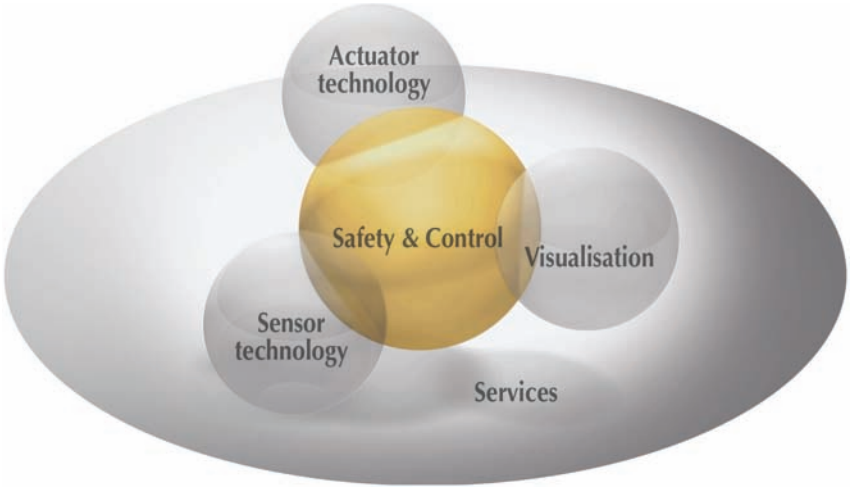


PSENopt light curtains and light barriers

more than automation
safe automation

Configuration guide

Technical catalogue 2.2 – February 2007 edition



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February 2007

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Basics

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Basics

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Basics	
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Basics
Description

This technical catalogue describes the units in the PSENopt and PSENopt SB product ranges:
Safety light curtains **PSENopt**:
- PSEN op2H
- PSEN op2B
- PSEN op4F
- PSEN op4H
- PSEN op4B
- PSEN op4F-s
- PSEN op4H-s
- PSEN op4F-b
- PSEN op4H-b
- PSEN op4F-m
- PSEN op4H-m
- PSEN op4F-bm
- PSEN op4H-bm
- PSEN op4F-sl
- PSEN op4H-sl
- PSEN op4B-T
- PSEN op4B-L
- PSEN op4B-S

Safety light curtains **PSENopt SB** with integral SafetyBUS p interface:
- PSEN opSB-4F
- PSEN opSB-4H
- PSEN opSB-4B

Operation

Safety light curtains in the PSENopt product range are optoelectronic protection devices. They are used to safeguard access areas, danger points or danger zones.

They are designed as safe type 2 or type 4 systems, for accident prevention in accordance with applicable international standards, in particular EN 61496-1, 1997 and IEC 61496-2, 1997.

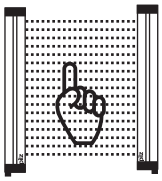
The safety light curtains consist of a transmitter and a receiver, which are optically synchronised.
The infrared beams are controlled and monitored via a microprocessor.
As soon as at least one of the beams emitted by the transmitter is interrupted, the OSSD outputs switch to LOW and the hazardous movement is stopped.

Evaluation devices

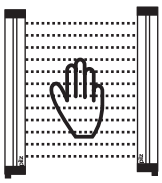
- **PSENopt SB** safety light curtains have an integral SafetyBUS p interface and are designed for use on SafetyBUS p. They can be connected directly via M12 connectors
- **PSENopt** safety light curtains can be used in conjunction with the following evaluation devices:
  - PNOZelog electronic safety relays
  - PNOZmulti modular safety relays
  - PNOZ safety relays
  - PSS programmable safety systems
  - Safe, open bus system SafetyBUS p

Selection criteria for safety light curtains

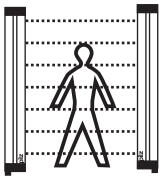
- Area of use
- Resolution, depending on the part of the body requiring protection:



- Finger protection (R = 14 mm)



- Hand protection (R = 30 mm)



- Body protection (R > 40 mm)
- Length of the protected area/ length of the sensing area

Application areas

Safety light curtains in the PSENopt product range are used in particular to stop hazardous movements of mechanical parts, i.e. on:
- Automatic machinery
- Packaging, handling and storage machinery
- Textile processing, woodworking and ceramic processing machinery
- Automatic or semi-automatic assembly lines
- Automated high-bay racking

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Basics
Description

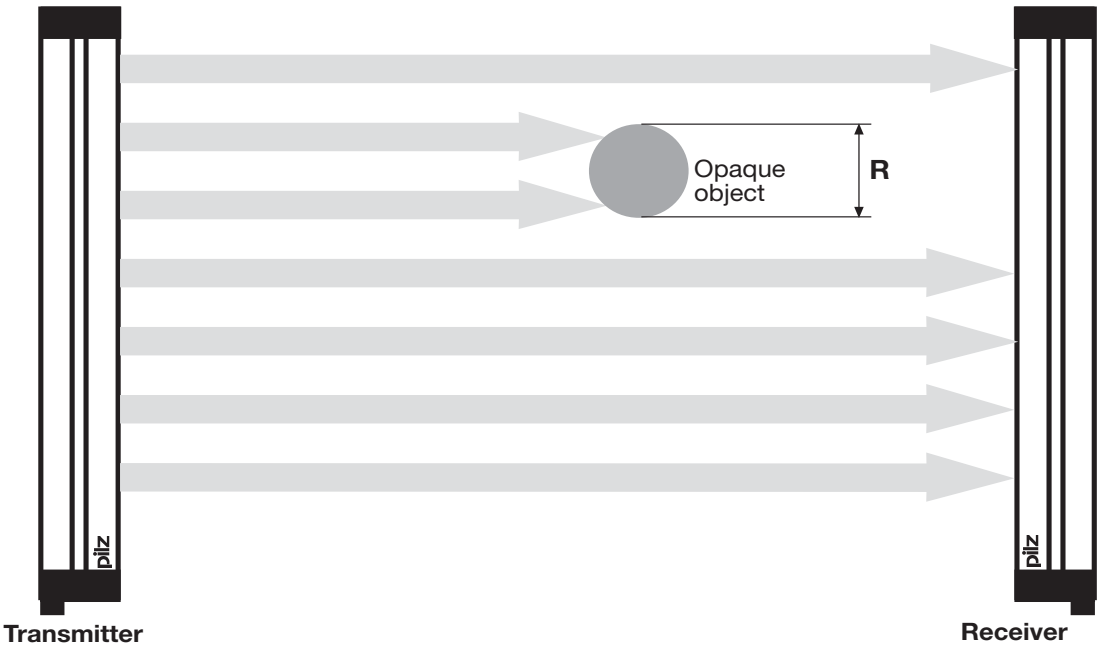


Fig. 1.1-1: Resolution, depending on the part of the body requiring protection

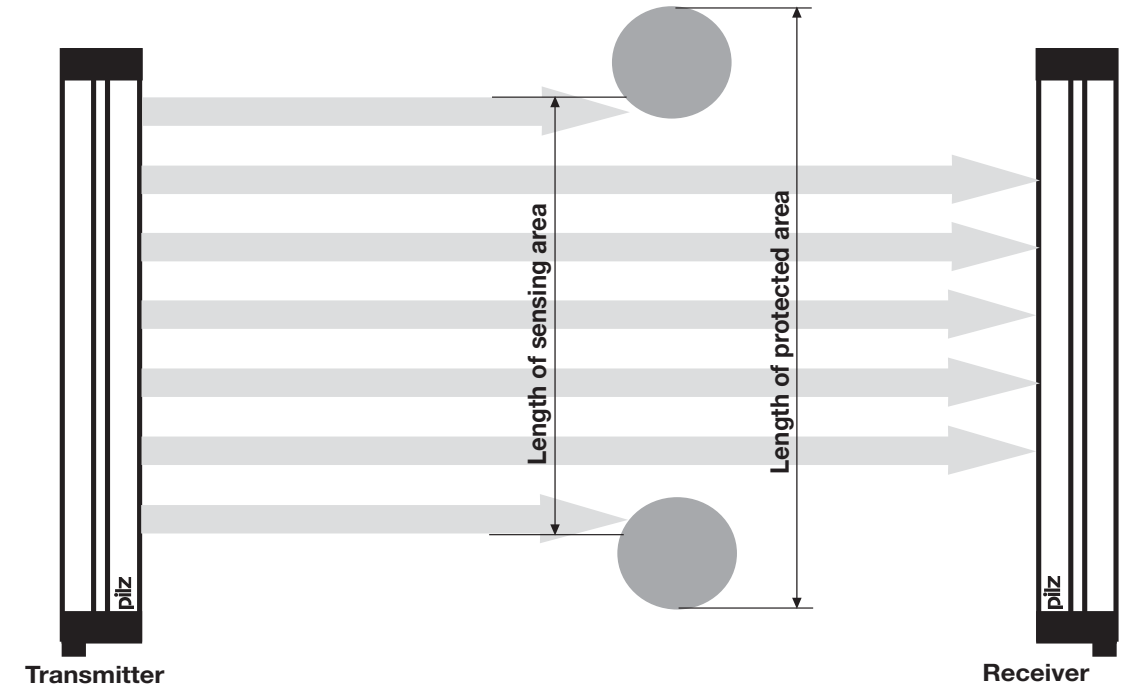


Fig. 1.1-2: Length of the protected area, length of the sensing area

Basics
Functions PSENopt

The integrated functions depend on the individual unit:

PSEN op2B, PSEN op4F/H/B:
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Integrated muting/override function
- Diagnostic function (LED)
- Test function

PSEN op2H:
- Automatic reset
- Diagnostic function (LED)
- Test function

PSEN op4F/H-s
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Reset function
- Feedback loop monitoring function
- Diagnostic function (LED)

PSEN op4F/H-b
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Reset function
- Feedback loop monitoring function
- Blanking function (fixed blanking, floating blanking)
- Diagnostic function (LED)

PSEN op4F/H-m (Master)
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Reset function
- Feedback loop monitoring function
- Cascading function (Master)
- Diagnostic function (LED)

PSEN op4F/H-bm (Master)
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Reset function
- Feedback loop monitoring function
- Blanking function (fixed blanking, floating blanking)
- Cascading function (Master)
- Diagnostic function (LED)

PSEN op4F/H-sl (Slave)
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Reset function
- Feedback loop monitoring function
- Cascading function (Slave)
- Diagnostic function (LED)

PSEN op4B-T/L/S
- Function selection via the integrated DIP switches
- Automatic/manual reset
- Reset function
- Feedback loop monitoring function
- Integrated muting/override function (T, L or linear configuration)
- Diagnostic function (LED)
- Test function

Operating modes

- **Automatic reset**: Following interruption of the beam between the transmitter and the receiver, the safety light curtain resumes normal operation as soon as the detected object has been removed from the protected area.
- **Manual reset**: Following interruption of the beam between the transmitter and the receiver, the safety light curtain does not resume normal operation until the detected object has been removed from the protected area and the restart button (Test/Reset button) has been pressed.

Muting function

The **muting function** enables the safety function to be temporarily suspended by blanking the protected area. The muting function is used to allow a conveyed item to pass through the protected field unhindered.
Muting sensors (muting signals) are used to reliably detect the conveyed item. Muting lamps are used to signal the activity of the muting function. Both need to be connected for activation of a muting function and are available as accessories (refer to the “Accessories” chapter).

The PSENopt can undertake the full muting operations thanks to its **integral muting function**:

PSEN op4F/H/B, PSEN op2B
- **Total muting function:** The entire protected area is blanked.
- **Partial muting function:** Only certain zones in the protected area are blanked.

PSEN op4B-T/L/S
PSEN op4B-L and PSEN op4B-T are equiped with muting sensors that are pre-assembled, pre-cabled and pre-set.
- **“L” Configuration (PSEN op4B-L):** Suitable for applications in which an object is moved out of the danger zone.
- **“T” Configuration (PSEN op4B-T):** Suitable for applications in which an object has two approach directions.
- **Linear model (PSEN op4B-S):** No integrated muting sensors; muting sensors can easily be incorporated via a connector. Muting sensors in T or L-Configuration can be ordered separately.

If several safety functions are required or if more extensive muting options are needed, then the muting function can also be implemented externally using the following evaluation devices:

- **PMUT X1P**
  Muting controller
  - The full muting functionality is provided by PMUT, PSENopt only supplies the information: “Protected field broken“
  - Partial muting is not available

- **PNOZmulti**
  Modular safety system
  For use with multiple safety functions
  - PSENopt receives the information that the muting function is active via the inputs MS1 and MS2.

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Basics
Functions PSENopt

- Muting times are variable and adjustable
- Partial muting is available

- **PSS/SafetyBUS p**
  Programmable safety system
  For use with multiple safety functions
  - The muting function is performed via the standard function blocks in the safety system
  - PSENopt receives the information that the muting function is active via the inputs MS1 and MS2.
  - Muting times are variable and adjustable
  - Partial muting is available

Override function

The muting function can be reactivated with the override function if the machine needs to be restarted despite at least one of the beams being interrupted. The aim is to clear the danger zone of any material that may have accumulated due to a fault in the operating cycle.

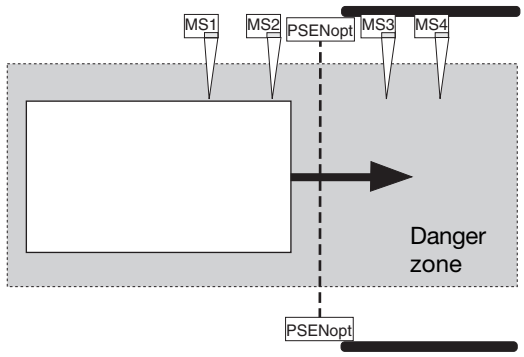


Fig. 1.1-3: Muting application with four muting sensors

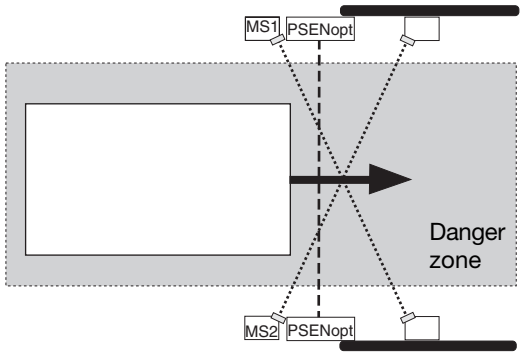


Fig. 1.1-4: Muting application with two muting sensors

Blanking function

The blanking function allows an object that is larger than the detection capability of the ESPE to be inside the protected field without the OSSD outputs switching off. There are two types of blanking function: Floating blanking and fixed blanking. These two function types can either be activated separately or simultaneously.

- **Floating blanking:**
  Enables 1, 2 or 3 beams inside any area of the protected field to be blanked. The blanked area follows the position of a moved object. The detection capability of the other areas remains the same.
- **Fixed blanking:**
  Enables a predetermined area of the protected field to be blanked. The position of the blanked area does not change during operation.

Feedback loop monitoring function

A feedback loop is used to monitor externally connected contactors.

Reset function

The reset function is used in the case of internal errors. The reset function cancels the reset lock and restores the normal operating status.

Cascading function

The cascading function can be used to connect pairs of light curtains in a cascading configuration. The connected light curtain pairs are described as Master and Slave. Only the Master has OSSD outputs and is responsible for controlling the output switching elements based on its own status and also that of the Slave's.

Diagnostic functions

The following states can be diagnosed via the LEDs located on the transmitter and receiver:

- Operating status
- Alignment (yes/no)
- Error messages, fault diagnostics

Test function

The function of the light curtain's safety outputs is checked every 0.5 s during the normal operating cycle. The test function can also be manually activated.

Basics
Functions PSEN opSB-4

The functions of the PSEN opSB safety light curtains can be performed locally via the I/O connector on the safety light curtain or externally via the PSS.
When functions are selected externally, they are configured in the "Editor for light curtains from the PSEN opSB-4 series" in the SafetyBUS p Configurator.

Functions:
- Automatic/manual reset
- Integrated muting override function
- Diagnostic function
- Test function

Operating modes

- **Automatic reset**
  Following interruption of the beam between the transmitter and the receiver, the safety light curtain resumes normal operation as soon as the detected object has been removed from the protected area.
- **Manual reset**
  Following interruption of the beam between the transmitter and the receiver, the restart is blocked. The safety light curtain does not resume normal operation until the object has been removed from the protected field and either
  - the restart button (test/reset button) has been operated for at least 0.5 s (local activation)

  or
  - the restart has been activated via the external command "LG_RESTART_EXT" (external activation)

Muting function

The **muting function** enables the safety function to be temporarily suspended by blanking the protected area. The muting function is used to allow a conveyed item to pass through the protected field unhindered.
Muting sensors (muting signals) are used to reliably detect the conveyed item. Muting lamps are used to signal the activity of the muting function. Both need to be connected for activation of a muting function and are available as accessories (refer to the "Accessories" chapter).

Connection of muting sensors
- **Local connection of muting sensors**
  The 2 or 4 muting sensors are connected to the local muting inputs on the safety light curtain.
- **External connection of muting sensors**
  The muting sensors are connected to the inputs on a PSS or an I/O-Device on SafetyBUS p. The signals from the sensors are transmitted to the safety light curtain via the external commands
  "LG_Muting_SensorOvrd (1)" and "LG_Muting_SensorOvrd (2)". The muting function in the safety light curtain processes the sensor signals in the same way as described under "Local connection of muting sensors".

Simultaneity of the muting sensors
The "Simultaneity of the muting sensors" setting in the editor can be used to set the maximum time that is permitted to elapse between activation of both muting sensors. The following times can be set: 0.5 s, 1 s, 3 s and 4 s.
If the second muting sensor is not activated within the preset time, the muting function will not start and the safety light curtain will remain in normal mode.

Muting duration
This setting can be used to adjust the maximum muting duration. The following times can be set: 10 min, 1 h, 8 h and "infinity" (ca. 90 h). Once the set muting duration has elapsed the muting function is ended and the safety light curtain returns to normal mode, even if the muting sensors are still activated.

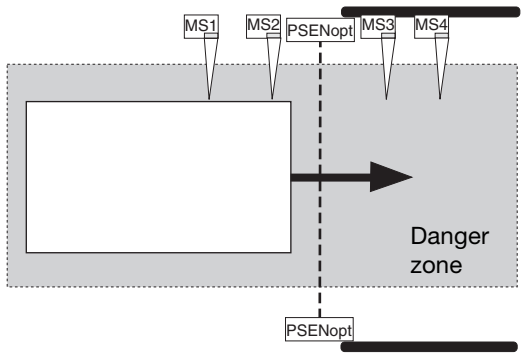


Fig. 1.1-5: Muting application with four muting sensors

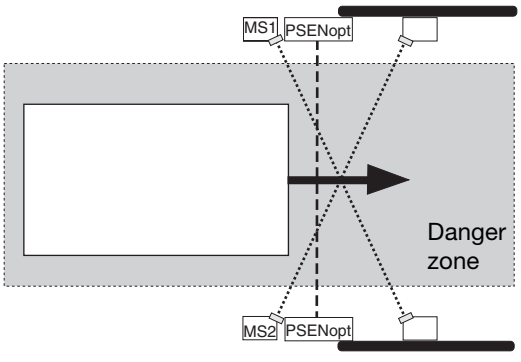


Fig. 1.1-6: Muting application with two muting sensors

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Basics
Functions PSEN opSB-4

Partial/total muting
- **Total muting function:**
  The entire protected area is blanked
- **Partial muting function:**
  Only certain zones in the protected area are blanked.

Override function
The muting function can be activated with the override function if the machine needs to be restarted despite at least one of the beams being interrupted. The aim is to clear the danger zone of any material that may have accumulated due to a fault in the operating cycle.

Test function

The test function can be used to carry out a function test on the safety light curtain.

The test function can be activated in two ways:
- **Local activation**
  The test function is activated via the local input (test/reset) on the receiver.
- **External activation**
  The test function is activated via an external command (LG_TEST).

