Technical Catalogue
PSEN – non-contact, magnetic safety gate switches

pilz
more than automation
safe automation

Safe sensors for position and safety gate monitoring

November 2003 edition

Safe Automation from Pilz

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- Risk analysis
- Safety concepts
- Safety check
- Project management
- Delivery of complete systems

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November 2003

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Our technical catalogue for the PSEN has been compiled with great care. It contains information about our company and our PSEN products. All statements are made in accordance with the current status of technology and to the best of our knowledge and belief. However, we cannot except liability for the accuracy and entirety of the information provided, except in the case of gross negligence. In particular it should be noted that statements do not have the legal quality of assurances or assured properties. We are grateful for any feedback on the contents of this manual.

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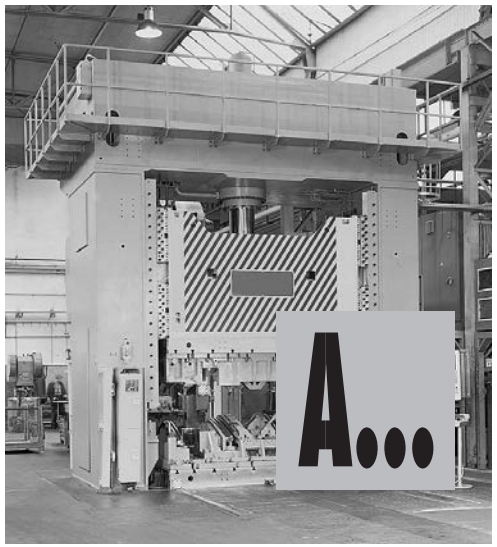
Introduction
Machinery directive



Extract from:
Machine safety – On the basis of the European safety standards/Winfried Gräf

1. Machinery directive

This chapter is intended to shed light on the technical regulations included in the machinery directive and the corresponding European (EN) standards, designed to turn the European single market into a reality. According to the German safety equipment act (GSG), the introduction of the single European internal market on 1.1.93 meant that national standards and regulations of EU member states had to be harmonised. On account of the 9th ordinance of the GSGV, BGB1 Part I 5/93, all member states of the European Economic Area (EEA) are to accept the machinery directive as an internal market directive and adopt it, unamended, into their domestic law, so that plant and machinery regulations within the EEA can be unified. This means that a German DIN, an English BS or a French NF standard etc. is harmonised and converted into an EN standard, to be valid throughout Europe by law. As this can be a very prolonged process, draft copies of the standards are made available as prEN standards before they are ratified.

Where no EN or prEN standard is available, previous requirements for the design of machinery can be used for a transitional period.

The European standards for the machinery directive are subdivided into a hierarchy of A, B and C standards.

A standards:
Basic standards containing essential information on the design, strategy and operation of the European machinery directive standardisation.

B standards:
Group standards, subdivided into B1 and B2 standards. B1 standards detail the overriding safety aspects while B2 standards cover the actual safety devices.

C standards:
Product standards containing detailed requirements for specific machinery, with reference to the B standards.

Two institutions are responsible for drafting these standards, namely CEN for non-electrical standards and CENELEC for electrical standards.

Type A
- EN 292 Parts 1 and 2
  General principles for design
- EN 414
  Rules for the drafting and presentation of safety standards
- EN 1050
  Safety of machinery,
  Risk assessment

Type B1
- EN 294
  Safety distances to prevent danger zones being reached
- EN 349
  Minimum gaps to avoid crushing of parts of the body
- EN 954-1
  Safety-related parts of control systems
  General principles for design
- prEN 954-2
  Test, error lists
- EN 1037
  Prevention of unexpected start-up

Type B2
- EN 574
  Two-hand control devices
- EN 418
  E-STOP equipment (e.g. mushroom-headed stop buttons)
- EN 953
  Design of fixed and movable guards
- EN 1088
  Interlocking devices
- EN 60204
  Electrical equipment of machines
- EN 61496
  Electrosensitive protective equipment

Introduction
Risk analysis

Type C
- EN 201
  Injection moulding machines
- EN 422
  Blow moulding machines
- EN 415
  Packaging machines
- EN 692
  Mechanical presses
- EN 693
  Hydraulic presses
- EN 775
  Industrial robots

1.1 CE marking of machinery

According to EU directive 89/392/EEC, since 01.01.1995 it has been necessary to apply a CE mark not only on “complete machines” but also on “machines operating non-independently” and “interchangeable equipment”. Since 01.01.1997, “individual safety components” have also required CE marking. This EU directive is binding for the whole internal market, i.e. including machinery that does not cross any international border. Even machinery made for a company’s own use must carry the CE mark.

1.1.1 Recommended procedure

The following procedure is recommended for the approval of machinery within the EEA:

1. Check that the machine falls within the scope of the machinery directive
2. Check whether any additional directives that provide for CE marking need to be considered for this product; in this case you will need to check conformity to all the directives used
3. Classify the products under the terms of the machinery directive (machine, components, ...)
4. Check whether it is a “dangerous machine” as detailed in Annex IV; in this case you will need to contact an accredited body
5. Check which standards can be used to achieve the safety objectives
6. Carry out a hazard analysis
7. Generate the “Technical Documentation”
8. Design and build the machine in accordance with the hazard analysis and the “Technical Documentation”
9. Generate the declaration of conformity (Annex II A)
10. Affix the CE mark

1.1.2 Responsibility

The machinery directive is geared towards the machine manufacturer. Everyone involved in the design of the machine is therefore responsible for its safety. For safety, the hazard analysis represents an important link between the technologies and it should be carried out at or before the machine’s design stage, in accordance with the directive.
The directive states: “The manufacturer is obliged to carry out a hazard analysis in order to determine all the hazards associated with the machine; the machine must then be designed and built in accordance with that analysis.”
It is advisable and economical, therefore, for all designers to be informed about the requirements of the machinery directive.

2. Risk analysis

Designers should carry out a risk analysis in order to judge the regulations that need to be taken into account, and to what extent. Standard EN 292: “Safety of machinery. General principles for design”, EN 1050: “Principles for risk assessment” and EN 954-1: “Safety-related parts of control systems” should be used for this purpose.

2.1 Risk limit

EN 1050, 11/96
The standard starts from the assumption that every machine constitutes a risk, that is to say, its risk without measurement and control safety measures. This risk is determined by assessing the machine before any safety components are employed. If the level of the risk is above the justifiable risk limit, measures must be taken to reduce the risk. These are the “measurement and control safety measures”; these should be used to reduce the actual residual risk to below the level of the justifiable risk limit.

- **Risk limit**
  This is the highest justifiable risk associated with a specific technical process or condition. In general, the risk limit cannot be quantified. It is normally defined indirectly on the basis of established technical principles.
- **Hazard**
  This is the condition in which the risk is greater than the risk limit.
- **Safety**
  This is the condition in which the risk is less than than the risk limit.
- **Residual risk**
  This is the risk that remains after all the risk reduction measures have been taken
- **Risk without safety measures**
  This is the risk involved when no risk reduction measures are taken on a machine.

Introduction
Risk analysis

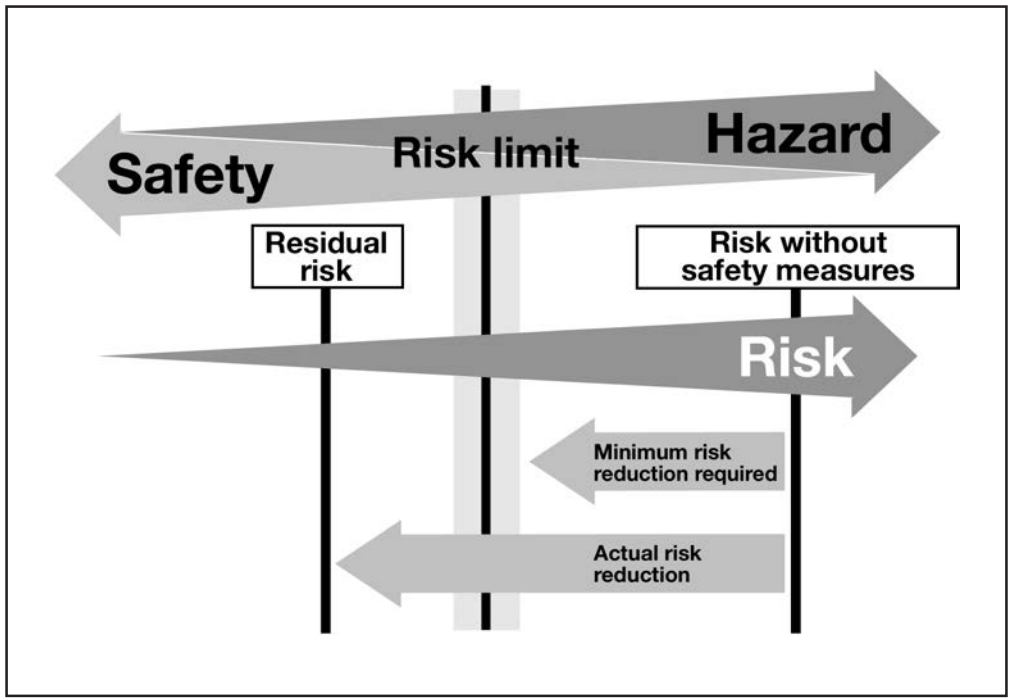
2.1.1 Risk assessment

Extracts from EN 1050, 11/96
The risk assessment of plant or machinery must include:

- The hazard, hazardous situation and events that could cause harm
- The foreseeable probability and severity of harm
- The complexity of the machine with regard to safety and
- The complexity of the interaction between man and machine during all operations, including foreseeable **misuse.**

2.1.2 Basic concept

EN 1050, 11/96 Section 4.1
Risk assessment is a series of logical steps to enable the hazards associated with machinery to be examined in a systematic way. Depending on the result, the risk assessment is followed by risk reduction in accordance with EN 292. Repeating this assessment results in an interactive process which is used to eliminate the hazard as far as possible and to implement safety measures.



The risk assessment includes:

- A risk analysis containing:
  a) determination of the machine's design (effective) limits (see EN 1050);
  b) hazard identification;
  c) risk estimation;
- Risk evaluation.

2.1.3 Information on risk assessment

EN 1050, 11/96 Section 4.2
The information for risk assessment and any qualitative and quantitative analysis shall include the following:

- The machine's design (effective) limits
- Safety requirements for the individual life phases of the machinery
- Design drawings and other means of establishing the nature of the machinery
- Type of energy supply
- Any accident and incident history (if available)
- Information about potential damage to health which can be attributed to operation of the machinery

This information shall be updated as the design develops and when modifications are required.

The absence of an accident history, a small number of accidents or low severity of accidents shall not be taken as an automatic presumption of a low risk.

Point 2.1.4 not shown.

2.1.5 Combination of elements of risk

EN 1050, 11/96 Section 7.2.1
The risk associated with a particular situation or technical process is derived from a combination of the following elements:

- Severity of harm
- Probability of occurrence of that harm, which is a function of:
  – the frequency and duration of the exposure of persons to the hazard
  – the probability of occurrence of a hazardous event and the technical and human possibilities to avoid or limit the harm

Introduction
Risk analysis

2.1.6 Elements of risk

Risk
related to the considered hazard

is a function of

Severity
of the possible harm for the considered hazard

and

Probability of occurrence of that harm in consideration of the

frequency and duration of exposure to the hazard

Possibility to avoid or limit the harm

Probability of occurrence of a hazardous event

Several methods have been developed for the systematic analysis of these elements of risk.
See EN 1050, 11/96 Annex B.

2.2 Harm

2.2.1 Severity

EN 1050, 11/96 Section 7.2.2
The degree of possible harm can be estimated by taking into account the following criteria:

- The nature of what is to be protected:
  a) persons
  b) property
  c) environment
- The severity of injuries or damage to health:
  a) slight, normally reversible
  b) serious, normally irreversible
  c) death
- The extent of harm, for each machine:
  a) one person affected
  b) several persons affected

2.2.2 Probability of occurrence of harm

EN 1050, 11/96 Section 7.2.3
The probability of harm occurring is the key factor. Experience shows that every conceivable unpleasant event can occur in reality. This rather general statement could be viewed as an exaggeration when referring to the design of a plant or machine. This is why the standard allows the frequency and duration of exposure to the hazard and the possibility of avoiding it to be included in the assessment. In certain circumstances this can result in optimum protection for personnel together with a reduction in costs.

2.2.3 Frequency and duration of exposure

EN 1050, 11/96 Section 7.2.3.1
Depending on the need to access the danger zone:

- The nature of access,
- The time spent in the danger zone and
- The number of people requiring access

must be assessed because they could increase the probability of an accident.

2.2.4 Probability of occurrence of a hazardous event

EN 1050, 11/96 Section 7.2.3.2
According to the standard, the probability of occurrence of a hazardous event can be derived from:

- The reliability of the technology used
- Other statistical data
- Accident history (if available)
- History of damage to health from similar plant or machinery
- Risk comparison (see EN 1050, 11/96)

Note: The occurrence of a hazardous event can be of technical or human origin.

2.3 Harm to people

2.3.1 Persons exposed

EN 1050, 11/96 Section 7.3.1
Risk estimation shall take into account all persons exposed to the hazards (see EN 292-1 Section 3.21).

2.3.2 Type, frequency and duration of exposure

EN 1050, 11/96 Section 7.3.2
The estimation of the exposure to the hazard requires analysis of and shall account for all modes of operation of the machinery. In particular this affects the need for access during setting, teaching, process changeover or correction, cleaning, fault finding and maintenance (see EN 292-1, section 3.11).

Introduction
Risk assessment and graph

3. Risk assessment

EN 954 -1, prEN 954 -2
The European standards EN 954 -1, prEN 954 -2 define categories and requirements and describe characteristics of safety functions and design principles for safety-related parts of control systems. This includes programmable systems for all types of machinery and related protective devices. They apply to all safety-related parts of control systems, regardless of the type of energy used, (e.g. electrical, hydraulic, pneumatic, mechanical). However, they do not specify which safety functions and which categories shall be used in a particular case.
EN 954-1 and prEN 954-2 contain details of safety requirements and orientation aids for the design, construction, programming, operation, maintenance and repair of safety-related parts of control systems for machinery.
They also apply to all machinery applications for professional and non-professional use. Where appropriate, they can also apply to the safety-related parts of control systems used in other technical applications with similar hazards.
The categories used in the standards are designed to allow for component faults and to accept fault exclusion. (Fault exclusion means that a fault can be excluded if the chances of it arising or occurring are improbable.) In order to have objective and verifiable criteria, EN 954 publishes lists of potential component faults which need to be taken into account when evaluating safety-related parts of control systems. These lists of faults do not claim to be exhaustive and, if necessary, additional faults should also be considered.

In general, the following observations on faults should be borne in mind:
- Two independent, random faults shall not occur simultaneously
- Should a fault cause other components to fail, the first fault and all consequent faults shall be viewed as a single fault
- Systematic multiple faults shall be viewed as single faults

The following faults should be considered on electrical/electronic components:
- Short circuit or open circuit, e.g. short circuit to the protective conductor or to any bare conductive part, open circuit of any conductor
- Short circuit or open circuit in single components, e.g. position switches
- Non drop-out or non pick-up of electromagnetic components, e.g. contactors, relays, solenoid valves
- Non-starting or non-stopping of motors
- Mechanical blocking of moving elements, e.g. position switches
- Drift beyond the tolerance values for analogue components, e.g. resistors, capacitors
- Oscillation of unstable output signals in integrated, non-programmable components
- Loss of entire function or partial functions in the case of programmable components (worst case behaviour)

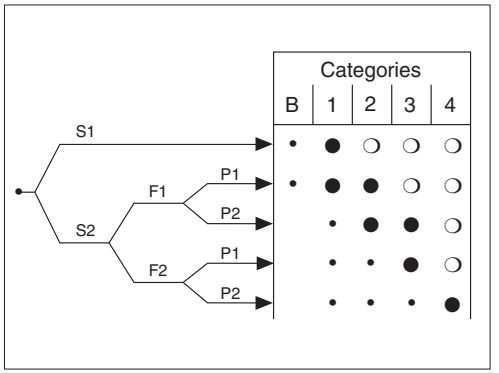
Note from the standards committee:

The categories are not intended to be used in any given order or in any given hierarchy in respect of safety requirements.

The risk assessment will indicate whether the total or partial loss of the safety function(s) arising from faults is acceptable. It is clear, therefore, that discussions over whether product XY should be category 2, 3 or 4 goes against the intentions of the standards committee and is not in the spirit of the standard. Most machines have a front and a back. The dangerous side is the front, because it is generally from there that the machine is assembled and operated. The back of the machine is less dangerous because it can usually be encased by metal plates and guard rails.

3.1 Risk graph

EN 954 -1, Annex B 12/96
This risk evaluation must be carried out separately for each application.
The graphic below may be helpful.



