



▶ PSEN 2.2p-24

PILZ
THE SPIRIT OF SAFETY

Operating Manual-20971-EN-19
- 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

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Introduction

Validity of documentation

This documentation is valid for the product PSEN 2.2p-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:

- ▶ The N/O of the safety contact opens and the N/C of the safety contact closes, when the actuator is removed beyond the assured release distance s_{ar} or when the actuator is not detected.


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 ec mc IIC 80°C (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 actuator PSEN 2.2-20,
 - the interface PSEN i1 and
 - the approved evaluation devices.

The safety switch is designed for applications in series connections and it must only be operated with the following components:

- ▶ Actuator PSEN 2.2-20,
- ▶ Interface PSEN i1 (see Order reference) and
- ▶ a suitable evaluation device (see [Requirements and connection to evaluation devices](#) [ 11]).

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](#) [ 19]).



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, maintained and decommissioned 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 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 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 outside the potentially explosive area.

- ▶ The IP protection type (see [Technical details](#) [ 19]) has been determined in accordance with DIN EN 60529 with a safety switch that is as new.

Unit features

- ▶ The actuator PSEN 2.2-20 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: round (M30)
- ▶ Operation Magnetic

- ▶ Switching voltage 24 VDC
- ▶ Series connection via PSEN i1 interface
- ▶ ECOLAB tested
- ▶ LED to display switch status

Function description

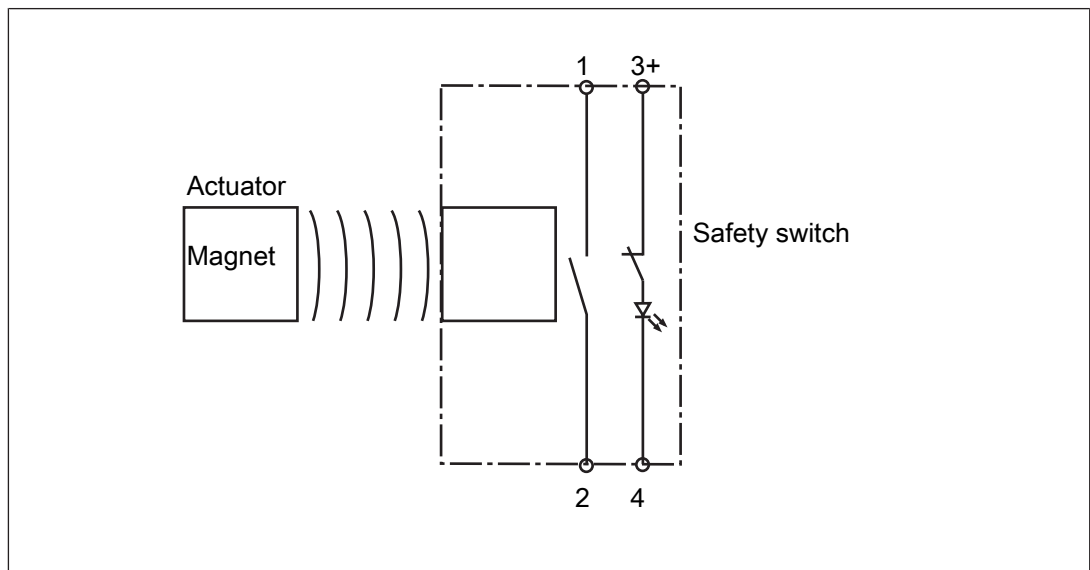
If the actuator is within the response range (safety gate closed), the safety contacts of the safety switch are closed and the LED will go out.

The safety switch is designed for applications in series connections.

