Safe sensor technology PSEN for plant and machinery

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Non-contact, magnetic and coded safety switches,
light curtains and light barriers

The safe, complete solution.

Pilz – Products and services

Control and monitoring technology (Electrical safety to IEC 60204-1)	**Electronic monitoring relays**			S-Range							
Control and signalling	**E-STOP pushbutton**			PITestop							
	Muting lamps			PITsign							
											
Sensor technology	**Safety switches**		Non-contact, magnetic	PSENmag		◆					
			Non-contact, coded	PSENcode		◆					
	Optoelectronic protection devices		Light curtains Light barriers	PSENopt			◆				
Safe control technology (Functional safety to EN 954-1)	**Safety relays**		Compact	PNOZelog PNOZ X	◆	◆	◆	◆	◆	◆	
			Modular	PNOZmulti PNOZpower	◆	◆	◆	◆	◆	◆	
	Programmable safety systems		Safety systems for centralised solutions	PSS	◆	◆	◆	◆	◆	◆	
	Safe bus systems		Safety systems for decentralised solutions	SafetyBUS p	◆	◆	◆	◆	◆	◆	
Operating and monitoring	**Operator terminals**			PMImicro diag	Diagnostics						
	Line-based operator terminals			PX PXT	Diagnostics and visualisation						
	Operator terminals with touchscreen		With PMI-PRO software	PMIvisu	Diagnostics and visualisation						
			Open hardware platform	PMIopen	Visualisation						
Services	**Safety advice and engineering**		Plant assessment Risk assessment Safety concept Safety design CE services Safety sign-off								
	Training		Seminars and courses								

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Safe automation from Pilz

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Family-owned company with customer value

Pilz has a tradition as a family-run company stretching back over 50 years. Real proximity to customers is visible in all areas, instilling confidence through individual consultation, total flexibility and reliable service.

Heading into the future together

Pilz rigorously pursues clearly defined goals, which at the same time represent the route to a successful future. Our focus is to complete our safe automation range and dovetail this core competency with the expansion of standard solutions.

Solution supplier in Safety & Control

Solutions from Pilz protect man, machine and capital. That's why all our competency goes into innovative individual products, system solutions that are well thought through plus appropriate services.

You can find more details about Pilz and our products and services on the Internet:

▶ www.pilz.com

Safe sensor technology PSEN for plant and ma

More than automation – safe automation

Industrial safety systems such as safety switches and opto-electronic protective equipment provide effective personal security and industrial safety in automated production and logistics processes.

In conjunction with Pilz evaluation devices they protect man and machine in compliance with the standards.

The optimum safety solution for each application

Based on the different features and functionalities, PSEN safe sensor technology can be divided into the following product ranges:

Safety switches for safety gate and position monitoring

In compliance with the standards, machinery must be fitted with guards that can neither be defeated nor manipulated.

If the guards are opened, the PSEN safety switches are triggered and the dangerous machine movement is stopped. They are suitable for monitoring gates in safety fences for safety zones, for example.

Safety switch PSENmag with built-in protection against defeat

Magnetic safety switches are used wherever the risk analysis specifies a high category, where there is heavy soiling and where strict hygiene regulations need to be met.

They can be used to monitor the position of movable guards and can also be used in applications in which it is difficult to guide the gates accurately, where machine gates are subject to a high level of vibration and where large tolerances are required on start up.

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With safety switches PSENcode, manipulation protection exceeds the standards

In EN 1088 legislators require that manipulation protection on safety devices be guaranteed. If non-coded sensors are used, designers are required to guarantee this through concealed installation.

With PSENcode, protection against manipulation is built into the switch:
The safety switch and actuator work together in such a way that the enable from the safety device is only triggered if the actuating element is within the switch's response range and the code number on the actuator matches that of the switch. Two versions of this key lock principle are available: for use with any actuator or with an actuator that is uniquely assigned to the PSENcode.

PNOZpower *PNOZelog* *PNOZmulti*

PSS

The safe, complete solution

PSENopt

Optoelectronic protection devices for safeguarding interaction between man and machine

If the production process requires active intervention, there is a high potential risk.
Mechanical protection devices can seriously disrupt the work cycle. The solution is to design workstations ergonomically using active optoelectronic protection devices such as light curtains and light barriers PSENopt.

An invisible protected field of infrared beams protects the danger zones. If a light beam is broken it will immediately trigger a safe shutdown command. With PSENopt you can protect your staff and capital goods – safely, efficiently and economically.

Non-contact safety switches PSENmag and PSE

Economical safety is our strength

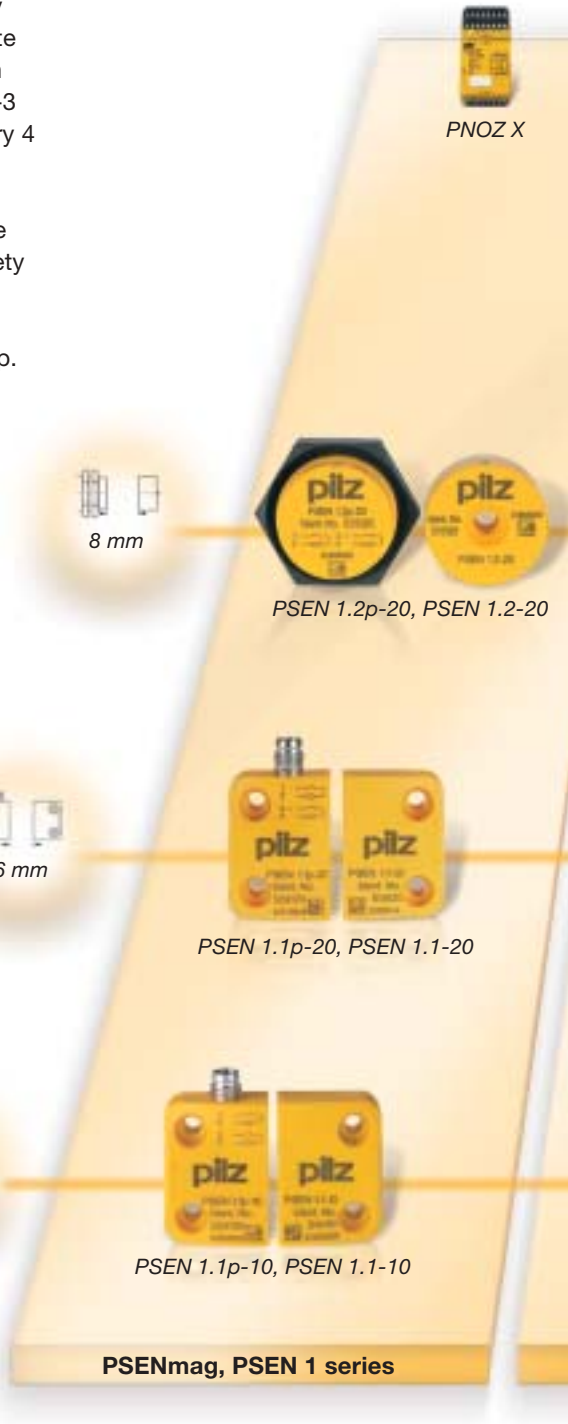
As a solution supplier Pilz offers the optimum concept for safe, economical safety gate and position monitoring: non-contact safety switches on the input side in conjunction with proven evaluation devices, including relay, semiconductor and power outputs, on the output side.

The result is reliable, high-quality components and maximum compatibility! The sensors have a compact design and rugged housing, ensuring a simple, space-saving installation and a long product service life. Just one single PSEN safety switch is sufficient for applications up to Category 4.

