY

Operating Manual-22176-EN-11

- PSEN sensor technology



This document is the original document.

Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

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SD means Secure Digital

Introduction	4
Validity of documentation	4
Using the documentation	4
Definition of symbols	4
Safety	5
Intended use	5
Safety regulations	5
Safety assessment	5
Use of qualified personnel	6
Warranty and liability	6
Disposal	6
For your safety	7
Unit features	7
Function description	7
Block diagram	8
Operating distances	8
Lateral and vertical offset	9
Wiring	11
Pin assignment	11
Requirements and connection to evaluation devices	12
Installation	15
Adjustment	18
Periodic test	18
Dimensions in mm	19
Technical details	20
Safety characteristic data	22
Order reference	22
System	22
Accessories	22
EC declaration of conformity	24
UKCA-Declaration of Conformity	24

Introduction

Validity of documentation

This documentation is valid for the product PSEN ma1.3n-20/with cube. 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:

- The safety contacts open when the actuator is removed beyond the assured release distance s_{ar} or when the actuator is not detected.

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](#) [12]).

Improper use

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 operating manual,
- Use of the product outside the technical details (see chapter entitled [Technical Details](#) [20]).



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 device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with EN ISO 13849 and EN IEC 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, de-commissioned and maintained by persons who are competent to do so.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with the state of the art and the applicable national, European and international laws, directives and standards.

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 the section entitled Safety
- ▶ 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 stated 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 substitute actuators are used, these must be installed as described under [Installation](#) [15].
- If the original actuators are replaced with substitute actuators, the original actuators must be destroyed before disposal.

- ▶ Do not remove the connector's protective cap until you are just about to connect the product. This will prevent potential contamination.

Unit features

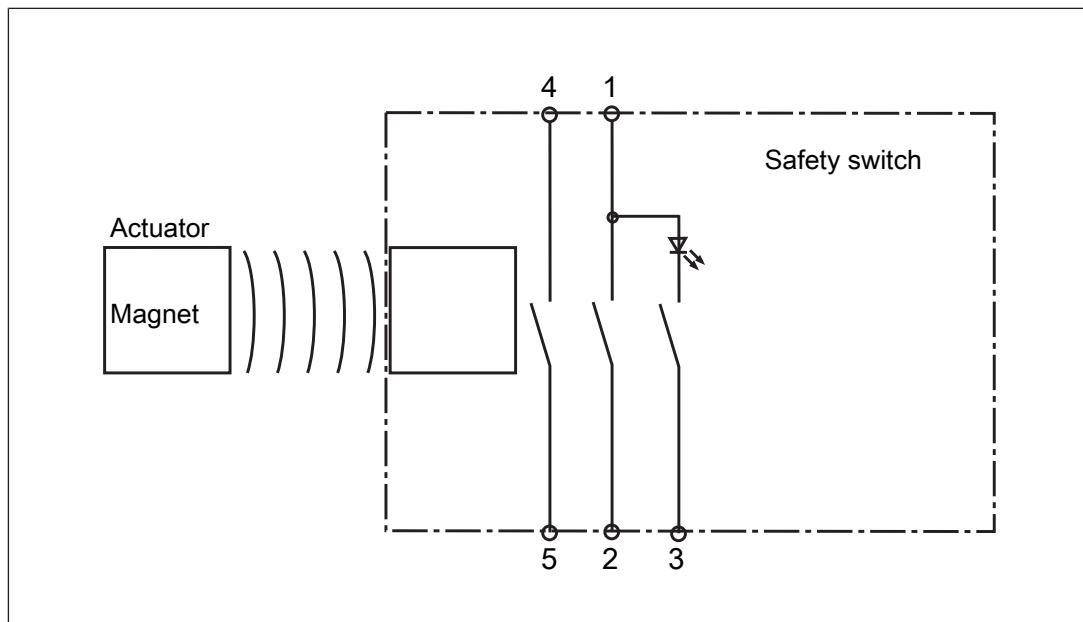
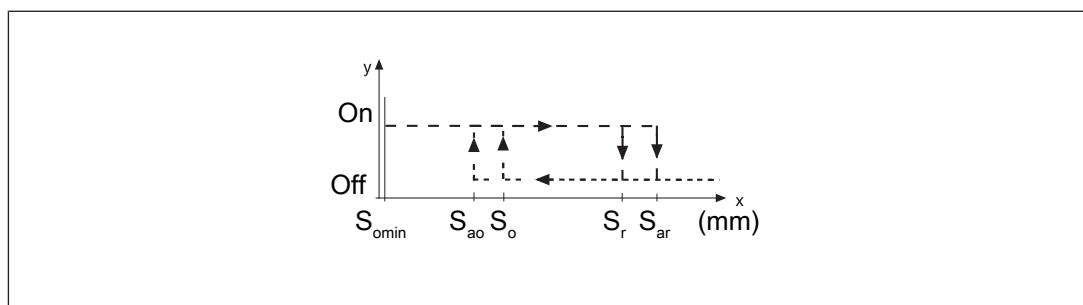
- ▶ The actuator PSEN ma1.3-08 or PSEN ma1.3-12 belongs to the safety switch.
- ▶ Coded actuator
- ▶ Safety switch with 5-pin M12 male connector
- ▶ 2 safety contacts (reed contacts - N/O)
- ▶ 1 auxiliary contact (N/O)
- ▶ Different operating distances depending on the actuator see [Technical details](#) [20]
- ▶ 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 ma1.3n-20/with cube 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](#) [12]).

