PSEN cs5.1n

PSEN sensor technology

Operating Manual-1003427-EN-01

Introduction

Validity of documentation

This documentation is valid for the product PSEN cs5.1n. 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 functions of the safety switch are:

- safe detection of the presence of the actuator
- 2 safety outputs, each of which supply a high signal when the actuator is in the switch's response range.

The safety switch meets the requirements in accordance with:

- EN 60947-5-3 with the actuator PSEN cs5.1 M12 : PDDB
- EN 62061: SIL CL 3
- EN ISO 13849-1: PL eCat. 4
- EN ISO 14119

The safety switch may only be used with the corresponding actuator PSEN cs5.1 M12.

The safety level PL e (Cat. 4)/SIL CL 3 is only achieved if

- the safety outputs use 2-channel processing.

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 chapter entitled "Technical Details").

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

DANGER!

Risk to life due to manipulation / defeat of the safeguard

If replacement actuators are obtained, these must be installed as described in the chapter entitled Installation [16].
If replacement actuators are used manipulatively or the function of the safeguard is defeated, there is a risk to life when operating the plant or machine! This must be considered in the operator's hazard assessment and the operator must define appropriate measures to exclude manipulation.

- Do not remove the protective cap until you are just about to connect the unit. This will prevent potential contamination.

Unit features

- Transponder technology for presence detection (safety function)
- Coding: coded (measure to minimise defeat possibilities in accordance with ISO 14119)
- Dual-channel operation
- 2 safety outputs
- 1 signal output
- LED display for:
  - State of the actuator
  - State of the inputs (always lights up yellow)
  - Supply voltage/fault
- 4 actuation directions, each with 3 approach directions (see Explanation of markings)
  - Square marking for normal operating distance
  - Triangle marking for short operating distance
  - 2 semicircle markings for a lateral approach. Please note the Lateral and vertical offset [13] with the lateral approach to the semicircle marking.

  The guaranteed safe operating distances only apply when the actuator approaches the switch vertically. With the other approach directions, the operating distances may sometimes be considerably larger (particularly when approaching the semicircle).

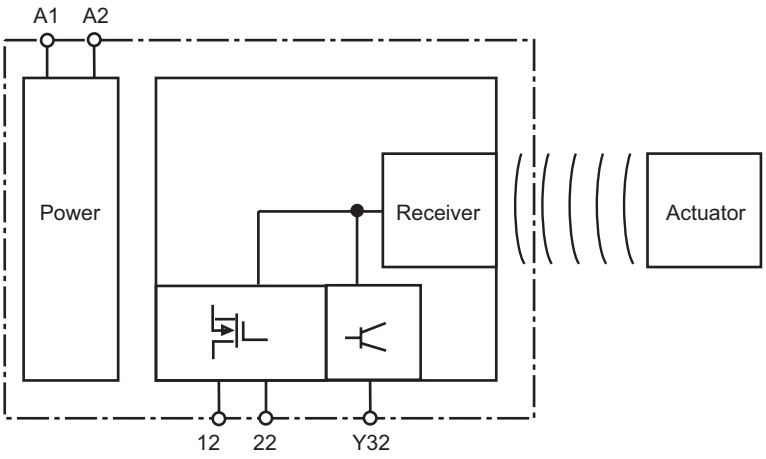
Function description

The safety outputs may have a high or low signal, depending on the position of the actuator.

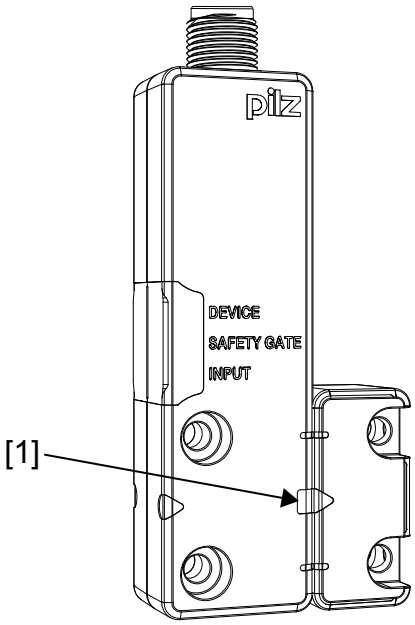
State of the outputs:

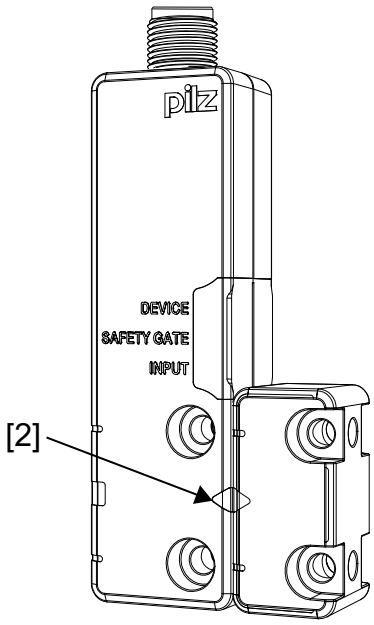
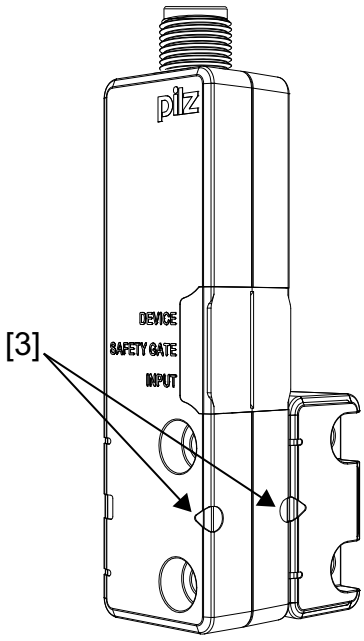
Actuator in the response range	Safety output 12	Safety output 22	Signal output Y32
Yes	High	High	High
No	Low	Low	Low

