



► PSEN sensor technology

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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	6
Safety assessment	6
Use of qualified personnel	6
Warranty and liability	6
Disposal	6
For your safety	7
Unit features	7
Function description	8
Block diagram	8
Operating distances	8
Lateral and vertical offset	9
Wiring	9
Pin assignment	10
Requirements and connection to evaluation devices	10
Installation	13
Adjustment	14
ATEX installation and operating regulations (X)	14
Periodic test	15
Dimensions in mm	16
Technical details	17
Safety characteristic data	18
Order reference	19
System	19
Accessories	19
EC declaration of conformity	20

Introduction

Validity of documentation

This documentation is valid for the product PSEN 2.1p-24, ATEX. 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 is approved for use in potentially explosive atmospheres in accordance with EN 60079-0, EN 60079-15, EN 60079-18, EN 60079-31.

Ex area Group II, Category 3G, Zone 2 (Gas): II 3G Ex mc nAc IIC T6 and Category 3D, Zone 22 (dust): II 3D Ex mc tc IIIC T80°C.

The safety switch meets the requirements in accordance with:

- ▶ EN 60947-5-3: PDDDB only in connection
 - with the operator PSEN 2.1-20 and
 - the suitable evaluation devices (see [Requirements and connection to evaluation devices](#)  10]).

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](#)  17]).



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 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 a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of 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 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](#) [ 13].
- 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 unit. This will prevent potential contamination.
- ▶ The connector should be protected from accidental loosening (e.g. using a cable tie).

**WARNING!****Ignition spark from cable separator/connector within the potentially explosive area can trigger an explosion**

When the cable separators/connectors are used within the potentially explosive area, sparks can be caused and lead to an explosion.

- Make sure that the cable separators/connectors are used only within the potentially explosive area.

- ▶ The IP protection type (see [Technical details](#) [ 17]) has been determined in accordance with DIN EN 60529 with a safety switch that is as new.

Unit features

- ▶ The actuator PSEN 2.1-20 belongs to the safety switch.
- ▶ Coded actuator
- ▶ Safety switch with 4-pin M8 male connector
- ▶ 2 safety contacts (reed contacts - N/C and N/O)
- ▶ Design: Square
- ▶ Operation Magnetic
- ▶ Switching voltage 24 VDC
- ▶ ECOLAB tested
- ▶ LED to display switch status

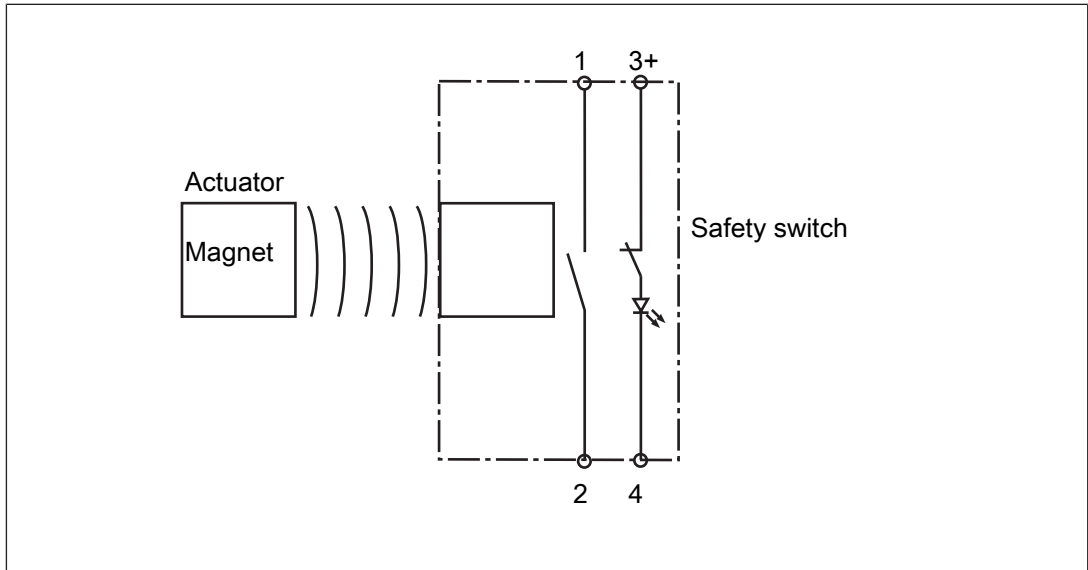
Function description

If the actuator is within the response range (safety gate closed), the safety contacts of the safety switch are closed and the LED will go out.