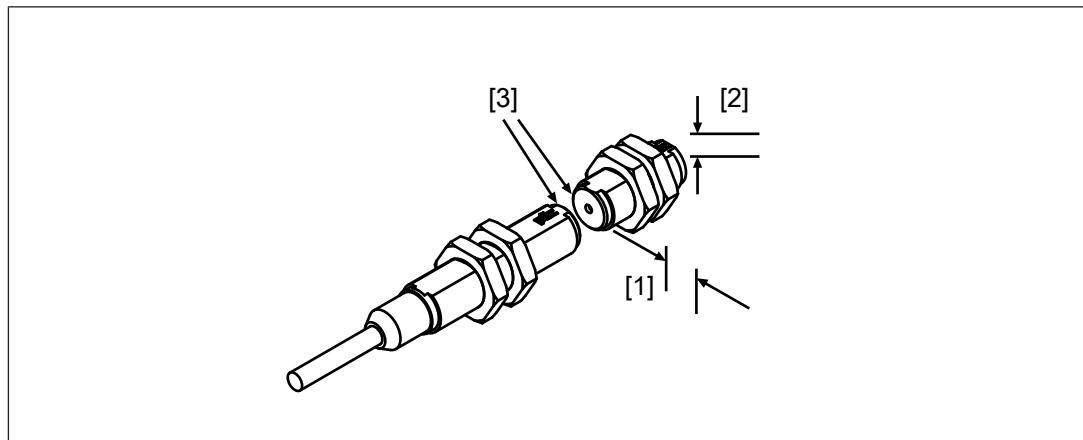
Block diagram**Operating distances****Legend**

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](#) [20].