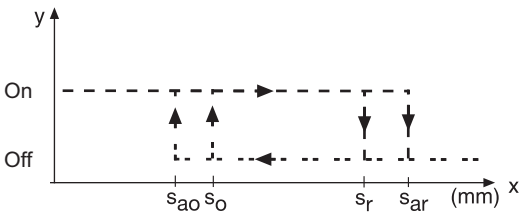
Block diagram



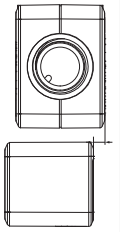
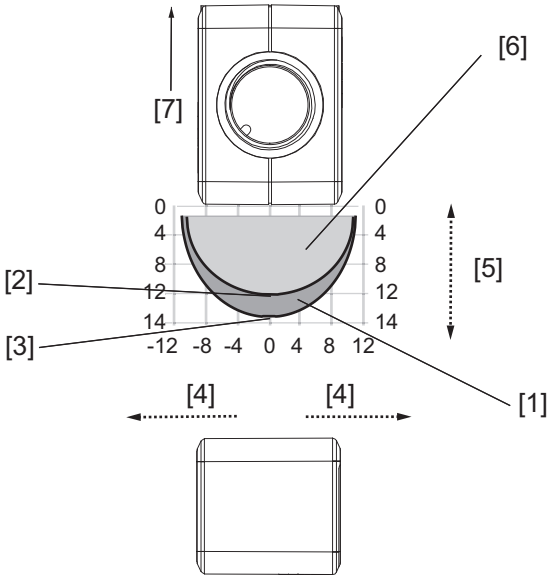
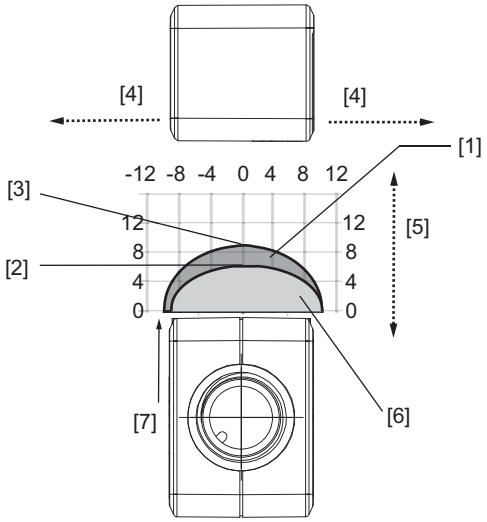
Operating distances

Alignment of the actuator	Operating distances
[1] Actuator aligned to the square marking on the switch 	S_{ao} Assured operating distance: 8 mm S_o Typical operating distance: 11 mm S_r Typical release distance: 14 mm S_{ar} Assured release distance: 20 mm

[2] Actuator aligned to the triangle marking on the switch 	S_{ao} Assured operating distance: 4 mm S_o Typical operating distance: 5 mm S_r Typical release distance: 8 mm S_{ar} Assured release distance: 12 mm
[3] Actuator aligned to the semicircle marking on the switch 	S_{ao} Assured operating distance: 3 mm S_o Typical operating distance: 6 mm S_r Typical release distance: 8 mm S_{ar} Assured release distance: 16 mm