Diagnostic functions

Status or fault diagnostics can be carried out in a number of ways:
- Via the LEDs on the receiver and transmitter
- By evaluating the safety light curtain's error stack in the SafetyBUS p Configurator in the PSS WIN-PRO system software
- By evaluating the process status diagnostics LG_PD in the user program

The following states can be diagnosed:
- Operating status
- Alignment (yes/no)
- Error

Basics

Connection to evaluation devices, wiring - PSENopt

Permitted evaluation devices

- PNOZ X2.9P
- PNOZsigma
- PNOZelog
- PNOZmulti
- PMUT X1P
- PSS
- SafetyBUS p

The connection is dual-channel without detection of shorts across contacts

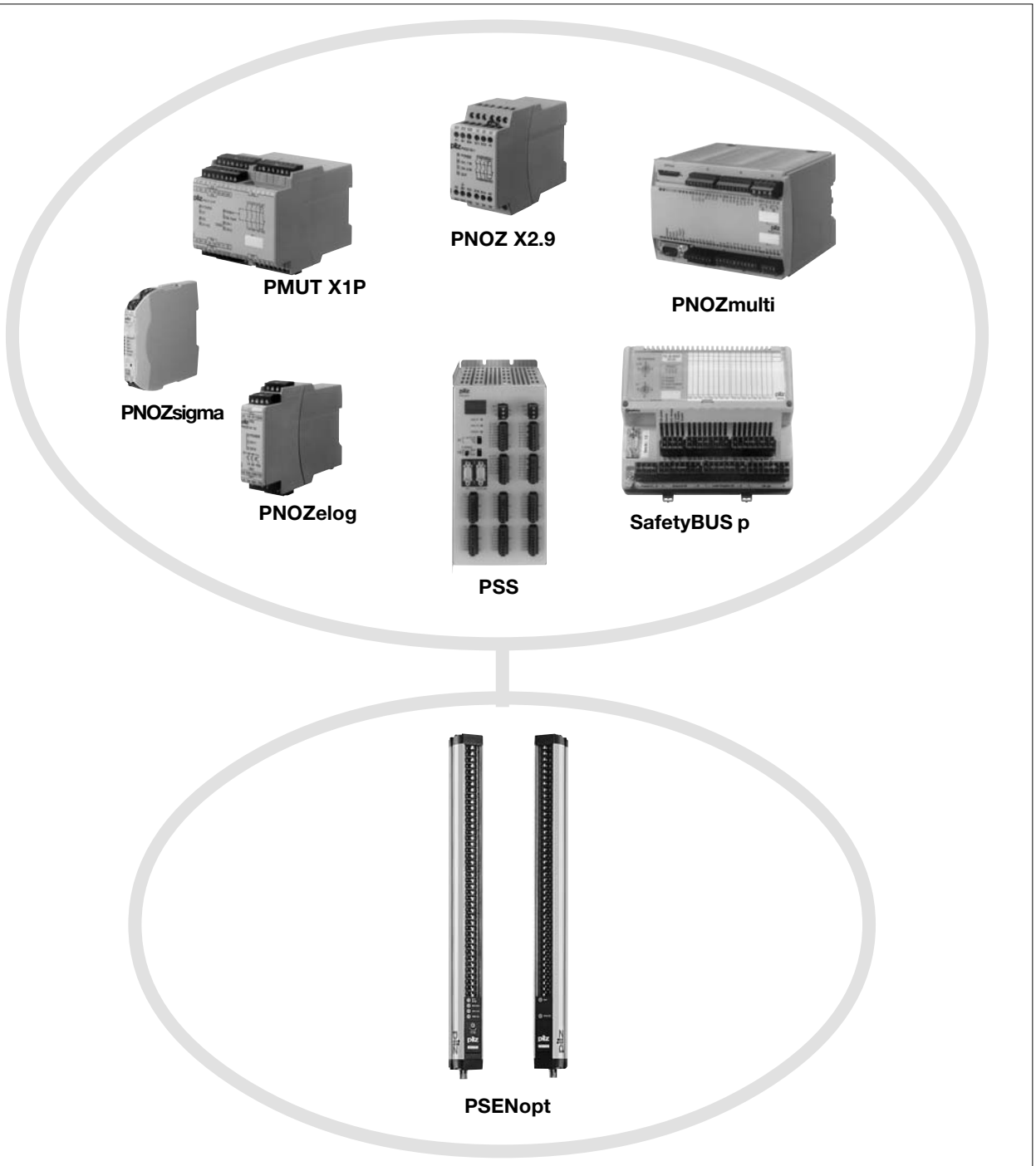


Fig. 1.1-7: Safety light curtain PSEN op and evaluation devices

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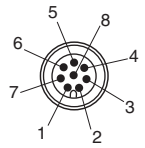
Basics

Connection to evaluation devices, wiring - PSENopt

Pin assignment for PSEN op2B, PSEN op4F, PSEN op4H, PSEN op4B

Receiver

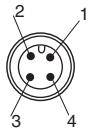
Assignment of the 8-pin M12 male connector



PIN	Function	Cable colour
1:	TEST/START	white
2:	+ 24 V U_B	brown
3:	MUTING1	green
4:	MUTING2	yellow
5:	OSSD1	grey
6:	OSSD2	pink
7:	0 V U_B	blue
8:	LAMP	red

Transmitter

Assignment of the 4-pin M12 male connector

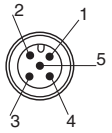


PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

Pin assignment for PSEN op2H

Receiver

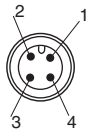
Assignment of the 5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	OSSD1	white
3:	0 V U_B	blue
4:	OSSD2	black
5:	TEST	grey

Transmitter

Assignment of the 4-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

INFORMATION
Please refer to the "Accessories" chapter for details of the connection cables that need to be used.

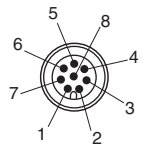
Basics

Connection to evaluation devices, wiring - PSENopt

Pin assignment for PSEN op4B-T, PSEN op4B-L, PSEN op4B-S

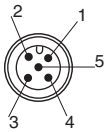
Receiver

Assignment of the 8-pin M12 male connector



PIN	Function	Cable colour
1:	TEST/START	white
2:	+ 24 V U_B	brown
3:	OVERRIDE 1	green
4:	Feedback loop	yellow
5:	OSSD1	grey
6:	OSSD2	pink
7:	0 V U_B	blue
8:	OVERRIDE 2	red

Assignment of the 5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	MUTING 1	white
3:	0 V U_B	blue
4:	MUTING 2	black
5:	Not assigned	grey

Transmitter

Assignment of the 4-pin M12 male connector

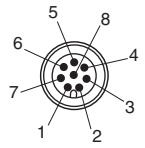


PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

Pin assignment for PSEN op4F-s, PSEN op4H-s

Receiver

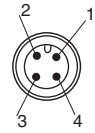
Assignment of the 8-pin M12 male connector



PIN	Function	Cable colour
1:	TEST/START	white
2:	+ 24 V U_B	brown
3:	Not assigned	green
4:	Feedback loop	yellow
5:	OSSD1	grey
6:	OSSD2	pink
7:	0 V U_B	blue
8:	Not assigned	red

Transmitter

Assignment of the 4-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

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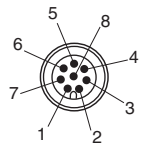
Basics

Connection to evaluation devices, wiring - PSENopt

**Pin assignment for PSEN op4F-b,
PSEN op4H-b (blanking model)**

Receiver

Assignment of the
8-pin M12 male connector



PIN	Function	Cable colour
1:	TEST/START	white
2:	+ 24 V U_B	brown
3:	TEACH-IN	green
4:	Feedback loop	yellow
5:	OSSD1	grey
6:	OSSD2	pink
7:	0 V U_B	blue
8:	Blanking tolerance	red

Transmitter

Assignment of the
4-pin M12 male connector

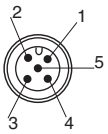


PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

**Pin assignment for PSEN op4F-sl,
PSEN op4H-sl
(cascading model: slave)**

Receiver

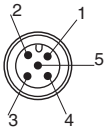
Assignment of the
5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	LINE A	white
3:	0 V U_B	blue
4:	LINE B	black
5:	Screening	grey

Transmitter

Assignment of the
5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	LINE A	white
3:	0 V U_B	blue
4:	LINE B	black
5:	Screening	grey

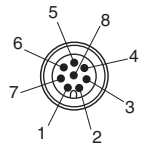
Basics

Connection to evaluation devices, wiring - PSENopt

Pin assignment for PSEN op4F-m, PSEN op4H-m (cascading model: master)

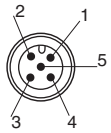
Receiver

Assignment of the 8-pin M12 male connector



PIN	Function	Cable colour
1:	TEST/START	white
2:	+ 24 V U_B	brown
3:	Not assigned	green
4:	Feedback loop	yellow
5:	OSSD1	grey
6:	OSSD2	pink
7:	0 V U_B	blue
8:	Not assigned	red

Assignment of the 5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	LINE A	white
3:	0 V U_B	blue
4:	LINE B	black
5:	Screening	grey

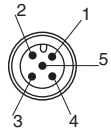
Transmitter

Assignment of the 4-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

Assignment of the 5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	LINE A	white
3:	0 V U_B	blue
4:	LINE B	black
5:	Screening	grey

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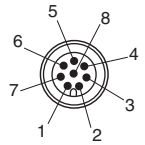
Basics

Connection to evaluation devices, wiring - PSENopt

Pin assignment for PSEN op4F-bm, PSEN op4H-bm (blanking cascading model: master)

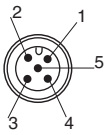
Receiver

Assignment of the 8-pin M12 male connector



PIN	Function	Cable colour
1:	TEST/START	white
2:	+ 24 V U_B	brown
3:	TEACH-IN	green
4:	Feedback loop	yellow
5:	OSSD1	grey
6:	OSSD2	pink
7:	0 V U_B	blue
8:	Blanking tolerance	red

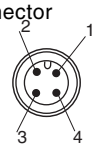
Assignment of the 5-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	LINE A	white
3:	0 V U_B	blue
4:	LINE B	black
5:	Screening	grey

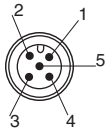
Transmitter

Assignment of the 4-pin M12 male connector



PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	Not assigned	-
3:	0 V U_B	blue
4:	Not assigned	-

Assignment of the 5-pin M12 male connector



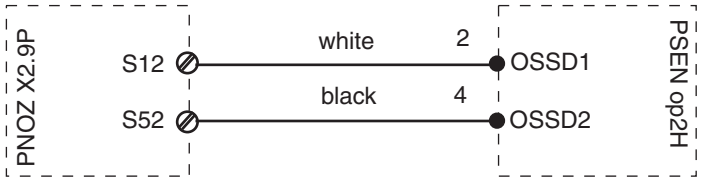
PIN	Function	Cable colour
1:	+ 24 V U_B	brown
2:	LINE A	white
3:	0 V U_B	blue
4:	LINE B	black
5:	Screening	grey

Basics

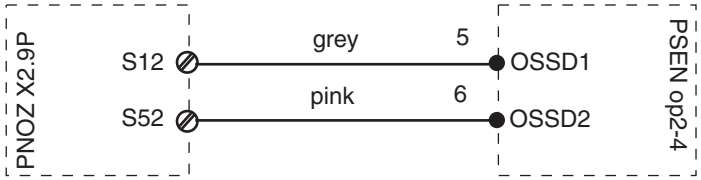
Connection to evaluation devices, wiring - PSENopt

PSENopt connection to PNOZ X2.9P

PSEN op2H

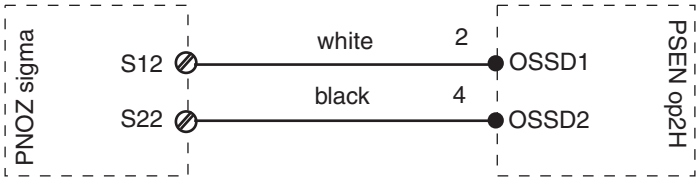


PSEN op2-4

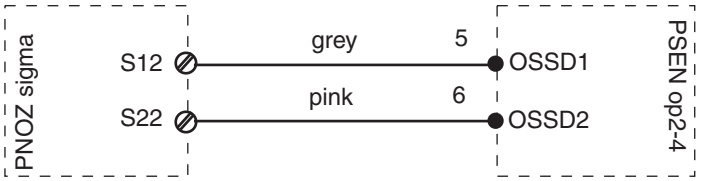


PSENopt connection to PNOZ s3, PNOZ s4, PNOZ s5

PSEN op2H

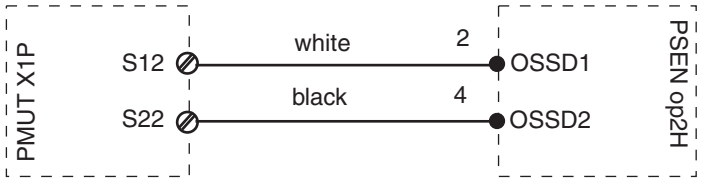


PSEN op2-4

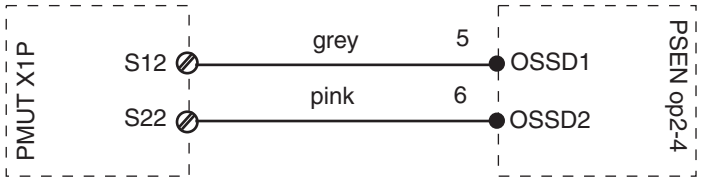


PSENopt connection to PMUT X1P

PSEN op2H



PSEN op2-4



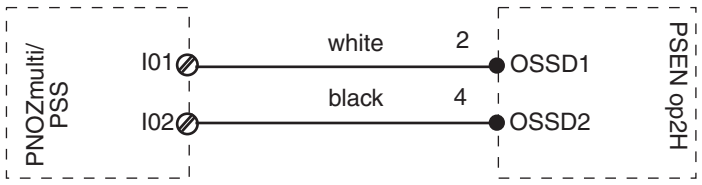
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Basics

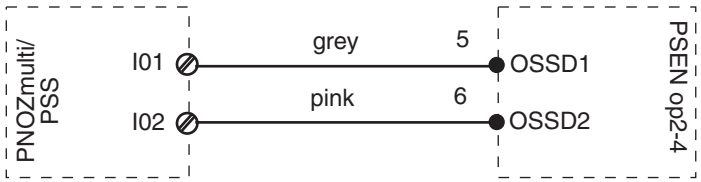
Connection to evaluation devices, wiring - PSENopt

PSENopt connection to PNOZmulti/PSS

PSEN op2H



PSEN op2-4



Basics
Wiring PSENopt SB

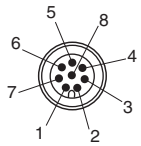
Pin assignment for PSEN opSB-4F, PSEN opSB-4H PSEN opSB-4B

1.1

Receiver

Local I/O connector

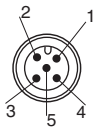
Assignment of the 8-pin M12 male connector



PIN	Function	Cable colour
1:	V4: insulated power supply	white
2:	Not assigned	brown
3:	MUTING1 - in	green
4:	Not assigned	yellow
5:	LAMP	grau
6:	Not assigned	pink
7:	MUTING2 - in	blue
8:	TEST/START	red

Bus connector

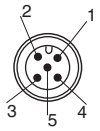
Assignment of the 5-pin M12 male connector



PIN	Function	Cable colour
1:	Screen	-
2:	V CC	red
3:	GND	white
4:	Can_H	green
5:	Can_L	brown

Transmitter

Assignment of the 4-pin M12 male connector



PIN	Function	Cable colour
1:	Not assigned	-
2:	V CC	red
3:	GND	white
4:	Not assigned	green
5:	Not assigned	brown

CAUTION!
To supply the inputs and outputs, only connect the supply voltage "V4"!

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Basics
Wiring PSENopt SB

PSEN opSB-4 connection to SafetyBUS p

To make the connection to SafetyBUS p, the safety light curtain must be linked to the SafetyBUS p main branch. To do this use the active SafetyBUS p junction “PSS SB ACTIVE JUNCTION BASIS”.

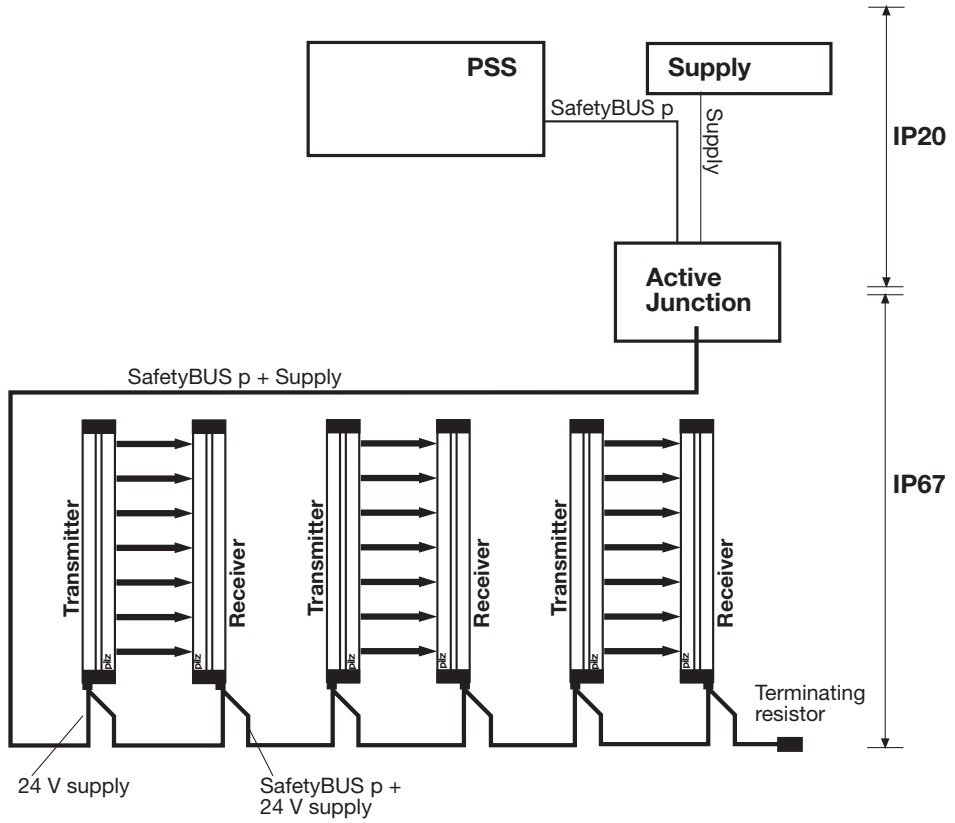


Fig. 1.1-8: Connecting the PSEN opSB-4 safety light curtain to SafetyBUS p

Basics
Wiring PSENopt SB

Light curtain calculation tool

The maximum number of subscribers and the maximum possible cable runs for the cable segments from the ACTIVE JUNCTION BASIS to the last connected subscriber depend on the type of subscriber and the supply voltage on the ACTIVE JUNCTION BASIS.

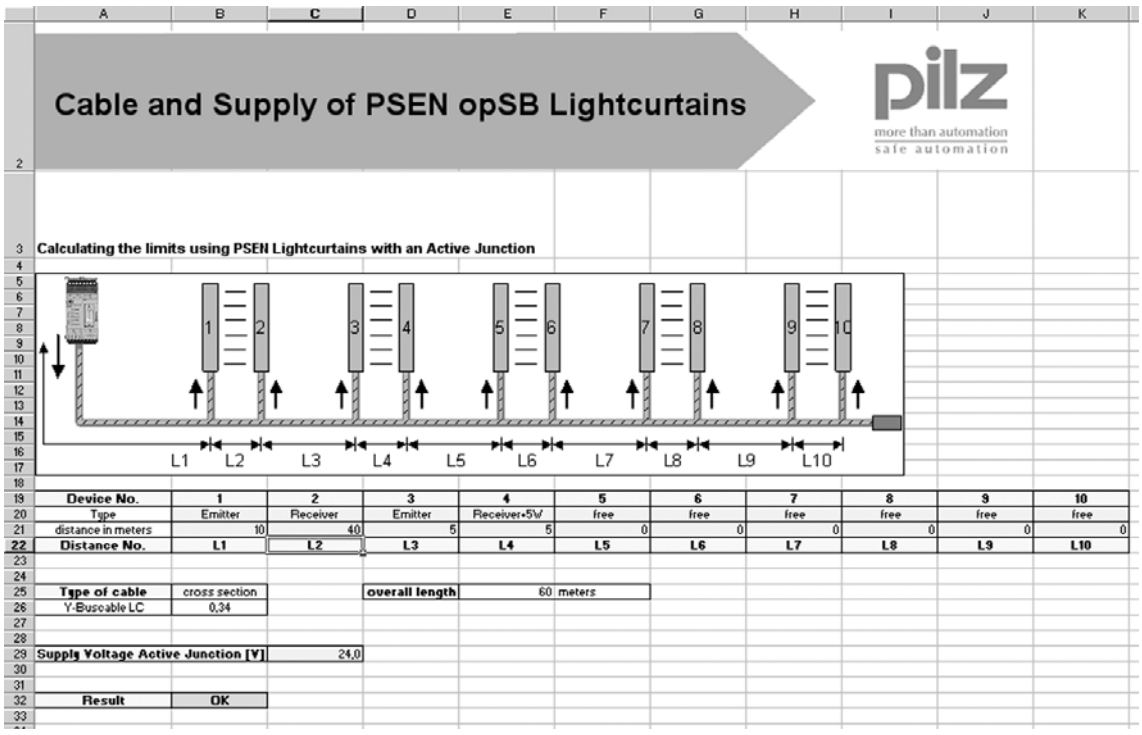
The Pilz light curtain calculation tool enables you to check how many subscribers can be used and how long the cable runs can be, taking into account the subscriber type and the supply voltage.
The light curtain calculation tool is available on the Internet from the Pilz homepage at www.pilz.com.

Entry in the light curtain calculation tool

- Select all subscribers under "Type":
  - Emitter (transmitter (TX))
  - Receiver (RX)
  - Receiver + X W (3 W or 5 W) A selection must be made if a muting lamp (3 W or 5 W) is connected to the receiver's (RX) I/O connector
- Under "distance in meters", enter the required cable runs L1 … LX (see diagram in the light curtain calculation tool).
- Under "Supply Voltage ACTIVE JUNCTION (V)", enter the supply voltage at the ACTIVE JUNCTION BASIS.

Result

- If a green "OK" field appears under "Result", the supply voltage at the last subscriber is sufficient.
- If a red "Not OK!" field appears under "Result", the supply voltage at the last subscriber is too low and you will need to make some adjustments.



Device No.	1	2	3	4	5	6	7	8	9	10
Type	Emitter	Receiver	Emitter	Receiver+5W	free	free	free	free	free	free
distance in meters	10	40	5	5	0	0	0	0	0	0
Distance No.	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10

Type of cable	cross section	overall length	60 meters
Y-Buscable LC	0,34		

Supply Voltage Active Junction [V]	24,0
Result	OK

Fig. 1.1-9: Light curtain calculation tool

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Basics
Wiring PSENopt SB

Basics
Safety

Safety assessments

Before using a unit it is necessary to perform a safety assessment in accordance with the Machinery Directive. The safety system guarantees functional safety, but not the safety of the entire application. You should therefore define the safety requirements for the plant as a whole, and also define how these will be implemented from a technical and organisational standpoint.

Before using optoelectronic protection devices, please refer to the standards EN 999 and IEC 62046 in particular.

General safety requirements

Always ensure the following safety requirements are met:
- Only install and commission the unit if you are familiar with the information in the operating instructions or this technical catalogue, as well as the relevant regulations concerning health and safety at work and accident prevention.
- Only use the unit for the purpose for which it is intended and comply with both the general and specific technical details.
- Transport, storage and operating conditions should all conform to EN 60068-2-6 (see general technical details on the individual units, in the chapter entitled "Unit-specific descriptions").

You must observe the warning notes given in other parts of this technical catalogue. These are highlighted visually through the use of symbols.

NOTICE
Failure to comply with the safety requirements will render the guarantee invalid, as will use of the unit contrary to its intended purpose.

Intended use

The units' intended use depends on the individual unit and is therefore explained in the chapter entitled "Unit-specific descriptions".

Expert inspection

Proper operation of the optoelectronic protection devices needs to be verified:
- Before initial commissioning
- In Europe: at regular intervals in accordance with Work Equipment Directive 89/655/EEC

Key points to be inspected:
- Is the operation of the safety device appropriate for the current machine application?
- Is the type of safety device appropriate for the hazards that may arise?
- Does the safety device conform to the type required in accordance with IEC 61496?
- Does the incorporation of the safety device meet the required category in accordance with EN 954, right through to the transfer of the signal to the controller?
- Is the safety device difficult to defeat?