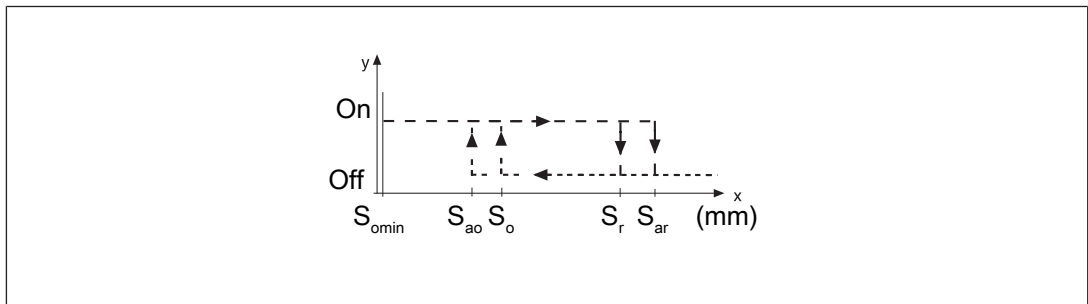
Operate the PSEN 2.1p-24, ATEX in conjunction with the following components:

- ▶ Actuator PSEN 2.1-20 (see [Order reference \[19\]](#)) and
- ▶ a connected evaluation device (see [Requirements and connection to evaluation devices \[10\]](#)).

Block diagram



Operating distances

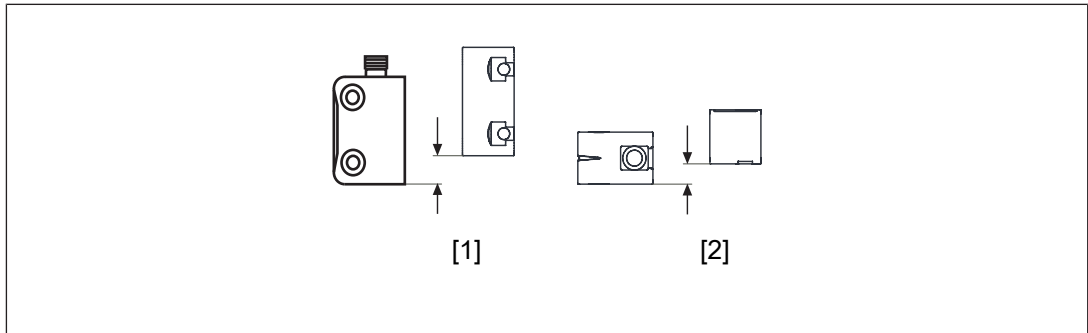


Legend

- 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 \[17\]](#).

Lateral and vertical offset



Legend

- [1] Lateral offset
- [2] Vertical offset

Actuator PSEN 2.1-20

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

Assured operating distance S_{ao} in mm						
Vertical offset	Lateral offset					
		1.0	1.5	2.0	2.5	3.0
1		7.5	7.5	7.5	7.0	7.0
2		7.5	7.5	7.0	7.0	7.0
3		7.0	7.0	7.0	6.5	6.5
4		6.5	6.5	6.5	6.5	6.5
5		6.0	6.0	6.0	5.5	5.5

Wiring

- ▶ Information given in the [Technical details \[17\]](#) must be followed.
- ▶ Calculation of the max. cable length l_{max} :

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

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

R_i = Internal resistance sensor (see [Technical details \[17\]](#))

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

- ▶ Ensure the wiring and EMC requirements of EN 60204-1 are met.
- ▶ Refer to the notes on wiring in EN 60079-14.
- ▶ Depending on which evaluation device is used, the overall cable resistance must be checked; before commissioning it may also be necessary to check the cross circuit detection function.
- ▶ Ensure that the safety switch's electrical connections cannot work loose.
- ▶ Protect the safety switch's electrical connections from corrosion.
- ▶ The safety contacts are not short circuit-proof.