Lateral and vertical offset**Actuator PSEN ma1.3-08****Legend**

[1] Lateral offset

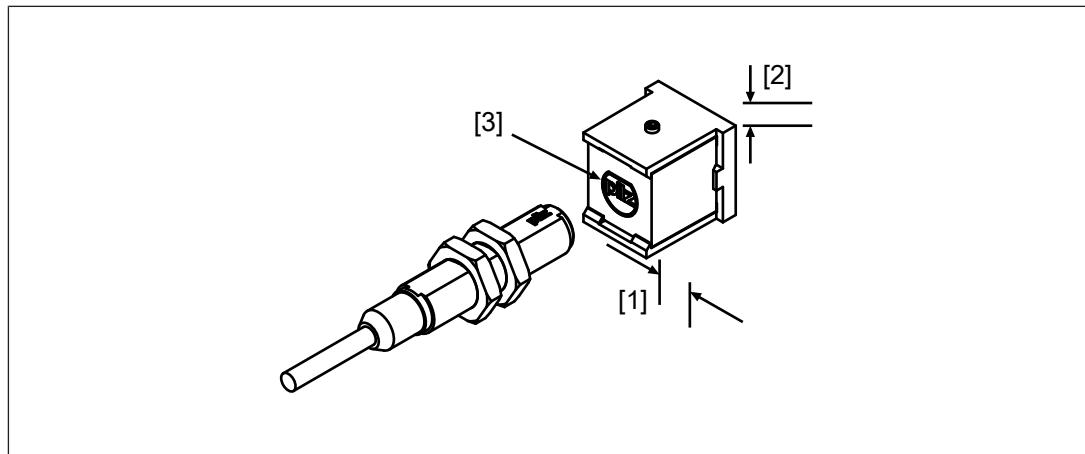
[2] Vertical offset

[3] Sensing faces

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.

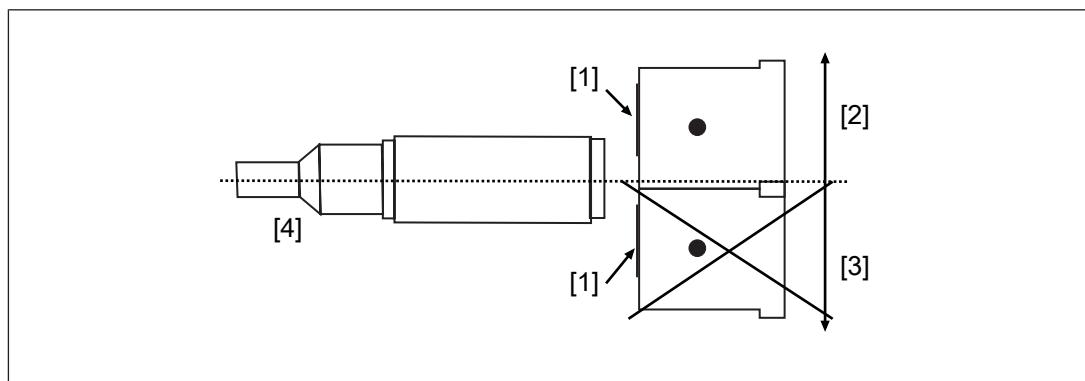
Negative vertical offset, not permitted

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](#) [20] must be followed.

► Calculation of the max. cable length l_{max} :

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

R_{lmax} = Max. overall cable resistance (see evaluation device's technical details)

R_i = Internal resistance sensor (see [Technical details](#) [20])

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

► Ensure the wiring and EMC requirements of EN 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.

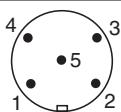
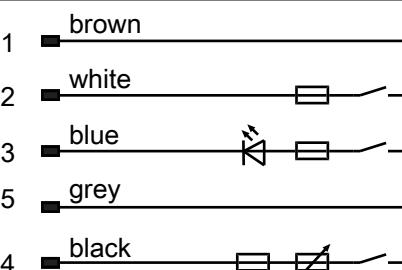
Pin assignment



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.

Assignment of the 5-pin connector		
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NOTICE

The auxiliary contact

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

Requirements and connection to evaluation devices

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

Connect the PSEN ma1.3n-20/with cube

- ▶ **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

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
- ▶ Inputs and outputs on the evaluation device must fulfil the requirements of IEC 61131, Type 3
- ▶ Technical data of the evaluation device must fulfil the requirements in the [Technical details](#) [20] of PSEN ma1.3n-20/with cube
 - Always comply with the max. switching current safety contacts of PSEN ma1.3n-20/with cube.
- ▶ 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](#) [20]) and the processing and delay times of the evaluation device (s. operating manual for the relevant evaluation device).