In general, this type of testing and inspection takes a lot of time. Short-term changes and modifications to the ESPE may increase the risk of accidents.
For this reason we recommend that you take advantage of our "ESPE inspection" service and make the most of the experience of our experts.

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Basics
Installation and assembly

The unit should be installed in such a way that it is not possible to access the danger zone without interrupting the protected area.
To exclude the possibility of the machine being accessed from above or below, it is necessary to install a light curtain of sufficient length to completely cover access to the danger zone.

If it is impossible to install the light curtain in immediate proximity to the danger zone, a second light curtain must be installed, aligned horizontally, to exclude access from the side.

Minimum safety distance

The following must be taken into account when positioning the light curtain:
When the safety device is triggered, there is a delay before the machine comes to a standstill.

The distance between the light curtain and the nearest danger zone must be large enough for the hazardous movement to come to a standstill before the operator can reach the danger zone. All access directions must be taken into account. According to **EN 999, "The positioning of protective equipment in respect of approach speeds of parts of the human body"**, this minimum distance is calculated using the following formula:

S = K x T + C

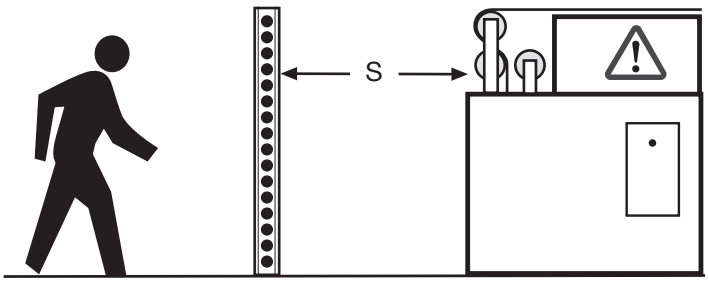
Approach direction perpendicular to the protected field

S = Minimum distance from the danger zone to the detection point, detection line, detection plane or protected field

K = The speed at which the object requiring detection (body or parts of the body) approaches the danger zone, in mm/s
K = 2000 mm/s, if the calculated value for S ≤ 500 mm
K = 1600 mm/s, if the calculated value for S > 500 mm

T = Overrun of the entire system
t_1 = Reaction time of the safety device in seconds
t_2 = Overrun time of the machine in seconds

C = Additional distance in millimetres, based on intrusion into the danger zone prior to actuation of the safety device:
8 (d-14) for a safety device with a
resolution d < 40 mm
850 mm for a safety device with a resolution
d > 40 mm
1200 mm for single-beam safety devices



Bottom beam: ≤ 300 mm
Top beam: ≥ 900 mm

Fig. 1.1-10: Minimum safe distance S from the safety device to the danger zone for a perpendicular approach

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Basics
Installation and assembly

Approach direction parallel to the protected field

S = Minimum distance from the danger zone to the detection point, detection line, detection plane or protected field

K = The speed at which the object requiring detection (body or parts of the body) approaches the danger zone, in mm/s
K = 1600 mm/s

T = Overrun of the entire system
t_1 = Reaction time of the safety device in seconds
t_2 = Overrun time of the machine in seconds

C = Additional distance in millimetres, based on intrusion into the danger zone prior to actuation of the safety device:
C = (1200 mm - 0.4 H) ≥ 850 mm

H = (Height of the protected field above the reference plane)

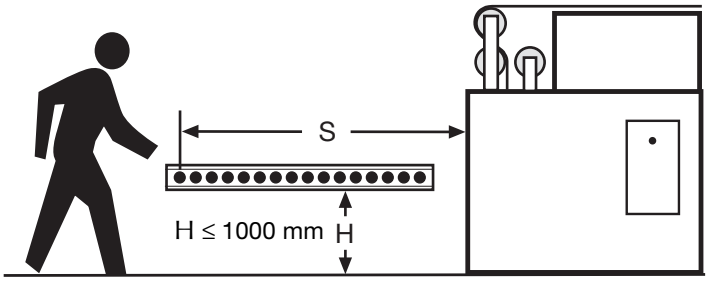


Fig. 1.1-11: Minimum safe distance S from the safety device to the danger zone for a parallel approach

Approach direction at any angle to the protected field

ß > 30° see perpendicular approach
ß < 30° see parallel approach

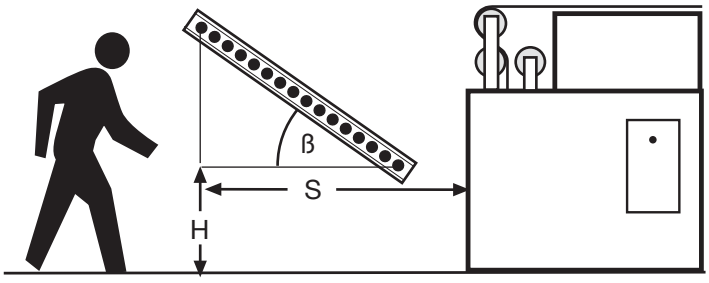


Fig. 1.1-12: Minimum safe distance S from the safety device to the danger zone for an angled approach

Basics
Installation and assembly

Use of deviating mirrors

Deviating mirrors can be used to monitor danger zones where access is possible from various sides (see "Deviating mirrors" in the "Accessories" chapter).

Installing several adjacent safety light curtains

When installing several safety devices side by side, please note that the transmitter of one device must not interfere with the receiver of another device. To prevent this, the devices will need to be installed facing in opposite directions, or they should be separated via screening.

Installation

The transmitter and receiver should be installed with the optical surfaces aligned parallel and opposite each other, and with the plugs arranged on the same side.
The distance between the transmitter and the receiver must be within the range of the model used (refer to the type label or the operating manual, "Technical details" chapter).

Before carrying out assembly and installation work, always read the "Devices" chapter of the operating manual for the relevant units.

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Basics
Installation and assembly

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Unit-specific description

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Unit-specific description

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Unit-specific description	
Approvals	1.2-2
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PSENopt SB	1.2-6

Unit-specific description
Approvals

Approvals

Model	c UL us LISTED	TÜV PRODUCT SERVICE	Model	c UL us LISTED	TÜV PRODUCT SERVICE
PSEN op2B-2-050	◆	◆	PSEN op4F-m-14-015	◆	◆
PSEN op2B-3-080	◆	◆	PSEN op4F-m-14-030	◆	◆
PSEN op2B-4-090	◆	◆	PSEN op4F-m-14-045	◆	◆
PSEN op2B-4-120	◆	◆	PSEN op4F-m-14-060	◆	◆
PSEN op2H-30-015	◆	◆	PSEN op4F-m-14-075	◆	◆
PSEN op2H-30-030	◆	◆	PSEN op4F-m-14-090	◆	◆
PSEN op2H-30-045	◆	◆	PSEN op4F-m-14-105	◆	◆
PSEN op2H-30-060	◆	◆	PSEN op4F-m-14-120	◆	◆
PSEN op2H-30-075	◆	◆	PSEN op4F-s-14-015	◆	◆
PSEN op2H-30-090	◆	◆	PSEN op4F-s-14-030	◆	◆
PSEN op2H-30-105	◆	◆	PSEN op4F-s-14-045	◆	◆
PSEN op2H-30-120	◆	◆	PSEN op4F-s-14-060	◆	◆
PSEN op2H-30-135	◆	◆	PSEN op4F-s-14-075	◆	◆
PSEN op2H-30-150	◆	◆	PSEN op4F-s-14-090	◆	◆
PSEN op4B-2-050	◆	◆	PSEN op4F-s-14-105	◆	◆
PSEN op4B-3-080	◆	◆	PSEN op4F-s-14-120	◆	◆
PSEN op4B-4-090	◆	◆	PSEN op4F-sl-14-015	◆	◆
PSEN op4B-4-120	◆	◆	PSEN op4F-sl-14-030	◆	◆
PSEN op4B-L-2-050	◆	◆	PSEN op4F-sl-14-045	◆	◆
PSEN op4B-L-3-080	◆	◆	PSEN op4F-sl-14-060	◆	◆
PSEN op4B-S-2-050	◆	◆	PSEN op4F-sl-14-075	◆	◆
PSEN op4B-S-3-080	◆	◆	PSEN op4F-sl-14-090	◆	◆
PSEN op4B-T-2-050	◆	◆	PSEN op4F-sl-14-105	◆	◆
PSEN op4B-T-3-080	◆	◆	PSEN op4F-sl-14-120	◆	◆
PSEN op4F-14-015	◆	◆	PSEN op4H-30-015	◆	◆
PSEN op4F-14-030	◆	◆	PSEN op4H-30-030	◆	◆
PSEN op4F-14-045	◆	◆	PSEN op4H-30-045	◆	◆
PSEN op4F-14-060	◆	◆	PSEN op4H-30-060	◆	◆
PSEN op4F-14-075	◆	◆	PSEN op4H-30-075	◆	◆
PSEN op4F-14-090	◆	◆	PSEN op4H-30-090	◆	◆
PSEN op4F-b-14-015	◆	◆	PSEN op4H-30-105	◆	◆
PSEN op4F-b-14-030	◆	◆	PSEN op4H-30-120	◆	◆
PSEN op4F-b-14-045	◆	◆	PSEN op4H-30-135	◆	◆
PSEN op4F-b-14-060	◆	◆	PSEN op4H-30-150	◆	◆
PSEN op4F-b-14-075	◆	◆	PSEN op4H-30-165	◆	◆
PSEN op4F-b-14-090	◆	◆	PSEN op4H-b-30-015	◆	◆
PSEN op4F-b-14-105	◆	◆	PSEN op4H-b-30-030	◆	◆
PSEN op4F-b-14-120	◆	◆	PSEN op4H-b-30-045	◆	◆
PSEN op4F-bm-14-015	◆	◆	PSEN op4H-b-30-060	◆	◆
PSEN op4F-bm-14-030	◆	◆	PSEN op4H-b-30-075	◆	◆
PSEN op4F-bm-14-045	◆	◆	PSEN op4H-b-30-090	◆	◆
PSEN op4F-bm-14-060	◆	◆	PSEN op4H-b-30-105	◆	◆
PSEN op4F-bm-14-075	◆	◆	PSEN op4H-b-30-120	◆	◆
PSEN op4F-bm-14-090	◆	◆	PSEN op4H-b-30-135	◆	◆
PSEN op4F-bm-14-105	◆	◆	PSEN op4H-b-30-150	◆	◆
PSEN op4F-bm-14-120	◆	◆	PSEN op4H-b-30-165	◆	◆

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Unit-specific description
Approvals

Model	c UL us LISTED	TÜV PRODUCT SERVICE
PSEN op4H-bm-30-015	◆	◆
PSEN op4H-bm-30-030	◆	◆
PSEN op4H-bm-30-045	◆	◆
PSEN op4H-bm-30-060	◆	◆
PSEN op4H-bm-30-075	◆	◆
PSEN op4H-bm-30-090	◆	◆
PSEN op4H-bm-30-105	◆	◆
PSEN op4H-bm-30-120	◆	◆
PSEN op4H-bm-30-135	◆	◆
PSEN op4H-m-30-015	◆	◆
PSEN op4H-m-30-030	◆	◆
PSEN op4H-m-30-045	◆	◆
PSEN op4H-m-30-060	◆	◆
PSEN op4H-m-30-075	◆	◆
PSEN op4H-m-30-090	◆	◆
PSEN op4H-m-30-105	◆	◆
PSEN op4H-m-30-120	◆	◆
PSEN op4H-m-30-135	◆	◆
PSEN op4H-m-30-150	◆	◆
PSEN op4H-m-30-165	◆	◆
PSEN op4H-s-30-015	◆	◆
PSEN op4H-s-30-030	◆	◆
PSEN op4H-s-30-045	◆	◆
PSEN op4H-s-30-060	◆	◆
PSEN op4H-s-30-075	◆	◆
PSEN op4H-s-30-090	◆	◆
PSEN op4H-s-30-105	◆	◆
PSEN op4H-s-30-120	◆	◆
PSEN op4H-s-30-135	◆	◆
PSEN op4H-s-30-150	◆	◆
PSEN op4H-s-30-165	◆	◆
PSEN op4H-sl-30-015	◆	◆
PSEN op4H-sl-30-030	◆	◆
PSEN op4H-sl-30-045	◆	◆
PSEN op4H-sl-30-060	◆	◆
PSEN op4H-sl-30-075	◆	◆
PSEN op4H-sl-30-090	◆	◆
PSEN op4H-sl-30-105	◆	◆
PSEN op4H-sl-30-120	◆	◆
PSEN op4H-sl-30-135	◆	◆
PSEN op4H-sl-30-150	◆	◆
PSEN op4H-sl-30-165	◆	◆

Model	c UL us LISTED	TÜV PRODUCT SERVICE
PSEN opSB-4F-14-030	◆	◆
PSEN opSB-4F-14-045	◆	◆
PSEN opSB-4F-14-060	◆	◆
PSEN opSB-4F-14-075	◆	◆
PSEN opSB-4F-14-090	◆	◆
PSEN opSB-4H-30-030	◆	◆
PSEN opSB-4H-30-045	◆	◆
PSEN opSB-4H-30-060	◆	◆
PSEN opSB-4H-30-075	◆	◆
PSEN opSB-4H-30-090	◆	◆
PSEN opSB-4H-30-105	◆	◆
PSEN opSB-4H-30-120	◆	◆
PSEN opSB-4H-30-135	◆	◆
PSEN opSB-4H-30-150	◆	◆
PSEN opSB-4H-30-165	◆	◆
PSEN opSB-4B-2-050	◆	◆
PSEN opSB-4B-3-080	◆	◆
PSEN opSB-4B-4-090	◆	◆
PSEN opSB-4B-4-120	◆	◆

Unit-specific description
PSENopt

PSEN op2H

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 2

Unit features:
- Type 2
- Resolution: 30 mm
- Range 0.2 ... 15 m
- Automatic reset
- Test function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op2H-30-015	147	187	8	31 x 32 x 227	For further data refer to the PSEN op2H operating manual
PSEN op2H-30-030	294	334	16	31 x 32 x 375	
PSEN op2H-30-045	441	481	24	31 x 32 x 521	
PSEN op2H-30-060	588	628	32	31 x 32 x 668	
PSEN op2H-30-075	735	775	40	31 x 32 x 815	
PSEN op2H-30-090	882	922	48	31 x 32 x 962	
PSEN op2H-30-105	1029	1069	56	31 x 32 x 1109	
PSEN op2H-30-120	1176	1216	64	31 x 32 x 1256	
PSEN op2H-30-135	1323	1363	72	31 x 32 x 1403	
PSEN op2H-30-150	1470	1510	80	31 x 32 x 1550	

PSEN op2B

Light curtains for body protection, in accordance with EN/IEC 61496-1/-2: Type 2

Unit features:
- Type 2
- Range 0.5 ... 50 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Resolution (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op2B-2-050	515	515	2	35 x 40 x 652	For further data refer to the PSEN op2/4 operating manual
PSEN op2B-3-080	815	415	3	35 x 40 x 952	
PSEN op2B-4-090	915	315	4	35 x 40 x 1052	
PSEN op2B-4-120	1215	415	4	35 x 40 x 1352	

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Unit-specific description
PSENopt

PSEN op4F

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4F-14-015	147	161	21	35 x 40 x 256	For further data refer to the PSEN op2/4 operating manual
PSEN op4F-14-030	294	308	42	35 x 40 x 403	
PSEN op4F-14-045	441	455	63	35 x 40 x 550	
PSEN op4F-14-060	588	602	84	35 x 40 x 697	
PSEN op4F-14-075	735	749	105	35 x 40 x 844	
PSEN op4F-14-090	882	896	126	31 x 32 x 991	

PSEN op4H

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4H-30-015	147	180	8	35 x 40 x 256	For further data refer to the PSEN op2/4 operating manual
PSEN op4H-30-030	294	327	16	35 x 40 x 403	
PSEN op4H-30-045	441	474	24	35 x 40 x 550	
PSEN op4H-30-060	588	621	32	35 x 40 x 697	
PSEN op4H-30-075	735	768	40	35 x 40 x 844	
PSEN op4H-30-090	822	915	48	35 x 40 x 991	
PSEN op4H-30-105	1029	1062	56	35 x 40 x 1138	
PSEN op4H-30-120	1176	1209	64	35 x 40 x 1285	
PSEN op4H-30-135	1323	1356	72	35 x 40 x1432	
PSEN op4H-30-150	1470	1503	80	35 x 40 x1579	
PSEN op4H-30-165	1617	1650	88	35 x 40 x 1726	

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Unit-specific description
PSENopt

PSEN op4B

Light curtains for body protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Range 0.5 ... 25 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Resolution (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the PSEN op2/4 operating manual
PSEN op4B-2-050	515	515	2	35 x 40 x 652	
PSEN op4B-3-080	815	415	3	35 x 40 x 952	
PSEN op4B-4-090	915	315	4	35 x 40 x 1052	
PSEN op4B-4-120	1215	415	4	35 x 40 x 1352	

PSEN op4F-s

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4F-s-14-015	147	161	21	35 x 40 x 256	
PSEN op4F-s-14-030	294	308	42	35 x 40 x 403	
PSEN op4F-s-14-045	441	455	63	35 x 40 x 550	
PSEN op4F-s-14-060	588	602	84	35 x 40 x 697	
PSEN op4F-s-14-075	735	749	105	35 x 40 x 844	
PSEN op4F-s-14-090	882	896	126	31 x 32 x 991	
PSEN op4F-s-14-0105	1029	1043	147		
PSEN op4F-s-14-0120	1176	1190	168		

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Unit-specific description
PSENopt

PSEN op4H-s

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 15 m
- Automatic/manual reset
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4H-s-30-015	147	180	8	35 x 40 x 256	
PSEN op4H-s-30-030	294	327	16	35 x 40 x 403	
PSEN op4H-s-30-045	441	474	24	35 x 40 x 550	
PSEN op4H-s-30-060	588	621	32	35 x 40 x 697	
PSEN op4H-s-30-075	735	768	40	35 x 40 x 844	
PSEN op4H-s-30-090	822	915	48	35 x 40 x 991	
PSEN op4H-s-30-105	1029	1062	56	35 x 40 x 1138	
PSEN op4H-s-30-120	1176	1209	64	35 x 40 x 1285	
PSEN op4H-s-30-135	1323	1356	72	35 x 40 x1432	
PSEN op4H-s-30-150	1470	1503	80	35 x 40 x1579	
PSEN op4H-s-30-165	1617	1650	88	35 x 40 x 1726	

PSEN op4F-b

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Blanking function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4F-b-14-015	147	161	21	35 x 40 x 256	
PSEN op4F-b-14-030	294	308	42	35 x 40 x 403	
PSEN op4F-b-14-045	441	455	63	35 x 40 x 550	
PSEN op4F-b-14-060	588	602	84	35 x 40 x 697	
PSEN op4F-b-14-075	735	749	105	35 x 40 x 844	
PSEN op4F-b-14-090	882	896	126	31 x 32 x 991	
PSEN op4F-b-14-0105	1029	1043	147		
PSEN op4F-b-14-0120	1176	1190	168		

Unit-specific description
PSENopt

PSEN op4H-b

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 15 m
- Automatic/manual reset
- Blanking function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4F-b-30-015	147	180	8	35 x 40 x 256	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4H-b-30-030	294	327	16	35 x 40 x 403	
PSEN op4H-b-30-045	441	474	24	35 x 40 x 550	
PSEN op4H-b-30-060	588	621	32	35 x 40 x 697	
PSEN op4H-b-30-075	735	768	40	35 x 40 x 844	
PSEN op4H-b-30-090	822	915	48	35 x 40 x 991	
PSEN op4H-b-30-105	1029	1062	56	35 x 40 x 1138	
PSEN op4H-b-30-120	1176	1209	64	35 x 40 x 1285	
PSEN op4H-b-30-135	1323	1356	72	35 x 40 x1432	
PSEN op4H-b-30-150	1470	1503	80	35 x 40 x1579	
PSEN op4H-b-30-165	1617	1650	88	35 x 40 x 1726	

PSEN op4F-m (Master)

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Cascading function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4F-m-14-015	147	161	21	35 x 40 x 256	**For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s**
PSEN op4F-m-14-030	294	308	42	35 x 40 x 403	
PSEN op4F-m-14-045	441	455	63	35 x 40 x 550	
PSEN op4F-m-14-060	588	602	84	35 x 40 x 697	
PSEN op4F-m-14-075	735	749	105	35 x 40 x 844	
PSEN op4F-m-14-090	882	896	126	31 x 32 x 991	
PSEN op4F-m-14-0105	1029	1043	147		
PSEN op4F-m-14-0120	1176	1190	168		

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Unit-specific description
PSENopt

PSEN op4H-m (Master)

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 15 m
- Automatic/manual reset
- Cascading function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4H-m-30-015	147	180	8	35 x 40 x 256	
PSEN op4H-m-30-030	294	327	16	35 x 40 x 403	
PSEN op4H-m-30-045	441	474	24	35 x 40 x 550	
PSEN op4H-m-30-060	588	621	32	35 x 40 x 697	
PSEN op4H-m-30-075	735	768	40	35 x 40 x 844	
PSEN op4H-m-30-090	822	915	48	35 x 40 x 991	
PSEN op4H-m-30-105	1029	1062	56	35 x 40 x 1138	
PSEN op4H-m-30-120	1176	1209	64	35 x 40 x 1285	
PSEN op4H-m-30-135	1323	1356	72	35 x 40 x 1432	
PSEN op4H-m-30-150	1470	1503	80	35 x 40 x 1579	
PSEN op4H-m-30-165	1617	1650	88	35 x 40 x 1726	

PSEN op4F-bm (Master)

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Blanking function
- Cascading function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4F-bm-14-015	147	161	21	35 x 40 x 256	
PSEN op4F-bm-14-030	294	308	42	35 x 40 x 403	
PSEN op4F-bm-14-045	441	455	63	35 x 40 x 550	
PSEN op4F-bm-14-060	588	602	84	35 x 40 x 697	
PSEN op4F-bm-14-075	735	749	105	35 x 40 x 844	
PSEN op4F-bm-14-090	882	896	126	31 x 32 x 991	
PSEN op4F-bm-14-0105	1029	1043	147		
PSEN op4F-bm-14-0120	1176	1190	168		

Unit-specific description
PSENopt

PSEN op4H-bm (Master)