Lateral offset when aligning to the triangle or square marking

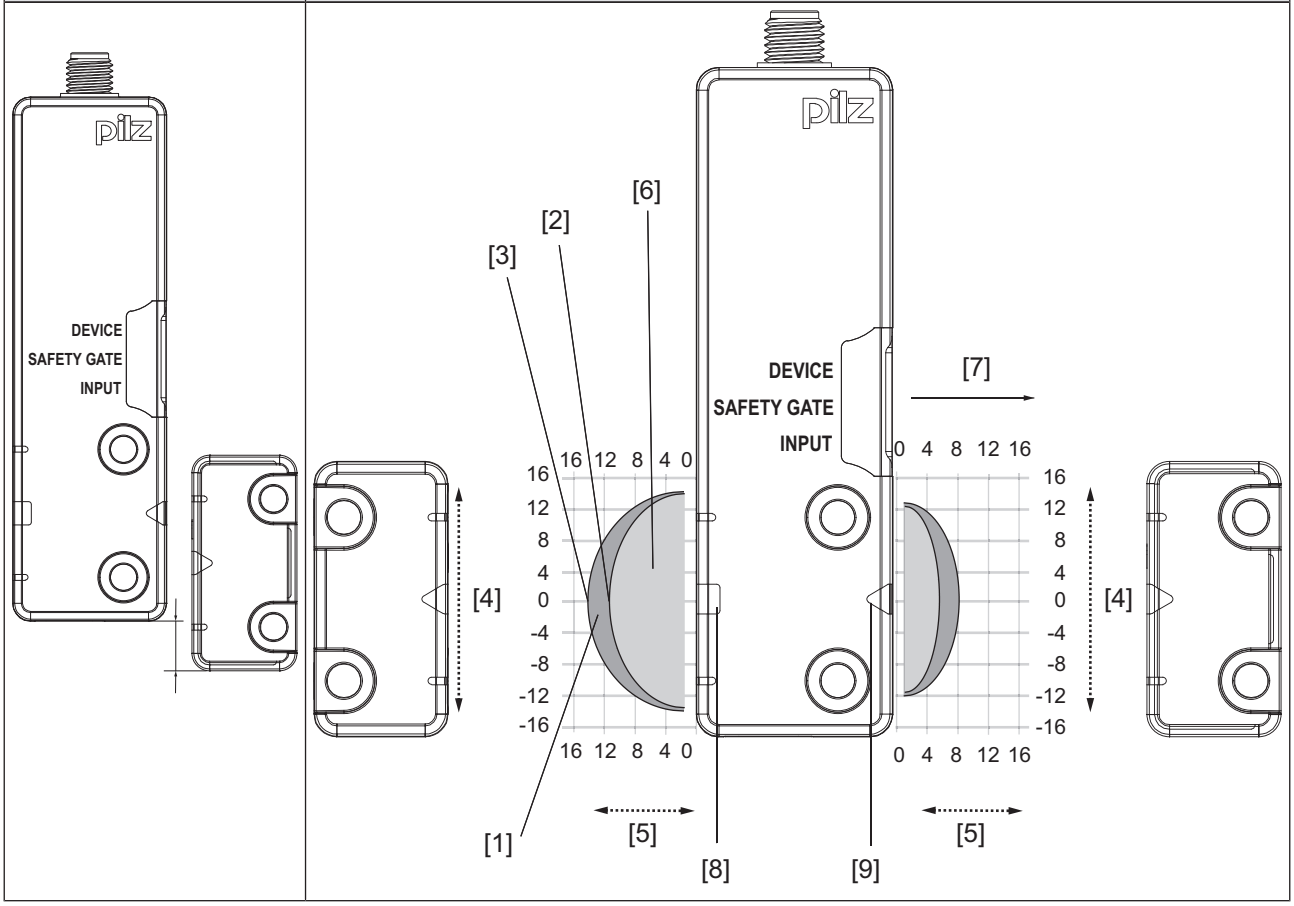
	Alignment 1: Actuator aligned to the square marking on the switch	Alignment 2: Actuator aligned to the triangle marking on the switch
		

Legend:

- [1]: Hysteresis
- [2]: Typical operating distance S_O
- [3]: Typical release distance S_r
- [4]: Offset in mm
- [5]: Operating distance in mm
- [6]: Response range
- [7]: Status of LED

Vertical offset when aligning to the triangle or square marking

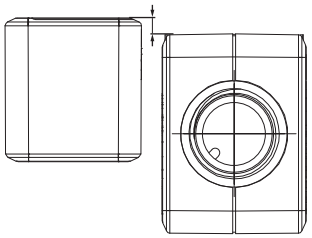
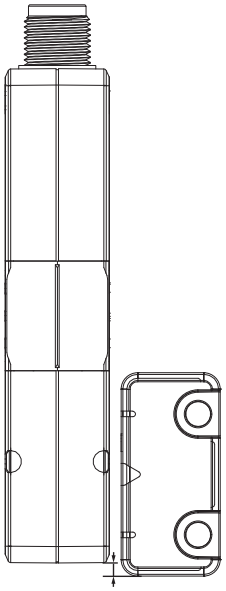
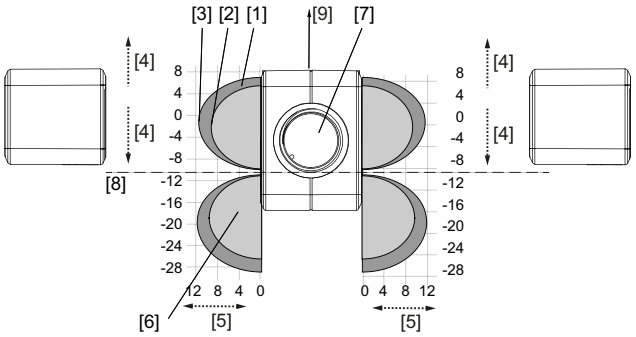
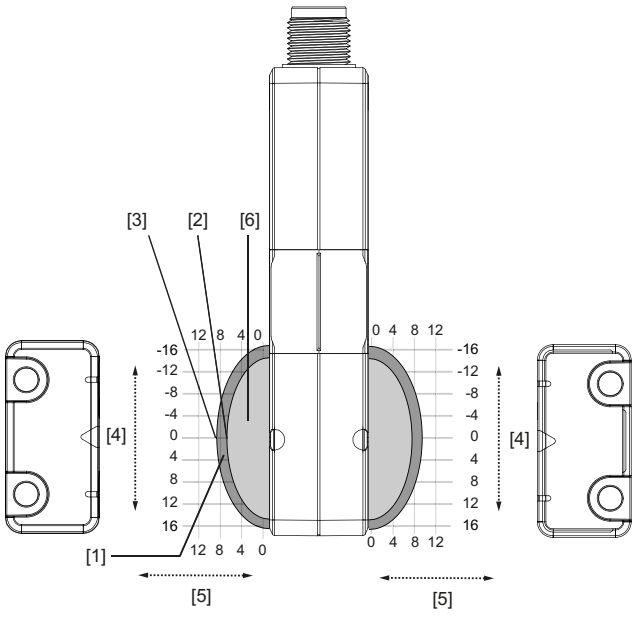
	Alignment 1/2: Actuator aligned to the triangle or square marking on the switch



Legend

- [1]: Hysteresis
- [2]: Typical operating distance S_O
- [3]: Typical release distance S_r
- [4]: Offset in mm
- [5]: Operating distance in mm
- [6]: Response range
- [7]: Status of LED
- [8]: Square marking
- [9]: Triangle marking

Lateral and vertical offset when aligning to the semicircle marking

Alignment 3: Actuator aligned to the semicircle marking on the switch	
Lateral offset	**Vertical offset**
	
	

Two actuators are shown in the diagrams because the sensor can be approached from both sides at the semicircle marking. However, only one actuator can be used.