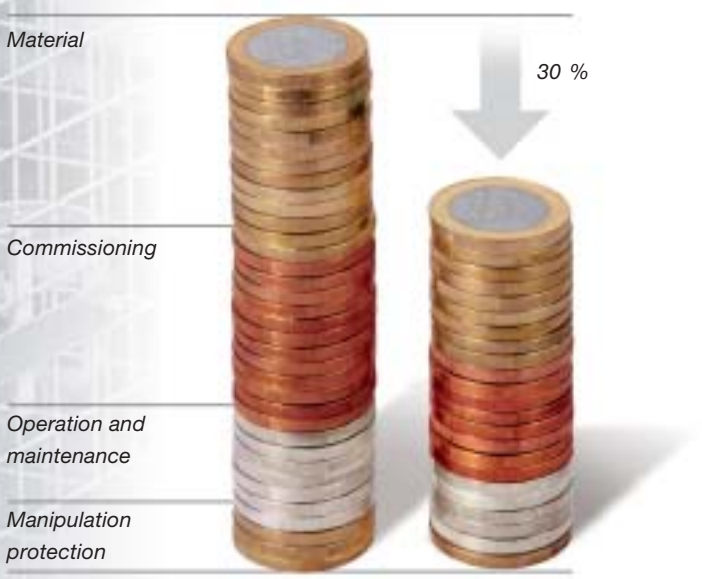
Approved, complete solution

In conjunction with Pilz evaluation devices, Pilz safety switches offer a safe, complete solution – with BG approval in accordance with EN 60947-5-3 for applications up to Category 4 of EN 954-1.

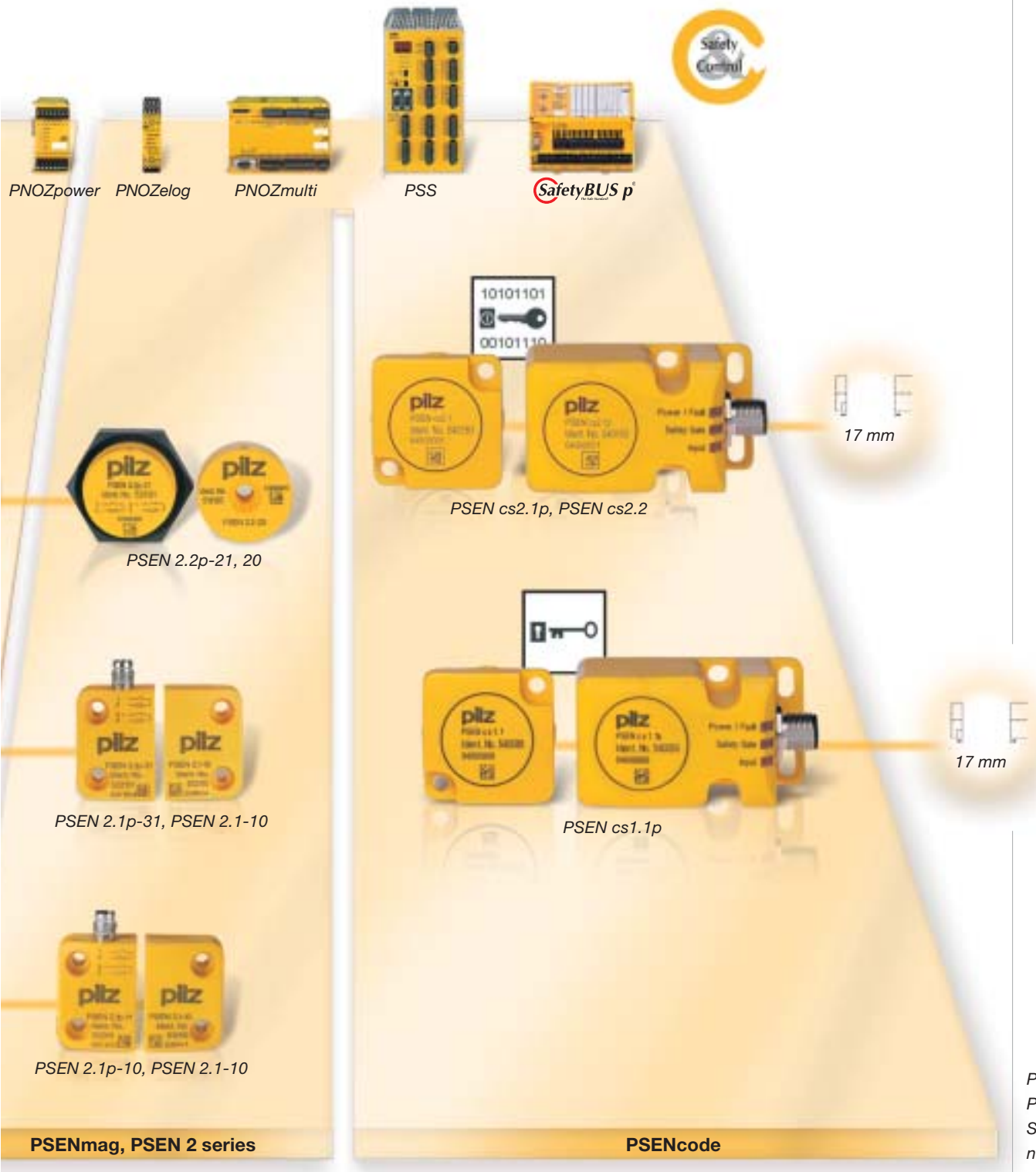
Evaluation devices include the extensive PNOZ-range of safety relays, PSS programmable safety systems and the safe, open bus system SafetyBUS p.



30% cost savings when compared with mechanical switches



Ncode

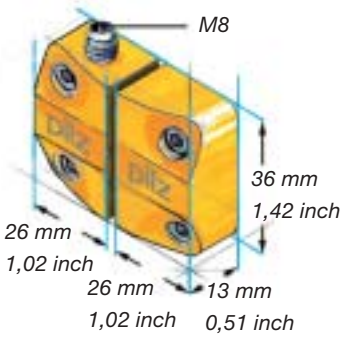


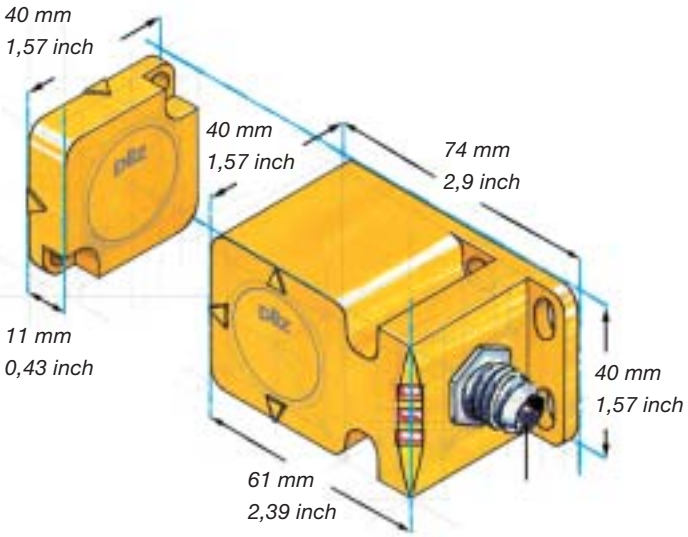
PSENmag and PSENcode – Safe, compact, non-contact

Safe, compact, non-contact – PSENmag and

- Safe, complete solution from Pilz with BG approval to EN 60947-5-3 for applications up to Category 4 in accordance with EN 954-1
- High level of safety with just one switch, up to Category 4 of EN 954-1
- Possible to conceal installation to protect against defeat in accordance with VDE 0660
- PSENcode has the highest level of manipulation protection via coding of switch and counterpart
- Flexibility and speed during installation plus high availability for your plant through
  - compact design
  - five directions of actuation
  - long switching distances
  - plug-in cable and
  - clearly visible status
- Cost-effective due to potential series connection
- Long product service life as it is mechanically non-wearing and insensitive to shock and vibration
- Housing is insensitive to dirt, dust-tight and waterproof to IP67