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 15 m
- Automatic/manual reset
- Blanking function
- Cascading function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4H-bm-30-015	147	180	8	35 x 40 x 256	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4H-bm-30-030	294	327	16	35 x 40 x 403	
PSEN op4H-bm-30-045	441	474	24	35 x 40 x 550	
PSEN op4H-bm-30-060	588	621	32	35 x 40 x 697	
PSEN op4H-bm-30-075	735	768	40	35 x 40 x 844	
PSEN op4H-bm-30-090	822	915	48	35 x 40 x 991	
PSEN op4H-bm-30-105	1029	1062	56	35 x 40 x 1138	
PSEN op4H-bm-30-120	1176	1209	64	35 x 40 x 1285	
PSEN op4H-bm-30-135	1323	1356	72	35 x 40 x 1432	
PSEN op4H-bm-30-150	1470	1503	80	35 x 40 x 1579	
PSEN op4H-bm-30-165	1617	1650	88	35 x 40 x 1726	

PSEN op4F-sl (Slave)

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Cascading function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4F-sl-14-015	147	161	21	35 x 40 x 256	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4F-sl-14-030	294	308	42	35 x 40 x 403	
PSEN op4F-sl-14-045	441	455	63	35 x 40 x 550	
PSEN op4F-sl-14-060	588	602	84	35 x 40 x 697	
PSEN op4F-sl-14-075	735	749	105	35 x 40 x 844	
PSEN op4F-sl-14-090	882	896	126	31 x 32 x 991	
PSEN op4F-sl-14-0105	1029	1043	147		
PSEN op4F-sl-14-0120	1176	1190	168		

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Unit-specific description
PSENopt

PSEN op4H-sl (Slave)

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 15 m
- Automatic/manual reset
- Cascading function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4H-sl-30-015	147	180	8	35 x 40 x 256	For further data refer to the operating manual PSEN op4F/H-bm / PSEN op4F/H-sl / PSEN op4F/H-b / PSEN op4F/H-m / PSEN op4F/H-s
PSEN op4H-sl-30-030	294	327	16	35 x 40 x 403	
PSEN op4H-sl-30-045	441	474	24	35 x 40 x 550	
PSEN op4H-sl-30-060	588	621	32	35 x 40 x 697	
PSEN op4H-sl-30-075	735	768	40	35 x 40 x 844	
PSEN op4H-sl-30-090	822	915	48	35 x 40 x 991	
PSEN op4H-sl-30-105	1029	1062	56	35 x 40 x 1138	
PSEN op4H-sl-30-120	1176	1209	64	35 x 40 x 1285	
PSEN op4H-sl-30-135	1323	1356	72	35 x 40 x 1432	
PSEN op4H-sl-30-150	1470	1503	80	35 x 40 x 1579	
PSEN op4H-sl-30-165	1617	1650	88	35 x 40 x 1726	

PSEN op4B-T

Light curtains for body protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Range 0.5 ... 3 m
- Automatic/manual reset
- Integrated muting/override function with muting sensors (T-Configuration)
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Resolution (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN op4B-T-2-050	515	515	2	35 x 40 x 652	For further data refer to the operating manual PSEN op4B-T, PSEN op4B-L, PSEN op4B-S
PSEN op4B-T-3-080	815	415	3	35 x 40 x 952	

Unit-specific description
PSENopt

PSEN op4B-L

Light curtains for body protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Range 0.5 ... 3 m
- Automatic/manual reset
- Integrated muting/override function with muting sensors (L-Configuration)
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Resolution (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4B-T, PSEN op4B-L, PSEN op4B-S
PSEN op4B-L-2-050	515	515	2	35 x 40 x 652	
PSEN op4B-L-3-080	815	415	3	35 x 40 x 952	

PSEN op4B-S

Light curtains for body protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Type 4
- Range 0.5 ... 3 m
- Automatic/manual reset
- Integrated muting/override function
- Feedback loop monitoring function
- Reset function
- Diagnostic function

Model	Length of the sensing area (mm)	Resolution (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the operating manual PSEN op4B-T, PSEN op4B-L, PSEN op4B-S
PSEN op4B-L-2-050	515	515	2	35 x 40 x 652	
PSEN op4B-L-3-080	815	415	3	35 x 40 x 952	

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pilz
more than automation
safe automation

Unit-specific description
PSENopt

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Unit-specific description
PSENopt SB

PSEN opSB-4F

Light curtains for finger protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Integral SafetyBUS p interface
- Type 4
- Resolution: 14 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN opSB-4H-14-030	294	308	42	35 x 40 x 403	For further data refer to the PSEN opSB-4 operating manual
PSEN opSB-4F-14-045	441	455	63	35 x 40 x 550	
PSEN opSB-4F-14-060	588	602	84	35 x 40 x 697	
PSEN opSB-4F-14-075	735	749	105	35 x 40 x 844	
PSEN opSB-4F-14-090	882	896	126	31 x 32 x 991	

PSEN opSB-4H

Light curtains for hand protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Integral SafetyBUS p interface
- Type 4
- Resolution: 30 mm
- Range 0.2 ... 6 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Length of the protected area (mm)	Number of beams	Dimensions (H x W x D) (mm)	
PSEN opSB-4H-30-015	147	180	8	35 x 40 x 256	For further data refer to the PSEN opSB-4 operating manual
PSEN opSB-4H-30-030	294	327	16	35 x 40 x 403	
PSEN opSB-4H-30-045	441	474	24	35 x 40 x 550	
PSEN opSB-4H-30-060	588	621	32	35 x 40 x 697	
PSEN opSB-4H-30-075	735	768	40	35 x 40 x 844	
PSEN opSB-4H-30-090	822	915	48	35 x 40 x 991	
PSEN opSB-4H-30-105	1029	1062	56	35 x 40 x 1138	
PSEN opSB-4H-30-120	1176	1209	64	35 x 40 x 1285	
PSEN opSB-4H-30-135	1323	1356	72	35 x 40 x1432	
PSEN opSB-4H-30-150	1470	1503	80	35 x 40 x1579	
PSEN opSB-4H-30-165	1617	1650	88	35 x 40 x 1726	

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Unit-specific description
PSENopt SB

PSEN opSB-4B
Light curtains for body protection, in accordance with EN/IEC 61496-1/-2: Type 4

Unit features:
- Integral SafetyBUS p interface
- Type 4
- Range 0.2 ... 6 m
- Automatic/manual reset
- Integrated muting/override function
- Test function

Model	Length of the sensing area (mm)	Resolution (mm)	Number of beams	Dimensions (H x W x D) (mm)	For further data refer to the PSEN opSB-4 operating manual
PSEN opSB-4B-2-050	515	515	2	35 x 40 x 652	
PSEN opSB-4B-3-080	815	415	3	35 x 40 x 952	
PSEN opSB-4B-4-090	915	315	4	35 x 40 x 1052	
PSEN opSB-4B-4-120	1215	415	4	35 x 40 x 1352	

Applications

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Applications

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Applications

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Applications

Safety assessments

Before using a unit it is necessary to perform a safety assessment in accordance with the Machinery Directive. The units as individual components guarantee functional safety, but not the safety of the entire application. You should therefore define the safety requirements for the plant as a whole, and also define how these will be implemented from a technical and organisational standpoint (e.g. refer to BIA [BG Institute for Occupational Safety] Report 6/97).

Applications

PSENop2H with PNOZ X2.9p evaluation device, Category 2, EN 954-1

Features

- 1 safety light curtain
- 1 safety relay PNOZ X2.9P
- Dual-channel with detection of shorts across contacts

Description

The danger zone is protected with a PSEN op2H safety light curtain, which is monitored by the evaluation device PNOZ X2.9P.
Safety outputs OSSD1 and OSSD2 are wired directly onto the terminals S12 and S52 of the PNOZ X2.9P.
The safety light curtain operates in guard mode.
The motor of the machine (contactors K1 and K2) is switched on when the light curtain is not interrupted.
If the light curtain is interrupted, the signal at the outputs changes from High to Low and the machine is switched off (contactors K1 and K2).

Feedback loop
N/C contacts K1 and K2 are connected in series to the reset circuit for feedback loop monitoring.

Reset
The reset behaviour of the PNOZ X2.9P can be selected via the wiring of the terminal pairs Y36/Y37 and S12/S34:

1. Automatic reset
   If the safety light curtain is not interrupted then the unit is active.
2. Manual reset
   If the light curtain is not interrupted then the units can be reset by pressing the reset button S2.
3. Monitored reset
   If the light curtain is not interrupted then the units can be reset by pressing the reset button S2.

Test
The test input can be supplied with 24 V either by a fixed connection or via a N/C contact S1. Press the S1 button to perform a test which checks that the light curtain is operating properly.
The signals at the outputs must change from High to Low and switch off the machine.

NOTICE
Buttons S1 and S2 must be positioned in such a way that the operator has a clear view of the protected area when reset or test procedures are in progress.

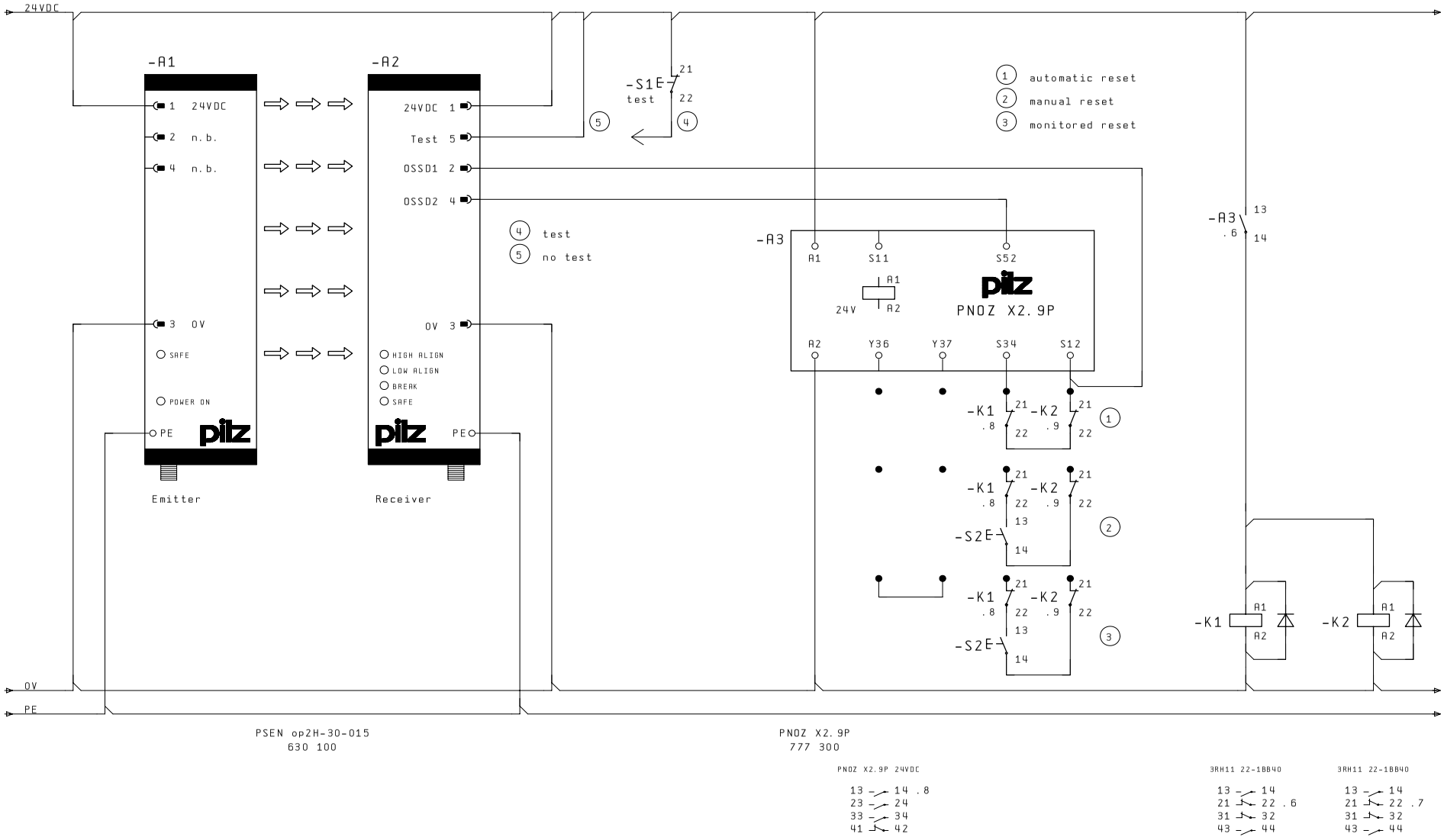
Safety assessment

- A short circuit between 24 VDC and the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.

Pilz units

Number	Type	Features	Order number
1	PSEN op2H-30-015	24 VDC	630 100
1	PNOZ X2.9P	24 VDC	777 300

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Revision	16. Nov. 2004	Date	05. Okt. 2004	PSENOPT technical catalogue	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	PSENop mit PNOZ X2.9P as evaluation device
Name	CLE	Name	CLE			Directory: ..\PILZ\PSEN\04PIL001
				Version 1		Page: 1
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Applications

PSEN op4F-s with evaluation device PNOZ s3, Category 4, EN 954-1

Features

- 1 safety light curtain
- 1 safety relay PNOZ s3
- Dual-channel with detection of shorts across contacts via safety light curtain
- Monitored reset with falling edge

Description

The danger zone is protected with a PSEN op4F-s safety light curtain, which is monitored by the evaluation device PNOZ s3.
Safety outputs OSSD1 and OSSD2 are wired directly onto the terminals S12 and S22 of the PNOZ s3.
The safety light curtain operates in guard mode.
The machine's motor (contactors K1 and K2) is switched on when the safety light curtain is not interrupted and the reset button (S1) has been operated.
If the safety light curtain is interrupted, the signal at the outputs changes from High to Low and the machine is switched off (contactors K1 and K2).

Feedback loop

N/C contacts K1 and K2 are connected in series to the reset circuit for feedback loop monitoring.

Reset

The reset behaviour of the PNOZ s3 can be selected via the wiring of the terminals S12-S34 (reset circuit) and the setting on the operating mode selector switch (mode).
Set the operating mode selector switch (mode) to "Monitored reset, rising edge without detection of shorts across contacts" (In2+).

If the safety light curtain is not interrupted then the units can be reset by pressing the reset button S1.

Test

The test input can be supplied with 24 V either by a fixed connection or via a N/C contact S1. Press the S1 button to perform a test which checks that the safety light curtain is operating properly.
The signals at the outputs must change from High to Low and switch off the machine.

NOTICE

Buttons S1 and S2 must be positioned in such a way that the operator has a clear view of the protected area when reset or test procedures are in progress.

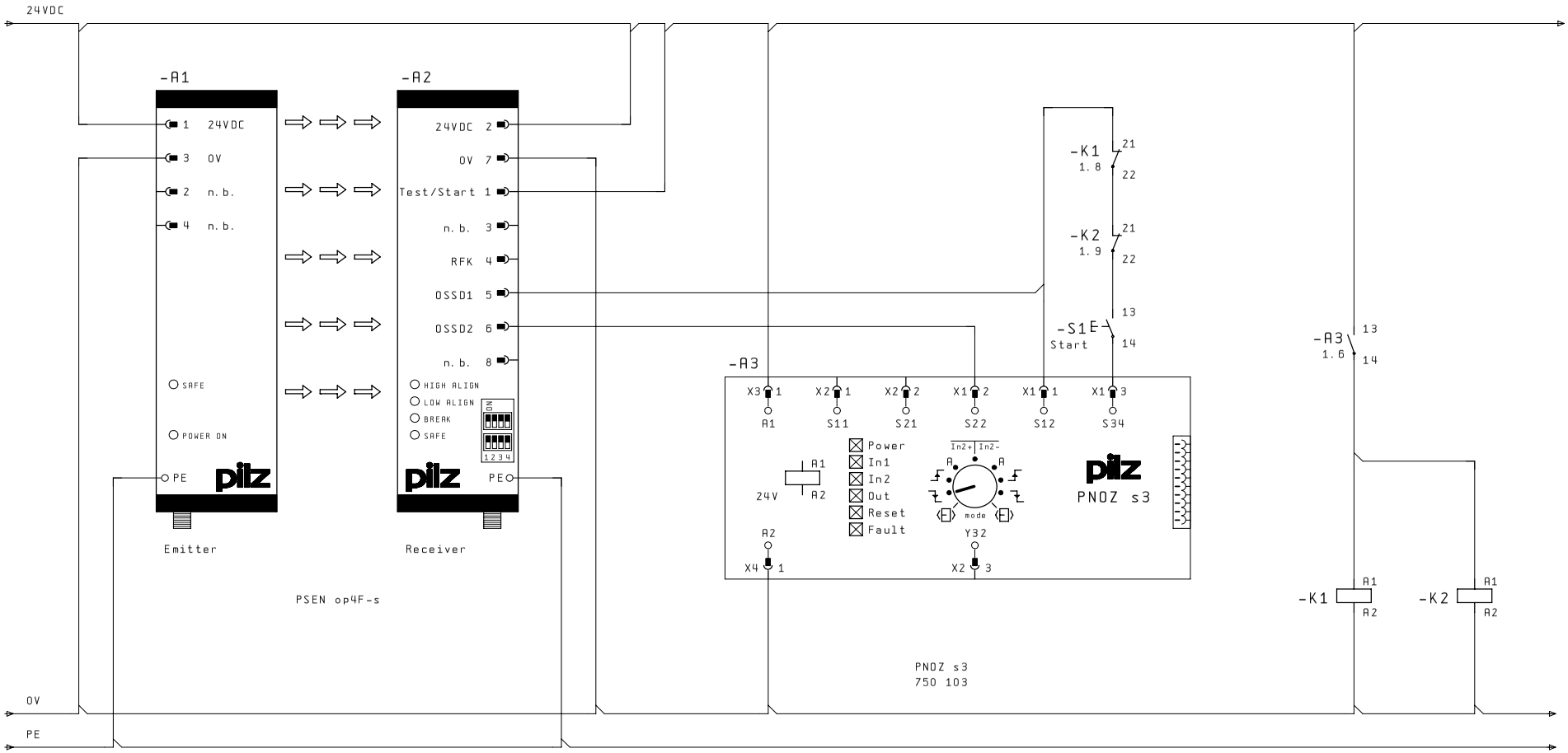
Safety assessment

- A short circuit between 24 VDC and the safety outputs OSSD1 and OSSD2 of the safety light curtain is detected as an error by the safety light curtain. The safety outputs will carry a low signal.
- A short between the safety outputs OSSD1 and OSSD2 of the safety light curtain is detected as an error by the safety light curtain. The safety outputs will carry a low signal.

Pilz units

Number	Type	Features	Order number
1	PSEN op4F-s-14-090	24 VDC	630 605
1	PNOZ s3	24 VDC	750 103

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Revision	26.01.07	Date	05.10.04	PSENOPT technical catalogue	Pilz GmbH & Co. KG Felix-Wankel-Str.2 73760 Ostfildern	PSENop4F-s with PNOZ s3 as evaluation device
Name	RDS	Name	RDS			Directory: ..\PILZ\PSEN\04PIL001
				Version 1		Page: 6
		Dep.	CS			

Applications

PSEN op4F with PSS or PNOZmulti, Category 4, EN 954-1

Features

- 1 safety light curtain
- PSS safety system
- Dual-channel with detection of shorts across contacts

Description

The danger zone is protected with a PSEN op4F safety light curtain, which is monitored by the PSS safety system.
The safety outputs OSSD1 and OSSD2 are wired directly onto the inputs of the safety system.
The motor of the machine (contactors K3 and K4) is switched on when the light curtain is not interrupted.
If the light curtain is interrupted, the signal at the outputs changes from High to Low and the machine is switched off (contactors K3 and K4).

Test
The test input has a fixed 24 V supply.

Reset
If the light curtain is not interrupted, the units can be started by pressing the reset button S3 (monitored reset).

INFORMATION
In this example, a matching solution can be implemented with the modular safety system PNOZmulti.

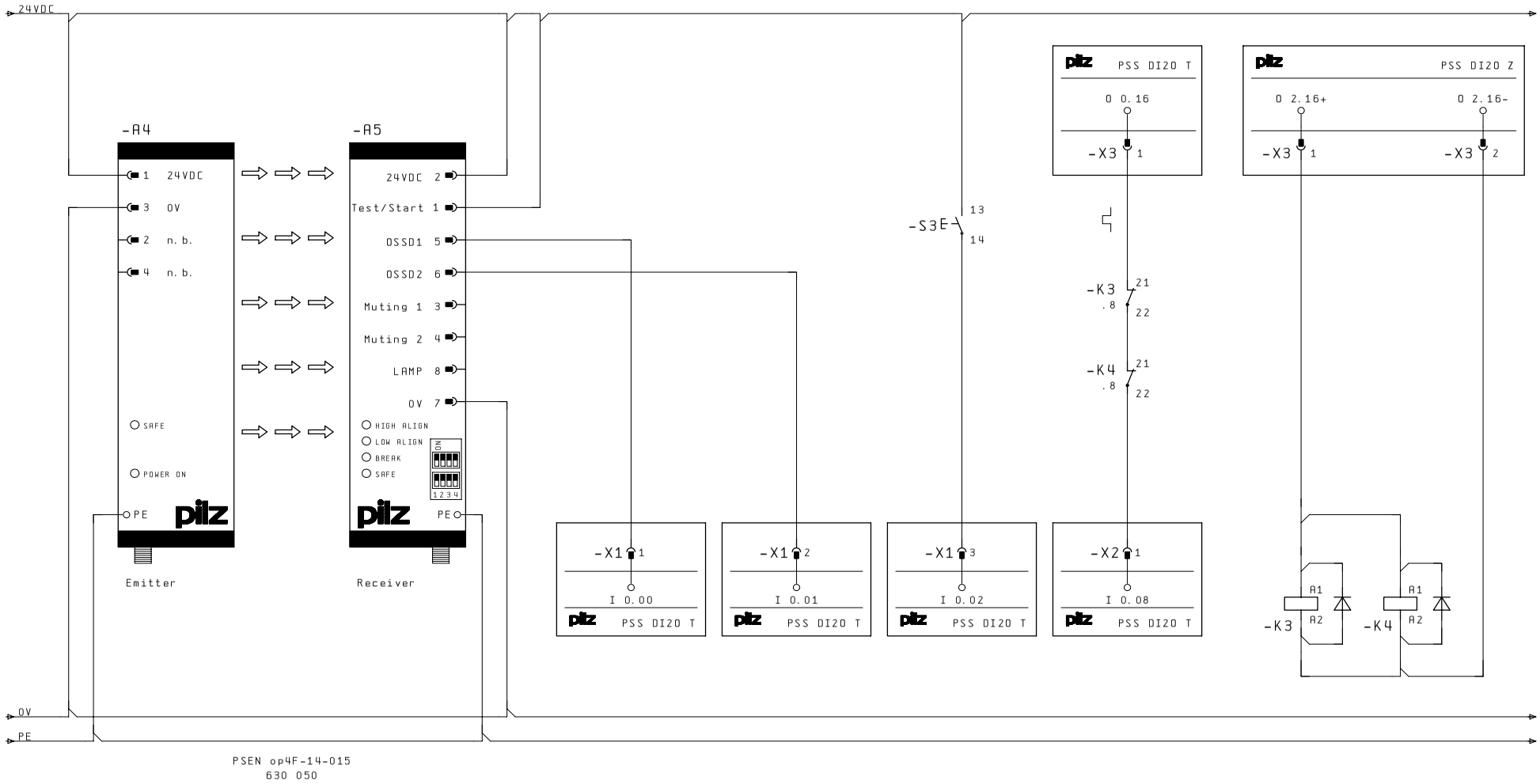
Safety assessment

- A short circuit between 24 VDC and the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.