Legend

- [1]: Hysteresis
- [2]: Typical operating distance S_o
- [3]: Typical release distance S_r
- [4]: Offset in mm
- [5]: Operating distance in mm
- [6]: Response range

- [7]: Connector on the sensor
- [8]: Limit of response range, position of gate hinge
- [9]: Status of LED

Wiring

Please note:

- Information given in the "Technical details" must be followed.
- The power supply must meet the regulations for extra low voltages with protective separation (SELV, PELV).
- The inputs and outputs of the safety switch must have a protective separation to voltages over 60 VDC.

INFORMATION

Only use safety relays with a 24 VDC supply voltage. Safety relays with universal power supply or in AC device versions have internal potential isolation and are not suitable as evaluation devices.

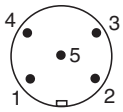
CAUTION!

Do not connect the signal output to 0 V!

If the signal output Y32 is connected to 0 V, the safety switch may be damaged as a result. Connect the signal output Y32 to a consumer, e.g. to the input on a control system, or leave the signal output unconnected.

- The supply voltage to the safety switch must be protected with a 2 A to 4 A quick-acting fuse.
- Ensure the EMC requirements of IEC 60204-1 are met.

Pin assignment, connector and cable

	5-pin M12 connector

PIN	Pin designation	Function	Wire colour
1	A1	+24 UB	brown
2	12	Output, channel1	white
3	A2	0 V UB	blue
4	22	Output, channel2	black
5	Y32	Signal output	grey

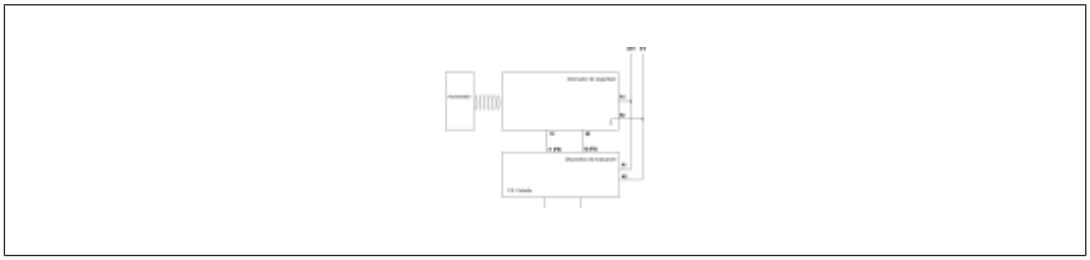
The wire colour also applies for the cable available from Pilz as an accessory.

Connection to evaluation devices

Make sure that the selected evaluation device has the following properties:

- Dual-channel with feasibility monitoring
- OSSD signals are evaluated

Connection diagram, single connection



Connection to Pilz evaluation devices

The safety switch PSEN cs5.1n can be connected to Pilz evaluation devices, for example. Make sure that an evaluation device is selected that can evaluate OSSD signals through two channels.

Suitable Pilz evaluation devices are, for example:

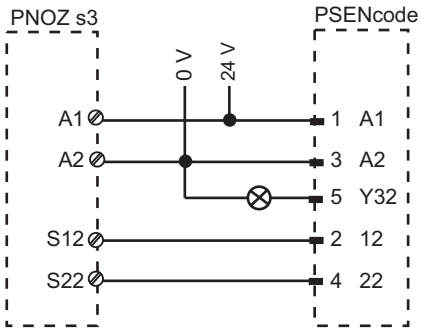
- PNOZelog for safety gate monitoring
- PNOZpower for safety gate monitoring
- PNOZsigma for safety gate monitoring
- PNOZ X for safety gate monitoring
- PNOZmulti for safety gate monitoring
  Configure the switch in the PNOZmulti Configurator with switch type 3.
- PSS for safety gate monitoring with standard function block SB064, SB066 or FS_Safety Gate

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

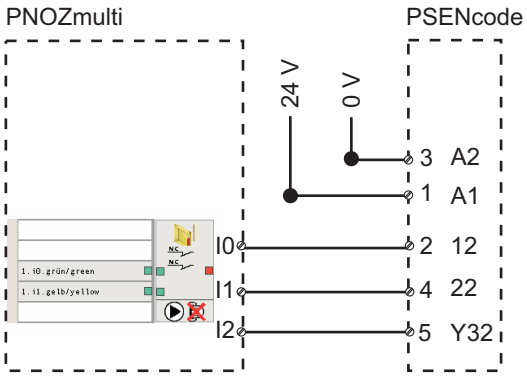
The connections to two evaluation devices are shown on the following pages, by way of example:

- PNOZ s3 and
- PNOZmulti

PNOZ s3



PNOZmulti



Legend:

I0	Input OSSD
I1	Input OSSD
I2	Signal input

Teaching in the actuator

Any Pilz actuator PSEN cs5.1 M12) is detected as soon as it is brought into the response range.

Installation

CAUTION!