Safety switch PSENcode with five directions of actuation



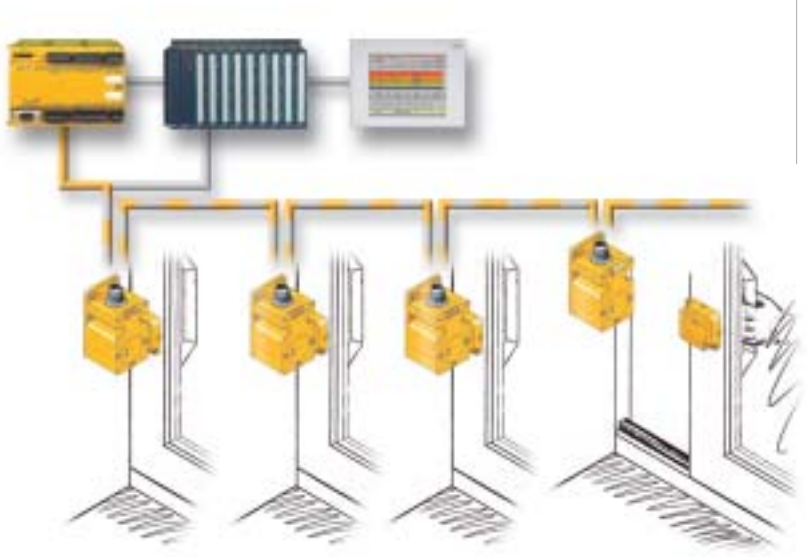


Compact design of the PSEN safety switches

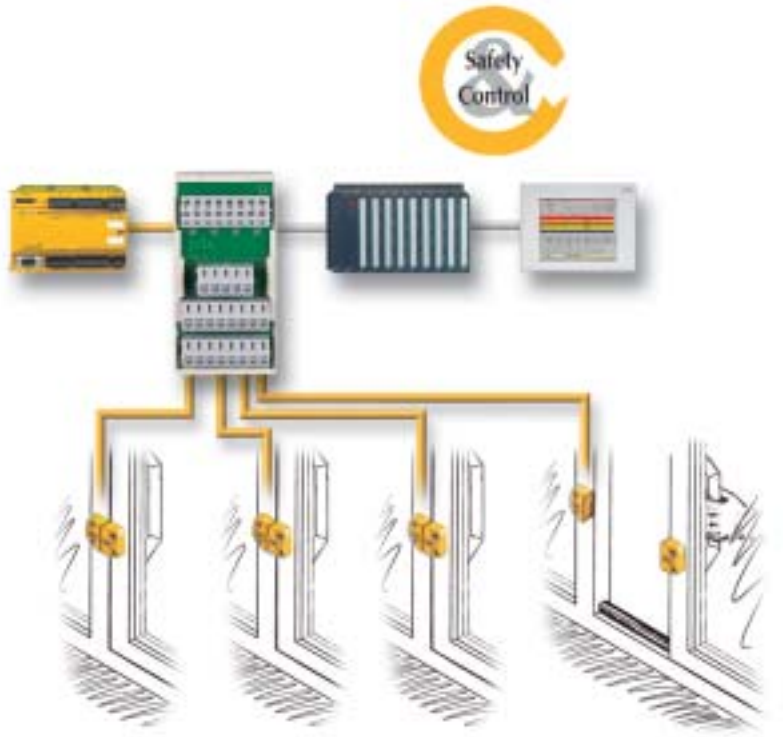
PSENcode

Series connection with PSEN safety switches up to Category 4

You can connect more than ten PSENcode safety switches in series and thereby achieve Category 4 in accordance with EN 954-1. You can also combine mechanical switches into the series via plug-in terminals.



Series connection of several PSENcode up to Category 4



Series connection of several PSENmag up to Category 3

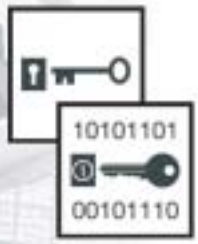
The safety interfaces PSEN ix1 and PSEN i1 enable you to cascade up to 48 PSENmag, depending on the evaluation device. This is particularly simple, fast and safe to perform using cage clamp terminals.

No additional wiring is required for the diagnostic and signal output, as the safety interface can be connected directly to the PLC, which signals the status of the safety gate via a status indicator.

Safely into the future with PSENmag and PSEN

Highest level of safety for your plant

With PSENmag safety switches you can easily protect against defeat in accordance with VDE 0660. The possibility of operating the switch unintentionally is also excluded.



Thanks to the coding of the switch and its counterpart, PSENcode offers manipulation protection that far exceeds the standard. A unique, fully coded version of the switch is available for particularly high safety requirements.

Flexible, economical installation and operation

Simple assembly and commissioning means your plant is quickly available.
With just a single switch you can achieve safety up to Category 4 of EN 954-1. This saves on wiring, while providing maximum safety and the highest level of integral protection from manipulation.

The five directions of actuation and long switching distance on the PSENcode ensure maximum freedom for installation. PSEN safety switches are therefore insensitive to spring-back or swinging from safety gates. The high lateral offset is a benefit here, enabling greater tolerances on the installation dimensions.

Plug-in cables ensure simple, quick wiring. Unlike mechanical switches, connection is quick and error-free using ready-made standard cables from Pilz. A protection type of up to IP67 can be achieved thanks to the use of M12/8 connectors with screw connection. Maintenance is therefore easier, as too is exchanging the safety switch.

Thanks to their small, compact structure, PSEN safety switches can be integrated perfectly into the existing working environment.
As the PSENmag is available in a square or round design, Pilz can supply the right safety switch to suit every installation requirement.

code

Product features PSENmag

- Approved for safe application up to Category 4 in accordance with EN 954-1
- Version also available with approval for use in potentially explosive atmospheres in accordance with the ATEX directive
- Switching distances S_{on} from 3 to 8 mm
- Suitable for series connection
- Square or round design
- Protection types IP65 and IP67
- With and without LED
- M8 connector, 4-pin
- Approved with all Pilz evaluation devices

Product features PSENcode

- Approved for safe application up to Category 4 in accordance with EN 954-1
- Series connection approved up to Category 4 in accordance with EN 954-1
- 5 directions of actuation
- Switching distances S_{on} up to 17 mm
- Coded or fully coded actuator (unique code)
- Diagnostic interface with 3 LEDs
- Protection types IP65 and IP67
- M12 connector, 8-pin
- Transponder technology
- ATEX approval in progress
- Approved with all Pilz evaluation devices

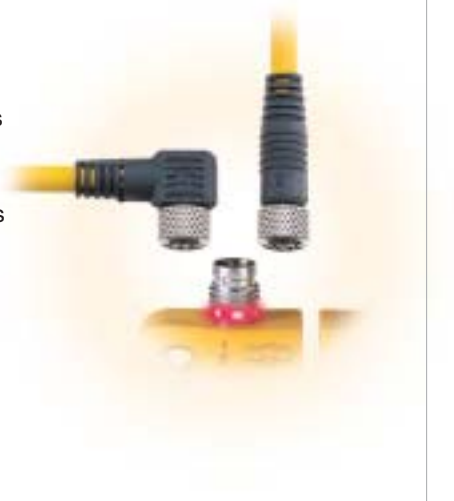
Safety in series

PSEN safety switches are also suitable for more complex plant or machinery, as it is possible to connect not just one but more than ten switches in series.

The benefit of series connection: several safety gates on a plant or machine can be monitored using a single evaluation device. The status of individual safety gates – open or closed – can also be transmitted to the PLC via signal outputs or can be read directly at the switch or at the multiple interface via LEDs.

Simple diagnostics using luminous LEDs

On the PSENmag the status display – i.e. the indication of an open safety gate – can be seen from all sides thanks to the LEDs located on the base of the connector thread.
More comprehensive diagnostics are also possible on the PSENcode through status display and monitoring of the series connection (input) and fault conditions.