Pilz units

Number	Type	Features	Order number
1	PSEN op4F-14-015	24 V DC	630 050
1	PSS CPU3	24 V DC	301 064
1	PSS BMP 4/2	24 V DC	301 006
1	PSS PS 24	24 V DC	301 051
1	PSS DI2OT	24 V DC	301 112
1	PSS DI2OZ	24 V DC	301 109

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Revision	16. Nov. 2004	Date	05. Okt. 2004	PSENOPT technical catalogue	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	PSENop with Pilz safety device PSS or PNOZmulti as evaluation device	Directory: ..\PILZ\PSEN\04PIL001
Name	CLE	Name	CLE				
				Version 1			Page: 2
		Dep.	CS				

Applications

Muting with PMUT X1P, Category 4, EN 954-1

Features

- 1 safety light curtain
- Muting controller PMUT X1P
- Dual-channel with detection of shorts across contacts
- 4 muting sensors
- 2 muting lamps
- 1 reset button
- 1 key switch

Description

Muting mode enables the safety function to be temporarily suspended in order, for example, to insert workpieces.
The full muting functionality is provided by the muting controller PMUT X1P. The light curtain only supplies the information: "Protected field broken".
In normal operation the drive is enabled and contactors K5 and K6 are switched on if the light curtain is not interrupted.
The muting sensors enable the light curtain function to be suspended. The muting sensors (N/O) supply a low signal when they are not operated. In muting mode, a high signal is present at the muting sensor outputs. As a result, the motor is enabled even if the light curtain is interrupted, and contactors K5 and K6 still remain switched on.
Muting mode finishes if just one muting sensor remains active.

Muting lamp
Muting mode is displayed via two monitored lamps.

Key switch
If the muting sensor simultaneity requirement of 3 s is exceeded, the unit will go to a fault condition. The simultaneity requirement can be reset by operating the key switch S5 at S43-S44. Then the reset button S4 needs to be operated at S33-34. The muting controller is ready for operation.

Reset
If the light curtain is not interrupted, the units can be started by pressing the reset button S4 (monitored reset).

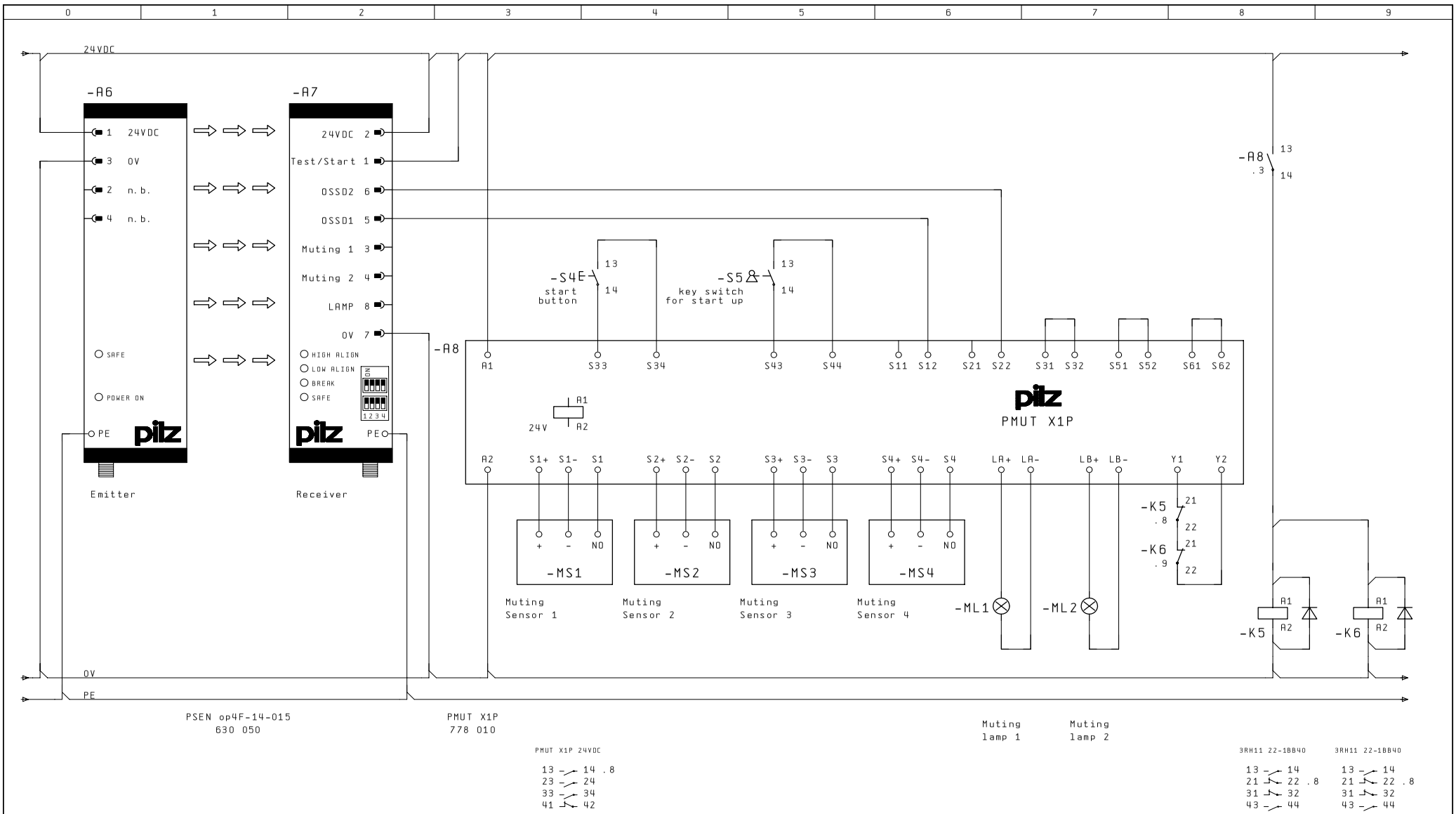
Safety assessment

- A short circuit between 24 VDC and the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.

Pilz units

Number	Type	Features	Order number
1	PSEN op4F-14-015	24 VDC	630 050
1	PMUT X1P	24 VDC	778 010
4	PSEN op1.3 muting sensors	24 VDC	630 320
2	PIT si1.1 muting lamps	24 VDC	620 010

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Revision	16. Nov. 2004	Date	05. Okt. 2004	PSENOPT technical catalogue	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	Muting with PMUT X1P
Name	CLE	Name	CLE			Directory: ..\PILZ\PSEN\04PIL001
				Version 1		Page: 3
		Dep.	CS			

Applications

Muting with PSEN op4F and PSS or PNOZmulti, Category 4, EN 954-1

Features

- 1 safety light curtain
- PSS safety system
- Dual-channel with detection of shorts across contacts
- 4 muting sensors
- 1 muting lamp
- 1 reset button
- 1 key switch
- Partial muting can be configured

Description

Muting mode enables the safety function to be temporarily suspended in order, for example, to insert workpieces.
The muting function is performed by a standard block in the PSS safety system.
The light curtain receives the "Muting active" information via the inputs MS1 and MS2.
In normal operation the drive is enabled and contactors K7 and K8 are switched on if the light curtain is not interrupted.
The muting sensors enable the light curtain function to be suspended.
The muting sensors (N/O) supply a low signal when they are not operated. In muting mode, a high signal is present at the muting sensor outputs. As a result, the motor is enabled even if the light curtain is interrupted, and contactors K7 and K8 still remain switched on.
Muting mode finishes if just one muting sensor is active or if the muting time elapses (max. 10 minutes).

Partial muting
There is an option to blank only certain zones of the protected area (settings made via DIP switches 1 to 3 at the light curtain).

Muting lamp
Muting mode is displayed via a monitored lamp.
The lamp must be connected to the lamp output of the PSENopt.

Key switch
If the muting sensor simultaneity requirement is exceeded, the unit will go to a fault condition. Key switch S7 can be used to override the muting station until no muting sensor is activated any more.

Reset
If the light curtain is not interrupted, the units can be started by pressing the reset button S6 (monitored reset).

INFORMATION
In this example, a matching solution can be implemented with the modular safety system PNOZmulti.

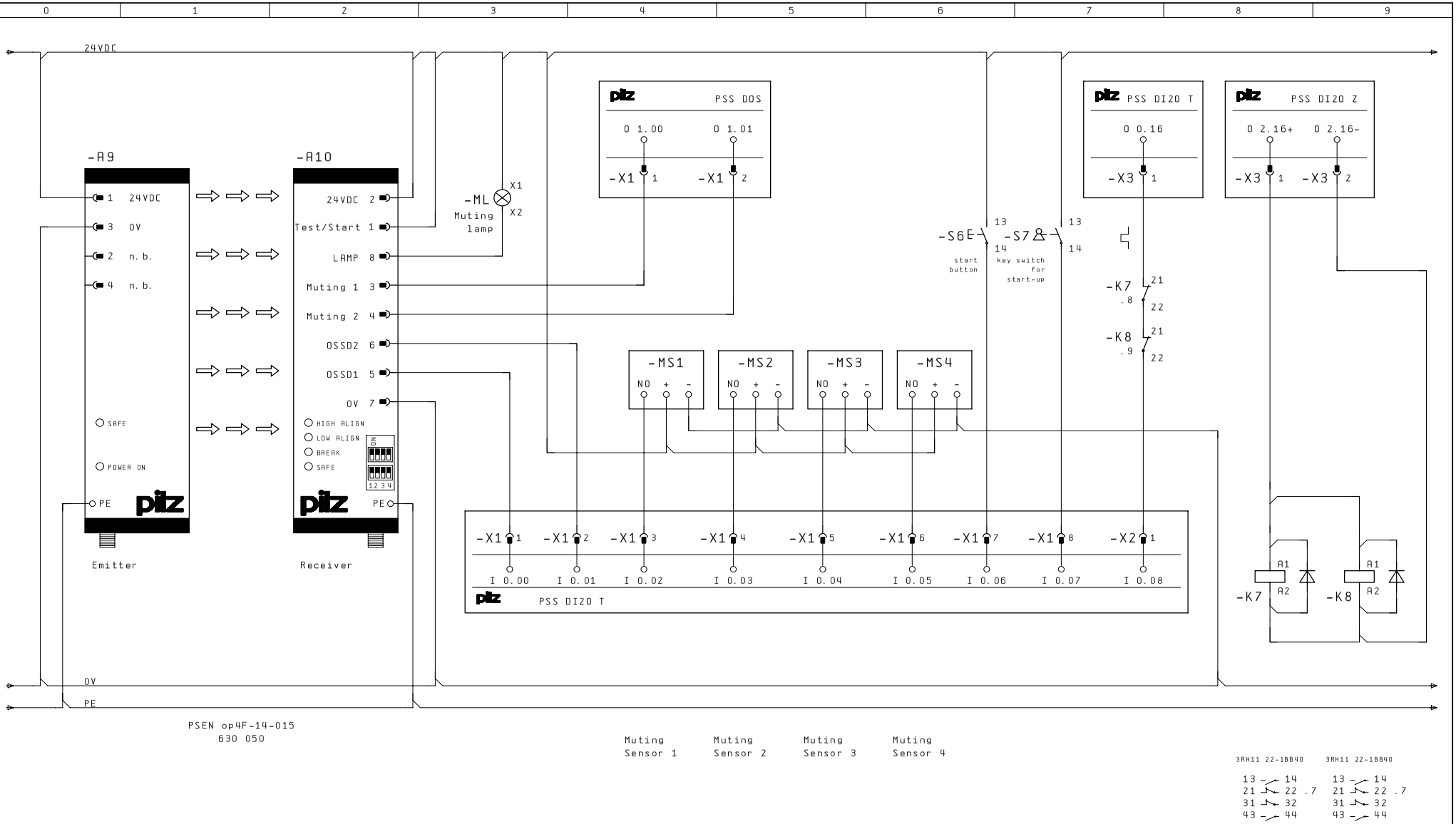
Safety assessment

- A short circuit between 24 VDC and the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between 24 VDC and the muting inputs of the light curtain will be detected as an error by the safety system.
- A short circuit between the muting inputs will be detected as an error by the light curtain.
- A broken wire in the lamp's filament will be detected as an error by the light curtain.

Pilz units

Number	Type	Features	Order number
1	PSEN op4F-14-015	24 VDC	630 050
1	PSS CPU3	24 VDC	301 064
1	PSS BMP 4/2	24 VDC	301 006
1	PSS PS 24	24 VDC	301 051
1	PSS DI2OT	24 VDC	301 112
1	PSS DI2OZ	24 VDC	301 109
1	PSS DOS	24 VDC	301 111
4	PSEN op1.3 muting sensors	24 VDC	630 320
1	PIT si1.1 muting lamps	24 VDC	620 010

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Revision	16. Nov. 2004	Date	05. Okt. 2004	PSENOPT technical catalogue	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	Muting with PSS/PNOZmulti
Name	CLE	Name	CLE			Directory: ..\PILZ\PSEN\04PIL001
				Version 1		
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Applications

Direct muting with PSEN op4F safety light curtain, Category 4, EN 954-1

Features

- 1 safety light curtain
- Dual-channel with detection of shorts across contacts
- 4 muting sensors
- 1 muting lamp
- 1 reset button
- Partial muting can be configured

Description

Muting mode enables the safety function to be temporarily suspended in order, for example, to insert workpieces.
The full muting functionality is provided by the light curtain PSENopt.
In normal operation the drive is enabled and contactors K9 and K10 are switched on if the light curtain is not interrupted.
The muting sensors enable the light curtain function to be suspended.
The muting sensors (N/O) supply a low signal when they are not operated.
Inputs MS1 and MS2 must be actuated simultaneously within 0.5 s.
In muting mode, a high signal is present at the muting sensor outputs. As a result, the motor is enabled even if the light curtain is interrupted, and contactors K9 and K10 still remain switched on.
Muting mode finishes if just one muting sensor is active or if the muting time elapses (max. 10 minutes).

Muting sensors 1 and 3 are connected in parallel to input MS1.
Muting sensors 2 and 4 are connected in parallel to input MS2.

Partial muting
There is an option to blank only certain zones of the protected area (settings made via DIP switches 1 to 3).

Overriding
Once the muting time has been exceeded the system needs to be "overridden".
- Switch the receiver off and back on via the "OFF" button S8.
- Press the "RESET" button S9 within 10 s of the device being switched back on and keep it pressed for 5 s.

Muting lamp
Muting mode is displayed via a monitored lamp.
The lamp must be connected to the lamp output of the PSENopt.

Reset
If the light curtain is not interrupted, the units can be started by pressing the reset button S10 (monitored reset).

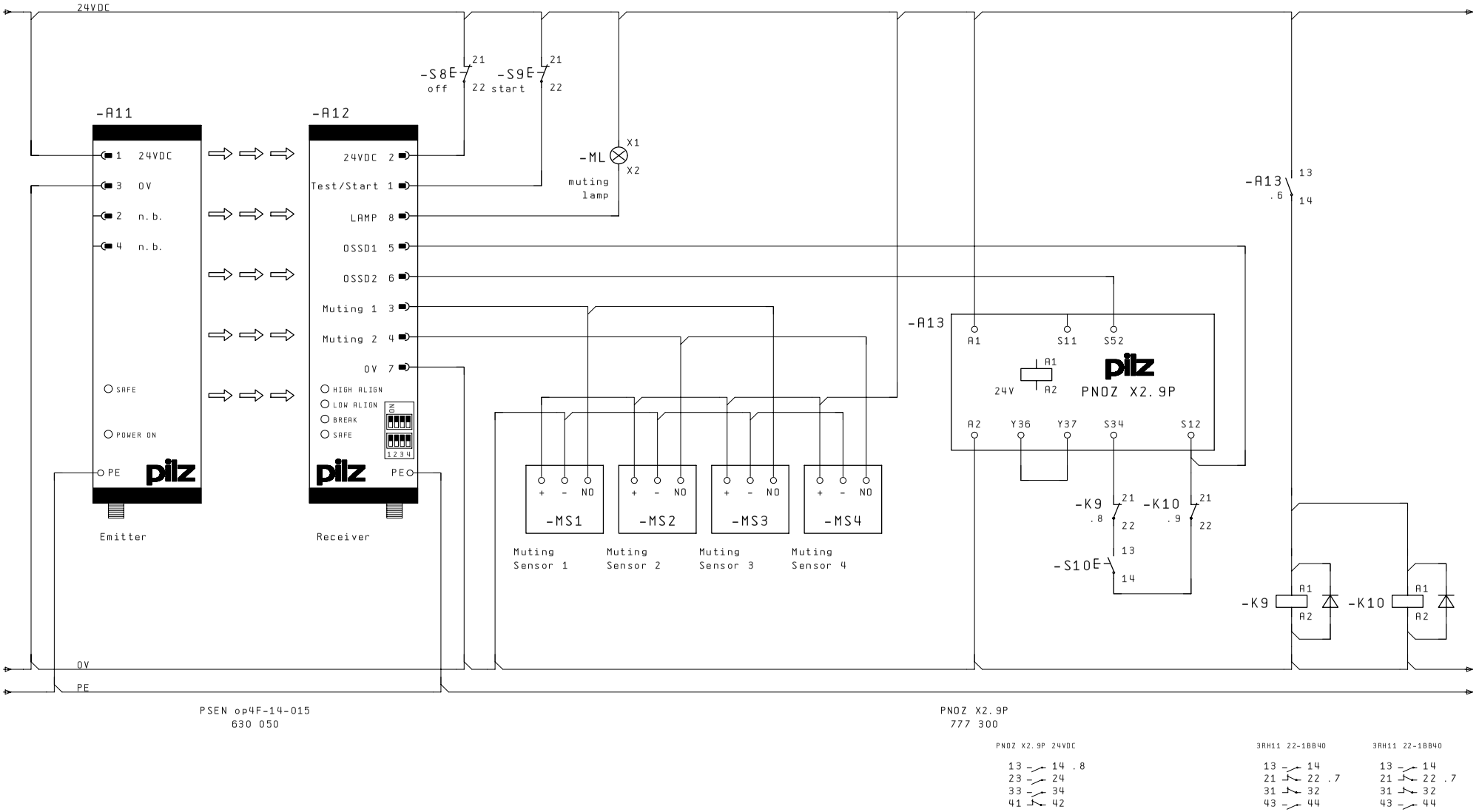
Safety assessment

- A short circuit between 24 VDC and the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between the safety outputs OSSD1 and OSSD2 of the light curtain is detected as an error by the light curtain. The safety outputs will carry a low signal.
- A short between 24 VDC and the muting inputs of the light curtain will be detected as an error by the safety system.
- A broken wire in the lamp's filament will be detected as an error by the light curtain.

Pilz units

Number	Type	Features	Order number
1	PSEN op4F-14-015	24 VDC	630 050
1	PNOZ X2.9P	24 VDC	777 300
4	PSEN op1.3 muting sensors	24 VDC	630 320
1	PIT si 1.1 muting lamps	24 VDC	620 010

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Revision	16. Nov. 2004	Date	05. Okt. 2004	PSENOPT technical catalogue	Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern	simple muting with PSENop	Directory: ..\PILZ\PSEN\04PIL001
Name	CLE	Name	CLE	Version 1			Page: 5
		Dep.	CS				

Applications

PSENopt SB with SafetyBUS p

Features

- Manual reset
- Reset lock
- IP67 wiring with pre-assembled hybrid cable (supply/ SafetyBUS p)
- Safety light curtain is configured in the PSS WIN-PRO system software (from Version 1.3.0)

Description
In this example the safety system with the safe bus system SafetyBUS p is monitoring the safety light curtain PSEN opSB-4 (B1/B2).
The SafetyBUS p address (device address 33) for the safety light curtain is set on the receiver via rotary switches (safety light curtain is given one bus address only).
The PSS SB Active Junction Basis (A1) supplies voltage to the safety light curtain and SafetyBUS p.
Pre-assembled cable sets (Pilz) with Y-junctions are used for the IP67 wiring. A terminating resistor (PSS SB M12 TERMINATOR) must be connected at the end of the SafetyBUS p branch.

Light curtain monitoring function
If the protected field is interrupted or an error occurs, the safety function in the safety light curtain is reset.
The status of the outputs on the safety light curtain is signalled to the PSS via SafetyBUS p.
When the PSS is cold started (PSS switched from off to on) and warm started (PSS transferring from STOP to RUN), the enable signals M80.00 and M81.00 (enable signals from safety gates for example) and the enable signal from the safety light curtain E33.00 are required in order to achieve an overall enable signal (M89.00), which will start or stop a hazardous movement, for example.
The enable signal on the safety light curtain (E33.00 LG_OSSD) does not need to be dual-channel because the signal is generated safely within the safety light curtain and is transmitted to the PSS safely via SafetyBUS p.
After the protected field has been interrupted, the safety light curtain does not resume normal operation until the object has been removed from the protected field and the Test/ Start button (S1) has been operated (1/0 pulse edge at the Test/Start input on the safety light curtain).