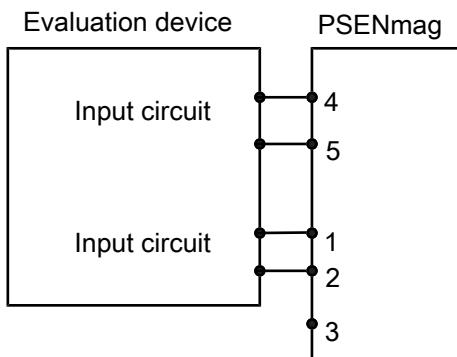
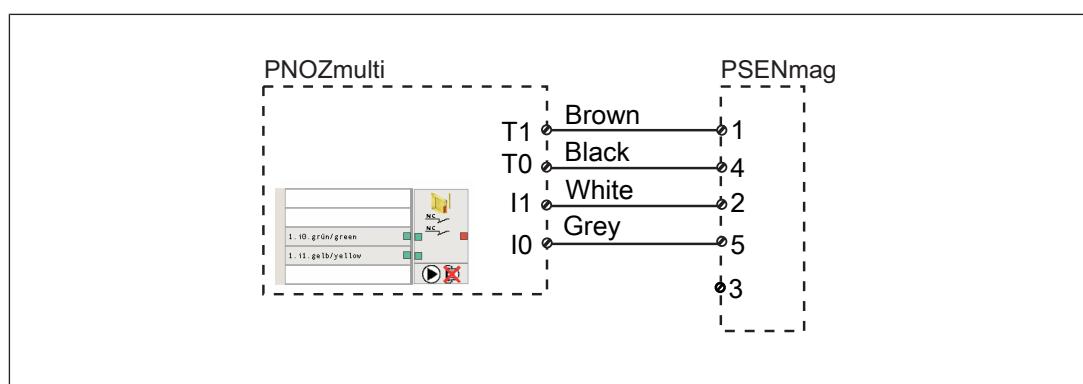
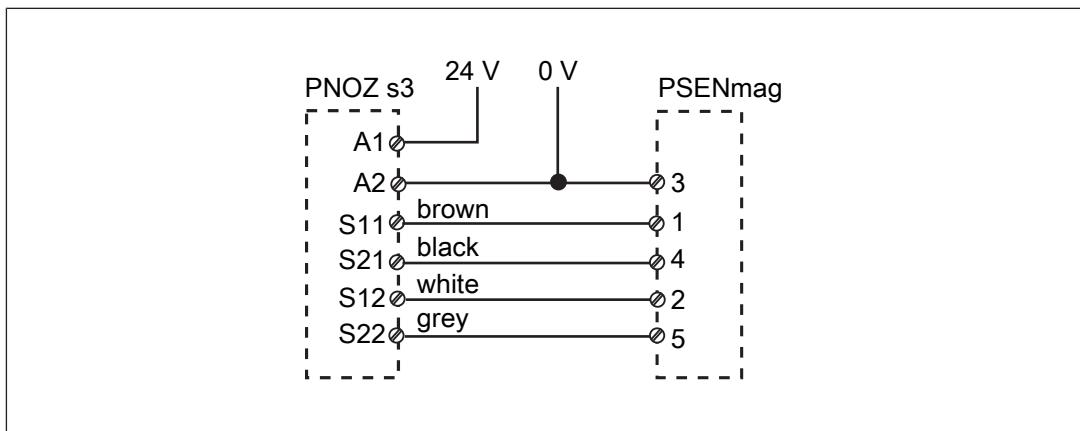