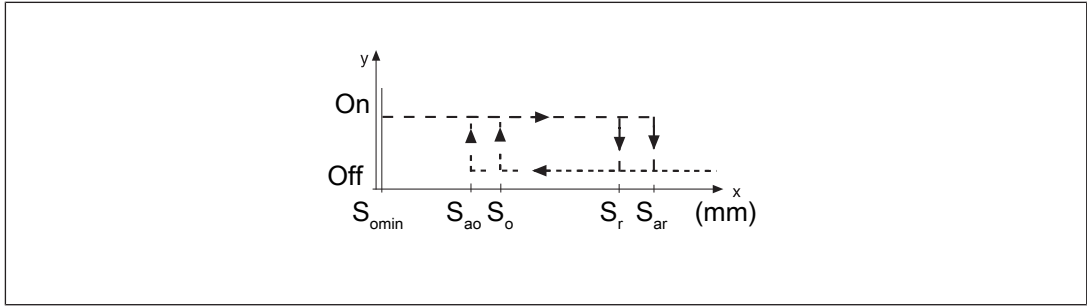
Operate the PSEN 2.2p-24, ATEX in conjunction with the following components:

- ▶ Actuator PSEN 2.2-20 (see [Order reference \[11\]](#)),
- ▶ Interface PSEN i1 (see [Order reference](#)) and
- ▶ a connected evaluation device (see [Requirements and connection to evaluation devices \[11\]](#)).

Block diagram



Operating distances

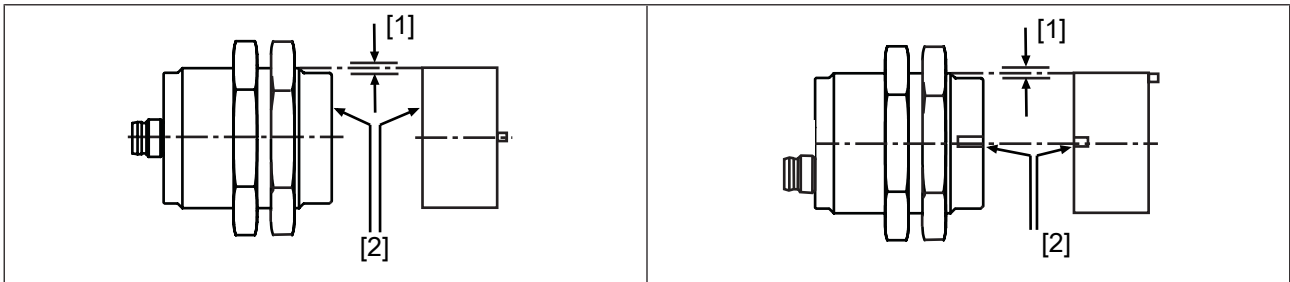


Legend

- 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 \[19\]](#).

Lateral and vertical offset



- [1] Vertical offset
- [2] Sensing faces at the safety switch and actuator
- [3] Lateral offset
- [4] Notches at the safety switch and actuator

Actuator PSEN 2.2-20

Assured operating distance S_{ao} in mm						
		Lateral offset				
Vertical offset		1	2	3	4	5
	1	7.5	7.5	7.0	7.0	5.5
	2	7.5	7.0	7.0	6.5	5.5
	3	7.0	7.0	7.0	6.0	5.5
	4	6.5	6.5	6.0	5.5	5.0
	5	6.0	6.0	6.0	5.0	4.5

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

Wiring

- ▶ Information given in the [Technical details \[19\]](#) must be followed.
- ▶ Calculation of the max. cable length l_{\max} :

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

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

R_i = Internal resistance sensor (see [Technical details \[19\]](#))

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.
- ▶ 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.
- ▶ The safety contacts are not short circuit-proof.
- ▶ UL requirement: the supply voltage must be provided via a Class 2 power supply.
- ▶ Ensure that the safety switch's electrical connections cannot work loose.
- ▶ Protect the safety switch's electrical connections from corrosion.