Safety assessment

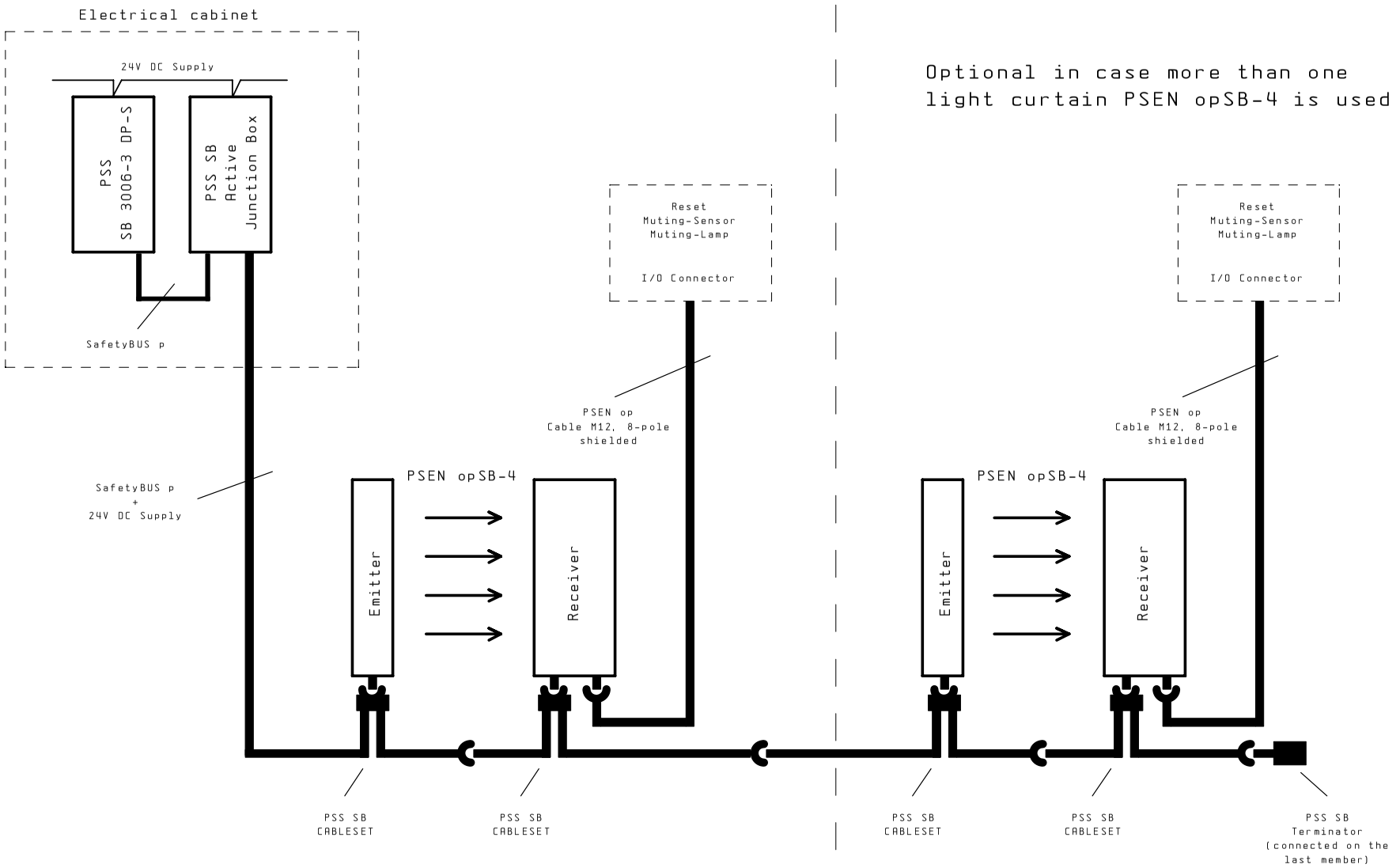
- The PSEN opSB-4 safety light curtain is approved up to Category 4 of EN 954-1 and Type 4 of EN/IEC 61496-1/-2.
- Status and fault diagnostics via displays, as well as externally via SafetyBUS p
- Data exchange via SafetyBUS p is safe.

Classification in accordance with EN 954-1
Depending on the application area and its respective regulations, this connection example is suitable for applications up to category 4, in accordance with EN 954-1.

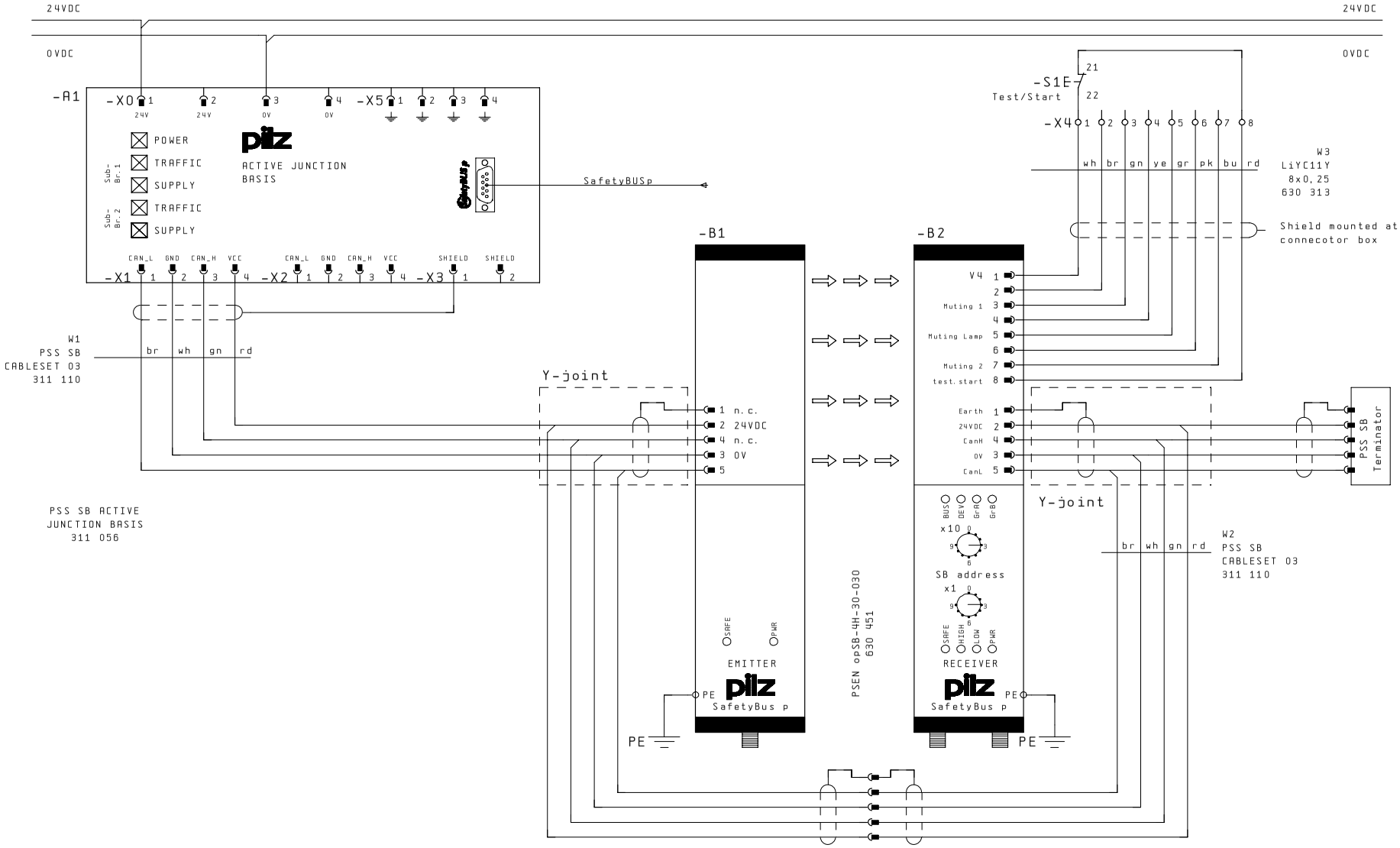
Pilz units

Number	Type	Order number
1	PSEN opSB-4H-30-030	301 600
1	PSS SB ACTIVE JUNCTION BASIS	311 056
1	PSS SB 3006-3 DP-S	630 451
2	PSS SB CABLESET 03	311 110
1	PSEN op cable axial M12 8-pin	630 451
1	PSS SB M12 TERMINATOR	311 032
2	PSS SB SUB-D1	311 051
1	PSS SB cable	311 070

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Revision	13.10.06	Date	03.06.05	AOPD wiring example	pilz Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	SafetyBUS p light curtain monitoring of type PSEN opSB 4	Directory: ..\Pilz\PSSSB\05PIL006
Name	WED	Name	WED				
				PSEN opSB-4			Page: 31
		Dep.	CS				



Revision	13.10.06	Date	03.06.05	AOPD in guard mode	Pilz GmbH & Co.KG Felix-Wankel-Str.2 73760 Ostfildern	SafetyBUS p light curtain monitoring of type PSEN opSB-4
Name	WED	Name	WED			Directory: ..\Pilz\PSSSB\05PIL006
				Category 4 EN 954-1		Page:31.1
		Dep.	CS			

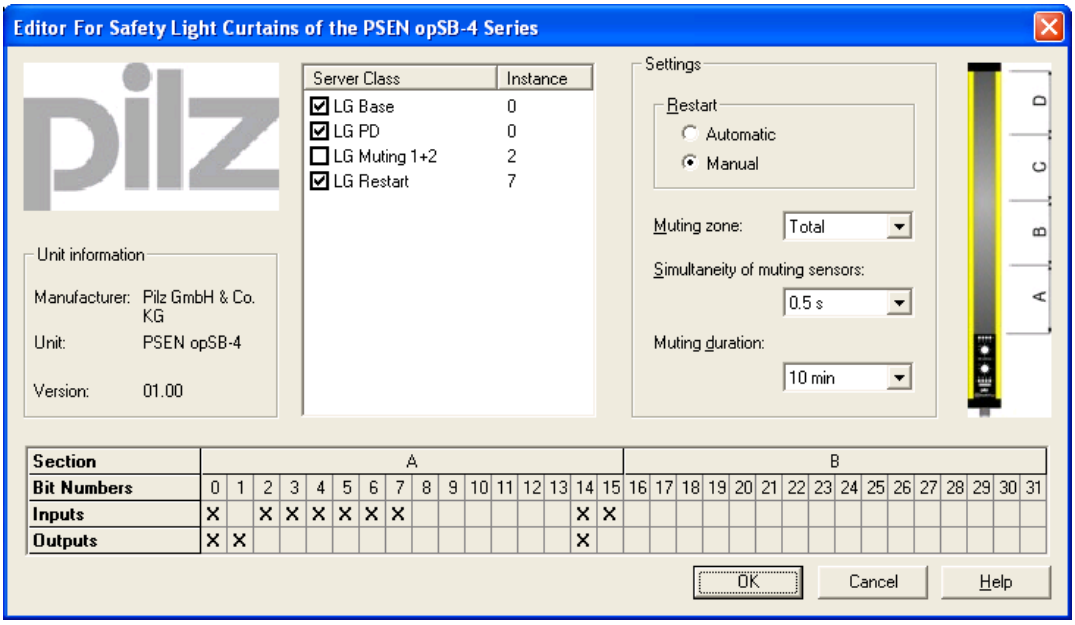
Applications

PSENopt SB with SafetyBUS p

Configuration of the safety light curtains

- Server class:
  LG Base activated — Light curtain basic function (OSSD and test)
  LG PD activated — Process diagnostics, which can be evaluated by the user program.
  LG Muting deactivated — Internal light curtain muting function
  LG Restart activated — Restart safety light curtain

- Settings:
  Manual restart



Program

Programming was carried out in OB101. It may also be carried out elsewhere, e.g. in a PB or FB.

Listing for OB101

```
      SEG 0

// Read in status of safety light curtain
// and link to other enable signals

  L   E  033.00   .LG_OSSD          // Status of OSSD;
                                    // 1 = Light curtain clear
  U   M 080.00    .Enable_1         // Enable signal from
                                    // another device (e.g. gate)
  U   M 081.00    .Enable_2         // Enable signal from
                                    // another device
                                    // (e.g. pressure mat)
  =   M 089.00    .Enable_total     // Overall enable signal
                                    // for further use

  BE
```

Appendix

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Appendix
Chemical resistance

Chemical resistance, housing material of the PSENopt safety light curtains

The resistance values listed here are only standard values and may be fundamentally changed by influencing factors such as filling material, changing temperatures, high load, environmental influences, reaction period etc. For this reason we cannot guarantee this information. This data was determined at room temperature and with normal to strong concentrations.

PC plastic (flap cover, flap, end caps)

Resistance to	Resistance
Acetone	No
Alcohol	Yes
Benzine	Yes
Benzol	No
Hot water, continuous	No
Chlorinated hydrocarbons	No
Hydrocarbons - halogenated, aliphatic, aromatic	No
Concentrated ethanoic acid	No
Methanol	No
Caustic soda	No
Fruit juices/citric acid	Yes
Oil	Yes
Cooking/salad oil	Yes
Toluene	No
Diluted alkaline solutions	Yes
Diluted acids	Yes
Detergent	Yes
Water/saltwater < 60°	Yes
Xylene	No

PMMA plastic (optical covers)

Resistance to	Resistance
Acetone	No
Alcohol	No
Ammonia	Yes
Benzine	Yes
Benzol	No
Chlorinated hydrocarbons	No
Hydrocarbons - halogenated, aliphatic, aromatic	No
Concentrated alkaline solutions	No
Concentrated acids	No
Methanol	No
Fruit juices/citric acid	Yes
Oil	Yes
Polar solvents	No
Cooking/salad oil	Yes
Toluene	No
Diluted alkaline solutions	Yes
Diluted acids	Yes
Detergent	Yes
Xylene	No

ABS plastic (muting sensor housings)

Resistance to	Resistance
Acetone	No
Alcohol	Yes
Benzine	No
Benzol	No
Chlorinated hydrocarbons	No
Hydrocarbons - halogenated, aliphatic, aromatic	No
Concentrated alkaline solutions	No
Concentrated acids	No
Methanol	Yes
Fruit juices/citric acid	Yes
Oil	Yes
Cooking/salad oil	Yes
Polar solvents	No
Toluene	No
Diluted alkaline solutions	Yes
Diluted acids	Yes
Detergent	Yes
Xylene	No

Aluminium AlMgSi 0.5 anodised (light curtain profile)

Resistance to	Resistance
Inorganic solvents	Yes
Atmospheric corrosion	Yes
Lime	No
Alkaline solutions	No
Organic solvents	Yes
Acids	No
Contaminations in a pH range from 5 to 8	Yes
Water/saltwater	Yes
Cement	No

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Appendix
Chemical resistance

Accessories

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Accessories

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Accessories

Unshielded cables, axial

Unit features:
- M12
- Axial

Model	Length (m)	Core
PSEN op cable axial M12 4-pole 3 m	3	4
PSEN op cable axial M12 4-pole 5 m	5	4
PSEN op cable axial M12 4-pole 10 m	10	4
PSEN op cable axial M12 5-pole 3 m	3	5
PSEN op cable axial M12 5-pole 5 m	5	5
PSEN op cable axial M12 5-pole 10 m	10	5

Shielded cables, axial

Unit features:
- M12
- Axial

Model	Length (m)	Core
PSEN op cable axial M12 4-p. shield. 3 m	3	4
PSEN op cable axial M12 4-p. shield. 5 m	5	4
PSEN op cable axial M12 4-p. shield. 10 m	10	4
PSEN op cable axial M12 4-p. shield. 30 m	30	4
PSEN op cable axial M12 8-p. shield. 3 m	3	8
PSEN op cable axial M12 8-p. shield. 5 m	5	8
PSEN op cable axial M12 8-p. shield. 10 m	10	8
PSEN op cable axial M12 8-p. shield. 30 m	30	8

Shielded cables, axial
To connect Master and Slave on
models PSEN op4F/H-sl/m

Unit features:
- M12
- Axial

Model	Length (m)	Core
PSEN op cable axial M12 5-p. shield. 0.5 m	0,5	4
PSEN op cable axial M12 5-p. shield. 1 m	1	4
PSEN op connector M12 5-p	Terminator for PSEN op4F/H-m (stand-alone application)	

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Accessories

Shielded cables with angled plug

Unit features:
- M12
- Angled

Model	Length (m)	Core
PSEN op cable angle M12 4-p. shield. 3 m	3	4
PSEN op cable angle M12 4-p. shield. 5 m	5	4
PSEN op cable angle M12 4-p. shield. 10 m	10	4
PSEN op cable angle M12 4-p. shield. 30 m	30	4
PSEN op cable angle M12 8-p. shield. 3 m	3	8
PSEN op cable angle M12 8-p. shield. 5 m	5	8
PSEN op cable angle M12 8-p. shield. 10 m	10	8
PSEN op cable angle M12 8-p. shield. 30 m	30	8

Cable/connector for muting applications (PSEN op4L/T/S)

Unit features:
- Can be used for the safety light curtains PSEN op4L/T/S

Model	Description
PSEN op cableset	Y-cable
PSEN op cable M12 4-p. 0.75, L-Muting	Cable for L-Muting

Caution!
Shielded cables must be used for PSENopt safety light curtains
Exception: PSEN op2H!

Cables for connecting PSENopt SB to SafetyBUS p

Model	Description	Length (m)	Core
PSS SB CABLESET 03	Y cable, 1 x M12 male connector, 2 x M12 female connectors	0.5 and 3	5
PSS SB CABLESET 05	Y cable, 1 x M12 male connector, 2 x M12 female connectors	0.5 and 5	5
PSS SB CABLESET 10	Y cable, 1 x M12 male connector, 2 x M12 female connectors	0.5 and 10	5
PSS SB CABLESET 15	Y cable, 1 x M12 male connector, 2 x M12 female connectors	0.5 and 15	5
PSS SB BUSCABLE LC	SafetyBUS p bus cable, low current, shielded	0.5 and 5	4
PSS SB M12 TERMINATOR	SafetyBUS p terminating resistor IP67, M12 male connector	0.5 and 10	-

Accessories

Floor brackets
Stand

Unit features:
- Can be used for all PSENopt light curtains and the deviating mirrors
- Dimensions of the floor mounting plate:
  240 x 240 mm

Model	Dimensions (L x W x H)	For further data refer to the operating manual, Stand 1000-1800 mm
PSEN op Stand 1000 mm	1000 x 30 x 30 mm	
PSEN op Stand 1200 mm	1200 x 30 x 30 mm	
PSEN op Stand 1500 mm	1500 x 45 x 45 mm	
PSEN op Stand 1800 mm	1800 x 45 x 45 mm	

Deviating mirrors
Mirror

Deviating mirrors can be used to monitor danger zones where access is possible from various sides.

Unit features:
- Can be used for all safety light curtains PSENopt, PSENopt SB
- Dimensions of the floor mounting plate:
  240 x 240 mm

Model	Length (mm)	For further data refer to the Deviating mirrors operating manual
PSEN op Mirror 550 mm	550	
PSEN op Mirror 700 mm	700	
PSEN op Mirror 900 mm	900	
PSEN op Mirror 1000 mm	1000	
PSEN op Mirror 1270 mm	1270	
PSEN op Mirror 1600 mm	1600	
PSEN op Mirror 1800 mm	1800	

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Accessories

Mounting bracket
PSEN op Bracket kit

Adjustable or vibration-proof mounting brackets are available for installations requiring mechanical adjustments or for applications which are subject to heavy vibrations.

Unit features:
- The standard mounting brackets are included in the delivery scope of the light curtains PSENopt, PSENopt SB.
- The adjustable or vibration-proof mounting brackets can be used for all light curtains PSENopt, PSENopt SB

Model	Features	
PSEN op Bracket kit	Standard mounting bracket	For further data refer to the Bracket kit PSEN4 operating manual
PSEN op Bracket kit adjustable	Adjustable mounting bracket *	
PSEN op Bracket kit anti vibration	Vibration-proof mounting bracket	

* Standard bracket kit PSEN 4 is additionally required for attachment of the PSEN op2H.

Laser pointer
LaserPointer for PSENopt 2/4

The LaserPointer helps to simplify the process of aligning the PSENopt light curtain transmitter and receiver.

Unit features:
- Can be used with the light curtains PSEN op4F/H/B, PSEN op2B

For further data refer to the operating manual for the LaserPointer for PSEN4/2

Accessories

Test rods

The correct operation of the PSENopt light curtain beams should be checked on a regular basis. This is done with a designated test rod.

Unit features:
- Can be used for the safety light curtains PSENopt, PSENopt SB

Model	Can be used as
Test rod F 14 mm	Safety light curtain for finger protection
Test rod H 30 mm	Safety light curtain for hand protection

Muting lamps PITsi

Muting lamps are used to signal the activity of the muting function.
A muting lamp must be connected before a muting function can be activated.

Unit features:
- Protection type IP65
- Can be used for muting applications with the safety light curtains PSEN op4F/H/B, PSEN op2B

Model	Features	For further data refer to the PIT si1.1/PIT si1.2 operating manual
PIT si1.1	Muting lamp, unmonitored	
PIT si1.2	Muting lamp, monitored	

Muting sensors for L- and T- Muting

Unit features:
- Can be used for the light curtains PSEN op4B-S
- Muting sensors for L- and T-Configuration

Model	Features
PSEN op1.4 L-Muting	Muting sensor for L-Configuration
PSEN op1.5 T-Muting	Muting sensor for T-Configuration

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Accessories

Muting sensors (muting signals)
PSENop1

The PSENop1 muting sensors are optoelectronic protection devices. They are used to reliably detect the conveyed item(s) when muting functions are active.
Muting sensors must be connected before a muting function can be activated.