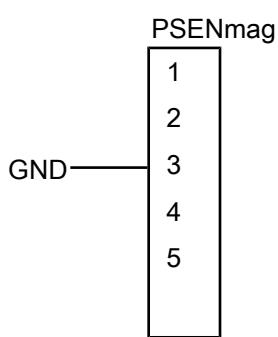
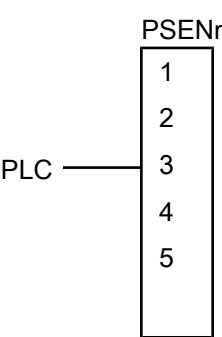
Fig.: Dual-channel connection PSEN ma1.3n-20/with cube to the input circuits of an evaluation device

Examples for connection to Pilz evaluation devices:**Legend**

- I0 Input OSSD
- I1 Input OSSD
- T0 Test pulse output
- T1 Test pulse output

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
		
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.



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.
- ▶ Attach the safety switches and actuators only with the supplied nuts.
- ▶ 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.

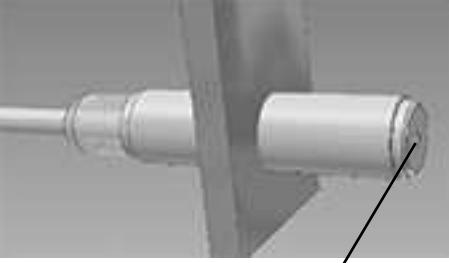


INFORMATION

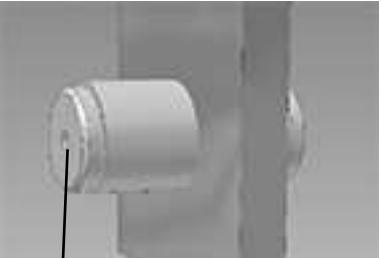
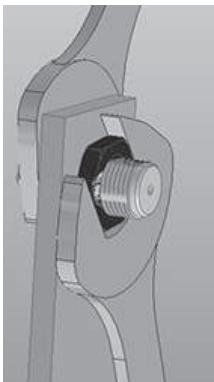
Protect the actuator from unauthorised removal (e.g. via a screw lock or concealed installation) and from contamination.

- ▶ 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](#) [20]).
- ▶ Safety switches and actuators
 - Should be kept away from iron swarf
 - Should not be exposed to strong magnetic fields
- ▶ 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 type 4 with coding level 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.
- ▶ Do not apply any installation tools (e.g. Pliers) on the surfaces of the switch.
- ▶ If possible, do not install the safety switch and actuator on to ferromagnetic material. Changes to the operating distances are to be expected.
- ▶ Protect the safety switch and actuator from UV light or direct sunlight.
- ▶ The protection type (see [Technical details](#) [20]) can only be achieved by using the Pilz connection leads available as an accessory.

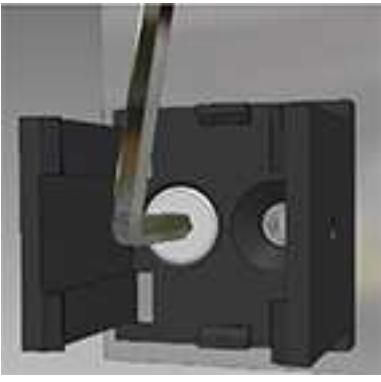
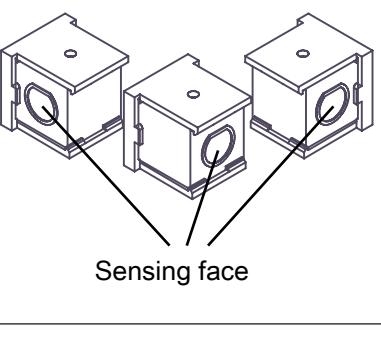
Installation of safety switch

 Sensing face	Slide the switch through the hole in the mounting surface with the sensing face towards the actuator.
	Attach the switch using 2 M12 hexagonal nuts with special threads. Note the max. torque setting (see Technical details [20]).