PSEN safety switches for every environment a

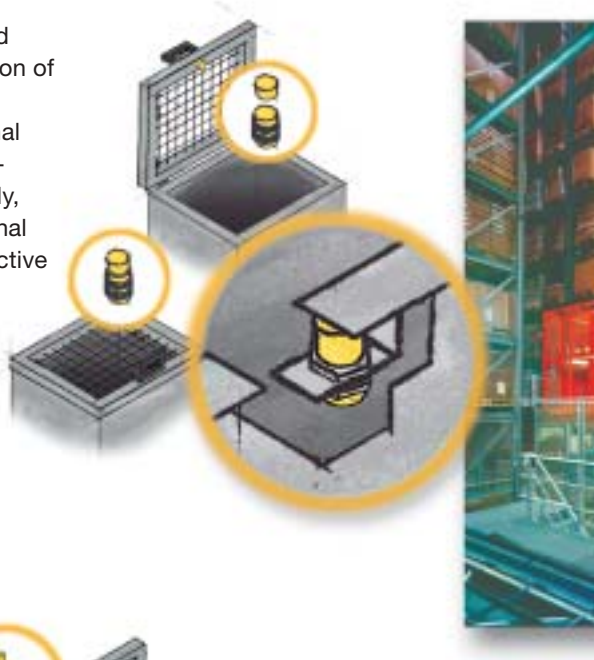
PSEN safety switches are insensitive to shock and vibration. They are mechanically long-wearing, so you can benefit from a long product service life.

The PSEN housing is made from silicone-free PBT plastic, which is insensitive to dirt. It has a smooth surface with laser inscription and the housing material is resistant to many chemicals; also, PSEN safety switches are dust-tight and waterproof to comply with the high protection type IP67, all of which makes them suitable for a variety of applications.

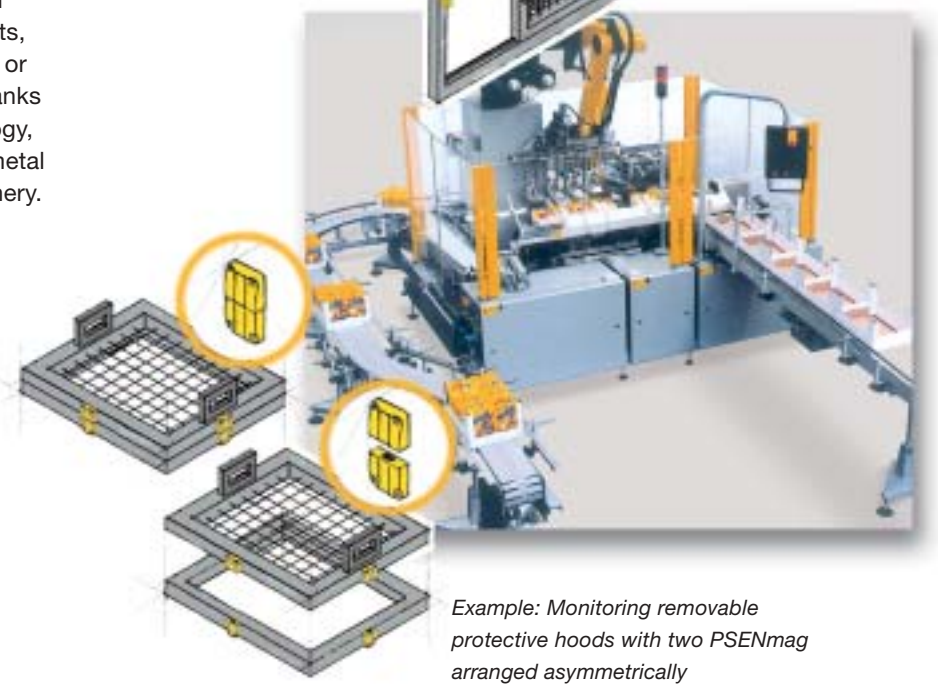
As they are secure against manipulation due to protection against defeat, Pilz safety switches are ideally suitable for monitoring safety gates and position monitoring, and can be used in a wide range of applications.

In classic mechanical engineering and sectors with rigorous hygiene requirements, such as the food, packaging or pharmaceutical industry. Thanks to its non-magnetic technology, PSENcode is also ideal for metal processing plant and machinery.

Furthermore, PSENmag and PSENcode provide the option of concealed installation. The PSENmag remains functional even when covered by non-magnetic materials. Similarly, PSENcode remains functional with non-electrically conductive materials.

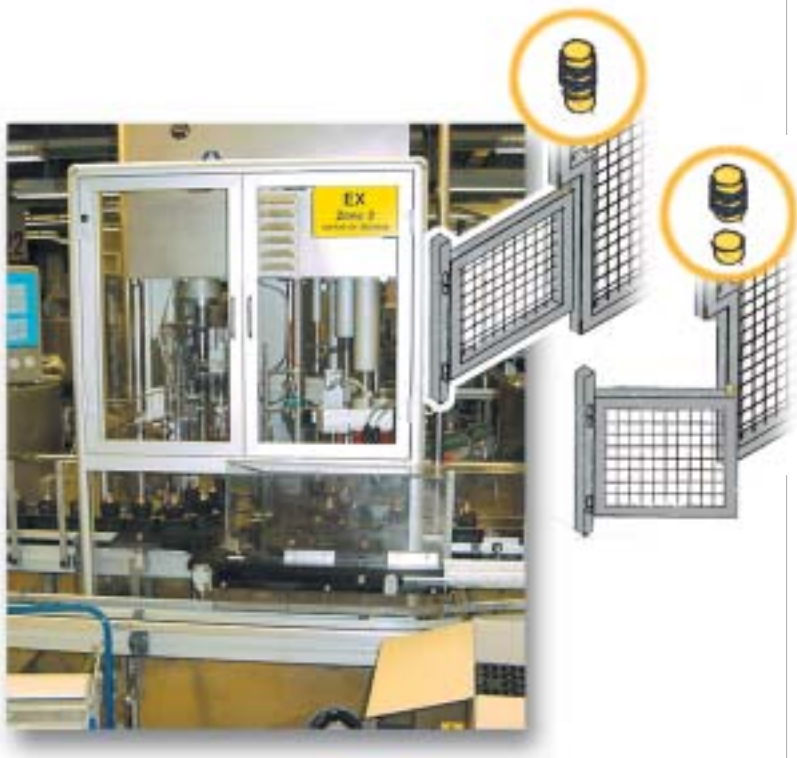


Example: Monitoring a sliding gate with a flexible installation of PSENcode



Example: Monitoring removable protective hoods with two PSENmag arranged asymmetrically

nd application



Example: Monitoring a swing gate with PSENmag in an EX area

Example: Monitoring double swing gates with one PSENmag for both swing gates

Example: Using the PSENcode to monitor a swing gate with large tolerances

Technical details – PSENmag

Non-contact, magnetic safety switches

Safety switches for monitoring the position of movable guards in accordance with EN 60947-5-3.