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.

- The safety switch and actuator should be installed opposite each other in parallel.

  Make sure that the actuator is aligned to the marking on the sensor that guarantees the operating distance required by the plant design (see Operating distances).
- Safety switches and actuators should only be secured using M4 screws with a flat head (e.g. M4 cheese-head or pan head screws).
- Torque setting: Note the stated max. torque in the Technical details [📖 22].
- The distance between two safety switches must be maintained (see Technical Details [📖 22]).
- If using angled connector plugs, note the defined angle of the cable routing.
- When installing make sure you comply with the requirements of EN ISO 14119.
- Make sure that the safety switch and actuator cannot be used as an end stop.
- The actuator should be protected from unauthorised removal and from contamination. Close the mounting holes using the seals provided (see diagrams). The use of seals should be regarded as equivalent to using permanent fastenings in accordance with Clause 7.2c of EN ISO 14119.

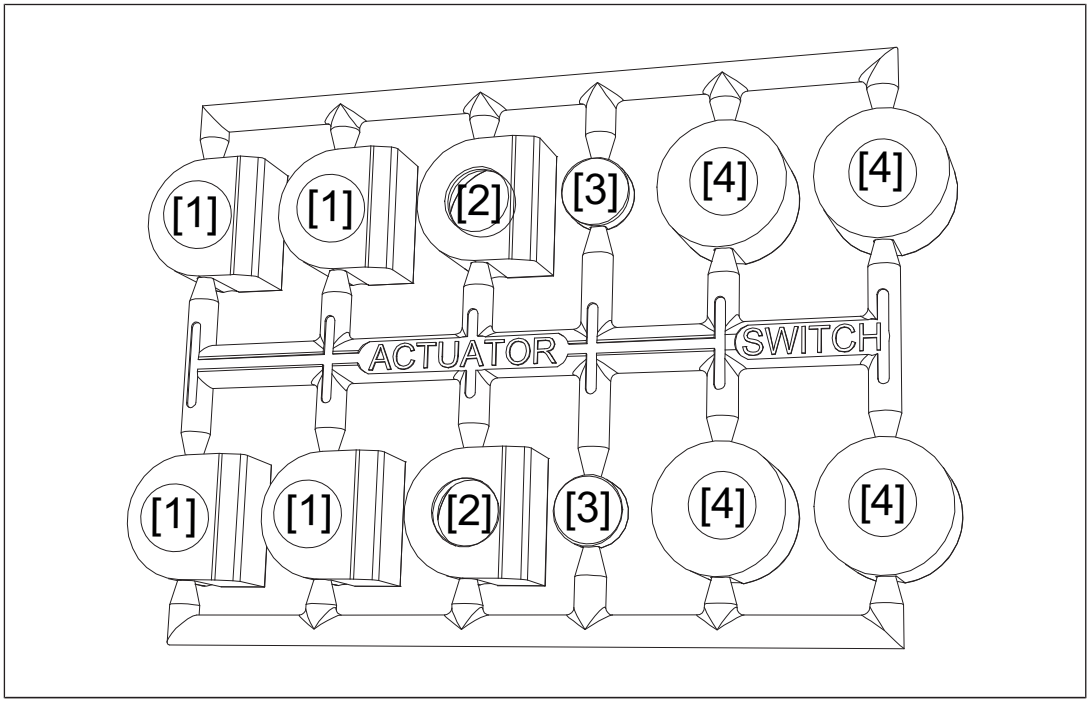


Fig.: Seals

[1]: 4 seals for actuators

[2]: 2 seals for actuators

[3]: 2 seals for actuators

[4]: 2 seals for switches and 2 seals for actuators

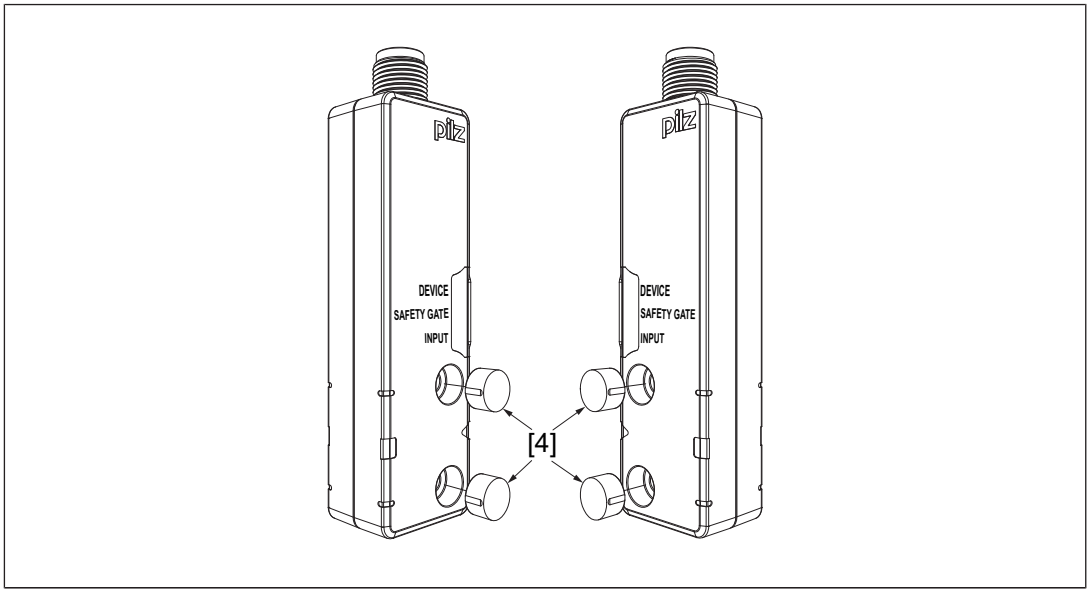


Fig.: Applying the screw cover [4] on the switch

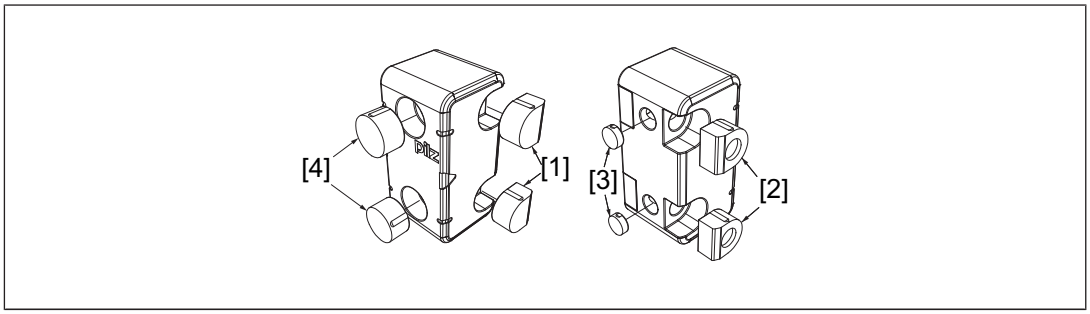
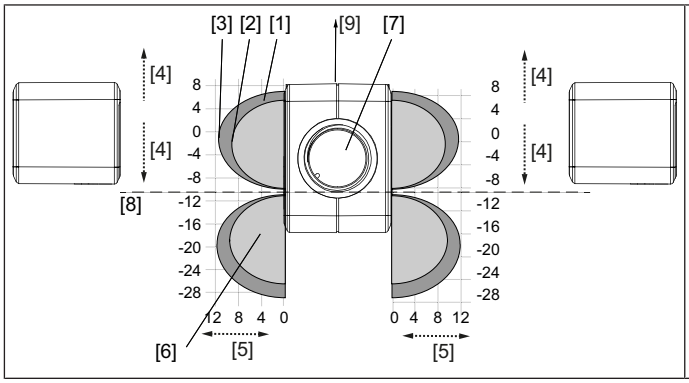


Fig.: Applying the screw covers [1] to [4] on the actuator

CAUTION!

Malfunction due to missing gate end stop on semicircle marking