Starting point for risk estimation for the safety-related part of the control system

S Severity of injury
S1 Slight (normally) reversible) injury
S2 Serious (normally irreversible) injury, including death.
F- Frequency and/or exposure time to the hazard
F1 Seldom to quite often and/or the exposure time is short
F2 Frequent to continuous and/or the exposure time is long

Introduction
Categories

P- Possibility of avoiding the hazard
(generally related to the speed and frequency with which the hazardous part moves and to the distance from the hazardous part)
P1 Possible under specific conditions
P2 Scarcely possible

B, 1-4 Categories for safety-related parts of control systems
● Preferred category for reference points
● Possible categories which can require additional measures
○ Measures which can be over dimensioned for the relevant risk

The risk is a statement of probability that takes into account the anticipated frequency of a hazard occurring and the consequent severity of injury. Appropriate measures should be used to reduce the anticipated risk to the level of safety required for the application.

3.2 Overview of categories

The main point of this summary is to classify the safety requirements of control systems into five sensible categories, irrespective of the technology. These range from simple to complex requirements, such as single fault tolerance, redundancy, diversity and/or self-monitoring.

Cat.	Summary of requirements	System behaviour	Principles to achieve safety
B	Safety-related parts of control systems and/or their protective equipment, as well as their components, shall be designed, constructed, selected, assembled and combined in accordance with relevant standards, so that they can withstand the expected influence.	The occurrence of a fault can lead to the loss of the safety function	Mainly characterised by selection of components.
1	Requirements of B shall apply. Use of well-tried components and well-tried safety principles.	As for category B, but with greater safety-related reliability of the safety functions.	
2	Requirements of B and the use of well-tried safety principles shall apply. Safety function shall be checked at suitable intervals by the machine control system.	The occurrence of a fault can lead to the loss of the safety function between the checks. The loss of the safety function is detected by the check.	Mainly characterised by structure.
3	Requirements of B and the use of well-tried safety principles shall apply. Safety-related parts shall be designed so that: – a single fault in any of these parts does not lead to a loss of the safety function; and – whenever reasonably practicable, the single fault is detected.	When the single fault occurs, the safety function is always performed. Some but not all faults will be detected. Accumulation of undetected faults can lead to the loss of the safety function.	
4	Requirements of B and the use of well-tried safety principles shall apply. Safety-related parts shall be designed so that: – a single fault in the control system does not lead to a loss of the safety function; and – the single fault is detected at or before the next demand upon the safety function. If this is not possible, then an accumulation of faults shall not lead to a loss of the safety function.	When the faults occur the safety function is always performed. The faults will be detected in time to prevent the loss of the safety function.	Mainly characterised by structure.

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PSEN product range

This technical catalogue describes the units in the PSEN product range:

- PSEN 1.1p-10
- PSEN 1.1p-12
- PSEN 1.1p-20
- PSEN 1.1p-22
- PSEN 1.2p-20
- PSEN 1.2p-22
- PSEN 2.1p-10
- PSEN 2.1p-11
- PSEN 2.1p-30
- PSEN 2.1p-31
- PSEN 2.2p-20
- PSEN 2.2p-21
- PSEN i1
- PSEN ix1

The first part of the technical catalogue contains information relating to the whole product range. This is followed by descriptions of the specific units and application examples. The appendix contains a table showing the chemical resistance of the safety switches.

This technical catalogue is divided into the following chapters:

1 Introduction
The introduction is designed to familiarise you with the contents, structure and specific order of this technical catalogue.

2 Overview
This chapter provides information on the most important features of the product range and provides a brief overview of the application range.

3 Safety
This chapter **must be read** as it contains important information on safety regulations.

4 Description
The description contains important information on how the safety switches operate and also on selection criteria.

5 Installation and adjustment
This chapter describes how to install and adjust the safety switches.

6 Wiring and commissioning
This chapter contains important information on wiring the safety switches.

7 Unit-specific descriptions
These descriptions refer exclusively to the specific features for the unit, such as intended use, description and wiring of individual units.

8 Applications
This chapter is a collection of application examples.

9 Appendix
This chapter contains a table showing the chemical resistance of the safety switches.

Definition of symbols

Information in this technical catalogue that is of particular importance can be identified as follows:

DANGER!
This warning must be heeded! It warns of a **hazardous situation that poses an immediate threat of serious injury and death** and indicates preventive measures that can be taken.

WARNING!
This warning must be heeded! It warns of a **hazardous situation that could lead to serious injury and death** and indicates preventive measures that can be taken.

CAUTION!
This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.

NOTICE
This describes a situation in which the unit(s) could be damaged and also provides information on preventive measures that can be taken.

INFORMATION
This gives advice on applications and provides information on special features, as well as highlighting areas within the text that are of particular importance.

PSEN product range

What is the PSEN product range?

The PSEN product range consists of non-contact, magnetic safety switches, which monitor the position of movable protection devices in conjunction with an actuator and an evaluation device. For safety-related applications, the safety switches must only be used in conjunction with approved evaluation devices. Approved, complete solutions are available for evaluating the position of rotatable, removable and displaceable safety devices in accordance with EN 60947-5-3.

Approved, complete solutions are implemented using:
- PNOZelog electronic safety relays
- PNOZmulti modular safety relays
- PNOZ X and PNOZpower safety relays
- PSS programmable safety systems
- Safe, open bus system SafetyBUS p

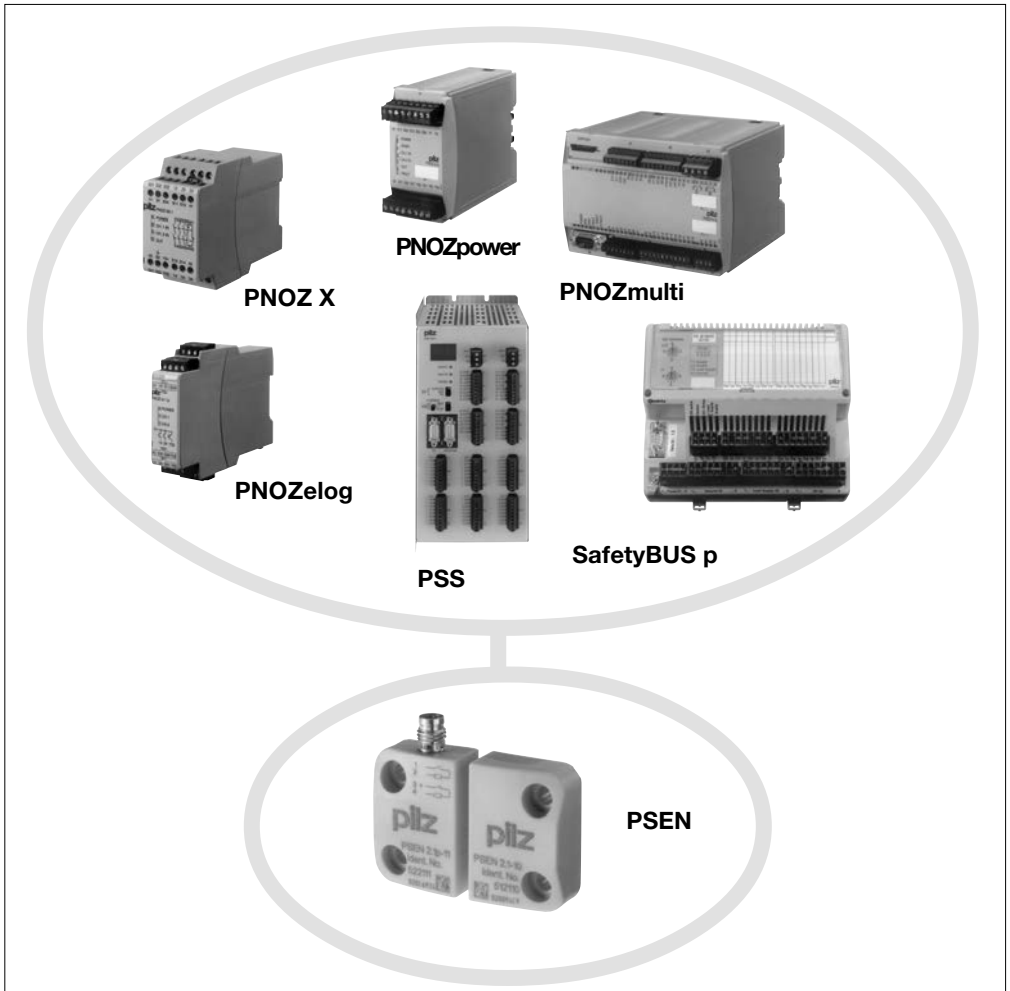


Fig. 2-1: PSEN product range and evaluation devices

PSEN product range

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.

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, 01/00 (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 keep to these safety regulations will render the warranty invalid.

Intended use

The units’ intended use depends on the individual unit and is therefore explained in the chapter entitled “Unit-specific Descriptions”.