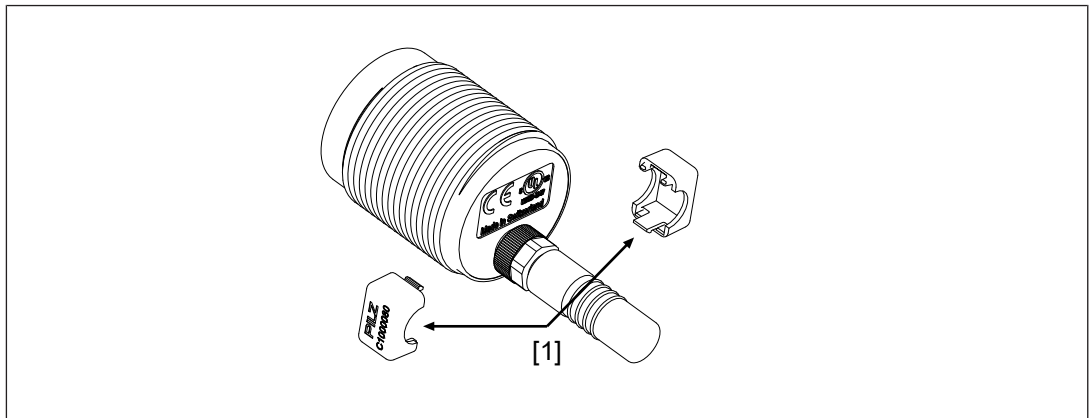
WARNING!

Risk of injury due to 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.

- ▶ Note the requirements in accordance with EN 60079-0 and EN 60079-14.
- ▶ The protection type must not be adversely affected by the plug-in connector.
- ▶ The plug-in connection may only be removed using a tool.
This may be for example
 - by design, using shielding plates or
 - using the clips supplied
- ▶ Check the compatibility of the mechanical dimension of clip and round plug-in connector.
- ▶ As shown in the diagram, combine the clips supplied above the screw connection of the cable and press both parts firmly onto each other. The clips must audibly lock into position and they must not be manually detachable.



Legend

[1] Manipulation protection CABLE/M8/CLIP

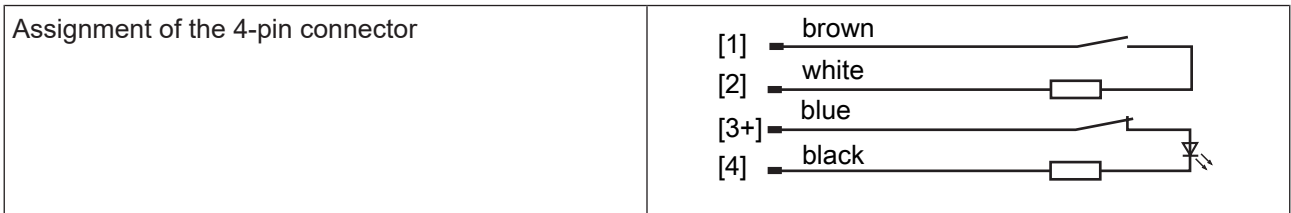
Pin assignment



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 2.2p-24, ATEX in accordance with DIN EN 60947-5-3 an evaluation device must be connected.

Connect the PSEN 2.2p-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 \[19\]](#) of PSEN 2.2p-24, ATEX
 - Always comply with the max. switching current safety contacts of PSEN 2.2p-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 \[19\]](#)) and the processing and delay times of the evaluation device (s. operating manual for the relevant evaluation device).