If you use the semicircle marking on a safety gate, make sure that a gate end stop is used. The actuator may not be moved beyond the limit of the response range (see diagram).



[1]: Hysteresis
[2]: Typical operating distance S_O
[3]: Typical release distance S_r
[4]: Offset in mm
[5]: Operating distance in mm
[6]: Response range
[7]: Connector on the sensor
[8] Limit of response range, position of gate end stop
[9]: Status of LED

Procedure:

1. Drill holes (for M4 screws) in the mounting surface to secure the actuator and sensor (see Dimensions in mm [21]).
2. Use a screw to fix the sensor to the mounting surface.

   Make sure that the sensor marking that is be used for operation can be operated using the actuator from the right side.
3. Do not fully tighten the second screw on the safety switch.
4. Use a screw to fix the actuator to the mounting surface.

   Make sure that the actuator with the marking (triangle) points towards the marking on the sensor.
5. Do not fully tighten the second screw on the actuator.
6. Align the safety switch and tighten the screws.
7. Align the actuator and tighten the screws.

For simpler installation, the mounting brackets with order number 532 110 can be used.

Adjustment

- The stated operating distances (see Technical details [22]) only apply when the safety switch and actuator are installed facing each other in parallel. 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 [13]).

Operation

Check the function of the safety switch before commissioning.

Status indicators:

Legend:

●	LED off
☼	LED on
◐	LED flashes (500 ms on, 500 ms off)
◐	LED flashes quickly (50 ms on, 950 ms off)