Type	Design	Switching distance	Category	Protection type
PSEN 1 series				
▸ Approved for safety-related applications in conjunction with virtually all the evaluation devices from the PNOZ X safety relay (please refer to the operating manual for further information) ▸ Approved for safety-related applications in conjunction with the PNOZ p1p evaluation device from the PNOZpower safety relay ▸ Without LED ▸ Connected directly or via the PSEN ix1 interface (see accessories)	**For single connection**			
	With ATEX approval for single connection			
	For series connection via PSEN ix1			
	With ATEX approval for series connection via PSEN ix1			
PSEN 2 series				
▸ Approved for safety-related applications in conjunction with the following evaluation devices from the electronic PNOZelog safety system: PNOZelog: PNOZ e3.1p, PNOZ e3vp 10 s, PNOZ e3vp 300 s, PNOZ e5.13p ▸ Approved for safety-related applications in conjunction with all the evaluation devices from the modular PNOZmulti safety system ▸ Approved for safety-related applications in conjunction with all the evaluation devices for PSS programmable safety systems with/ without SafetyBUS p connection (with standard function block SB066 for safety gate monitoring) ▸ Connected directly or via the PSEN i1 interface (see accessories)	**With LED**			
	With ATEX approval, with LED			
	Without LED			
	With ATEX approval, without LED			

PSEN 1.1p-10/-12, **PSEN 2.1p-10/-11**	**PSEN 1.1p-20/-22/-23/-25** **PSEN 2.1p-30/-31/-34**	**PSEN 1.2p-20/-22/-23/-25** **PSEN 2.2p-20/-21/-24**
		
Square	Square	Round
S_{on} ≤ 3 mm	S_{on} ≤ 6 mm	S_{on} ≤ 8 mm
Category 4 of EN 954-1	Category 4 of EN 954-1	Category 4 of EN 954-1
IP65 and IP67	IP65 and IP67	IP65 and IP67
PSEN 1.1p-10 Order number*: 504 210	PSEN 1.1p-20 Order number*: 504 220	PSEN 1.2p-20 Order number*: 505 220
	PSEN 1.1p-23 Order number*: 504 223	PSEN 1.2p-23 Order number*: 505 223
PSEN 1.1p-12 Order number*: 504 212	PSEN 1.1p-22 Order number*: 504 222	PSEN 1.2p-22 Order number*: 505 222
	PSEN 1.1p-25 Order number*: 504 225	PSEN 1.2p-25 Order number*: 505 225
PSEN 2.1p-11 Order number*: 502 211	PSEN 2.1p-31 Order number*: 502 231	PSEN 2.2p-21 Order number*: 503 221
	PSEN 2.1p-34 Order number*: 502 234	
PSEN 2.1p-10 Order number*: 502 210	PSEN 2.1p-30 Order number*: 502 230	PSEN 2.2p-20 Order number*: 503 220
		PSEN 2.2p-24 Order number*: 503 224

** Order number for safety switch and actuator (one unit).*

Technical details – PSENmag

Accessories PSENmag

PSEN ix1
Multiple interface for PSENmag safety switches PSEN 1 series

Order number: 535 120

- Connection of max. 4 safety switches from the PSEN 1 series or position switches with N/O / N/O combination
- Connection to evaluation devices for PSEN 1 series (see page 14)
- Series connection when evaluated via the above safety relays: max. 12 safety switches from the PSEN 1 series with max. 48 safety switches/position switches
- Volt-free signal outputs to evaluate the switch status
- Connection via spring-loaded terminals

PSEN i1
Multiple interface for PSENmag safety switches PSEN 2 series

Order number: 535 110

- Connection of max. 4 safety switches from the PSEN 2 series or position switches with N/C / N/O combination
- Connection to evaluation devices for PSEN 2 series (see page 14)
- Series connection possible when evaluated via:
  - PNOZelog electronic safety system: max. 6 PSEN i1 with max. 24 safety switches/position switches
  - PNOZmulti modular safety system: max. 4 PSEN i1 with max. 12 safety switches/position switches
  - PSS programmable safety system with/without SafetyBUS p connection: max. 4 PSEN i1 with max. 12 safety switches/position switches
- Diagnostic outputs to evaluate the switch status of the N/C circuits via external LEDs or a PLC
- Connection via spring-loaded terminals

PSEN cable angleplug/
PSEN cable straightplug
Cable for PSENmag safety switches

- 4-pin M8 connector
- Screw-on
- Straight or angled plug

Order numbers:

2 m with angled plug	533 110
5 m with angled plug	533 120
10 m with angled plug	533 130
30 m with angled plug	533 140
2 m with straight plug	533 111
5 m with straight plug	533 121
10 m with straight plug	533 131
30 m with straight plug	533 141

PSEN spacer
Spacer for safety switches from the PSENmag-range, in square design

- Height 8 mm

Order number: 534 310

PSEN bracket
Bracket for safety switches in the PSENmag-range, in square design

- Adjustable
- Aluminium

Order number: 532 110

Technical details – PSENcode

Non-contact, coded safety switches

Safety switches for monitoring the position of movable guards in accordance with EN 60947-5-3, can be connected to all Pilz evaluation devices.

Type
Coding type
Switching distance
Category
Operation
Direction of actuation
Protection type
Connection type
Special features
Without ATEX approval
With ATEX approval

Accessories PSENcode

PSEN cable angleplug/
PSEN cable straightplug
Cable for safety switch PSENcode

Order numbers:
3 m with angled plug 540322
5 m with angled plug 540323
10 m with angled plug 540324
3 m with straight plug 540319
5 m with straight plug 540320
10 m with straight plug 540321

- Unshielded
- 8-pin M12 connector
- Screw-on
- Straight or angled plug

PSEN cs1.1p **PSEN cs1.13p**	**PSEN cs2.1p** **PSEN cs2.13p**	**PSEN cs2.2p**
		
Coded	Fully coded	Unique, fully coded
S_{on} ≤ 17 mm	S_{on} ≤ 17 mm	S_{on} ≤ 17 mm
up to Category 4 of EN 954-1	up to Category 4 of EN 954-1	up to Category 4 of EN 954-1
transponder technology	transponder technology	transponder technology
5	5	5
IP67	IP67	IP67
8-pin M12 connectors	8-pin M12 connectors	8-pin M12 connectors
	Where there is operational damage to the actuator, possible to teach-in a new actuator up to 8 times	Unique assignment of safety switch and its actuator via coding
PSEN cs1.1p Order number*: 540 000	PSEN cs2.1p Order number*: 540 100	PSEN cs2.2p Order number*: 540 200
PSEN cs1.13p Order number*: 540 005	PSEN cs2.13p Order number*: 540 105	

** Order number for safety switch and actuator (one unit).*

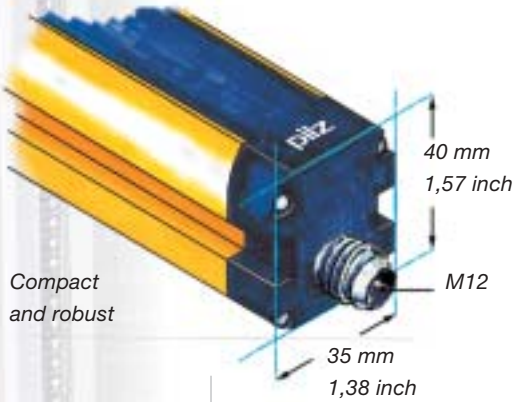
Light curtains and light barriers PSENopt