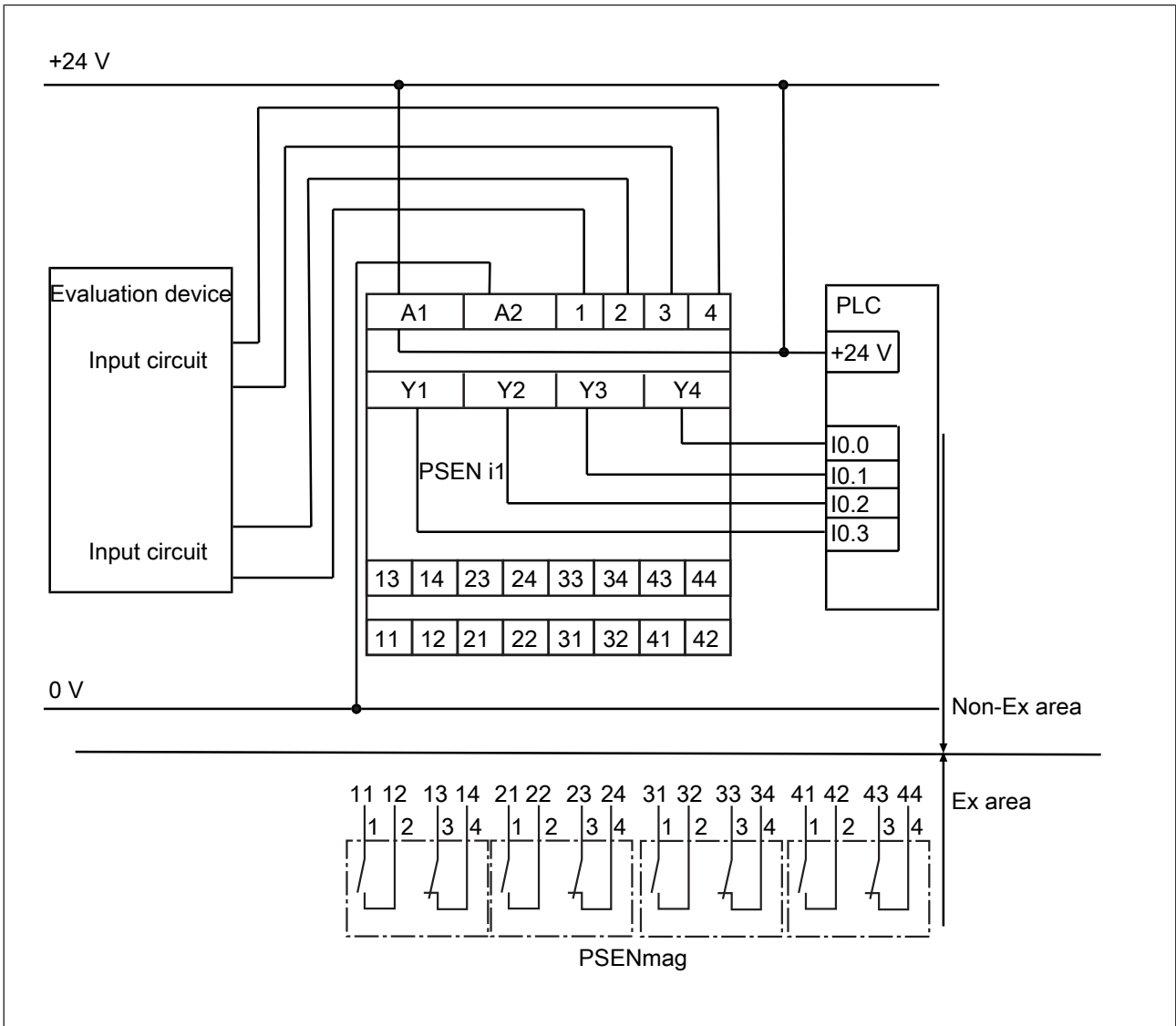
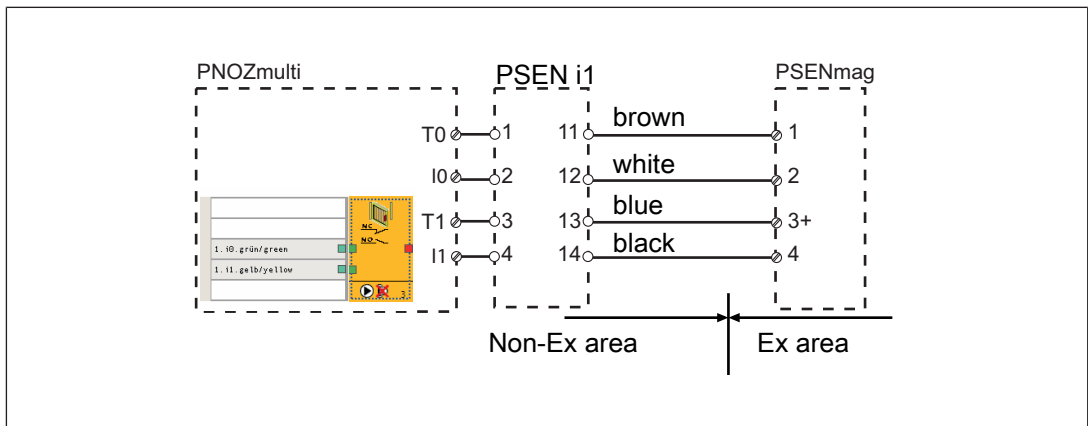