PSEN product range

Operation of the safety switch

Safety switches in the PSEN product range act in conjunction with an actuator in non-contact, magnetic operation. Each safety switch has an approved actuator. Together with an authorised evaluation device they form an approved, complete solution.

The safety switches are available with different contact combinations (N/C / N/O, N/O / N/O). If the actuator is within the response range, the magnets switch the reed contacts on the safety switch. If the actuator is outside the response range (safety gate open), the reed contacts on the safety switch will switch. On some safety switches this is signalled by a red LED.

Protection against defeat

Safety switches from the PSEN range are designed to guarantee security against manipulation through protection against defeat in accordance with VDE 0660.

Selection criteria for safety switches

- Switching distances
- Switch type (e.g. N/C / N/C combination)
- Design (compact, round, square)
- Type of evaluation device
- Connection to evaluation device
  - directly to the safety switch (single connection)
  - via an interface to the safety switch (series connection of several safety switches)
- Category to be achieved in accordance with EN 954-1 and EN 60947-5-3
- LED to display switch status
- Type of cable connection on the safety switch (plug-in with screw connection, straight or angled)
- Housing material, application area

Switching distance:
Safety switches with different switching distances are available for different applications, e.g. with an assured operating distance s_{ao} of 3 or 8 mm.

A high lateral and vertical offset can be achieved with long switching distances. This will provide greater tolerances for installation and even less sensitivy towards spring-back or swinging from safety gates.

Assured switching distances:
- Assured operating distance s_{ao}:
  This is the distance from the sensing face, within which the presence of the specified target is correctly detected under all specified environmental conditions, manufacturing tolerances and internal component faults.
- Assured release distance s_{ar}
  This is the distance from the sensing face, beyond which the presence of the specified target is correctly detected under all specified environmental conditions, manufacturing tolerances and internal component faults.

Hysteresis:
The assured release distance is longer than the assured operating distance ($s_{ar} > s_{ao}$). The safety switches therefore have a hysteresis. If the actuator is within $s_{ao,}$ vibrations up to s_{ar} will not cause the safety switch to de-energise.

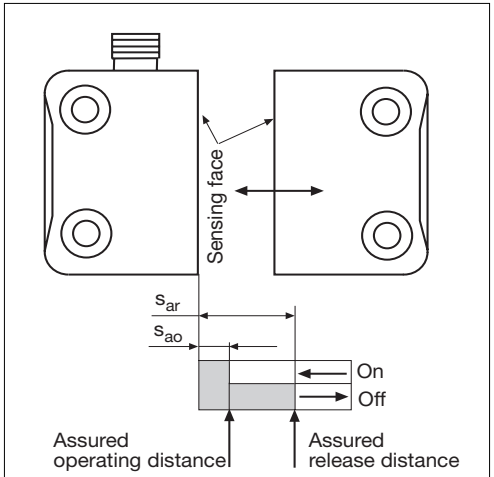


Fig. 4-1: Assured switching distances

Lateral and vertical offset:
The switching distances stated in the technical datails only apply if the sensing faces of the safety switch and actuator are installed opposite each other in parallel. Switching distances may deviate if other arrangements are used. The maximum permitted lateral and vertical offset will depend on the safety switch you are using (see chapter entitled “Unit-specific Descriptions”, section on “Max. lateral and vertical offset in mm”).

PSEN product range

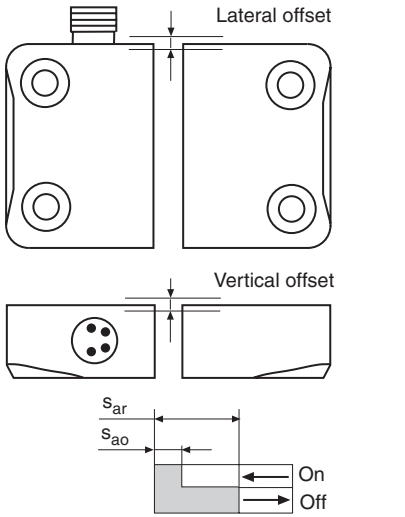


Fig. 4-2: Max. lateral and vertical offset

Actuator's direction of movement:
The sensing face of the actuator is permitted to move in parallel to the sensing face on the safety switch. Movements in which the actuator is tilted in relation to the safety switch are not permitted (Fig. 4-3).

Actuator's pass-by speed:
If the safety switch is being used as a position switch, the maximum permitted pass-by speed of the actuator is important. This must be defined so that the evaluation device can detect the status of the safety switch. This value is device-specific.

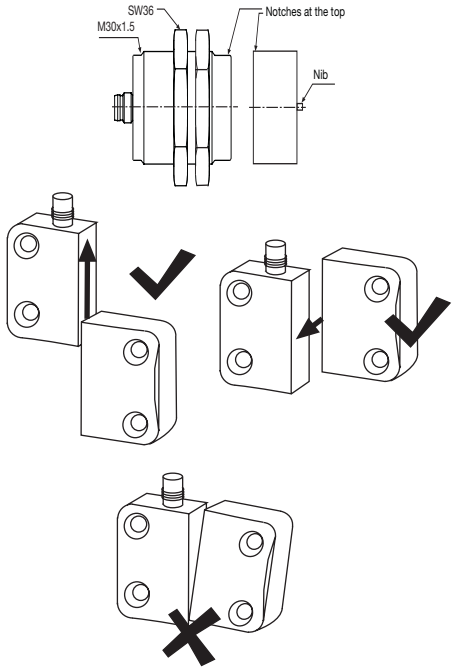


Fig. 4-3: Actuator's direction of movement

Compact structure:
The safety switches are small and compact in design, enabling them to integrate perfectly into an existing working environment.

With a round or square design, the safety switches can easily be adapted to suit installation requirements.

Evaluation devices:
Each safety switch has an approved evaluation device and possibly also an interface.

INFORMATION
For details of which evaluation device is approved for which safety switch, please refer to the chapter entitled "Wiring and Commissioning" or to the details in the chapter entitled "Unit-specific Descriptions".

Connecting safety switches in series:
Several safety switches are connected to an input on an evaluation device via an interface. This means, for example, that several safety gates on a plant can be monitored using a single evaluation device.

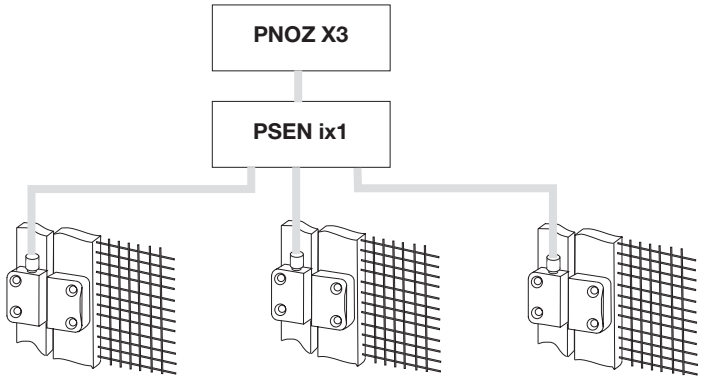


Fig. 4-4: Connecting 3 safety switches in series, e.g. to a PNOZ X3 via the PSEN ix1

PSEN product range

The interface type and the number of safety switches that can be connected will depend on the selected evaluation device. The interface connects the safety switches in series to the evaluation device. The switch status of the individual safety switches (safety gate open or closed) is displayed through LEDs and can be evaluated via auxiliary outputs, e.g. with a PLC.

Housing material:
The housing of the PSEN safety switch is made from silicone-free PBT plastic, which is insensitive to dirt. For details of the chemical resistance of the housing material, please refer to the table in Chapter 9, “Appendix”.

Cable with connector:
The cables for the safety sensors have a plug-in connection. This enables the cable and switches to be installed separately. The plug connectors are 4-pin male M8 screw connectors with lock. They are available straight or angled.

Fig. 4-5: Connection cable with connector

Category:
Safety switches in the PSEN product range have two independent contacts. They are classified as PDF-M in accordance with EN 60947-5-3 and can therefore be used for applications up to category 4 in accordance with EN 954-1.
If an interface (e.g. PSEN i1) is used to connect the safety switches in series, the classification to EN 60947-5-3 is reduced to PDF-S. This means the safety switches can be used for applications up to category 3 in accordance with EN 954-1.

Application areas:
Thanks to the high protection type IP65/67, integral protection against defeat and long service life, the safety switches are suitable for use:

- In mechanical engineering
- In areas with rigorous hygiene requirements, such as the food, packaging or pharmaceutical industry.

PSEN product range

Installation position

The unit can be installed in any position. However, the sensing faces of the safety switch and actuator should be positioned opposite each other in parallel.