Normal mode

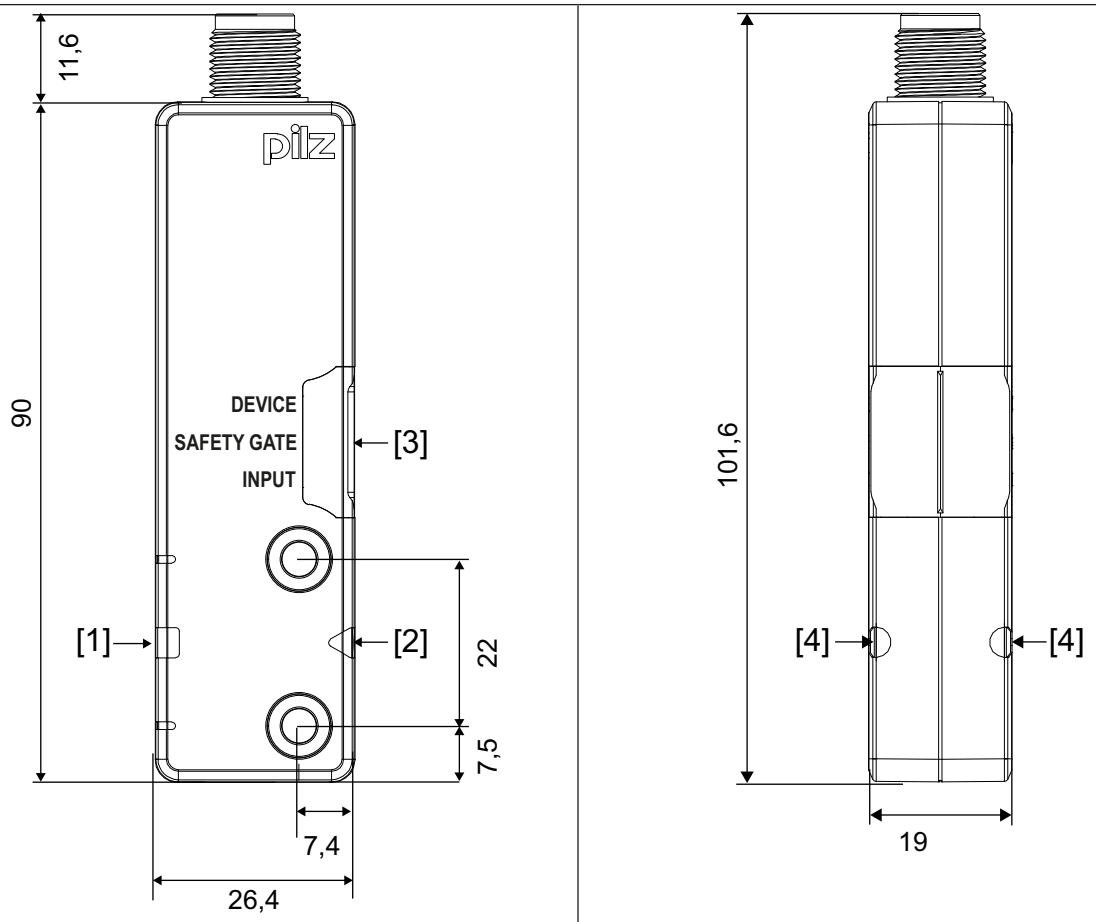
LED status		Switch status
Device	green	Ready for operation
Safety gate	yellow	Actuator is within the response range
	Off	Actuator is outside the response range
Input	yellow	The unit is ready for operation

Error display

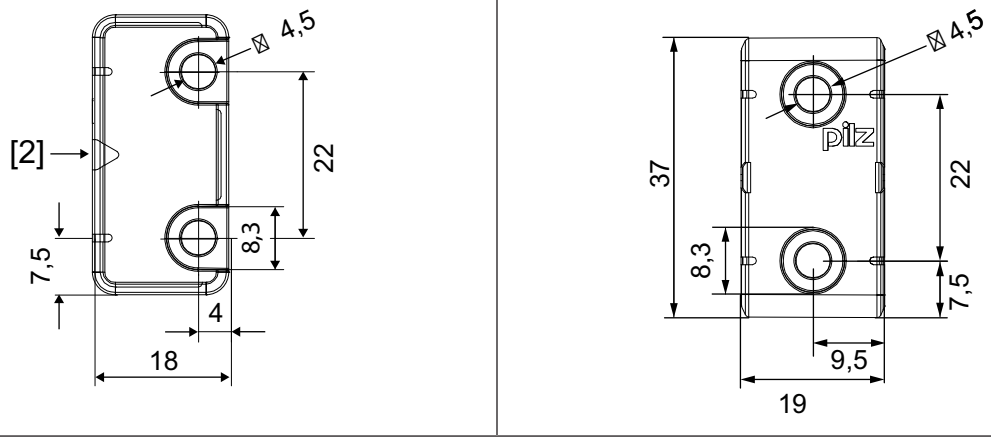
LED status			Switch status	Remedy / measure
Device	**Safety gate**	**Input**		
red	Off	Off	Internal error on switch	Change the switch
red	yellow	yellow	Supply voltage is outside the tolerance range	Ensure the voltage supply corresponds to the Technical details [📖 22].
yellow	Display not definitive	Display not definitive	Supply voltage is at the limit of the tolerance range	Ensure the voltage supply corresponds to the Technical details [📖 22].
red	Display of last status	Display of last status	Outputs in fault condition	Check the outputs and switch the voltage off and then on again.
green	yellow	Display not definitive	Wrong actuator	Use the actuator PSEN cs5.1 M12.
Off	yellow	yellow	Switch doesn't start	Change the switch.

Dimensions in mm

Safety switch



Actuator



Legend:

[1] Square marking

[2] Triangle marking

[3] LEDs

[4] Semicircle marking

Technical details

General	
Approvals	**CE, EAC (Eurasian), ECOLAB, FCC, IC, TÜV, UL/ cUL**
Sensor's mode of operation	**Transponder**
Codification in accordance with ISO 14119	**Low**
Building class in accordance with ISO 14119	**4**
Classification to EN 60947-5-3	**PDDB**
Electrical data	
Supply voltage	
Voltage	**24,0 V**
Kind	**DC**
Voltage tolerance	**-20 %/+20 %**
Output of external power supply (DC)	**1,0 W**
Max. switching frequency	**3 Hz**
Max. cable capacitance at the safety outputs	
No-load, PNOZ with relay contacts	**40 nF**
PNOZmulti, PNOZelog, PSS	**40 nF**
Max. inrush current impulse	
Current pulse, A1	**0,50 A**
No-load current	**25 mA**
Semiconductor outputs	
OSSD safety outputs	**2**
Signal outputs	**1**
Switching current per output	**100 mA**
Breaking capacity per output	**2,4 W**
Residual current at outputs	**400 µA**
Voltage drop at OSSDs	**1,0 V**
Conditional rated short circuit current	**100 A**
Lowest operating current	**0 mA**
Utilisation category in accordance with EN 60947-1	**DC-12**
Times	
Test pulse duration, safety outputs	**150 µs**
Switch-on delay	
after UB is applied	**1,0 s**
Actuator typ.	**30 ms**
Actuator max.	**50 ms**
Delay-on de-energisation	
Actuator typ.	**30 ms**
Actuator max.	**40 ms**
Risk time in accordance with EN 60947-5-3	**150 ms**
Supply interruption before de-energisation in the input circuit	**450,0 µs**
Supply interruption before de-energisation	**20 ms**
Simultaneity, channel 1 and 2	∞