Complete solutions from one source

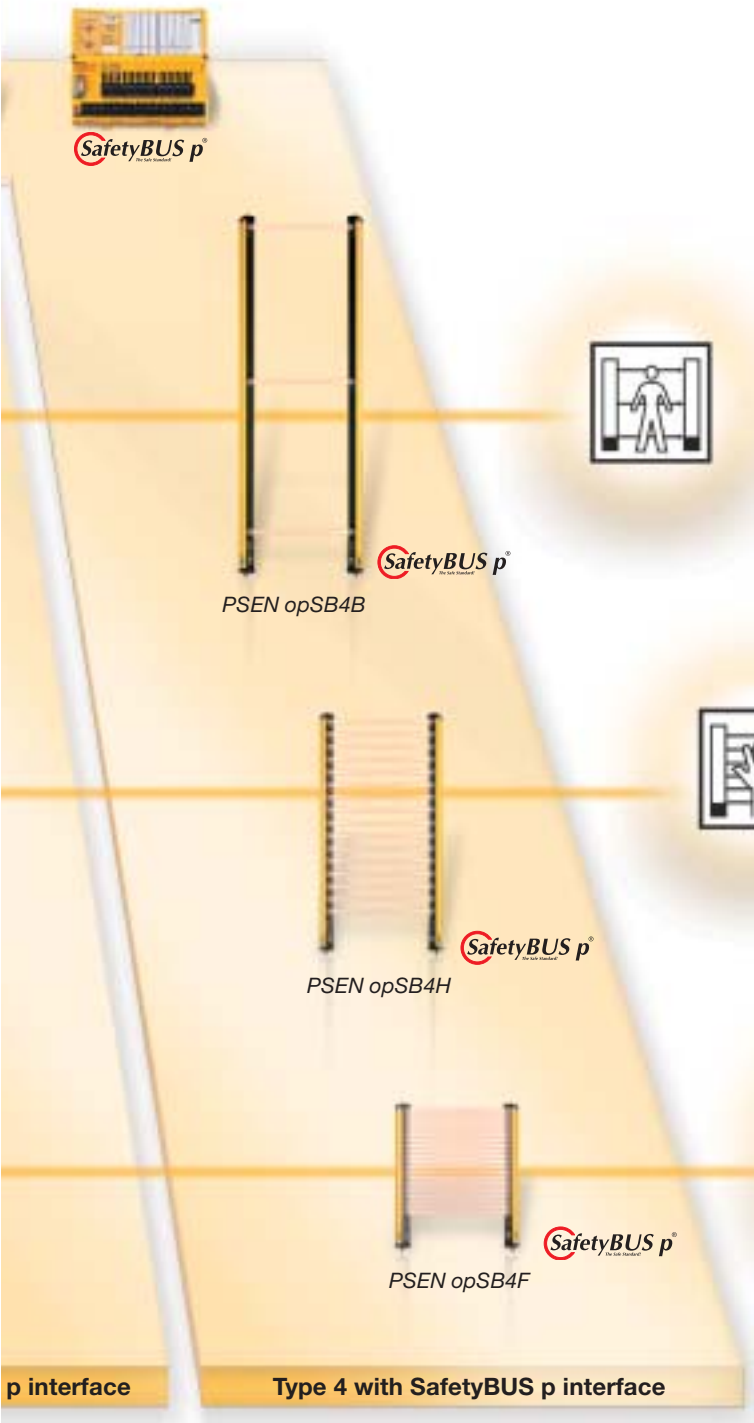
Optoelectronic protection devices such as light curtains and light barriers PSENopt are used to safeguard danger points and danger zones where the production process requires active intervention.

Pilz offers a safe, complete solution in conjunction with the following approved evaluation devices:

- PNOZ safety relays (we recommend PNOZ X2.9P, for example)
- PSS programmable safety systems
- Safe, open bus system SafetyBUS p



Compact and robust



PSENopt – Safety for finger, hand and body in conjunction with approved evaluation devices

Simplified commissioning through LED status display

Muting function is simple to select via DIP switches

Safety for finger, hand and body – PSENopt

- Maximum safety, as it conforms to standards and directives and is tested and approved
- The complete solution in conjunction with approved evaluation devices
- Compact dimensions make it easier to install on any plant
- Simple commissioning and economical operation due to integrated alignment guide and status LEDs
- Save space and costs through the integral muting function, including partial muting and monitoring of muting lamps in accordance with the ESPE standard 61496-1/-2
- The version with integrated SafetyBUS p interface combines high functionality with fast, simple installation
- Simple diagnostics via built-in diagnostic function
- Ergonomic workstation design in comparison to mechanical safety devices

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PSENopt with integrated muting function

Muting is the safe, automatic and temporary suspension of a protection device. It is frequently used to transport material into and out of a danger zone.

Muting sensors are used to detect this material. During the process optoelectronic protection devices are suspended temporarily, while muting lamps signal their status.

Light curtains and light barriers PSENopt have a certified, integral muting function. The integral muting solution on the PSENopt can be used cost-effectively for single safety functions.
If several safety functions are present, or particular demands are placed on the muting function, we recommend that the muting function is controlled via the PNOZmulti or via PSS/ SafetyBUS p components.

Additional functions such as override, monitored or automatic reset and partial muting can be set via the integrated DIP switches. Monitoring of the muting lamp is also incorporated as standard.

Product features PSENopt

- Conforms to the standard IEC/EN 61508
- Can be used in applications in accordance with Category 2/Category 4 of EN 954-1
- Can be used for finger, hand and body protection
- Built-in muting function, total or partial
- Integral SafetyBUS p interface
- Compact design

PSENopt with SafetyBUS p interface

SafetyBUS p®

To integrate PSENopt into a system with SafetyBUS p, M12 connectors can be used to connect the PSENopt directly. Simple, quick installation means you can save costs and gain potential savings later during operation.

PSENopt with SafetyBUS p connection also provides the following functions:

- PSENopt can be reset via the safe bus SafetyBUS p
- Monitored or automatic reset is possible via the reset button or SafetyBUS p
- Status and fault diagnostics via PSENopt or SafetyBUS p

You also have the option to connect the following additional safety functions directly to PSENopt:

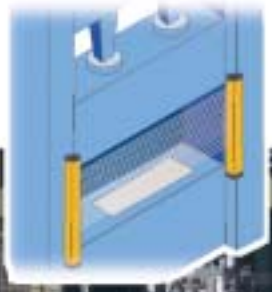
- E-STOP
- Reset button (manual or monitored)
- Up to 2 muting sensors
- One muting lamp

Highly versatile – PSENopt

Whenever it is necessary to intervene in the production process, PSENopt can be used to safeguard danger points and danger zones.

As it is non-wearing and has faster access times compared to mechanical protection devices such as safety gates, PSENopt is suitable for all industries and applications:

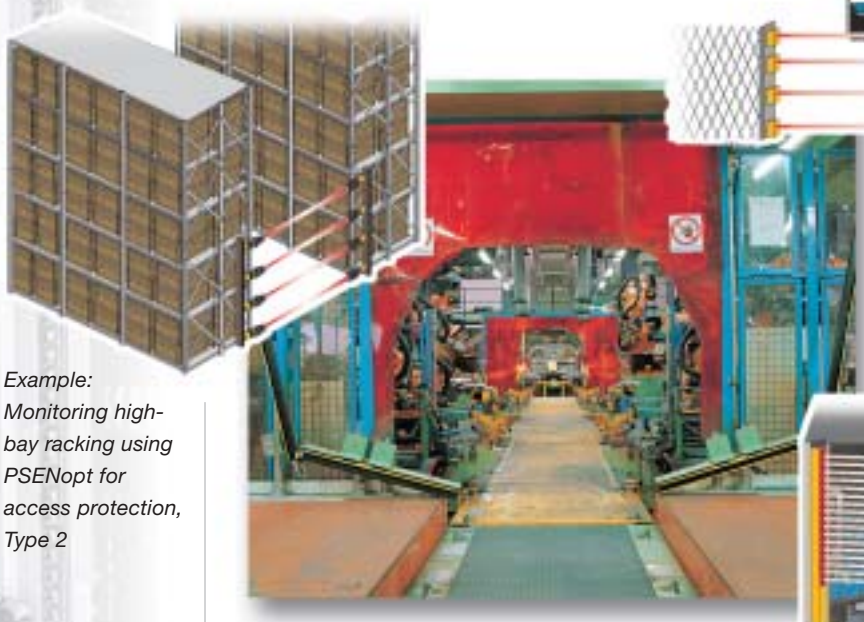
- Packaging machines
- Presses and punch machines
- Processing centres
- Robot systems, assembly lines
- Transport and conveyor systems, high-bay racking
- Wood, leather, ceramics and textile processing machines



Example: Monitoring a press using PSENopt for finger protection, Type 4

Example: Monitoring a plant using PSENopt for body protection, Type 4

Example: Monitoring a robot using PSENopt for access protection, Type 4



Example: Monitoring high-bay racking using PSENopt for access protection, Type 2

Example: Monitoring a cutting machine using PSENopt for hand protection, Type 4

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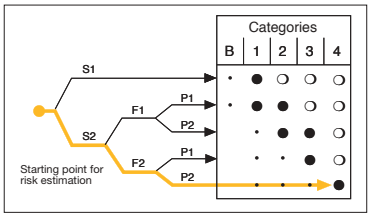
Product selection PSENopt

Safety assessment in accordance with EN 954-1

Machine manufacturers are encouraged to perform a hazard analysis and risk assessment even in the development phase. The resulting safety assessment in accordance with EN 954-1 defines the category required for each application.