Unit features:
- Can be used for muting applications with the light curtains PSEN op4F/H/, PSEN op2B, PSEN opSB-4F/H/B, PSEN op4B-S
- Supply voltage: 10 ... 30 VDC
- Connection: M12 connector, 4-pin
- Output: PNP, n/o and n/c

Model	Features	Operating range	For further data refer to the following operating manuals: PSEN op1.1, PSEN op1.2 PSEN op1.3
PSEN op1.1 Receiver pnp NO/NC M12	Infrared one-way light barrier, receiver	0 ... 20 m	
PSEN op1.2 Emitter M12	Infrared one-way light barrier, transmitter (emitter)	0 ... 20 m	
PSEN op1.3 Reflex pnp NO/NC M12	Reflex light barrier, polarised, with reflector	0.1 ... 6 m	
Reflector	Reflector		
Bracket	Mounting bracket for PSEN op1-3		

Junction box
PSEN iop1

The junction box simplifies the connection and operation of the safety light curtains

Unit features:
- Can be used for the light curtains PSEN op4B-T/L/S
- Key switches for the override function
- TEST-RESET button for activating the test, restart and reset function
- Connections for:
  - Receiver (RX)
  - Transmitter (TX):
  - Supply voltage
  - Relay outputs
  - External control unit

For further data refer to the operating manual PSEN op4B-T/L/S

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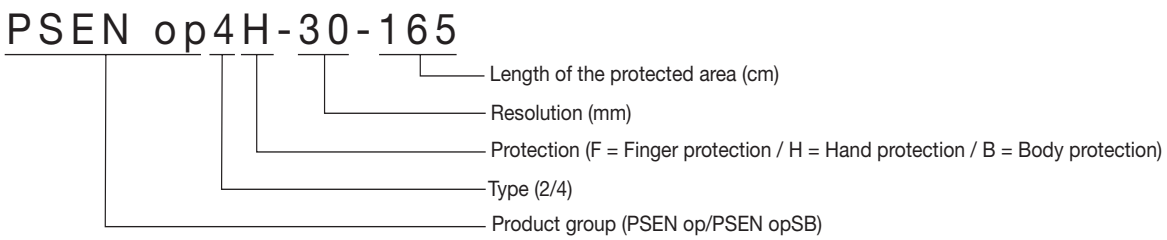
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more than automation
safe automation

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Numerically by order number	2.1-5

Alphabetically by type

Please note the following key when ordering:



Model	Features	Order number	Page
PSEN op2B-2-050	Muting, auto/manual reset	630 200	1.2-4
PSEN op2B-3-080	Muting, auto/manual reset	630 201	1.2-4
PSEN op2B-4-090	Muting, auto/manual reset	630 202	1.2-4
PSEN op2B-4-120	Muting, auto/manual reset	630 203	1.2-4
PSEN op2H-30-015	Auto reset	630 100	1.2-4
PSEN op2H-30-030	Auto reset	630 101	1.2-4
PSEN op2H-30-045	Auto reset	630 102	1.2-4
PSEN op2H-30-060	Auto reset	630 103	1.2-4
PSEN op2H-30-075	Auto reset	630 104	1.2-4
PSEN op2H-30-090	Auto reset	630 105	1.2-4
PSEN op2H-30-105	Auto reset	630 106	1.2-4
PSEN op2H-30-120	Auto reset	630 107	1.2-4
PSEN op2H-30-135	Auto reset	630 108	1.2-4
PSEN op2H-30-150	Auto reset	630 109	1.2-4
PSEN op4B-2-050	Muting, auto/manual reset	630 250	1.2-6
PSEN op4B-3-080	Muting, auto/manual reset	630 251	1.2-6
PSEN op4B-4-090	Muting, auto/manual reset	630 252	1.2-6
PSEN op4B-4-120	Muting, auto/manual reset	630 253	1.2-6
PSEN op4B-L-2-050	Muting (L-Config), auto/manual reset, FL	630 703	1.2-12
PSEN op4B-L-3-080	Muting (L-Config), auto/manual reset, FL	630 704	1.2-12
PSEN op4B-S-2-050	Muting (Linear model), auto/manual reset, FL	630 705	1.2-12
PSEN op4B-S-3-080	Muting (Linear model), auto/manual reset, FL	630 706	1.2-12
PSEN op4B-T-2-050	Muting (T-Config), auto/manual reset, FL	630 701	1.2-11
PSEN op4B-T-3-080	Muting (T-Config), auto/manual reset, FL	630 702	1.2-11
PSEN op4F-14-015	Muting, auto/manual reset	630 050	1.2-5
PSEN op4F-14-030	Muting, auto/manual reset	630 051	1.2-5
PSEN op4F-14-045	Muting, auto/manual reset	630 052	1.2-5
PSEN op4F-14-060	Muting, auto/manual reset	630 053	1.2-5
PSEN op4F-14-075	Muting, auto/manual reset	630 054	1.2-5
PSEN op4F-14-090	Muting, auto/manual reset	630 055	1.2-5
PSEN op4F-b-14-015	Blanking, auto/manual reset, FL	630 621	1.2-7
PSEN op4F-b-14-030	Blanking, auto/manual reset, FL	630 622	1.2-7
PSEN op4F-b-14-045	Blanking, auto/manual reset, FL	630 623	1.2-7
PSEN op4F-b-14-060	Blanking, auto/manual reset, FL	630 624	1.2-7
PSEN op4F-b-14-075	Blanking, auto/manual reset, FL	630 625	1.2-7

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more than automation
safe automation

Alphabetically by type

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PSEN op4F-b-14-090	Blanking, auto/manual reset, FL	630 626	1.2-7
PSEN op4F-b-14-105	Blanking, auto/manual reset, FL	630 627	1.2-7
PSEN op4F-b-14-120	Blanking, auto/manual reset, FL	630 628	1.2-7
PSEN op4F-bm-14-015	Blanking, Cascade (Master), auto/manual reset, FL	630 661	1.2-9
PSEN op4F-bm-14-030	Blanking, Cascade (Master), auto/manual reset, FL	630 662	1.2-9
PSEN op4F-bm-14-045	Blanking, Cascade (Master), auto/manual reset, FL	630 663	1.2-9
PSEN op4F-bm-14-060	Blanking, Cascade (Master), auto/manual reset, FL	630 664	1.2-9
PSEN op4F-bm-14-075	Blanking, Cascade (Master), auto/manual reset, FL	630 665	1.2-9
PSEN op4F-bm-14-090	Blanking, Cascade (Master), auto/manual reset, FL	630 666	1.2-9
PSEN op4F-bm-14-105	Blanking, Cascade (Master), auto/manual reset, FL	630 667	1.2-9
PSEN op4F-bm-14-120	Blanking, Cascade (Master), auto/manual reset, FL	630 668	1.2-9
PSEN op4F-m-14-015	Cascade (Master), auto/manual reset, FL	630 641	1.2-8
PSEN op4F-m-14-030	Cascade (Master), auto/manual reset, FL	630 642	1.2-8
PSEN op4F-m-14-045	Cascade (Master), auto/manual reset, FL	630 643	1.2-8
PSEN op4F-m-14-060	Cascade (Master), auto/manual reset, FL	630 644	1.2-8
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PSEN op4F-m-14-105	Cascade (Master), auto/manual reset, FL	630 647	1.2-8
PSEN op4F-m-14-120	Cascade (Master), auto/manual reset, FL	630 648	1.2-8
PSEN op4F-s-14-015	Auto/manual reset, FL	630 600	1.2-6
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PSEN op4F-sl-14-030	Cascade (Slave), auto/manual reset, FL	630 682	1.2-10
PSEN op4F-sl-14-045	Cascade (Slave), auto/manual reset, FL	630 683	1.2-10
PSEN op4F-sl-14-060	Cascade (Slave), auto/manual reset, FL	630 684	1.2-10
PSEN op4F-sl-14-075	Cascade (Slave), auto/manual reset, FL	630 685	1.2-10
PSEN op4F-sl-14-090	Cascade (Slave), auto/manual reset, FL	630 686	1.2-10
PSEN op4F-sl-14-105	Cascade (Slave), auto/manual reset, FL	630 687	1.2-10
PSEN op4F-sl-14-120	Cascade (Slave), auto/manual reset, FL	630 688	1.2-10
PSEN op4H-30-015	Muting, auto/manual reset	630 150	1.2-5
PSEN op4H-30-030	Muting, auto/manual reset	630 151	1.2-5
PSEN op4H-30-045	Muting, auto/manual reset	630 152	1.2-5
PSEN op4H-30-060	Muting, auto/manual reset	630 153	1.2-5
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PSEN op4H-30-090	Muting, auto/manual reset	630 155	1.2-5
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PSEN op4H-b-30-045	Blanking, auto/manual reset, FL	630 632	1.2-8
PSEN op4H-b-30-060	Blanking, auto/manual reset, FL	630 633	1.2-8
PSEN op4H-b-30-075	Blanking, auto/manual reset, FL	630 634	1.2-8
PSEN op4H-b-30-090	Blanking, auto/manual reset, FL	630 635	1.2-8
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PSEN op4H-b-30-120	Blanking, auto/manual reset, FL	630 637	1.2-8
PSEN op4H-b-30-135	Blanking, auto/manual reset, FL	630 638	1.2-8
PSEN op4H-b-30-150	Blanking, auto/manual reset, FL	630 639	1.2-8

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PSEN op4H-bm-30-030	Blanking, Cascade (Master), auto/manual reset, FL	630 671	1.2-10
PSEN op4H-bm-30-045	Blanking, Cascade (Master), auto/manual reset, FL	630 672	1.2-10
PSEN op4H-bm-30-060	Blanking, Cascade (Master), auto/manual reset, FL	630 673	1.2-10
PSEN op4H-bm-30-075	Blanking, Cascade (Master), auto/manual reset, FL	630 674	1.2-10
PSEN op4H-bm-30-090	Blanking, Cascade (Master), auto/manual reset, FL	630 675	1.2-10
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PSEN op4H-bm-30-120	Blanking, Cascade (Master), auto/manual reset, FL	630 677	1.2-10
PSEN op4H-bm-30-135	Blanking, Cascade (Master), auto/manual reset, FL	630 678	1.2-10
PSEN op4H-bm-30-150	Blanking, Cascade (Master), auto/manual reset, FL	630 679	1.2-10
PSEN op4H-bm-30-165	Blanking, Cascade (Master), auto/manual reset, FL	630 680	1.2-10
PSEN op4H-m-30-015	Cascade (Master), auto/manual reset, FL	630 650	1.2-9
PSEN op4H-m-30-030	Cascade (Master), auto/manual reset, FL	630 651	1.2-9
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PSEN op4H-m-30-090	Cascade (Master), auto/manual reset, FL	630 655	1.2-9
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PSEN op4H-sl-30-030	Cascade (Slave), auto/manual reset, FL	630 691	1.2-11
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PSEN op4H-sl-30-105	Cascade (Slave), auto/manual reset, FL	630 696	1.2-11
PSEN op4H-sl-30-120	Cascade (Slave), auto/manual reset, FL	630 697	1.2-11
PSEN op4H-sl-30-135	Cascade (Slave), auto/manual reset, FL	630 698	1.2-11
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PSEN opSB-4H-30-105	Muting, auto/manual reset, SafetyBUS p interface	630 456	1.2-14
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630 626	PSEN op4F-b-14-090	Blanking, auto/manual reset, FL	1.2-7
630 627	PSEN op4F-b-14-105	Blanking, auto/manual reset, FL	1.2-7
630 628	PSEN op4F-b-14-120	Blanking, auto/manual reset, FL	1.2-7
630 630	PSEN op4H-b-30-015	Blanking, auto/manual reset, FL	1.2-8
630 631	PSEN op4H-b-30-030	Blanking, auto/manual reset, FL	1.2-8
630 632	PSEN op4H-b-30-045	Blanking, auto/manual reset, FL	1.2-8
630 633	PSEN op4H-b-30-060	Blanking, auto/manual reset, FL	1.2-8
630 634	PSEN op4H-b-30-075	Blanking, auto/manual reset, FL	1.2-8
630 635	PSEN op4H-b-30-090	Blanking, auto/manual reset, FL	1.2-8
630 636	PSEN op4H-b-30-105	Blanking, auto/manual reset, FL	1.2-8
630 637	PSEN op4H-b-30-120	Blanking, auto/manual reset, FL	1.2-8
630 638	PSEN op4H-b-30-135	Blanking, auto/manual reset, FL	1.2-8
630 639	PSEN op4H-b-30-150	Blanking, auto/manual reset, FL	1.2-8
630 640	PSEN op4H-b-30-165	Blanking, auto/manual reset, FL	1.2-8
630 641	PSEN op4F-m-14-015	Cascade (Master), auto/manual reset, FL	1.2-8
630 642	PSEN op4F-m-14-030	Cascade (Master), auto/manual reset, FL	1.2-8
630 643	PSEN op4F-m-14-045	Cascade (Master), auto/manual reset, FL	1.2-8
630 644	PSEN op4F-m-14-060	Cascade (Master), auto/manual reset, FL	1.2-8
630 645	PSEN op4F-m-14-075	Cascade (Master), auto/manual reset, FL	1.2-8
630 646	PSEN op4F-m-14-090	Cascade (Master), auto/manual reset, FL	1.2-8
630 647	PSEN op4F-m-14-105	Cascade (Master), auto/manual reset, FL	1.2-8
630 648	PSEN op4F-m-14-120	Cascade (Master), auto/manual reset, FL	1.2-8
630 650	PSEN op4H-m-30-015	Cascade (Master), auto/manual reset, FL	1.2-9
630 651	PSEN op4H-m-30-030	Cascade (Master), auto/manual reset, FL	1.2-9
630 652	PSEN op4H-m-30-045	Cascade (Master), auto/manual reset, FL	1.2-9
630 653	PSEN op4H-m-30-060	Cascade (Master), auto/manual reset, FL	1.2-9
630 654	PSEN op4H-m-30-075	Cascade (Master), auto/manual reset, FL	1.2-9
630 655	PSEN op4H-m-30-090	Cascade (Master), auto/manual reset, FL	1.2-9
630 656	PSEN op4H-m-30-105	Cascade (Master), auto/manual reset, FL	1.2-9
630 657	PSEN op4H-m-30-120	Cascade (Master), auto/manual reset, FL	1.2-9
630 658	PSEN op4H-m-30-135	Cascade (Master), auto/manual reset, FL	1.2-9

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630 659	PSEN op4H-m-30-150	Cascade (Master), auto/manual reset, FL	1.2-9
630 660	PSEN op4H-m-30-165	Cascade (Master), auto/manual reset, FL	1.2-9
630 661	PSEN op4F-bm-14-015	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 662	PSEN op4F-bm-14-030	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 663	PSEN op4F-bm-14-045	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 664	PSEN op4F-bm-14-060	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 665	PSEN op4F-bm-14-075	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 666	PSEN op4F-bm-14-090	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 667	PSEN op4F-bm-14-105	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 668	PSEN op4F-bm-14-120	Blanking, Cascade (Master), auto/manual reset, FL	1.2-9
630 670	PSEN op4H-bm-30-015	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 671	PSEN op4H-bm-30-030	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 672	PSEN op4H-bm-30-045	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 673	PSEN op4H-bm-30-060	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 674	PSEN op4H-bm-30-075	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 675	PSEN op4H-bm-30-090	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 676	PSEN op4H-bm-30-105	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 677	PSEN op4H-bm-30-120	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 678	PSEN op4H-bm-30-135	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 679	PSEN op4H-bm-30-150	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 680	PSEN op4H-bm-30-165	Blanking, Cascade (Master), auto/manual reset, FL	1.2-10
630 681	PSEN op4F-sl-14-015	Cascade (Slave), auto/manual reset, FL	1.2-10
630 682	PSEN op4F-sl-14-030	Cascade (Slave), auto/manual reset, FL	1.2-10
630 683	PSEN op4F-sl-14-045	Cascade (Slave), auto/manual reset, FL	1.2-10
630 684	PSEN op4F-sl-14-060	Cascade (Slave), auto/manual reset, FL	1.2-10
630 685	PSEN op4F-sl-14-075	Cascade (Slave), auto/manual reset, FL	1.2-10
630 686	PSEN op4F-sl-14-090	Cascade (Slave), auto/manual reset, FL	1.2-10
630 687	PSEN op4F-sl-14-105	Cascade (Slave), auto/manual reset, FL	1.2-10
630 688	PSEN op4F-sl-14-120	Cascade (Slave), auto/manual reset, FL	1.2-10
630 690	PSEN op4H-sl-30-015	Cascade (Slave), auto/manual reset, FL	1.2-11
630 691	PSEN op4H-sl-30-030	Cascade (Slave), auto/manual reset, FL	1.2-11
630 692	PSEN op4H-sl-30-045	Cascade (Slave), auto/manual reset, FL	1.2-11
630 693	PSEN op4H-sl-30-060	Cascade (Slave), auto/manual reset, FL	1.2-11
630 694	PSEN op4H-sl-30-075	Cascade (Slave), auto/manual reset, FL	1.2-11
630 695	PSEN op4H-sl-30-090	Cascade (Slave), auto/manual reset, FL	1.2-11
630 696	PSEN op4H-sl-30-105	Cascade (Slave), auto/manual reset, FL	1.2-11
630 697	PSEN op4H-sl-30-120	Cascade (Slave), auto/manual reset, FL	1.2-11
630 698	PSEN op4H-sl-30-135	Cascade (Slave), auto/manual reset, FL	1.2-11
630 699	PSEN op4H-sl-30-150	Cascade (Slave), auto/manual reset, FL	1.2-11
630 700	PSEN op4H-sl-30-165	Cascade (Slave), auto/manual reset, FL	1.2-11
630 701	PSEN op4B-T-2-050	Muting (T-Config), auto/manual reset, FL	1.2-11
630 702	PSEN op4B-T-3-080	Muting (T-Config), auto/manual reset, FL	1.2-11
630 703	PSEN op4B-L-2-050	Muting (L-Config), auto/manual reset, FL	1.2-12
630 704	PSEN op4B-L-3-080	Muting (L-Config), auto/manual reset, FL	1.2-12
630 705	PSEN op4B-S-2-050	Muting (Linear model), auto/manual reset, FL	1.2-12
630 706	PSEN op4B-S-3-080	Muting (Linear model), auto/manual reset, FL	1.2-12

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Accessories

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331 032	PSS SB M12 TERMINATOR	SafetyBUS p terminating resistor IP67	1.5-3
311 074	PSS SB BUSCABLE LC	SafetyBUS p bus cable, low current, shielded	1.5-3
311 110	PSS SB CABLESET 03	SafetyBUS p Y-cable	1.5-3
311 120	PSS SB CABLESET 05	SafetyBUS p Y-cable	1.5-3
311 130	PSS SB CABLESET 10	SafetyBUS p Y-cable	1.5-3
311 140	PSS SB CABLESET 15	SafetyBUS p Y-cable	1.5-3
600 010	PIT si1.1	Muting lamp, unmonitored	1.5-6
600 020	PIT si1.2	Muting lamp, monitored	1.5-6
630 280	PSEN op cable axial M12 5-p. shield. 0.5 m		1.5-2
630 281	PSEN op cable axial M12 5-p. shield. 1 m		1.5-2
630 282	PSEN op cable M12 4-p. 0,75 m L-Muting		1.5-3
630 285	PSEN op connector M12 5-p.		1.5-2
630 295	PSEN op cableset		1.5-3
630 300	PSEN op cable axial M12 4-pole 3 m	Cable, unshielded	1.5-2
630 301	PSEN op cable axial M12 4-pole 5 m	Cable, unshielded	1.5-2
630 302	PSEN op cable axial M12 4-pole 10 m	Cable, unshielded	1.5-2
630 303	PSEN op cable axial M12 4-p. shield. 3 m	Cable, shielded	1.5-2
630 304	PSEN op cable axial M12 4-p. shield. 5 m	Cable, shielded	1.5-2
630 305	PSEN op cable axial M12 4-p. shield. 10 m	Cable, shielded	1.5-2
630 309	PSEN op cable axial M12 4-p. shield. 30 m	Cable, shielded	1.5-2
630 310	PSEN op cable axial M12 5-pole 3 m	Cable, unshielded	1.5-2
630 311	PSEN op cable axial M12 5-pole 5 m	Cable, unshielded	1.5-2
630 312	PSEN op cable axial M12 5-pole 10 m	Cable, unshielded	1.5-2
630 313	PSEN op cable axial M12 8-p. shield. 3 m	Cable, shielded	1.5-2
630 314	PSEN op cable axial M12 8-p. shield. 5 m	Cable, shielded	1.5-2
630 315	PSEN op cable axial M12 8-p. shield. 10 m	Cable, shielded	1.5-2
630 319	PSEN op cable angle M12 4-p. shield. 30 m	Cable, shielded	1.5-3
630 320	PSEN op1.3 Reflex pnp NO/NC M12	Muting sensor	1.5-7
630 321	PSEN op1.2 Emitter M12	Muting sensor	1.5-7
630 322	PSEN op1.1 Receiver pnp NO/NC M12	Muting sensor	1.5-7
630 323	Reflector		1.5-7
630 324	Bracket	Mounting bracket, muting sensor	1.5-7
630 325	PSEN op Bracket kit	Standard mounting bracket	1.5-5
630 326	PSEN op Bracket kit adjustable	Mounting bracket, adjustable	1.5-5
630 327	PSEN op Bracket kit anti vibration	Mounting bracket, anti-vibration	1.5-5
630 328	PSEN op cable axial M12 8-p. shield. 30 m	Cable, shielded	1.5-2
630 329	PSEN op cable angle M12 8-p. shield. 30 m	Cable, shielded	1.5-3
630 330	PSEN op Stand 1000 mm	Floor bracket	1.5-4
630 331	PSEN op Stand 1200 mm	Floor bracket	1.5-4
630 332	PSEN op Stand 1500 mm	Floor bracket	1.5-4
630 333	PSEN op Stand 1800 mm	Floor bracket	1.5-4
630 335	PSEN op Mirror 550 mm	Deviating mirror	1.5-4
630 336	PSEN op Mirror 700 mm	Deviating mirror	1.5-4
630 337	PSEN op Mirror 900 mm	Deviating mirror	1.5-4
630 338	PSEN op Mirror 1000 mm	Deviating mirror	1.5-4
630 339	PSEN op Mirror 1270 mm	Deviating mirror	1.5-4
630 340	LaserPointer for PSEN 4/2	LaserPointer	1.5-5
630 345	Test piece F 14 mm	Test rod	1.5-6
630 346	Test piece H 30 mm	Test rod	1.5-6
630 360	PSEN op Mirror 1600 mm	Deviating mirror	1.5-4
630 361	PSEN op Mirror 1800 mm	Deviating mirror	1.5-4
630 370	PSEN iop1	Junction box	1.5-7
630 707	PSEN op1.4 L-Muting	Muting sensor	1.5-6
630 708	PSEN op1.5 TMuting	Muting sensor	1.5-6

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European directives and status of the standards in Europe

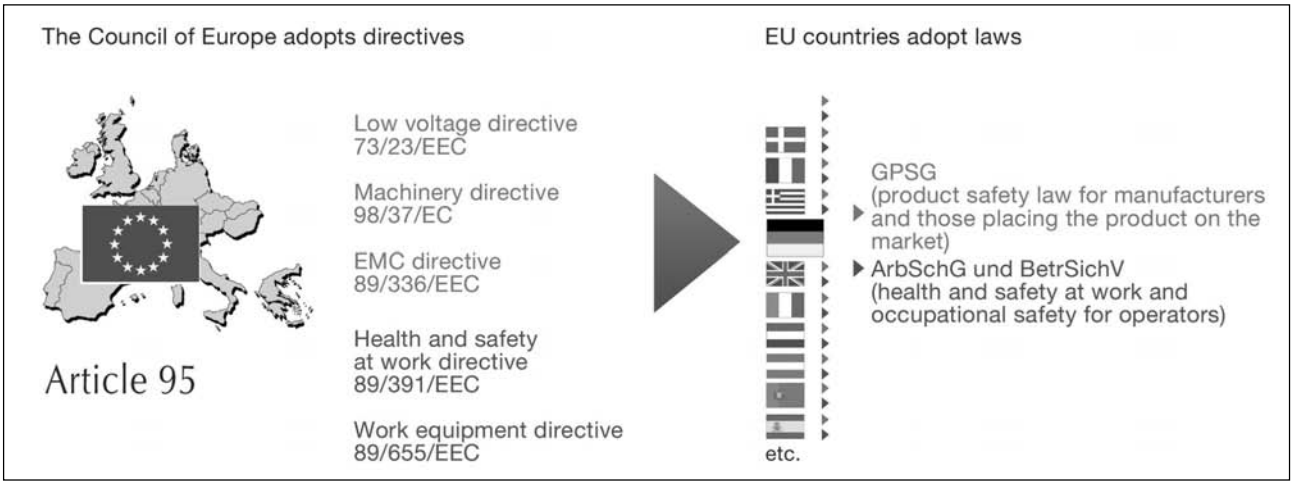


Fig. 1: Incorporation of the directives into domestic law (using Germany as an example)

European directives

The concept of a single European internal market in terms of the "New Approach" can be traced right back to the start of the 70s: The low voltage directive was the first piece of European legislation to take into account the approach towards harmonisation of a common internal market.