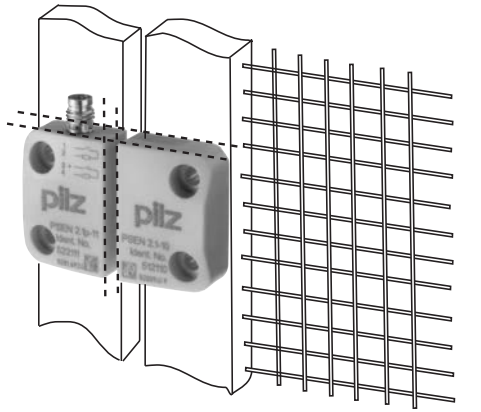


Fig. 5-1: Install facing each other and in parallel

On units with a **round design**, make sure that the two notches are exactly opposite each other. A nib on the actuator prevents it twisting.

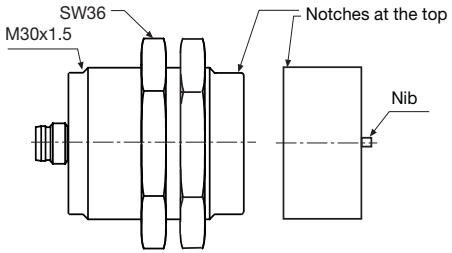


Fig. 5-2: Installing safety switches with a round design

Installation guidelines

Safety switch and actuator
- Keep away from iron swarf
- Do not expose to strong magnetic fields
- Do not expose to heavy shock or vibration
- Do not use as a limit stop
- Where possible do not install on top of ferromagnetic material (changes in the switching distances can be expected). In this case, units in the **square design** can use the spacer, order number 534 310.

The distance between two systems made up of safety switch and actuator must be at least 25 mm (see installation example, “Safety switches on swing gates”).

Attachment

Attach the safety switch to the fixed part of the safety device.

Square design:
Safety switches and actuators should only be secured using M4 screws with a flat head (e.g. M4 cheese-head or pan head screws). Torque setting max. 1 Nm. Use screws made of non-magnetic material (e.g. Messing).

Round design:
Secure the safety switch using the M30 nuts provided.
The torque setting for the M30 nuts is max. 300 Ncm.
The actuator should be secured using an M4 or M5 screw made of non-magnetic material (e.g. Messing).

CAUTION!
The actuator should be secured **permanently** to guarantee security against manipulation.

Adjustment

- The safety switch may only be used with a corresponding actuator.
- The actuator must not make contact with the safety switch. Please note the minimum switching distance stated in the technical details.
- Always test the function with one of the approved evaluation devices.
- Some safety switches have an LED. The LED lights when the contacts are unoperated (safety device open or safety switch and actuator wrongly adjusted). The LED is in the safety switch’s N/C circuit. The LED goes out when the contacts are operated.

INFORMATION
Further information about the switching distances (operating and release distance) and the maximum permitted lateral and vertical offset can be found in the chapters entitled “Description” and “Unit-specific Descriptions”.

Installing the interfaces PSEN i1 and PSEN ix1

CAUTION!
The unit should be installed in a control cabinet with a protection type of at least IP54.

- Use the notch on the rear of the unit to attach it to a DIN rail.
- Secure the unit on a vertical DIN rail (35 mm) using a retaining bracket or end angle.

PSEN product range

Accessories

Spacer for safety switch in square design:
If the safety switch and actuator are installed on to ferromagnetic material, the switching distances may vary. If this is the case you should use the spacer supplied under order number 534 310 (for dimensions please refer to the chapter entitled “Unit-specific Descriptions”).

Bracket for safety switch in square design:
An aluminium bracket is available for installing the safety switch and actuator at an angle. On this bracket it is possible to adjust the position of the safety switch and actuator (for dimensions please refer to the chapter entitled “Unit-specific Descriptions”).

Swing gates

On swing gates the safety switch must be positioned on the closed edge. The distance between two systems made up of safety switch and actuator must be at least 25 mm (see Fig. 5-3).

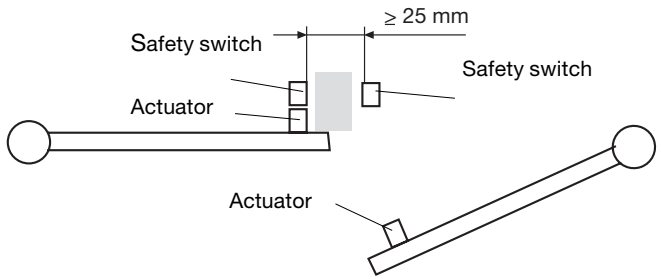


Fig. 5-3: Safety switches on swing gates

Concealed installation

To exclude the possibility of manipulation, the actuator must be fitted in such a way that it cannot be removed by the operator. (see section entitled “Attachment”). Security against manipulation can also be guaranteed by concealing the installation of the safety switch and actuator. A concealed installation also reduces the risk of injury.

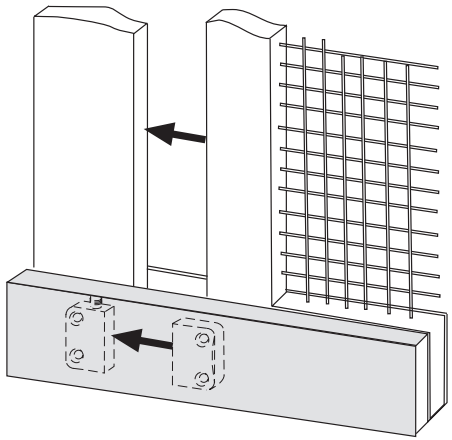


Fig. 5-4: Example for concealed installation on a sliding gate

PSEN product range

When wiring and commissioning, please note the following:

- The safety switches only conform to EN 60947-5-3 in conjunction with their approved evaluation devices and actuators.
- To connect the safety switches in series, the switches must be connected to the evaluation device via an interface that has been approved for this purpose.

NOTICE
Please note the colour marking on the connection cable. The colour marking for the connection lead only applies for the cable that Pilz supplies as an accessory.

- The safety switch is always shown in an unoperated condition.

- Calculating the max. cable runs I_{max} between the evaluation device and the safety switch, per channel:

$$I_{max} = \frac{R_{lmax}}{R_l / km}$$

R_{lmax} = max. overall cable resistance
R_l /km = cable resistance/km

Permitted evaluation devices

Operation of the safety switches is only approved in conjunction with certain evaluation devices. During configuration, please refer to the operating manuals for the respective evaluation device.

Overview: Evaluation device -> Safety switch

PNOZ X, PNOZpower:

Evaluation devices	Safety switch actuator
PNOZ X	PSEN 1.1p-10 and
PMUT X1P	PSEN 1.1-10
PNOZ X2, PNOZ X2.1	
PNOZ X2P	PSEN 1.1p-12 and
PNOZ X2.3P	PSEN 1.1-10
PNOZ X2.7P	(only with PSEN ix1)
PNOZ X2.8P	
PNOZ X2C	PNOZ 1.1p-20 and
PNOZ X2.1C	PNOZ 1.1-20
PNOZ X4	
PNOZ X5, PNOZ X5J	PNOZ 1.1p-22 and
PNOZ 11	PNOZ 1.1-20
PNOZ 16	(only with PSEN ix1)
PNOZ X13	
PNOZ X2.5P	PNOZ 1.2p-20 and
PNOZ X3, PNOZ X3.1	PNOZ 1.2-20
PNOZ X3P	
PNOZ X3.10P	PNOZ 1.2p-22 and
PNOZ XV2, PNOZ XV2P	PNOZ 1.2-20
PNOZ XV3, PNOZ XV3P	(only with PSEN ix1)
PNOZ X6	
PNOZ X8P	
PNOZ X9, PNOZ X9P	
PNOZ X10, PNOZ X10.1	
PNOZ X10.11P	
PNOZ Ex	
PNOZpower	
PNOZ p1p	

PNOZelog, PNOZmulti PSS-range with/without SafetyBUS p connection:

Evaluation devices	Safety switch actuator
PNOZelog	PSEN 2.1p-10 and
PNOZ e3.1p	PSEN 2.1-10
PNOZ e3vp 10 s	
PNOZ e3vp 300 s	PSEN 2.1p-11 and
	PSEN 2.1-10
	PSEN 2.1p-30 and
	PSEN 2.1-10
PNOZmulti	
PNOZ m1p	PSEN 2.1p-31 and
	PSEN 2.1-10
	PSEN 2.2p-20 and
	PSEN 2.2-20
PSS-range	PSEN 2.2p-21 and
with/without	PSEN 2.2-20
SafetyBUS p	
connection	PSEN 2.2p-24 ATEX
	and PSEN 2.2p-20
	Series connection via
	PSEN i1 possible with
	PSEN 2.1p-10
	PSEN 2.1p-11
	PSEN 2.1p-30
	PSEN 2.1p-31
	PSEN 2.2p-20
	PSEN 2.2p-21

Comparison of safety switches from the PSEN product range

The previous chapters have all described the common features of the safety switches. This chapter will deal with the specific features. The table shows the units' most important features. The pages that follow provide information on intended use, wiring and unit-specific data for each individual unit.