- ▶ UL requirement: the supply voltage must be provided via a Class 2 power supply.



WARNING!

Ignition in a potentially explosive area!

Unintentionally removing the connector while voltage is applied may trigger an explosion, causing serious injury and death.

- Switch off the supply voltage before removing the connector.
- Protect the connector from being removed unintentionally.

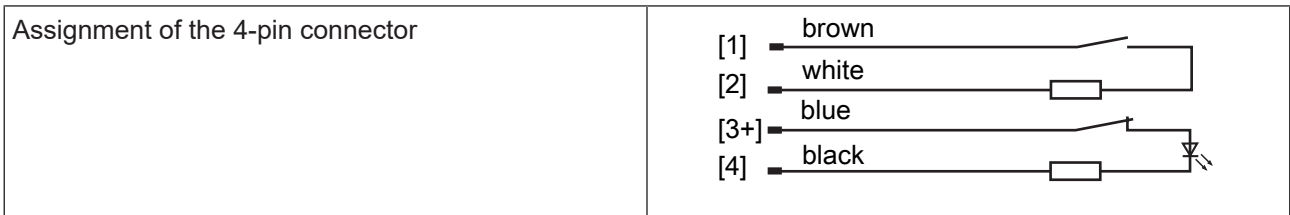
Pin assignment



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.



Requirements and connection to evaluation devices

For use of PSEN 2.1p-24, ATEX in accordance with DIN EN 60947-5-3 an evaluation device must be connected.

Connect the PSEN 2.1p-24, ATEX

- ▶ **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 e3.1p, PNOZ e3vp
 - PNOZ e5.13p
- ▶ 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 \[17\]](#) of PSEN 2.1p-24, ATEX
 - Always comply with the max. switching current safety contacts of PSEN 2.1p-24, ATEX.
- ▶ 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 \[17\]](#)) and the processing and delay times of the evaluation device (s. operating manual for the relevant evaluation device).