- S. Severity of injury
  - S1 Slight (normally reversible) injury (i.e. cut or bruise)
  - S2 Serious irreversible injury
- F. Frequency and/or exposure time to the hazard
  - F1 Seldom to quite often
  - F2 Frequent to continuous
- P. Possibility of avoiding the hazard (generally related to the speed and frequency with which the dangerous part moves and to the distance from the dangerous part)
  - P1 Possible under specific conditions
  - P2 Scarcely possible



Example risk assessment

Risk assessment in accordance with EN/IEC 61496-1/-2

PSENopt complies with the relevant ESPE standard for the safety of machinery, EN/IEC 61496-1/-2: Electrosensitive protective equipment (ESPE), Parts 1 and 2.

Deciding the appropriate resolution

The number of light beams and the way they are spaced will depend on the risk assessment and machine-specific Type C standards.

EN 999 differentiates safety light curtains for finger and hand protection with a detection capability of 14 to 40 mm / 0.55 to 1.57 inches.
ESPE used for body protection or access protection are called safety light barriers. They have 2 to 4 beams.

Product selection

Protection type	Finger (F)	Hand (H)	Body/access protection (B)
			
Resolution/ Number of beams Height of protected field	14 mm 150 … 900 mm	30 mm 150 … 1650 mm	2 … 4 beams 500 … 1200 mm
Product type 2 in accordance with EN/IEC 61496-1/-2		PSEN op2H	PSEN op2B
Product type 4 in accordance with EN/IEC 61496-1/-2	PSEN op4F/ PSEN opSB-4F*	PSEN op4H/ PSEN opSB-4H*	PSEN op4B/ PSEN opSB-4B*

** with SafetyBUS p connection*

Installation in compliance with the standards

All electrosensitive protective equipment (ESPE) in an industrial environment must be installed in such a way that the protection device will reliably detect anyone penetrating the danger zone. The following standards must be observed for the installation:

- EN 999: Approach speed of parts of the body for the positioning of safety devices
- EN 294: Safety distances to prevent danger zones being reached by the upper limbs

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Minimum safety distance in accordance with EN 999

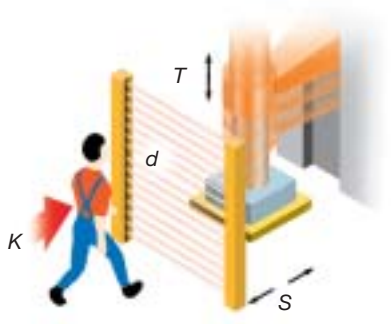
The minimum distance to the danger zone must be calculated in order to guarantee sufficient distance between the ESPE and the dangerous machine parts. The following formula should be used:

S = (K x T) + C
S = Minimum distance in mm from the danger zone to the protected field
K = Approach speed of a body or parts of the body, such as a finger or hand, in mm/s
T = The overall system stopping performance, in s
C = An additional distance in mm
d = Detection capability (resolution) of the light curtain in mm

Different approach speeds K and additional distance C should be used, depending on the application, i.e. finger, hand or body protection.

The following example distinguishes between two approach types:

Perpendicular approach/ perpendicular penetration into the plane of the protected field



With a vertical approach it is necessary to ensure that it is impossible to reach or climb under, over, round or through the device, or to get behind it. Please also note the following parameters during installation:

using PSENopt

For finger and hand protection with a perpendicular approach to the protected field

Safety distance from 100 to 500 mm:
S = (2 000 x T) + (8 x (d – 14))
K = 2 000 mm / s
C = 8 x (d-14 mm), ≥ 0
d ≤ 40 mm

Safety distance > 500 mm:
S = (1 600 x T) + (8 x (d – 14))
K = 1 600 mm / s
C = 8 x (d-14 mm), ≥ 0
d ≤ 40 mm

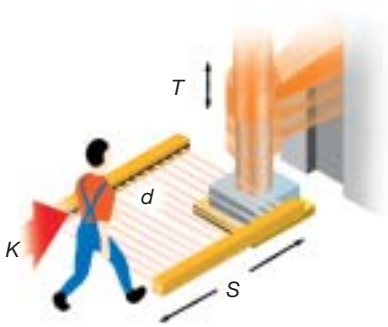
For body or access protection

S = (1 600 x T) + 850

Please also note the following installation heights above the reference plane (e.g. floor):

Number of beams	Height above reference plane in mm
4	300, 600, 900, 1 200
3	300, 700, 1 100
2	400, 900

Parallel approach/parallel penetration into the plane of the protected field



Where the danger zone is protected horizontally, the height of the protected field above the reference plane (H) must not exceed 1 000 mm or be less than 300 mm. If H > 300 mm, there is the risk that access beneath the protected field would go undetected. This must be taken into account in the risk assessment.

The following also applies:

S = (1 600 x T) + (1 200 – 0.4H)
K = 1 600 mm / s
C = 1 200 mm – 0,4H
Cmin = 850 mm
Hmax = 1 000 mm
Hmin = 15 (d – 50 mm)

If the height of the protected field is specified, the detection capability d must be calculated accordingly:
(d) = H / 15 + 50 mm.

Technical details – PSENopt

Light curtains, light barriers

Type

Protection type

Type 4 without SafetyBUS p interface

- Approved in accordance with DIN VDE 0801/IEC 61496-1/-2: Type 4
- Can be used for applications in accordance with EN 954-1: Category 4
- Supply voltage: 24 VDC
- Connection: Receiver Rx: M12, 8-pin; Transmitter Tx: M12, 4-pin
- Function selection: test, override, via DIP switches: manual/automatic reset, total muting/partial muting
- Dimensions: 35 x 40 mm

Operating range

Reaction times

Length of protected area / resolution or number of beams

Type 4 with SafetyBUS p interface

SafetyBUS p®

- Approved in accordance with DIN VDE 0801/IEC 61496-1/-2: Type 4
- Can be used for applications in accordance with EN 954-1: Category 4
- Integrated SafetyBUS p interface, simple, fast programming and parameters can be set for safety functions (e.g. muting) in the PSS
- Safe I/Os, E-STOP, enable switch and muting lamp (monitored/unmonitored) can also be connected directly
- Integrated muting function
- Supply voltage: 24 VDC
- Connection: Receiver Rx: M12, 8-pin and 5-pin; Transmitter Tx: M12, 4-pin
- Dimensions: 35 x 40 mm
- SafetyBUSp connection

Operating range

Reaction times

Length of protected area / resolution or number of beams

Type 2 without SafetyBUS p interface

- Approved in accordance with DIN VDE 0801/IEC 61496-1/-2: Type 2
- Can be used for applications in accordance with EN 954-1: Category 2
- Supply voltage: 24 VDC
- Connection:
  - PSEN op2H: Receiver Rx: M12, 5-pin; Transmitter Tx: M12, 4-pin
  - PSEN op2B: Receiver Rx: M12, 8-pin; Transmitter Tx: M12, 4-pin
- Functions:
  - PSEN op2H: Test, automatic reset
  - PSEN op2B: Function selection: test, override via DIP switches: manual/automatic reset, total muting/partial muting
- Dimensions:
  - PSEN op2H: 31 x 32 mm
  - PSEN op2B: 35 x 40 mm

Operating range

Reaction times

Length of protected area / resolution or number of beams

PSEN op4F, PSEN opSB-4F	**PSEN op4H, PSEN opSB-4H, PSEN op2H**	**PSEN op4B, PSEN opSB-4B, PSEN op2B**
		