Safety switches	Actuator	Operating/release distance s_{ao}/s_{ar}	Switch type	Design	LED	Evaluation device	Connection to evaluation device
PSEN 1.1p-10	PSEN 1.1-10	≤ 3 mm / ≥ 19 mm	2 N/O	Square	No	PNOZ X, PNOZpower	Direct
PSEN 1.1p-12	PSEN 1.1-10	≤ 3 mm / ≥ 19 mm	2 N/O	Square	No	PNOZ X, PNOZpower	Via PSEN ix1 interface
PSEN 1.1p-20	PSEN 1.1-20	≤ 6 mm / ≥ 25 mm	2 N/O	Square	No	PNOZ X, PNOZpower	Direct
PSEN 1.1p-22	PSEN 1.1-20	≤ 6 mm / ≥ 25 mm	2 N/O	Square	No	PNOZ X, PNOZpower	Via PSEN ix1 interface
PSEN 1.2p-20	PSEN 1.2-20	≤ 8 mm / ≥ 26 mm	2 N/O	Round	No	PNOZ X, PNOZpower	Direct
PSEN 1.2p-22	PSEN 1.2-20	≤ 8 mm / ≥ 26 mm	2 N/O	Round	No	PNOZ X, PNOZpower	Via PSEN ix1 interface
PSEN 2.1p-10	PSEN 2.1-10	≤ 3 mm / ≥ 19 mm	1 N/C /1 N/O	Square	No	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct or via PSEN i1 interface
PSEN 2.1p-11	PSEN 2.1-10	≤ 3 mm / ≥ 19 mm	1 N/C /1 N/O	Square	Yes	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct or via PSEN i1 interface
PSEN 2.1p-30	PSEN 2.1-10	≤ 6 mm / ≥ 25 mm	1 N/C /1 N/O	Square	No	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct or via PSEN i1 interface
PSEN 2.1p-31	PSEN 2.1-10	≤ 6 mm / ≥ 25 mm	1 N/C /1 N/O	Square	Yes	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct or via PSEN i1 interface
PSEN 2.2p-20	PSEN 2.2-20	≤ 8 mm / ≥ 26 mm	1 N/C /1 N/O	Round	No	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct or via PSEN i1 interface

Safety switches	Actuator	Operating/release distance s_{ao}/s_{ar}	Switch type	Design	LED	Evaluation device	Connection to evaluation device
PSEN 2.2p-21	PSEN 2.2-20	≤ 8 mm / ≥ 26 mm	1 N/C /1 N/O	Round	Yes	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct or via PSEN i1 interface
PSEN 2.2p-24 ATEX	PSEN 2.2-20	≤ 8 mm / ≥ 26 mm	1 N/C /1 N/O	Round	Yes	PNOZelog PNOZmulti PSS-range with/without SafetyBUS p	Direct

Approvals

Type				
PSEN 1.1p-10	◆	◆		
PSEN 1.1p-12	◆	◆		
PSEN 1.1p-20	Pending	◆		
PSEN 1.1p-22	Pending	◆		
PSEN 1.2p-20	Pending	◆		
PSEN 1.2p-22	Pending	◆		
PSEN 2.1p-10	◆	◆		
PSEN 2.1p-11	◆	◆		
PSEN 2.1p-30	◆	◆		
PSEN 2.1p-31	◆	◆		
PSEN 2.2p-20	◆	◆		
PSEN 2.2p-21	◆	◆		
PSEN 2.2p-24 ATEX			◆	◆
PSEN i1		◆		
PSEN ix1		◆		

PSEN 1.1p-10, PSEN 1.1p-20

Intended use

Safety switches PSEN 1.1p-10 and PSEN 1.1p-20 are intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switches only comply with EN 60947-5-3 in conjunction with the corresponding actuators and approved evaluation devices:

- PSEN 1.1p-10 with actuator PSEN 1.1-10
- PSEN 1.1p-20 with actuator PSEN 1.1-20

The safety switch should only be connected to the following evaluation devices:

PNOZ X:

- PNOZ 11
- PNOZ 16
- PNOZ Ex
- PMUT X1P
- PNOZ X2
- PNOZ X2.1 (24 VDC only)
- PNOZ X2P
- PNOZ X2.3P
- PNOZ X2.5P
- PNOZ X2.7P
- PNOZ X2.8P
- PNOZ X2C
- PNOZ X2.1C (24 VDC only)
- PNOZ X3, PNOZ X3.1
- PNOZ X3P
- PNOZ X3.10P
- PNOZ X4
- PNOZ X5, PNOZ X5J
- PNOZ X6
- PNOZ X8P
- PNOZ X9, PNOZ x9P
- PNOZ X10, PNOZ X10.1
- PNOZ X10.11P
- PNOZ X13
- PNOZ XV2, PNOZ XV2P
- PNOZ XV3, PNOZ XV3P

PNOZpower:

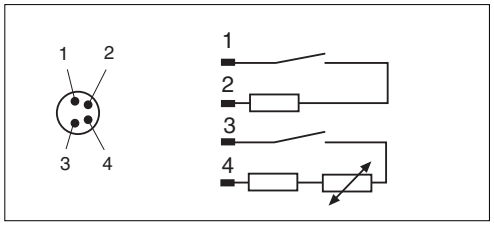
- PNOZ p1p

Description

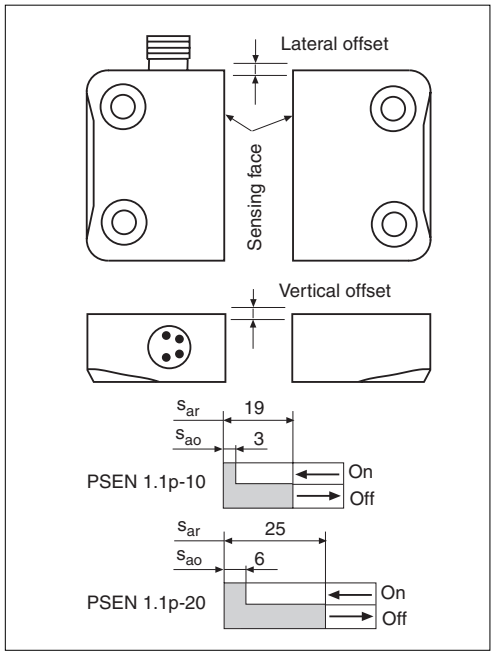
The safety switch PSEN 1.1p-10 is used with the actuator PSEN 1.1-10.
The safety switch PSEN 1.1p-20 is used with the actuator PSEN 1.1-20.
Features:

- 2 reed contacts (2 N/O)
- Assured operating distance:
  - PSEN 1.1p-10: ≤ 3 mm
  - PSEN 1.1p-20: ≤ 6 mm
- Assured release distance:
  - PSEN 1.1p-10: ≥ 19 mm
  - PSEN 1.1p-20: ≥ 25 mm
- Square design
- Works magnetically
- Switching voltage 24 VDC

Connections



Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

PSEN 1.1p-10:
Min. operating distances s_{ao} in mm

Lateral offset in mm \ Vertical offset in mm	0.5	1.0	1.5	2.0	2.5	3.0
1.0	2.5	2.5	2.5	2.0	1.5	1.5
1.5	2.0	2.0	2.0	2.0	1.0	1.0
2.0	2.0	2.0	1.5	1.5	1.0	0.5
2.5	1.5	1.5	1.0	0.5	-	-
3.0	0.5	0.5	0.5	-	-	-

Max. release distance s_{ar}: max. 19 mm with all vertical and lateral offsets

PSEN 1.1p-20:
Min. operating distances s_{ao} in mm

Lateral offset in mm \ Vertical offset in mm	1.0	2.0	3.0	4.0	5.0
1.0	5.5	5.5	5.0	5.0	3.5
2.0	5.5	5.0	5.0	4.5	3.5
3.0	5.0	5.0	5.0	4.0	3.5
4.0	4.5	4.5	4.0	3.5	3.0
5.0	4.0	4.0	4.0	3.0	2.5

Max. release distance s_{ar}: max. 25 mm with all vertical and lateral offsets

PSEN 1.1p-10, PSEN 1.1p-20

Direct connection to PNOZ X and PNOZpower

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device). The maximum permitted overall cable resistance is as follows:

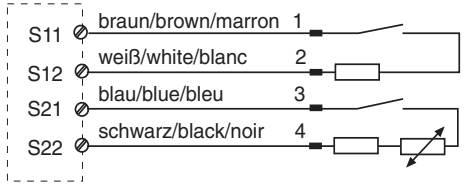
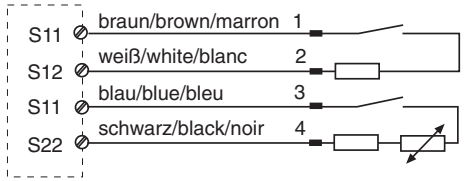
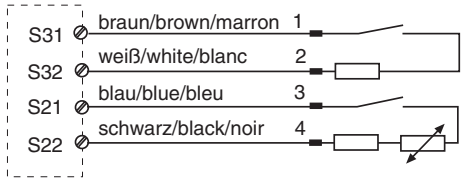
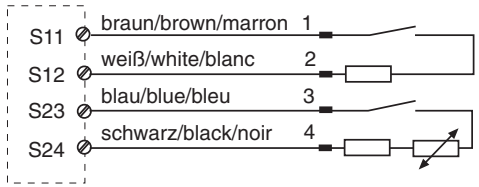
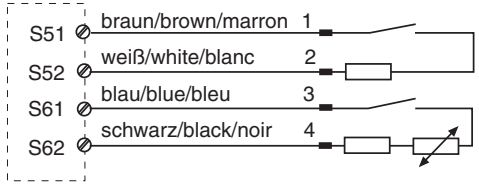
- Evaluation devices with DC supply voltage: **15 Ohms** per channel
- Evaluation devices with AC supply voltage: **20 Ohms** per channel
- For details of how to perform the test for shorts across the contacts, please refer to the operating manual for the relevant evaluation device.

Preparing for operation

- Connect the units from the **PNOZ X or PNOZpower series**. Please refer to the operating manual for the relevant units.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

CAUTION
Please note the following when using evaluation devices with delay-on de-energisation contacts (e.g. PNOZ XV2):

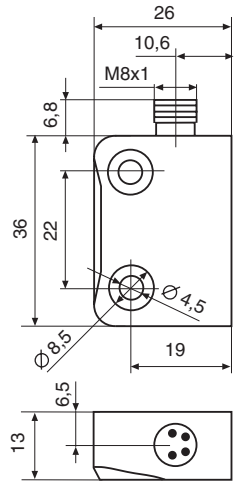
- **Delay time ≤ 30 s:**
  Delay-on de-energisation contacts satisfy the requirements of category 3 in accordance with EN 954-1, 12/96 and the requirements of a PDF with single-fault tolerance (PDF-S).
- **Delay time > 30 s:**
  Delay-on de-energisation contacts satisfy the requirements of category 1 in accordance with EN 954-1, 12/96 and the requirements of a PDF with designed reliability (PDF-D).

• PNOZ p1p • PNOZ X2/X2P • PNOZ X2.1 (24 VDC only) • PNOZ X2.3P • PNOZ X2.7P/2.8P • PNOZ X2C • PNOZ X2.1C (24 VDC only) • PNOZ X4/X8P • PNOZ X9/X9P • PNOZ X10/X10.1 • PNOZ X10.11P • PNOZ Ex	
• PNOZ X5 • PNOZ X5J	
• PNOZ 11 • PNOZ 16 • PNOZ X13 • PNOZ X2.5P • PNOZ X3 • PNOZ X3.1 • PNOZ X3P • PNOZ X3.10P • PNOZ XV2 • PNOZ XV2P • PNOZ XV3 • PNOZ XV3P	
• PNOZ X6 (Y3-Y4 linked)	
• PMUT X1P	

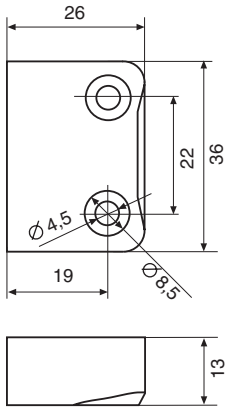
PSEN 1.1p-10, PSEN 1.1p-20

Dimensions in mm

PSEN 1.1p-10, PSEN 1.1p-20



PSEN 1.1-10, PSEN 1.1-20



Technical details

Operation	Reed contacts/magnetic actuation
Switching distances	
PSEN 1.1p-10	s_{ao}: > 0.5/≤ 3 mm, s_{ar}: ≥ 19 mm
PSEN 1.1p-20	s_{ao}: > 0.5/≤ 6 mm, s_{ar}: ≥ 25 mm
Switching voltage	24 VDC
Switching current	500 mA
Breaking capacity	10 W
Max. switching frequency	Max. 1 Hz
Max. cable runs	Depends on evaluation device
Actuator	PSEN 1.1-10 for PSEN 1.1p-10 PSEN 1.1-20 for PSEN 1.1p-20
Ambient temperature	-10 ... +55 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm^2
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic
Dimensions L x W x H	36 x 26 x 13 mm (1.41" x 1.02" x 0.51")
Weight	PSEN 1.1p-10, PSEN 1.1p-20: 15 g PSEN 1.1-10, PSEN 1.1-20: 15 g

PSEN 1.1p-12, PSEN 1.1p-22

Intended use

Safety switches PSEN 1.1p-12 and PSEN 1.1p-22 are intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switches only comply with EN 60947-5-3 in conjunction with the PSEN ix1 interface, corresponding actuators and approved evaluation devices:

- PSEN 1.1p-12 with actuator PSEN 1.1-10
- PSEN 1.1p-22 with actuator PSEN 1.1-20

The safety switch should only be connected to the following evaluation devices:

PNOZ X:

- PNOZ 11
- PNOZ 16
- PNOZ Ex
- PMUT X1P
- PNOZ X2
- PNOZ X2.1 (24 VDC only)
- PNOZ X2P
- PNOZ X2.3P
- PNOZ X2.5P
- PNOZ X2.7P
- PNOZ X2.8P
- PNOZ X2C
- PNOZ X2.1C (24 VDC only)
- PNOZ X3, PNOZ X3.1
- PNOZ X3P
- PNOZ X3.10P
- PNOZ X4
- PNOZ X5, PNOZ X5J
- PNOZ X6
- PNOZ X8P
- PNOZ X9, PNOZ x9P
- PNOZ X10, PNOZ X10.1
- PNOZ X10.11P
- PNOZ X13
- PNOZ XV2, PNOZ XV2P
- PNOZ XV3, PNOZ XV3P

PNOZpower:

- PNOZ p1p

Description

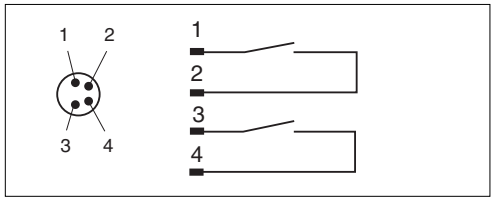
The safety switch PSEN 1.1p-12 is used with the actuator PSEN 1.1-10.
The safety switch PSEN 1.1p-22 is used with the actuator PSEN 1.1-20.
Features:

- 2 reed contacts (2 N/O)
- Assured operating distance:
  - PSEN 1.1p-12: ≤ 3 mm
  - PSEN 1.1p-22: ≤ 6 mm
- Assured release distance:
  - PSEN 1.1p-12: ≥ 19 mm
  - PSEN 1.1p-22: ≥ 25 mm
- Connection to evaluation device only via PSEN ix1 interface
- Square design
- Works magnetically
- Switching voltage 24 VDC

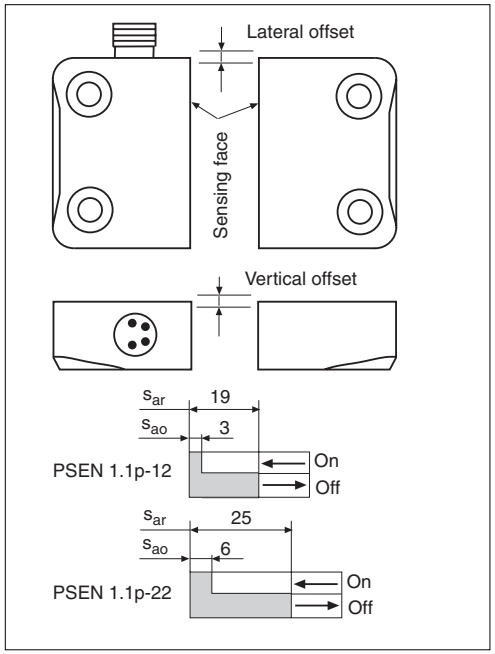
Wiring

INFORMATION
For details of how to wire the PSEN 1.1p-12, please refer to **PSEN ix1**, in this chapter.