Fig.: Dual-channel connection of four PSENmag to the input circuits of an evaluation device

Examples for connection to Pilz evaluation devices:

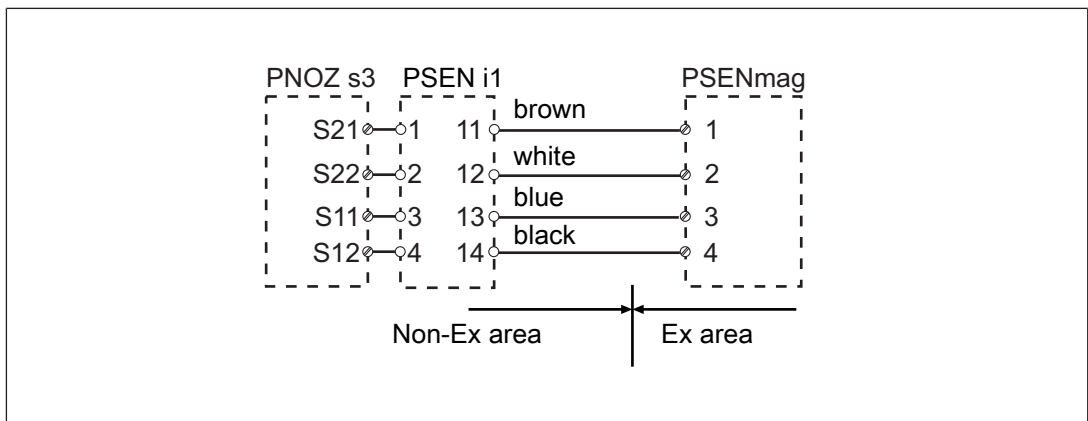


Legend

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.
- ▶ 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.