Environmental data	
Ambient temperature	
In accordance with the standard	**EN 60068-2-14**
Temperature range	**-25 - 70 °C**
Storage temperature	
In accordance with the standard	**EN 60068-2-1/-2**
Temperature range	**-40 - 85 °C**
Climatic suitability	
In accordance with the standard	**EN 60068-2-30**
Humidity	**93 % r. h. at 40 °C**
EMC	**EN 60947-5-3**
Vibration	
In accordance with the standard	**EN 60947-5-2**
Frequency	**10,0 - 55,0 Hz**
Amplitude	**1,00 mm**
Shock stress	
In accordance with the standard	**EN 60947-5-2**
Acceleration	**30g**
Duration	**11 ms**
Airgap creepage	
Overvoltage category	**III**
Pollution degree	**3**
Rated insulation voltage	**75 V**
Rated impulse withstand voltage	**1,00 kV**
Protection type	
Housing	**IP66, IP67**
Mechanical data	
Actuator 1	**PSEN cs5.1 M12**
Operating distances	
Repetition accuracy switching distances	**3 %**
Change of operating distance with temperature changes	**+-0,02mm/°C**
Operating distances when the actuator approaches square marking	
Assured operating distance Sao	**8 mm**
Assured release distance Sar	**20 mm**
Typical operating distance So	**11 mm**
Typical release distance Sr	**14 mm**
Typical hysteresis	**2 mm**
Operating distances when the actuator approaches triangle marking	
Assured operating distance Sao	**4 mm**
Assured release distance Sar	**12 mm**
Typical operating distance So	**5 mm**
Typical release distance Sr	**8 mm**
Typical hysteresis	**2 mm**

Mechanical data	
Operating distances when the actuator approaches semicircle marking	
Assured operating distance Sao	**3 mm**
Assured release distance Sar	**16 mm**
Typical operating distance So	**6 mm**
Typical release distance Sr	**8 mm**
Typical hysteresis	**2 mm**
Min. distance between safety switches	**250 mm**
Sensor flush installation in accordance with EN 60947-5-2	**Yes, follow installation guidelines**
Connection type	**M12, 5-pin male connector**
Material	**Lexan 9945, PA+GF, PBT**
Fixing screws torque settings	**1,00 Nm**
Dimensions	
Height	**26,4 mm**
Width	**101,6 mm**
Depth	**19,0 mm**
Actuator dimensions	
Height	**18,0 mm**
Width	**37,0 mm**
Depth	**19,0 mm**
Weight of safety switch	**68 g**
Weight of actuator	**15 g**
Weight	**83 g**

Where standards are undated, the 2014-09 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2008 PL	EN ISO 13849-1: 2008 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2008 T_M [year]
2-ch. OSSD	**PL e**	**Cat. 4**	**SIL CL 3**	**9,56E-10**	–	**8,51E-06**	**20**

All the units used within a safety function must be considered when calculating the safety characteristic data.

INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

Supplementary data

Radio approval

USA/Canada

FCC ID: VT8- PSENCS5
IC: 7482A- PSENCS5

FCC/IC-Requirements:
This product complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standards.
Operation is subject to the following two conditions:
1) this product may not cause harmful interference, and
2) this product must accept any interference received, including interference that may cause undesired operation.

Changes or modifications made to this product not expressly approved by Pilz may void the FCC authorization to operate this equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Le présent produit est conforme aux CNR d'Industrie Canada applicables aux appareils radio
exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
(1) le produit ne doit pas produire de brouillage, et
(2) l'utilisateur de le produit doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Order reference

System

Product type	Features	Connection type	Order no.
PSEN cs5.1n /PSEN cs5.1 M12	Safety gate system, coded	5-pin M12 connector	542 003
PSEN cs5.1n 1switch	Safety switch, coded	5-pin M12 connector	542 053
PSEN cs5.1 M12 1actuator	Actuator, coded		542 083

Accessories

Product type	Features	Order no.
PSEN Winkel / bracket	Mounting bracket	532 110

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

Support

Technical support is available from Pilz round the clock.

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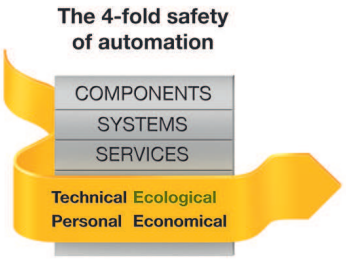
Pilz develops environmentally-friendly products using ecological materials and energy-saving technologies. Offices and production facilities are ecologically designed, environmentally-aware and energy-saving. So Pilz offers sustainability, plus the security of using energy-efficient products and environmentally-friendly solutions.

Energy saving by Pilz

BLUECOMPETENCE
Alliance Member
Partner of the Engineering Industry Sustainability Initiative



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