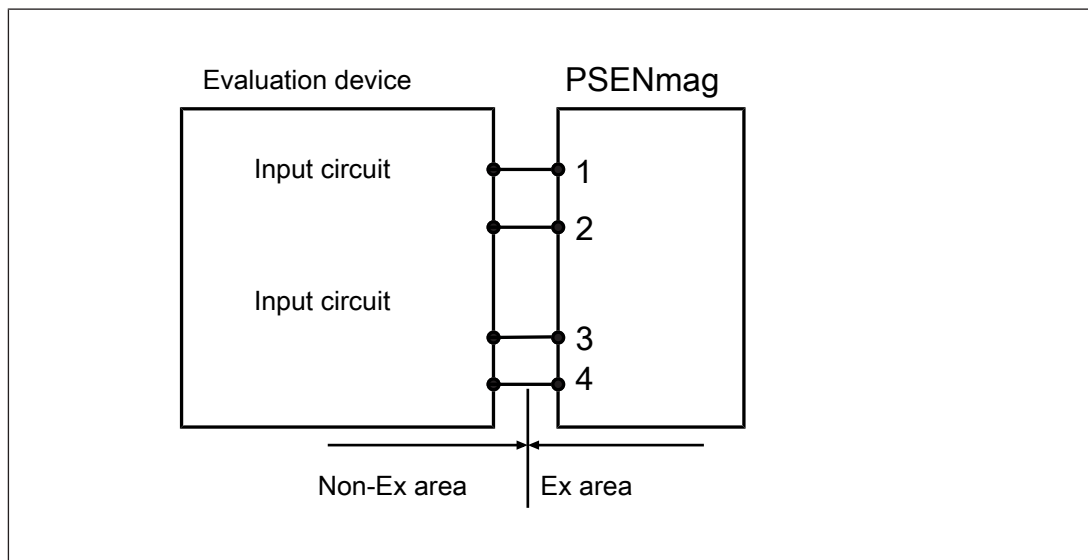
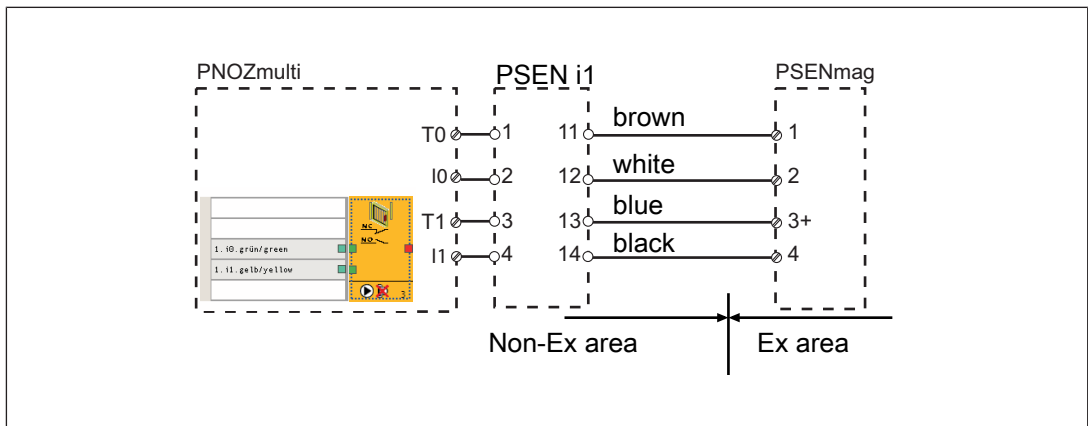


Fig.: Dual-channel connection PSEN 2.1p-24, ATEX to the input circuits of an evaluation device

Examples for connection to Pilz evaluation devices:

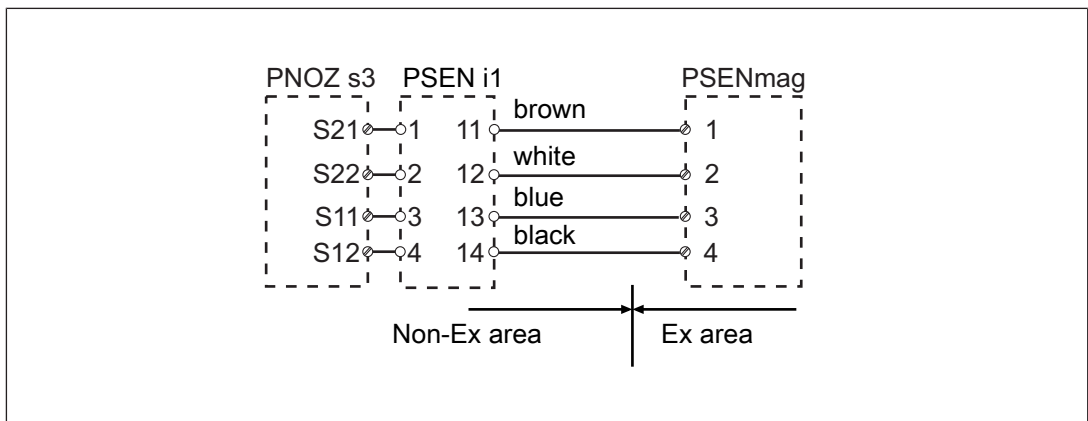


Legend

I0 Input OSSD

I1 Input OSSD

T1, T2 Test pulse outputs



Installation



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.
- ▶ The safety switch and actuator should only be secured using screws and nuts made of non-magnetic material (e.g. brass or stainless steel).
- ▶ 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](#) [ 17]).
- ▶ 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.
- ▶ Install safety switch and actuator
 - facing each other in parallel
 - so that the faces with the product names are opposite each other.
- ▶ The protection type (see [Technical details](#)  17]) can only be achieved by using the Pilz connection leads available as an accessory.
- ▶ If possible, do not install the safety switch and actuator on to ferromagnetic material. Changes to the operating distances are to be expected. In this case, use the spacer (see Order reference).
- ▶ Safety switches and actuators should only be secured using M4 screws with a flat head (e.g. M4 cheese-head or pan head screws). Use screws made of non-magnetic material (e.g. brass).

Adjustment

- ▶ The safety switch may only be used with the corresponding actuator PSEN 2.1-20.
- ▶ Always test the function with a connected evaluation device.
- ▶ The stated operating distances (see [Technical details](#)  17]) only apply when the safety switch and actuator are installed according to the specifications [Installation](#)  13]. 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]).


ATEX installation and operating regulations (X)

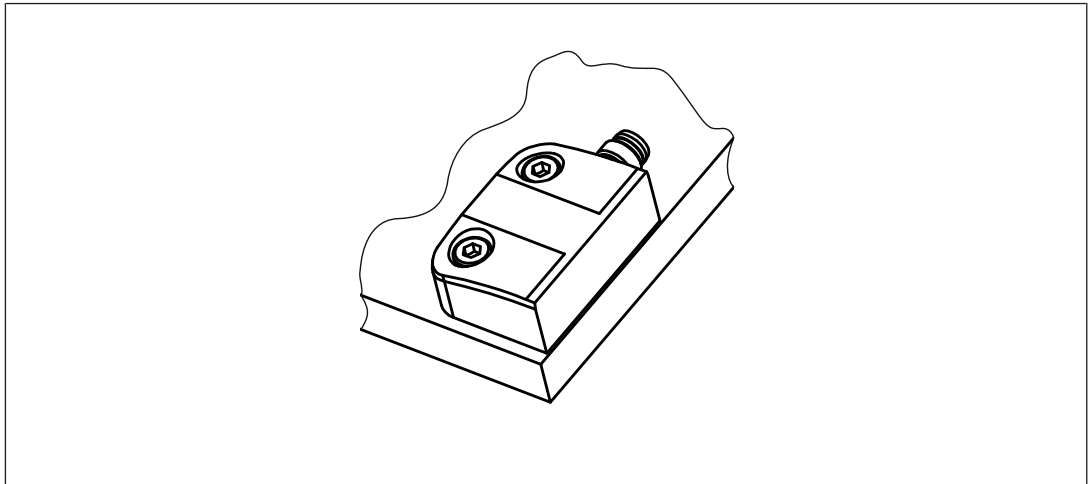


WARNING!

Risk of damage due to mechanical load. Live components on the safety switch in the potentially explosive area may become exposed.

Threat to life!

- Protect the edges of the safety switch base from shock. This can be achieved by full face installation, for example (see Installation example).
- Please also refer to the additional information in the [Installation](#)  13] section.



Installation example:

The full face of the safety switch is installed on the subplate.

As a result, the edges of the safety switch base are protected from shock.