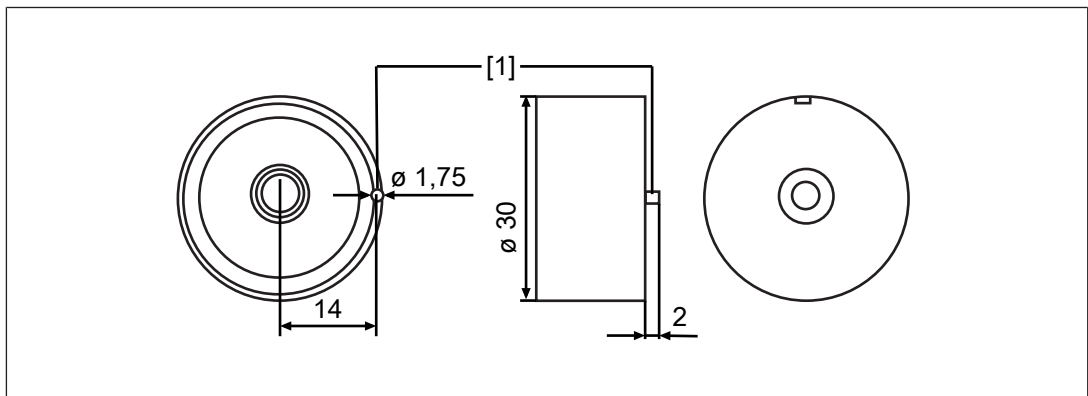


INFORMATION

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](#) [ 19]).
- ▶ 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 both notches (see [Lateral and vertical offset](#) [📖 9]) are exactly opposite each other.
- ▶ If possible, do not install the safety switch and actuator on to ferromagnetic material. Changes to the operating distances are to be expected.
- ▶ Secure the actuator using a countersunk screw M4 or M5.
- ▶ The safety switch and actuator should only be secured using screws and nuts made of non-magnetic material (e.g. brass or stainless steel).
- ▶ A nib on the actuator prevents it twisting (see [Dimensions](#) [📖 18]).
On the mounting surface, drill a hole (\varnothing 2 mm) as specified in the drawing, and place the nib in the drill hole when installing the actuator.



Legend

[1] Nib on the actuator

- ▶ The protection type (see [Technical details](#) [📖 19]) can only be achieved by using the Pilz connection leads available as an accessory.

Adjustment

- ▶ The safety switch may only be used with the corresponding actuator PSEN 2.2-20.
- ▶ Always test the function with the PSEN i1 interface and connected evaluation device.
- ▶ The stated operating distances (see [Technical details](#) [📖 19]) 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](#) [📖 9]).


ATEX installation and operating regulations (X)

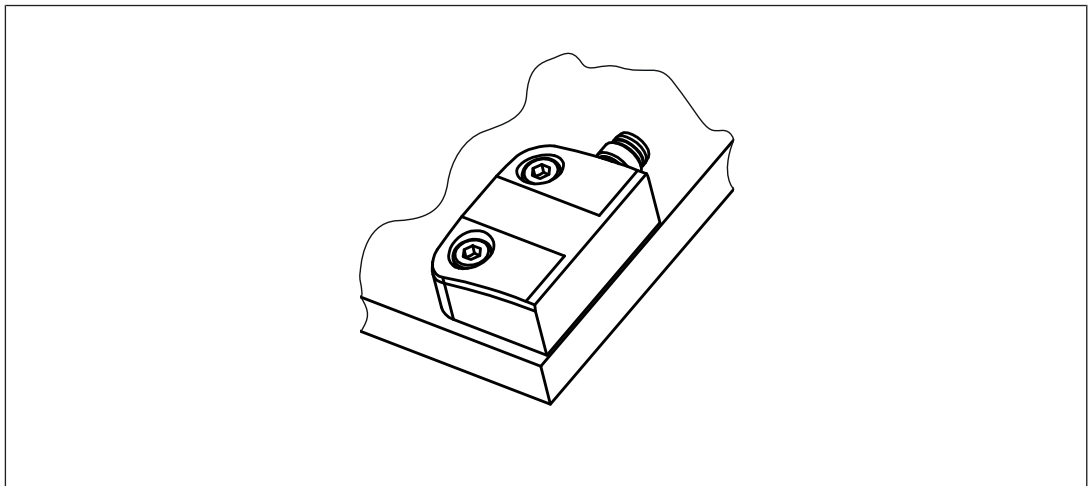


WARNING!

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](#)  15] 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.

The following additional regulations apply:

- ▶ The connector must be protected from mechanical impacts in accordance with EN 60079-0 section 26.4.2.
- ▶ The ambient temperature must be in the temperature range specified in [Technical details](#)  19]
- ▶ Protect the against plug-in connection against accidental disconnection. See [Wiring](#)  10].
- ▶ Attach a warning to the cable box:
 - "Warning - do not separate when energised"
 - "Warning - do not separate when energised".