For finger protection	For hand protection	For body protection
0.2 ... 6 m	0.2 ... 15 m	0.5 ... 25 m
18 ... 40 ms	15 ... 32 ms	14 ms
150/14 mm: PSEN op4F-14-015 Order number: 630 050	150/30 mm: PSEN op4H-30-015 Order number: 630 150	500 mm/2: PSEN op4B-2-050 Order number: 630 250
300/14 mm: PSEN op4F-14-030 Order number: 630 051	300/30 mm: PSEN op4H-30-030 Order number: 630 151	800 mm/3: PSEN op4B-3-080 Order number: 630 251
...*	...*	900 mm/4: PSEN op4B-4-090 Order number: 630 252
900/14 mm: PSEN op4F-14-090 Order number: 630 055	1 650/30 mm: PSEN op4H-30-165 Order number: 630 160	1 200 mm/4: PSEN op4B-4-120 Order number: 630 253
0.2 ... 6 m	0.2 ... 15 m	0.5 ... 25 m
18 ... 39 ms	15 ... 32 ms	15 ms
150/14 mm: PSEN opSB-4F-14-015 Order number: 630 350	150/30 mm: PSEN opSB-4H-30-015 Order number: 630 450	500 mm/2: PSEN opSB-4B-2-050 Order number: 630 550
300/14 mm: PSEN opSB-4F-14-030 Order number: 630 351	300/30 mm: PSEN opSB-4H-30-030 Order number: 630 451	800 mm/3: PSEN opSB-4B-3-080 Order number: 630 551
...*	...*	900 mm/4: PSEN opSB-4B-4-090 Order number: 630 552
900/14 mm: PSEN opSB-4F-14-090 Order number: 630 355	1 650/30 mm: PSEN opSB-4H-30-165 Order number: 630 460	1 200 mm/4: PSEN opSB-4B-4-120 Order number: 630 553
	0.2 ... 15 m	0.5 ... 50 m
	14 ... 24 ms	14 ms
	150/30 mm: PSEN op2H-30-015 Order number: 630 100	500 mm/2: PSEN op2B-2-050 Order number: 630 200
	300/30 mm: PSEN op2H-30-030 Order number: 630 101	800 mm/3: PSEN op2B-3-080 Order number: 630 201
	...*	900 mm/4: PSEN op2B-4-090 Order number: 630 202
	1 500/30 mm: PSEN op2H-30-150 Order number: 630 109	1 200 mm/4: PSEN op2B-4-120 Order number: 630 203

...: Please increase the length of the protected area by 150 mm each time and add one to the order number.*

Technical details – PSENopt

Accessories Muting/PSENopt

PSEN op1.1/PSEN op1.2

Order numbers:
Receiver: PSEN op1.1 ..... 630 321
Transmitter: PSEN op1.2 ..... 630 322

- Output: PNP, n/o and n/c
- Supply voltage: 10 ... 30 VDC
- Operating range: 0 ...20 m
- Connection: M12 connector, 4-pin

PSEN op1.3/PSEN op Reflektor
PSEN op1.3/PSEN op Reflector
Reflex light barrier, with polarised reflector

Order numbers:
Reflex: PSEN op1.3 ..... 630 320
Reflector: PSEN op Reflector .. 630 323

- With prism reflector
- Output: PNP, n/o and n/c
- Supply voltage: 10 ... 30 VDC
- Operating range: 0.1 ... 6 m
- Connection: M12 connector, 4-pin

Bracket
Mounting bracket for light barriers PSEN op1.1/1.2/1.3

Order number: 630 324

PIT si1.1
Muting lamp, unmonitored in accordance with EN 61496 and VDE 0113-201

Order numbers:
Muting lamp 600 010
incl. incandescent lamp, mounting bracket and 2 screws
Incandescent lamp 620 100

- Signal lamp for muting mode
- Suitable for use with light curtains and light barriers PSENopt (PSEN op4F/H/B, PSEN opSB 4F/H/B and PSEN op2B) and with PSS programmable safety systems (block FS SB095) and with dual-pole outputs (PSS DIO Z/DI2O Z)
- Protection type: IP65

PIT si1.2
Muting lamp, monitored in accordance with EN 61496 and VDE 0113-201

Order numbers:
Muting lamp 600 020
incl. incandescent lamp, mounting bracket and 2 screws
Incandescent lamp 620 100

- For applications in accordance with EN 954-1, up to Category 4
- For universal use thanks to integrated lamp monitoring in accordance with the ESPE standard 61496-1/-2
- 2 semiconductor outputs to monitor the function of the filament
- With TÜV approval
- Protection type: IP65

Accessories Muting/PSENopt

PSEN op Cable M12, 4-pole, shielded
M12, 4-core cable, shielded

Order numbers:
3 m, axial 630303
5 m, axial 630304
10 m, axial 630305
3 m, angled 630306
5 m, angled 630307
10 m, angled 630308

- The use of shielded cables is specified for product groups in the PSEN op4F/4H/4B/2B series.
- M12 coupling sockets
- 4-core
- Shielded
- Straight (axial) or angled plug
- Cable runs: 3, 5, 10 m

PSEN op Cable M12, 4-pole, unshielded
M12, 4-core cable, unshielded

Order numbers:
3 m, axial 630300
5 m, axial 630301
10 m, axial 630302
3 m, angled 630341
5 m, angled 630342
10 m, angled 630343

- M12 coupling sockets
- 4-core
- Unshielded
- Straight (axial) or angled plug
- Cable runs: 3, 5, 10 m

PSEN op Cable M12, 8-pole, shielded
M12, 8-core cable, shielded

Order numbers:
3 m, axial 630313
5 m, axial 630314
10 m, axial 630315
3 m, angled 630316
5 m, angled 630317
10 m, angled 630318

- The use of shielded cables is specified for product groups in the PSEN op4F/4H/4B/2B series.
- M12 coupling sockets
- 8-core
- Shielded
- Straight (axial) or angled plug
- Cable runs: 3, 5, 10 m

PSEN op Cable M12, 5-pole, unshielded
M12, 5-core cable, unshielded

Order numbers:
3 m, axial 630310
5 m, axial 630311
10 m, axial 630312
3 m, angled 630347
5 m, angled 630348
10 m, angled 630349

- M12 coupling sockets
- 5-core
- Unshielded
- Straight (axial) or angled plug
- Cable runs: 3, 5, 10 m

Accessories PSENopt

Stand
Floor brackets

Order numbers:
1 000 x 30 x 30 mm 630 330
1 200 x 30 x 30 mm 630 331
1 500 x 45 x 45 mm 630 332
1 500 x 45 x 45 mm 630 333

- Can be used for all light curtains and light barriers PSENopt and the deviating mirror
- Available in various sizes:
  - Height: 1 000 and 1 200 mm
    Profile dimension: 30 x 30 mm
  - Height: 1 500 and 1 800 mm
    Profile dimension: 45 x 45 mm
- Dimensions of the floor mounting plate: 240 x 240 mm

Mirror
Deviating mirror

Order numbers: :
550 mm 630 335
700 mm 630 336
900 mm 630 337
1 000 mm 630 338
1 270 mm 630 339

- Can be used for all light curtains and light barriers PSENopt
- Available in heights of 550, 700, 900, 1 000 and 1 270 mm
- Dimensions: width: 124 mm, depth: 6 mm

Accessories, alignment and installation PSENopt

Laserpointer

Order number: 630 340

- Can be used on PSEN op4 F/H/B and PSEN op2B

Bracket kit
Mounting bracket

Order numbers:
Mounting bracket, standard 630 325
Mounting bracket, adjustable .. 630 326
Mounting bracket,
vibration-resistant 630 327

- Included with the PSENopt
- Adjustable or vibration-resistant mounting brackets are available for all PSEN
- Packaged in 4s

Test piece
Test pieces

Order numbers:
Finger protection (Ø 14 mm) 630 345
Test piece F 14 mm
Hand protection (Ø 30 mm) 630 346
Test piece H 30 mm

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❑ Your services, e.g. project management, risk analysis, safety concepts, etc.

❑ Your training courses and seminars

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❑ PSEN sensor technology

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❑ PSS programmable safety systems

❑ SafetyBUS p safe bus systems

❑ Operating and monitoring PMI, PX, PXT

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