Installation with actuator PSEN ma1.3-08

 Sensing face	Slide the actuator through the hole in the mounting surface with the sensing face towards the safety switch.
	Attach the actuator using 2 M12 hexagonal nuts with special threads. Note the max. torque setting (see Technical details [20]).

Installation with actuator PSEN ma1.3-12

	<p>Attach the bracket using countersunk screws (M4).</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). Also note the low max. torque setting (see Technical details [15]).</p>

Adjustment

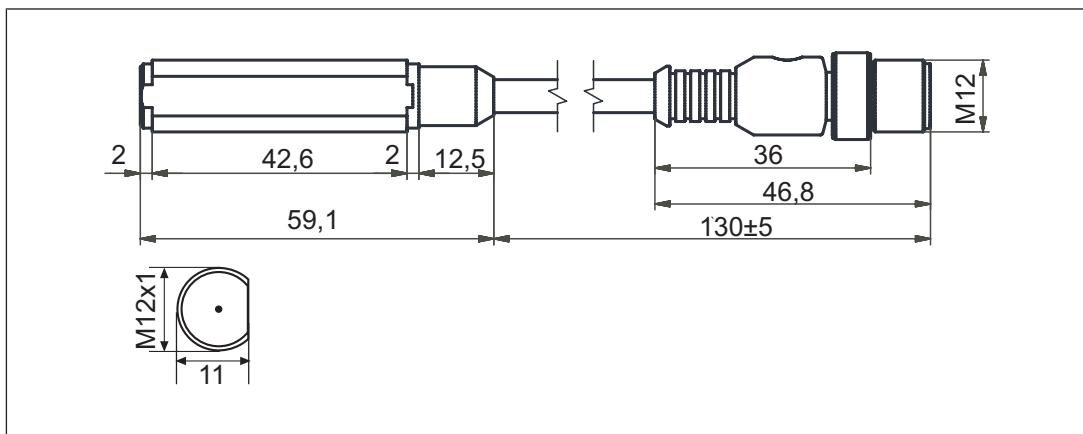
- ▶ The safety switch may only be used with the corresponding actuator PSEN ma1.3-08 or PSEN ma1.3-12.
- ▶ Always test the function with a connected evaluation device.
- ▶ The stated operating distances (see [Technical details \[15\]](#)) only apply when the safety switch and actuator are installed according to the specifications in [Installation \[15\]](#). 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

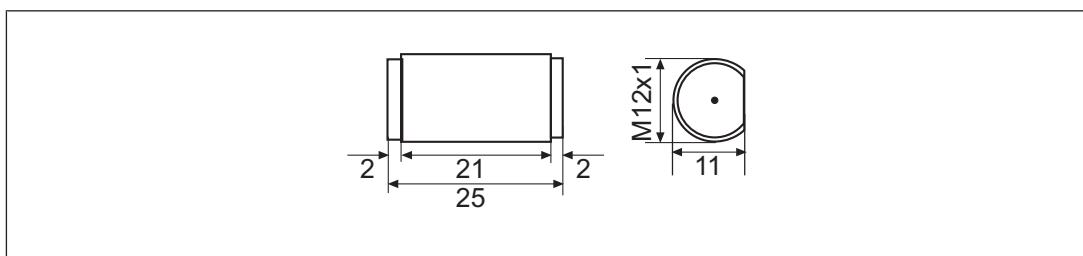
- ▶ Carry out a monthly function test on the safety switch and actuator.
- ▶ Always test the function with a connected evaluation device.
- ▶ The safety function may only be checked by qualified personnel.