Periodic test

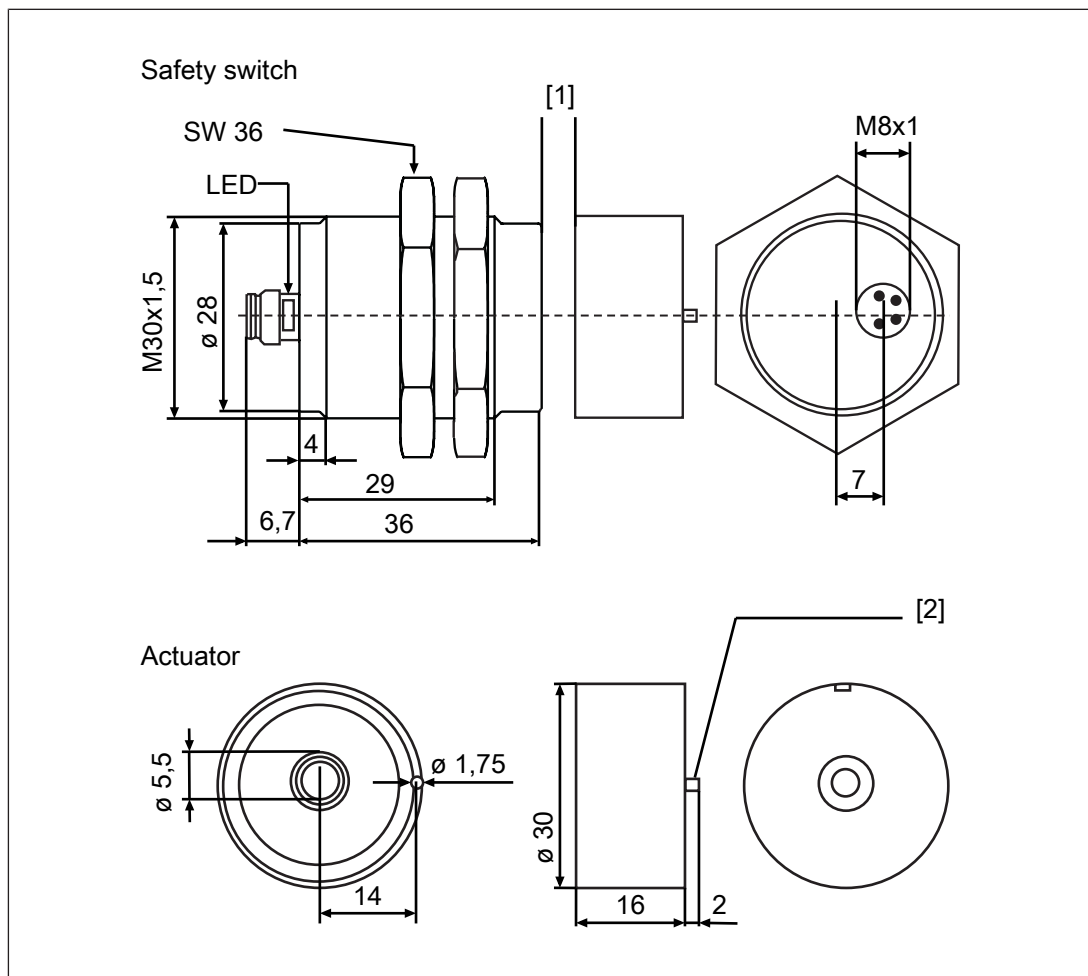
- ▶ Make sure that the work is **not** performed in an explosive atmosphere.
- ▶ Carry out a monthly function test on the safety switch and actuator.
- ▶ Always test the function with the PSEN i1 interface and connected evaluation device.
- ▶ The safety function may only be checked by qualified personnel.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



NOTICE

The safety functions 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



Legend

- [1] Notches at the safety switch and actuator
- [2] Nib at the actuator to prevent it from twisting