Products that are covered by one or more of the following directives have to apply a CE-mark, i.e. the product must be accompanied by a declaration of conformity. With a declaration of conformity, the manufacturer confirms that his product meets all the requirements of the European directives applicable to his product. This means he can launch and sell his product within the scope of the EU without consideration of any national regulations.

- Lifts 95/16/EC
- Construction products 89/106/EEC
- Pressure equipment directive 97/23/EC
- EMC directive 89/336/EEC
- ATEX 94/9/EC
- Appliances burning gaseous fuels 90/396/EEC
- Machinery directive 98/37/EC
- Medical device directive 93/42/EEC
- Low voltage directive 73/23/EEC
- Personal protective equipment 89/686/EEC
- Safety of toys directive 88/378/EEC

The directives are addressed to member states, who are obliged to incorporate the European directives into domestic law. In Germany, this is normally achieved through the device safety law.

Status of the standards in Europe

The legal status of standards is continuously discussed. Inside Europe, i.e. within the scope of the European directives that are subject to the CE-marking obligation, a manufacturer is not bound by standards or other specifications. He simply needs to comply with the health and safety requirements of the directive(s). The associated benefits of a division between standards and legislation are obvious: it is easier for legislators to agree on the essential requirements than on technical details. Also, the directives do not regularly have to be adapted to the state of technology; member states can use their own legal system for incorporation and the manufacturer is free to select how he implements the requirements of the directive.

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European directives and status of the standards in Europe

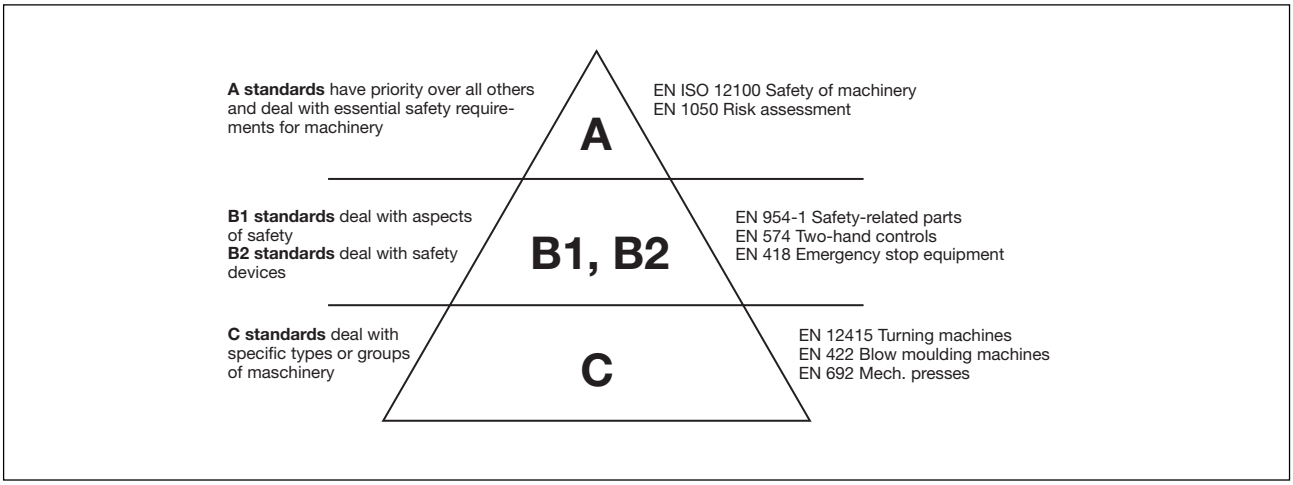


Fig. 2: Standards pyramid

So what are the benefits of applying the standards? With so-called harmonised standards with presumption of conformity, there is a shifting of the burden of proof, i.e. if a manufacturer applies these standards, he can assume that he will also comply with the specific requirements of the European directives. It would therefore be up to the regulatory authorities to prove that a manufacturer did not meet the legal requirements.

However, should a manufacturer deviate from the harmonised standards, he himself must prove how he has met the essential safety requirements. This is generally done via a hazard analysis. In practice people endeavour to apply the harmonised standards, unless the products concerned are highly innovative and no harmonised standards yet exist. The standards for which this “presumption effect” applies can be researched in the Official Journal of the EU (e.g. on the Internet). Standards in Europe are subdivided into A, B and C standards.

Legal regulations outside Europe and Standards for functional safety

Legal regulations outside Europe

The situation is somewhat different in the USA: primarily there are two types of standards: ANSI (American National Standards Institute) and OSHA (Occupational Safety and Health Administration). OSHA standards are published by the state and compliance is mandatory. ANSI standards, on the other hand, are developed by private organisations and generally their application is not strictly essential. However, ANSI standards are still quoted as part of a contract. And yet ANSI standards are being taken over by OSHA. You can still come across the NFPA (National Fire Protection Association), which developed NFPA 79 as a counterpart to EN 60204-1, for example. The OSHA standards can be compared with the European directives. Unlike the European directives, OSHA standards are more involved with formulating requirements for technical specifications than with abstract requirements.

The legal foundations in the USA can be seen as a mix of product standards, fire codes (NFPA), electrical codes (NEC) and national laws. Local government bodies have the authority to monitor that these codes are being enforced and implemented.

Russia and the CIS states implemented GOST-R certification some years ago. This means that technical devices falling within a specific product catalogue must undergo a certain certification process. Machinery and any corresponding technical accessories undergo a type approval test through a European notified body, for example. This test is generally recognised by a Russian-based approvals body. From the point of view of safety, the same requirements apply as in Europe.

China, on the other hand, has introduced CCC certification. Similar to the position in Russia, technical products are subject to mandatory certification through a national approvals body in China. In addition, production sites are inspected. If a technical device falls with the scope of the product catalogue, which is subdivided into 19 categories, certification is mandatory, otherwise it will be necessary to supply a type of “declaration of no objection” from a national notified body.

Japan is currently in a transition period: the plan is for Japan to adopt the European “new approach” – in other words, to keep standards and legislation separate. At the moment the international ISO and IEC standards are being directly incorporated into national legislation, which is why people are currently confronted with frequent amend-ments to laws and lengthy implementation periods.

Standards for functional safety

Different standards may be called upon to observe functional safety on control systems, depending on the application. In the area of machine safety, EN 954-1 is the main standard for safety-related control systems. This applies to the whole chain from the sensor to the actuator, irrespective of the technology. The risk graphs and corresponding risk parameters can be used to estimate the potential risk for danger zones on machinery. The category is initially established without the use of risk-reducing measures.

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Risk parameters and categories in accordance with EN 954-1

Risk parameters

S = Severity of injury:
1 = Slight (normally reversible) injury
2 = Serious (normally irreversible) injury, including death

F = Frequency and/or exposure to the hazard
1 = Seldom to quite often and/or exposure time is short
2 = Frequent to continuous and/or exposure time is long

P = Possibility of avoiding the hazard
1 = Possible under specific conditions
2 = Scarcely possible

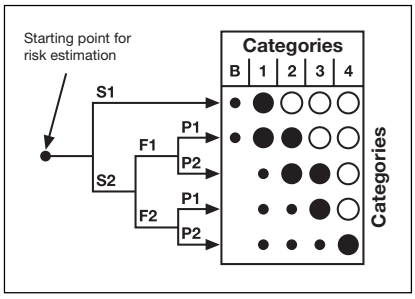


Fig. 3: Risk graph from EN 954

Categories in accordance with EN 954-1

The control system requirements derived from the risk graph are specified as follows:

Category B

Basic category with no special requirements = “good industrial standard”

Category 1

Safety-related parts must be designed and constructed using well-tried components and well-tried safety principles.

Well-tried means: the components have been widely used in the past with successful results in similar applications, or they have been manufactured using principles that demonstrate their suitability and reliability for safety-related applications.

Example: safety switch with forced-opening contacts.

Well-tried safety principles are circuits constructed in such a way that certain faults can be avoided by the appropriate arrangement or layout of components.

Example: avoiding a short circuit through appropriate separation, avoiding component failures that result from over-dimensioning, using the failsafe principle (on switching off).

Note: When a fault occurs it can lead to the loss of the safety function.

Category 2

Safety-related parts of control systems must be designed so that their safety function(s) are checked at suitable intervals by the machine control system. The safety function(s) must be checked: at the machine start-up and prior to the initiation of any hazardous situation; periodically during operation, if the risk assessment and the kind of operation show that it is necessary.

This check may be initiated automatically or manually. Automatically, for example, the check may be initiated by a signal generated from a control system at suitable intervals. The automatic test should be provided by preference. The decision about the type of test depends on the risk assessment and the judgement of the end user or machine builder. If no fault is detected, operation may be approved as a result of the test. If a fault is detected, an output must be generated to initiate an appropriate control action. A second, independent shutdown route is required for this.

Notes: In some cases Category 2 is not applicable because the checking of the safety function cannot be applied to all components and devices. Moreover, the cost involved in implementing Category 2 correctly may be considerable, so that it may make better economic sense to implement a different category. In general Category 2 can be realised with electronic techniques. The system behaviour allows the occurrence of a fault to lead to the loss of the safety function between checks; the loss of the safety function is detected by the check.

Category 3

Safety-related parts of control systems must be designed so that a single fault in any of these parts does not lead to the loss of the safety function.

Whenever reasonably practicable, the single fault shall be detected at or before the next demand upon the safety function. This does not mean that all faults will be detected. The accumulation of undetected faults can lead to an unintended output signal and a hazardous situation at the machine.

Category 4

Safety-related parts of control systems must be designed so that a single fault in any of these parts does not lead to a loss of the safety function; the single fault must be detected at or before the next demand upon the safety functions (e.g. immediately at switch on, at the end of a machine operating cycle). If this detection is not possible, then an accumulation of faults shall not lead to a loss of the safety function.

Functional safety and legal status of EN/IEC 61508

Functional safety with EN/IEC 61508?

EN/IEC 61508 is regarded as a generic safety standard, which deals with the functional safety of electrical, electronic and programmable electronic systems, irrespective of the application.

One of the main tasks of EN/IEC 61508 is to serve as a basis for the development of application-oriented standards. Standards' committees are currently busy in the areas of machine safety with EN/IEC 62061, and process safety with EN/IEC 61511. Also under revision is EN 954, the standard harmonised under the scope of the machinery directive, which in future will be listed as EN/ISO 13849.

These sector-specific standards are intended to continue the principle approaches of EN/IEC 61508 and to implement the requirements for the relevant application area in a suitably practical manner.

What is the legal status of EN/IEC 61508?

As EN/IEC 61508 is not listed in the Official Journal of the European Communities for implementation as a European directive, it lacks the so-called "presumption effect". If the standard is used on its own, a control system designer cannot assume that the relevant requirements of the specific European directive have been met.

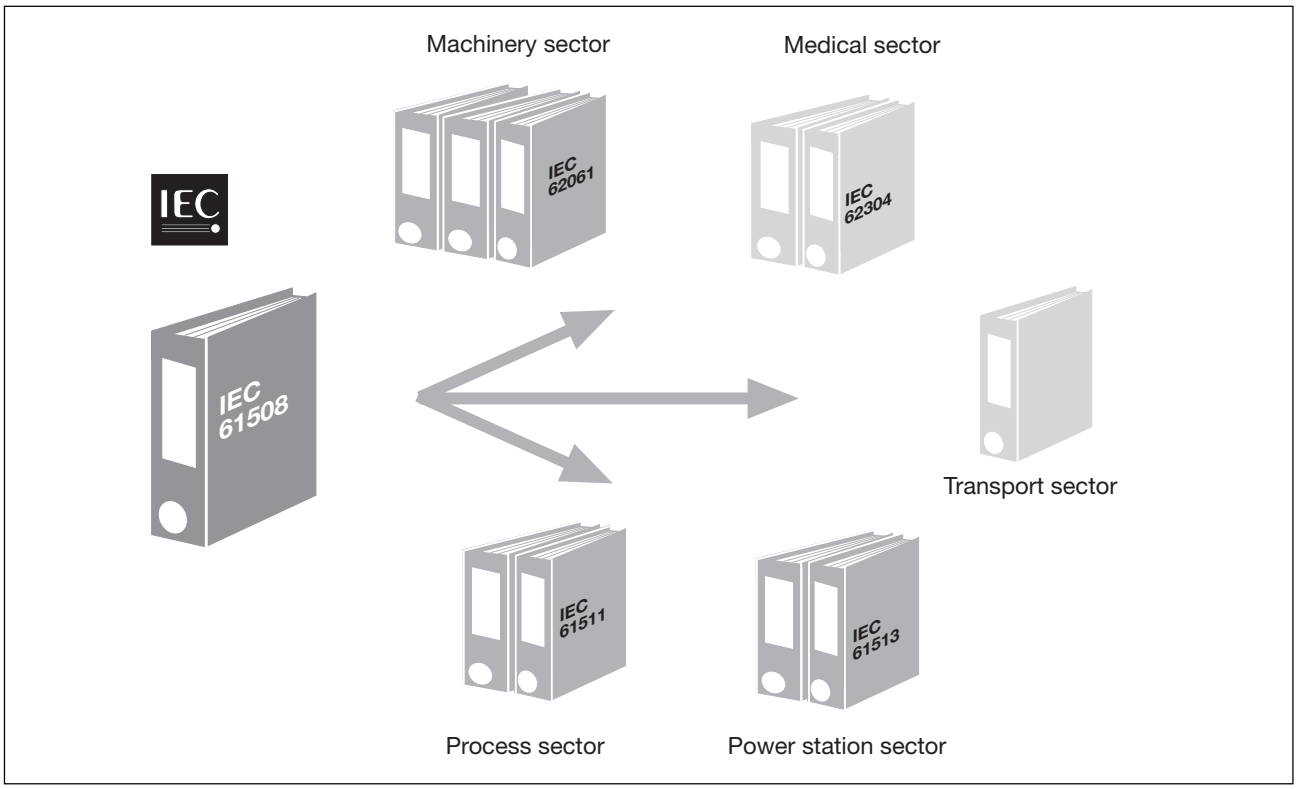


Fig. 4: Sector standards from IEC 61508

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Risk analysis

Risk analysis

Under the terms of the machinery directive, a machine manufacturer must carry out a risk analysis in order to identify all the hazards that apply to his machine. This analysis must then be taken into account in the design and construction of the machine. This requirement also applies to operators who act as manufacturers under the terms of the machinery directive. For example, this may occur with machines that are interlinked or for machinery that has been upgraded and substantially modified.

EN 1050 contains “Principles for risk assessment” on machinery. These approaches can be called upon as part of a comprehensive analysis. EN 954-1 expands on EN 1050 with regard to the assessment of safety-related parts of control systems.

The hazards emanating from a machine may be many and varied. For example, it is necessary to consider not just mechanical hazards through crushing and shearing, but also thermal and electrical hazards and hazards from radiation. Risk reduction is therefore an iterative process, i.e. it is carried out before and during the planning phase and after completion of the plant or machine.

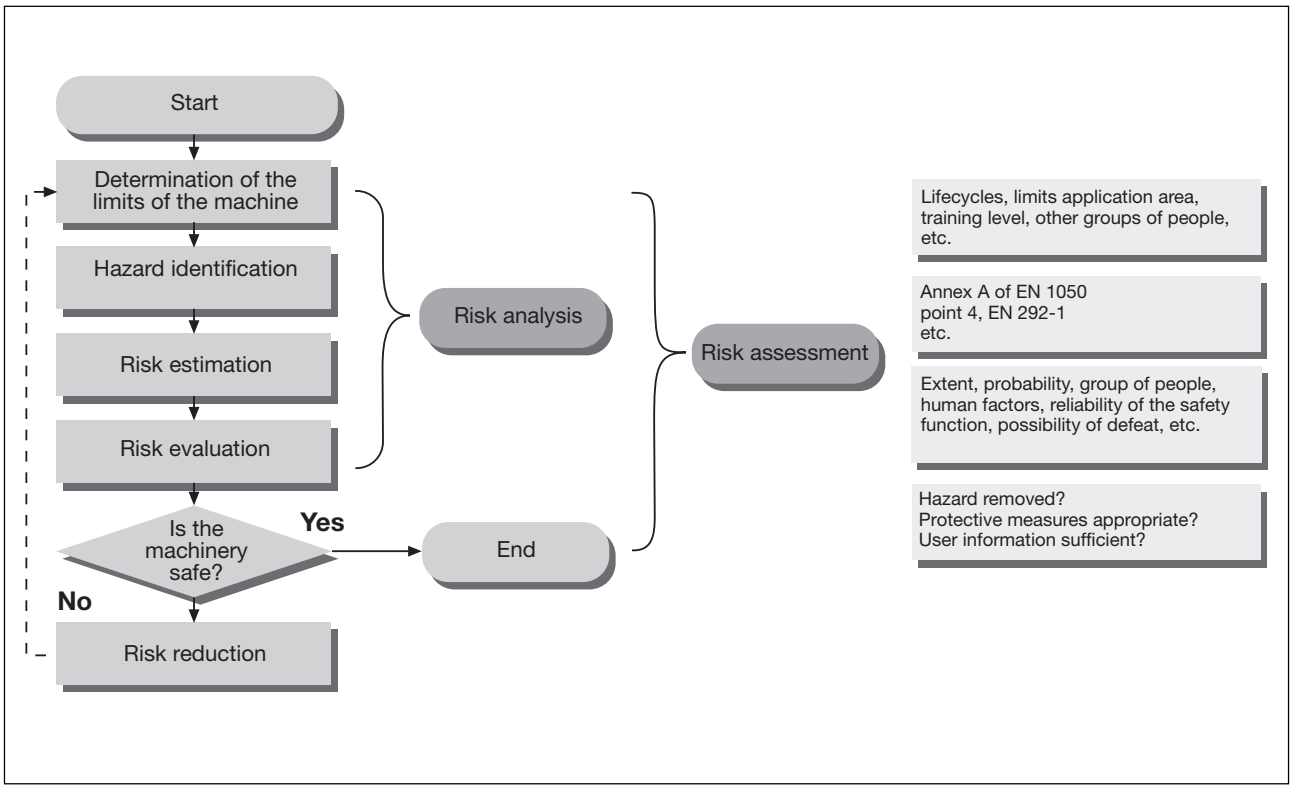


Fig. 5: Iterative process in accordance with EN 1050

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Pre-sales/after sales
Services, concepts and solutions



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Analysis and assessment of the safety-related condition of your plant and machinery. Presentation of basic proposals for improvement.

Risk assessment
Assessment of the hazards and risks on plant and machinery, based on standards and norms.

Safety concept
Based on the risk assessment, appropriate protective measures can be selected and a safety concept drawn up.

Safety design
Pilz can undertake all the tasks required to implement a project: component selection, preparation of circuit diagrams, programming, control cabinet, installation, commissioning.

CE services
Co-ordination and implementation of all the activities necessary for the "CE conformity" of plant and machinery.

Safety sign-off
Check of all the relevant safety-related documents, creation of check lists and examination of plant and machinery.

Technical support
Our engineers can support you in the selection, use and application of our products. They are in constant contact with customers from the widest range of industries and industrial sectors and are happy to answer your queries at any time.

E-Mail:
techsupport@pilz.de

24-hour hotline:
+49 711 3409-444

Training and education
A wide range of seminars and courses help to pass on the basics to minimise risks and safeguard your success.

Worldwide representatives
Our worldwide network of subsidiaries and sales partners ensures comprehensive support and assistance with your questions and problems.

Internet
Our homepage at www.pilz.com provides the latest information, electronic shopping, direct dialogue and enquiry functions, as well as extensive download options.

E-Business
The focus of Pilz's E-Business activities is to strengthen customer orientation through the use of new media and to increase added value via a supplementary business model for Business-to-Business.

Supply and repair service
From a fast, economical repair through to a long supply guarantee to safeguard your investment – always expect more from Pilz.

Certificates and approvals
Pilz is certified to DIN ISO 9001. International approvals and certification from recognised test bodies confirm our products' suitability for worldwide use.

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Business terms and conditions
Terms of delivery and payment



The terms of delivery and of payment of the respective Pilz company with whom a sales contract is closed are applied. As a rule this is the Pilz company that places the order. Please select the legal contract partner from the order confirmation.

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