Periodic test

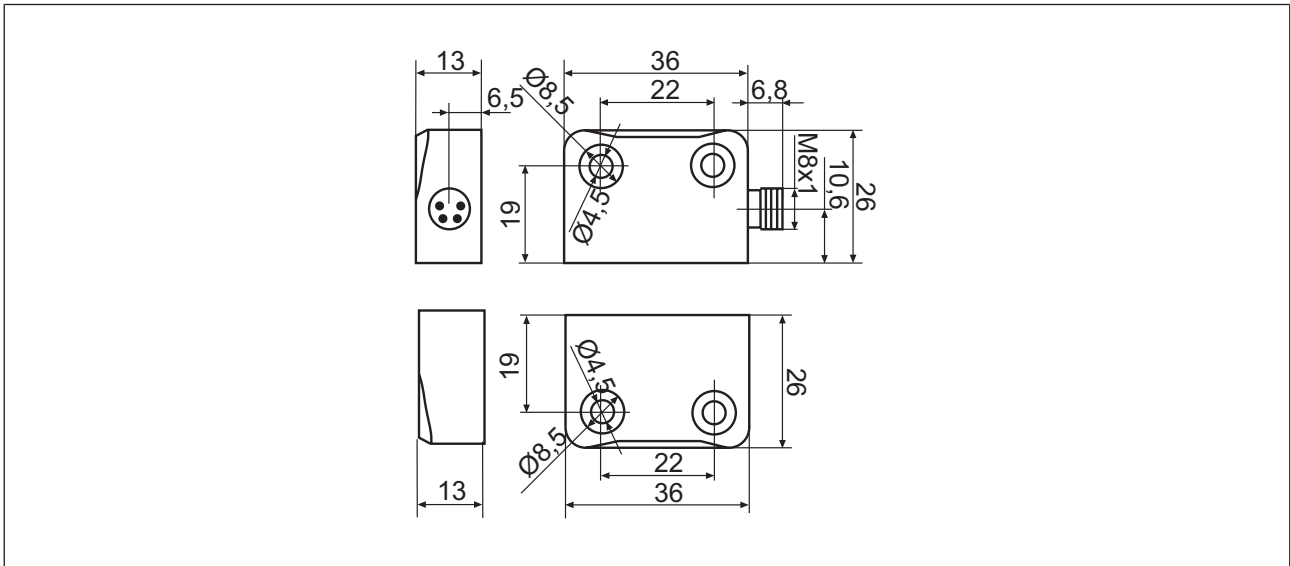
- ▶ Make sure that the work is **not** performed in an explosive atmosphere.
- ▶ Carry out a monthly function test on the safety switch and actuator.
- ▶ Always test the function with the PSEN i1 interface and connected evaluation device.
- ▶ The safety function may only be checked by qualified personnel.
- ▶ Refer to the notes on checking the safety switch in EN 60079-17 and EN 60079-19.



NOTICE

The safety function should be checked after initial commissioning and each time the plant/machine is changed. The safety functions may only be checked by qualified personnel.

Dimensions in mm



Technical details

General	
Certifications	ATEX, CE, EAC (Eurasian), ECOLAB, TÜV, cULus Listed, electrosuisse
Sensor's mode of operation	Magnetic
Coding level in accordance with EN ISO 14119	Low
Design in accordance with EN ISO 14119	4
Classification in accordance with EN 60947-5-3	PDDB
Electrical data	
Supply voltage	
Voltage	24 V
Kind	DC
Voltage tolerance	-20 %/+20 %
Max. switching frequency	1 Hz
Lowest operating current (I _m)	1 mA
Switching voltage	24 V
Internal resistance	100 Ohm
Max. switching current, safety contacts	10 mA
Max. breaking capacity, safety contacts	0,3 W
Max. permitted total power dissipation	170 mW
Times	
Reaction time (actuator removed)	2 ms
Environmental data	
ATEX certification	SEV 12 ATEX 0121 X
ATEX category, gas	II 3G Ex mc nAc IIC T6
ATEX category, dust	II 3D Ex mc tc IIIC T80°C
Application area	X: -25°C ≤ ta ≤ +55°C
Ambient temperature	
Temperature range	-25 - 55 °C
Climatic suitability	
In accordance with the standard	IEC 60068-2-30
Humidity	93 % r. h. at 40 °C
Max. operating height above sea level	2000 m
EMC	EN 60947-5-3
Vibration	
In accordance with the standard	EN 60947-5-2
Frequency	10 - 55 Hz
Amplitude	1 mm
Shock stress	
In accordance with the standard	EN 60947-5-2
Acceleration	30g
Duration	11 ms
Airgap creepage	
Pollution degree	3