Dimensions in mm

Safety switch



Actuator PSEN ma1.3-08



Actuator PSEN ma1.3-12

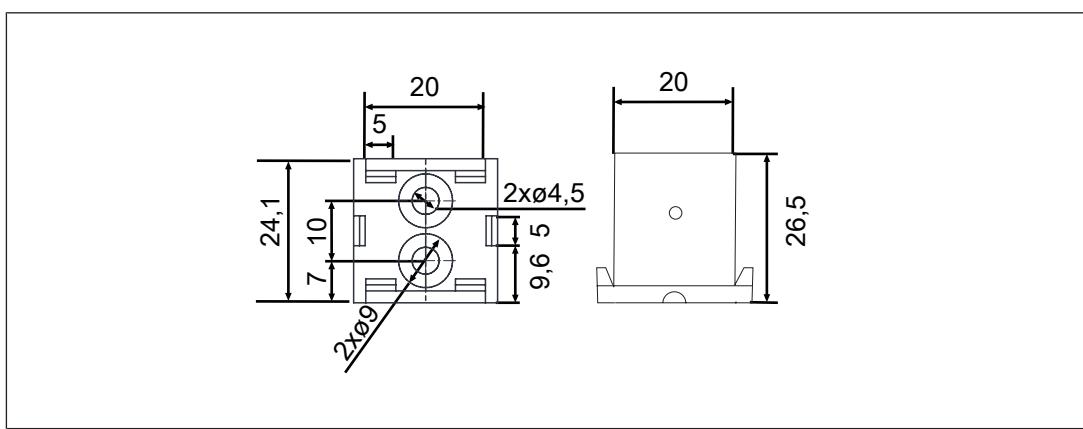
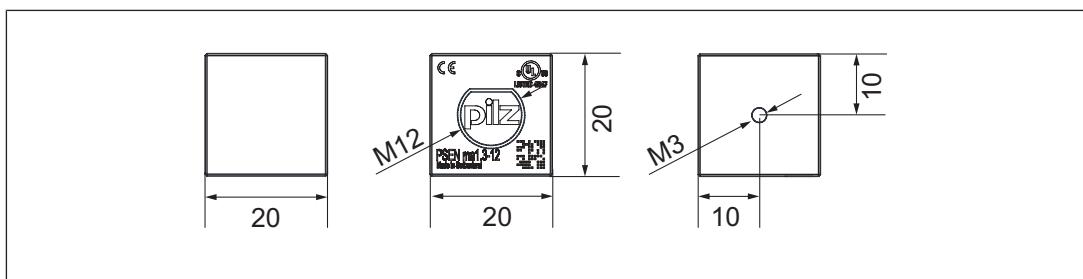


Fig.: Actuator holder

Technical details

Where standards are undated, the 2023-12 valid editions apply.

General	506228	506238
Certifications	CE, EAC, TÜV, UKCA, cULus Listed	CE, EAC, TÜV, UKCA, 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	506228	506238
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
Lowest operating current (Im)	1 mA	1 mA
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
Times	506228	506238
Reaction time (actuator removed)	2 ms	2 ms
Environmental data	506228	506238
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 SL	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	506228	506238
Shock stress		
Acceleration	30g	30g
Duration	11 ms	11 ms
Airgap creepage		
Pollution degree	3	3
Rated insulation voltage	125 V	125 V
Rated impulse withstand voltage	1,5 kV	1,5 kV
Protection type		
Housing	IP65	IP65
Connectors	IP67	IP67
Operating distances	506228	506238
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 %
Mechanical data	506228	506238
Actuator 1	PSEN ma1.3-08	PSEN ma1.3-12
Typ. hysteresis	2 mm	2,5 mm
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	M12, 5-pin male connector	M12, 5-pin male connector
Cable	Li9Y11Y 8 x 0.14 mm²	Li9Y11Y 8 x 0.14 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	11 mm
Width	12 mm	12 mm
Depth	25 mm	25 mm
Weight of safety switch	20 g	20 g
Weight of actuator	11 g	26 g
Weight	30 g	42 g