Technical details

General	
Certifications	ATEX, CE, EAC, ECOLAB, TÜV, UKCA, 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 ec mc IIC 80°C (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 SL	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
Connectors	IP67
Operating distances	
Assured operating distance Sao	8 mm
Min. operating distance Somin	0,5 mm
Assured release distance Sar	26 mm
Repetition accuracy switching distances	8 %
Mechanical data	
Actuator 1	PSEN 2.2-20
Typ. hysteresis	6 mm
Min. distance between safety switches	25 mm
Sensor flush installation in accordance with EN 60947-5-2	yes, follow installation guidelines
Connection type	M8, 4-pin male connector
Material	
Top	PBT
Max. torque setting	
Safety switch	3 Nm
Actuator 1	1 Nm
Dimensions	
Height	30 mm
Width	30 mm
Depth	44,9 mm
Actuator dimensions	
Height	30 mm
Width	30 mm
Depth	16 mm
Weight of safety switch	35 g
Weight of actuator	20 g
Weight	55 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 2.2p-24/PSEN2.2-20/ LED/8mm/ATEX	Magnetic safety switch, round actuator, with assured operating distance 8 mm, incl. 1 pair CABLE/M8/CLIP to safeguard 1 M8 plug-in connector	4-pin M8 male connector	503224
PSEN 2.2p-24/LED/8mm/ATEX 1 switch	Magnetic safety switch	4-pin M8 male connector	523124
PSEN 2.2-20 / 1 actuator	Actuator round, with assured operating distance 8 mm		513120

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	533110
PSEN Kabel Gerade /cable straightplug 2m	Female connector, M8 straight, 4-pin		2 m	533111
PSEN Kabel Winkel/cable angleplug 5m	Female connector, M8 angled, 4-pin		5 m	533120
PSEN Kabel Gerade/cable straightplug 5m	Female connector, M8 straight, 4-pin		5 m	533121
PSEN Kabel Winkel/cable angleplug 10m	Female connector, M8 angled, 4-pin		10 m	533130
PSEN Kabel Gerade /cable straightplug 10m	Female connector, M8 straight, 4-pin		10 m	533131
PSEN Kabel Winkel/cable angleplug 3m	Female connector, M8 angled, 4-pin		30 m	533140
PSEN Kabel Gerade /cable straightplug 30m	Female connector, M8 straight, 4-pin		30 m	533141
PSS67 Cable M8sf M12sm	Female connector, M8 straight, 4-pin	Male connector M12 straight	3 m	380200
			5 m	380201
			10 m	380202
			30 m	380203
PSS67 Cable M8af M12sm	Female connector M8 angled, 4-pin		3 m	380204
			5 m	380205
			10 m	380206
			30 m	380207

Product type	Features	Order no.
CABLE/M8/CLIP	Manipulation protection for plug-in connector and protection against unintended disconnection, for single use, 4 pieces for securing 4 M8 plug-in connectors	C1000080

Installation material

Product type	Features	Order no.
PSEN Winkel / bracket	Mounting bracket	532110

Connector

Product type	Features	Order no.
PSEN ma adapter	Adapter for connecting the safety switch to PSS67 and PDP67	380300

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	535110
PDP67 F 8DI ION	Decentralised input module IP67 for PNOZmulti	773600

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.

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) Regulations 2008
- ▶ Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016

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

Representative: Pilz Automation Technology, Pilz House, Little Colliers Field, Corby, Northamptonshire, NN18 8TJ United Kingdom, eMail: mail@pilz.co.uk

► Support

Technical support is available from Pilz round the clock.

Americas

Brazil

+55 11 97569-2804

Canada

+1 888 315 7459

Mexico

+52 55 5572 1300

USA (toll-free)

+1 877-PILZUSA (745-9872)

Asia

China

+86 400-088-3566

Japan

+81 45 471-2281

South Korea

+82 31 778 3300

Australia and Oceania

Australia

+61 3 95600621

New Zealand

+64 9 6345350

Europe

Austria

+43 1 7986263-444

Belgium, Luxembourg

+32 9 3217570

France

+33 3 88104003

Germany

+49 711 3409-444

Ireland

+353 21 4804983

Italy, Malta

+39 0362 1826711

Scandinavia

+45 74436332

Spain

+34 938497433

Switzerland

+41 62 88979-32

The Netherlands

+31 347 320477

Turkey

+90 216 5775552

United Kingdom

+44 1536 462203

You can reach our international hotline on:

+49 711 3409-222

support@pilz.com

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Headquarters: Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, E-Mail: info@pilz.com, Internet: www.pilz.com

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