Environmental data	
Rated insulation voltage	25 V
Rated impulse withstand voltage	0,33 kV
Protection type	
Housing	IP65, IP67
Mechanical data	
Actuator 1	PSEN 2.1-20
Typ. Hysteresis	6 mm
Operating distances	
Assured operating distance Sao	8 mm
Min. operating distance Somin	0,5 mm
Typical operating distance So	0,5 mm
Assured release distance Sar	26 mm
Repetition accuracy switching distances	6 %
Sensor flush installation in accordance with EN 60947-5-2	Yes, follow installation guidelines
Connection type	M8, 4-pin male connector
Material	
Top	PC
Max. torque setting	
Safety switch	1 Nm
Actuator 1	1 Nm
Dimensions	
Height	45 mm
Width	26 mm
Depth	13 mm
Actuator dimensions	
Height	36 mm
Width	26 mm
Depth	13 mm
Weight of safety switch	15 g
Weight of actuator	20 g
Weight	35 g

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

Safety characteristic data



NOTICE

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

Operating mode	B10d in accordance with EN ISO 13849-1: 2015 and EN 62061	TM [year] in accordance with EN ISO 13849-1:2015
Sensor, 2-channel	2.000.000	20

Order reference

System

Product type	Features	Connection type	Order no.
PSEN 2.1p-24/ PSEN2.1-20/8mm/LED/ EX/1unit	Magnetic safety switch, actuator round, with as- sured operating distance 8 mm	4-pin M8 male connector	502 224
PSEN 2.1p-24 1switch ATEX	Magnetic safety switch	4-pin M8 male connector	522 124
PSEN 2.1-20/1actuator	Actuator round, with as- sured operating distance 8 mm		512 120

Accessories

Cable

Product type	Connection 1	Connection 2	Length	Order no.
PSEN Kabel Winkel/cable angleplug 2m	Female connector, M8 angled, 4-pin	Open cable end	2 m	533 110
PSEN Kabel Gerade /cable straightplug2m	Female connector, M8 straight, 4-pin		2 m	533 111
PSEN Kabel Winkel/cable angleplug 5m	Female connector, M8 angled, 4-pin		5 m	533 120
PSEN Kabel Gerade/cable straightplug 5m	Female connector, M8 straight, 4-pin		5 m	533 121
PSEN Kabel Winkel/cable angleplug 10m	Female connector, M8 angled, 4-pin		10 m	533 130
PSEN Kabel Gerade /cable straightplug10m	Female connector, M8 straight, 4-pin		10 m	533 131
PSEN Kabel Winkel/cable angleplug 3m	Female connector, M8 angled, 4-pin		30 m	533 140
PSEN Kabel Gerade /cable straightplug30m	Female connector, M8 straight, 4-pin		30 m	533 141
PSS67 Cable M8sf M12sm	Female connector, M8 straight, 4-pin	Male connector M12 straight	3 m	380 200
			5 m	380 201
			10 m	380 202
			30 m	380 203
PSS67 Cable M8af M12sm	Female connector M8 angled, 4-pin		3 m	380 204
			5 m	380 205
			10 m	380 206
			30 m	380 207

Installation materials

Product type	Features	Order no.
PSEN Winkel / bracket	Mounting bracket	532 110
PSEN spacer	Spacer	534 310
PSEN reverse spacer	Spacer	534 320
PSEN screw M4x16 10pcs	Screws made of high-grade steel with one-way slot	540 310

Connector

Product type	Features	Order no.
PSEN ma adapter	Adapter for connecting the safety switch to PSS67 and PDP67	380 300

Series connection

Product type	Features	Order no.
PSEN i1 Interface for 4 PSEN 2	Interface PSEN i1 for connecting and evaluating several safety switches PSEN ma	535 110
PDP67 F 8DI ION	Decentralised input module IP67 for PNOZmulti	773 600

EC declaration of conformity

This product/these products meet the requirements of the following directives of the European Parliament and of the Council.

- ▶ 2006/42/EC on machines
- ▶ 2014/34/EU (ATEX)

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

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