Safety characteristic data

Operating mode	B10d in accordance with EN ISO TM [year] in accordance with EN 13849-1:2023 and EN 62061	ISO 13849-1:2023
Sensor, 2-ch, $\leq 5\text{mA}$	50.000.000	20
Sensor, 2-ch, $5\text{mA} < I \leq 60\text{ mA}$	8.500.000	20
Sensor, 2-ch, $> 60\text{ mA}$	4.000.000	20

**NOTICE**

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

Order reference**System**

Product type	Features	Connection type	Order no.
PSEN ma1.3n-20/ PSEN ma1.3-08/8mm/ 1unit	Magnetic safety switch, round actuator, with assured operating distance 8 mm	5-pin M12 connector	506228
PSEN ma1.3n-20/ PSEN ma1.3-12/12mm/ 1unit	Magnetic safety switch, actuator cube, with assured operating distance 12 mm	5-pin M12 connector	506238
PSEN ma1.3n-20/1switch	Magnetic safety switch	5-pin M12 connector	526128
PSEN ma1.3-08/1actuator	Actuator with assured operating distance 8 mm		516120
PSEN ma1.3-12/1actuator	Actuator with assured operating distance 12 mm		516130

Accessories**Cable**

Product type	Features	Connector X1	Connector X2	Connector X3	Order no.
PSEN op cable axial M12 5-pole 3m	3 m	M12, 5-pin female connector, straight			630310
PSEN op cable axial M12 5-pole 5m	5 m	M12, 5-pin female connector, straight			630311
PSEN op cable axial M12 5-pole 10m	10 m	M12, 5-pin female connector, straight			630312
PSEN cable M12-5sf 20m	20 m	M12, 5-pin female connector, straight			630298

Product type	Features	Connector X1	Connector X2	Connector X3	Order no.
PSEN op cable axial M12 5-pole 30m	30 m	M12, 5-pin female connector, straight			630297
PSEN op cable angle M12 5-pole 3m	3 m	M12, 5-pin female connector, angled			630347
PSEN op cable angle M12 5-pole 5m	5 m	M12, 5-pin female connector, angled			630348
PSEN op cable angle M12 5-pole 10m	10 m	M12, 5-pin female connector, angled			630349
PSEN op cable angle M12 5-pole 30m	30 m	M12, 5-pin female connector, angled			630350
PSS67 Cable M12sf M12sm, 3m	3 m	M12, 5-pin female connector, straight	M12, 5-pin male connector, straight		380208
PSS67 Cable M12sf M12sm, 5m	5 m	M12, 5-pin female connector, straight	M12, 5-pin male connector, straight		380209
PSS67 Cable M12sf M12sm, 10m	10 m	M12, 5-pin female connector, straight	M12, 5-pin male connector, straight		380210
PSS67 cable M12-5sf, M12-5sm, 20m	20 m	M12, 5-pin female connector, straight	M12, 5-pin male connector, straight		380220
PSS67 Cable M12sf M12sm, 30m	30 m	M12, 5-pin female connector, straight	M12, 5-pin male connector, straight		380211
PSS67 Cable M12af M12am, 3m	3 m	M12, 5-pin female connector, angled	M12, 5-pin male connector, angled		380212
PSS67 Cable M12af M12am, 5m	5 m	M12, 5-pin female connector, angled	M12, 5-pin male connector, angled		380213
PSS67 Cable M12af M12am, 10m	10 m	M12, 5-pin female connector, angled	M12, 5-pin male connector, angled		380214
PSS67 Cable M12af M12am, 30m	30 m	M12, 5-pin female connector, angled	M12, 5-pin male connector, angled		380215

Input module

Product type	Features	Order no.
PDP67 F 8DI ION	Decentralised input module IP67 for PNOZmulti	773600

EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC on 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.

Representative: Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

UKCA-Declaration of Conformity

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.

The complete UKCA Declaration of Conformity is available on the Internet at www.pilz.com/downloads.

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► Support

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We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.

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