Connections



Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

PSEN 1.1p-12:
Min. operating distances s_{ao} in mm

Lateral offset in mm \ Vertical offset in mm	0.5	1.0	1.5	2.0	2.5	3.0
1.0	2.5	2.5	2.5	2.0	1.5	1.5
1.5	2.0	2.0	2.0	2.0	1.0	1.0
2.0	2.0	2.0	1.5	1.5	1.0	0.5
2.5	1.5	1.5	1.0	0.5	-	-
3.0	0.5	0.5	0.5	-	-	-

Max. release distance s_{ar}: max. 19 mm with all vertical and lateral offsets

PSEN 1.1p-12, PSEN 1.1p-22

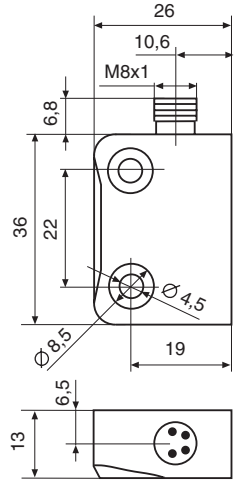
PSEN 1.1p-22:
Min. operating distances s_{ao} in mm

Lateral offset in mm	Vertical offset in mm 1.0	2.0	3.0	4.0	5.0
1.0	5.5	5.5	5.0	5.0	3.5
2.0	5.5	5.0	5.0	4.5	3.5
3.0	5.0	5.0	5.0	4.0	3.5
4.0	4.5	4.5	4.0	3.5	3.0
5.0	4.0	4.0	4.0	3.0	2.5

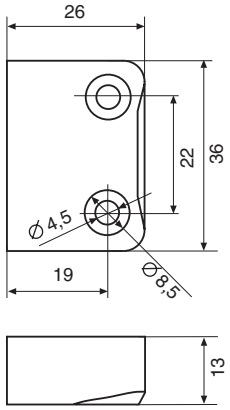
Max. release distance s_{ar}: max. 25 mm with all vertical and lateral offsets

Dimensions in mm

PSEN 1.1p-12, PSEN 1.1p-22



PSEN 1.1-10, PSEN 1.1-20



Technical details

Operation	Reed contacts/magnetic actuation
Switching distances	
PSEN 1.1p-12	s_{ao}: > 0.5/≤ 3 mm, s_{ar}: ≥ 19 mm
PSEN 1.1p-22	s_{ao}: > 0.5/≤ 6 mm, s_{ar}: ≥ 25 mm
Switching voltage	24 VDC
Switching current	500 mA
Breaking capacity	10 W
Max. switching frequency	Max. 1 Hz
Max. cable runs	Depends on evaluation device
Actuator	PSEN 1.1-10 for PSEN 1.1p-12
	PSEN 1.1-20 for PSEN 1.1p-22
Ambient temperature	-10 ... +55 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz
	Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm²
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic
Dimensions L x W x H	36 x 26 x 13 mm (1.41" x 1.02" x 0.51")
Weight	PSEN 1.1p-12, PSEN 1.1p-22: 15 g
	PSEN 1.1-10, PSEN 1.1-20: 15 g

PSEN 1.2p-20

Intended use

The safety switch PSEN 1.2p-20 is intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switch only complies with EN 60947-5-3 in conjunction with the actuator
PSEN 1.2-20 and the relevant, approved evaluation devices. The safety switch should only be connected to the following evaluation devices:

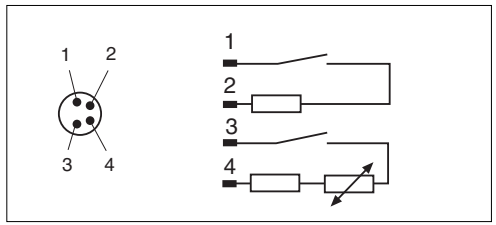
PNOZ X:
- PNOZ 11
- PNOZ 16
- PNOZ Ex
- PMUT X1P
- PNOZ X2
- PNOZ X2.1 (24 VDC only)
- PNOZ X2P
- PNOZ X2.3P
- PNOZ X2.5P
- PNOZ X2.7P
- PNOZ X2.8P
- PNOZ X2C
- PNOZ X2.1C (24 VDC only)
- PNOZ X3, PNOZ X3.1
- PNOZ X3P
- PNOZ X3.10P
- PNOZ X4
- PNOZ X5, PNOZ X5J
- PNOZ X6
- PNOZ X8P
- PNOZ X9, PNOZ x9P
- PNOZ X10, PNOZ X10.1
- PNOZ X10.11P
- PNOZ X13
- PNOZ XV2, PNOZ XV2P
- PNOZ XV3, PNOZ XV3P

PNOZpower:
- PNOZ p1p

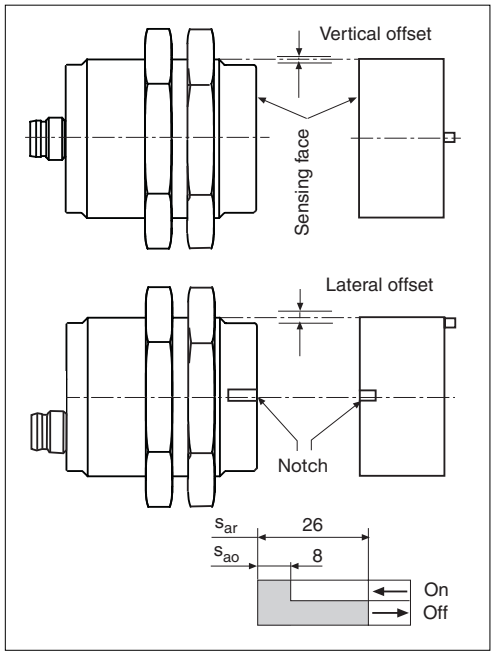
Description

The safety switch PSEN 1.2p-20 is used with the actuator PSEN 1.2-20.
Features:
- 2 reed contacts (2 N/O)
- Assured operating distance: ≤ 8 mm
- Assured release distance: ≥ 26 mm
- Round design
- Works magnetically
- Switching voltage 24 VDC

Connections



Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

Min. operating distances s_{ao} in mm

Lateral offset in mm	Vertical offset in mm: 1.0	2.0	3.0	4.0	5.0
1.0	7.5	7.5	7.0	7.0	5.5
2.0	7.5	7.0	7.0	6.5	5.5
3.0	7.0	7.0	7.0	6.0	5.5
4.0	6.5	6.5	6.0	5.5	5.0
5.0	6.0	6.0	6.0	5.0	4.5

Max. release distance s_{ar}: max. 26 mm with all vertical and lateral offsets

PSEN 1.2p-20

Direct connection to PNOZ X and PNOZpower

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device). The maximum permitted overall cable resistance is as follows:

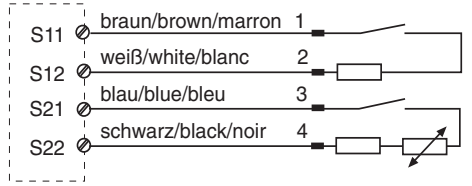
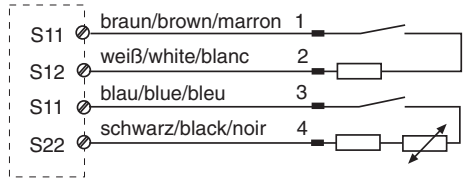
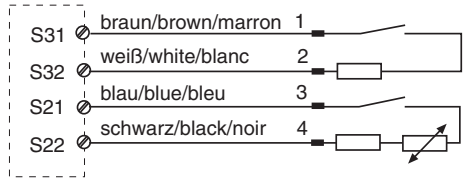
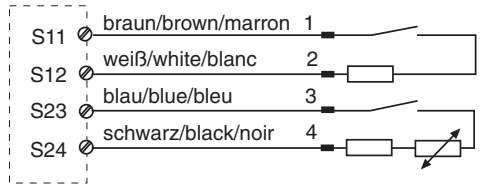
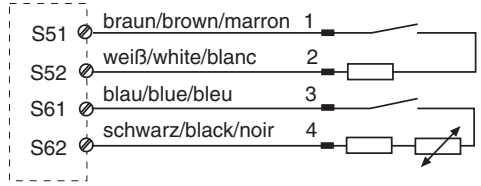
- Evaluation devices with DC supply voltage: **15 Ohms** per channel
- Evaluation devices with AC supply voltage: **20 Ohms** per channel
- For details of how to perform the test for shorts across the contacts, please refer to the operating manual for the relevant evaluation device.

Preparing for operation

- Connect the units from the **PNOZ X or PNOZpower series**. Please refer to the operating manual for the relevant units.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

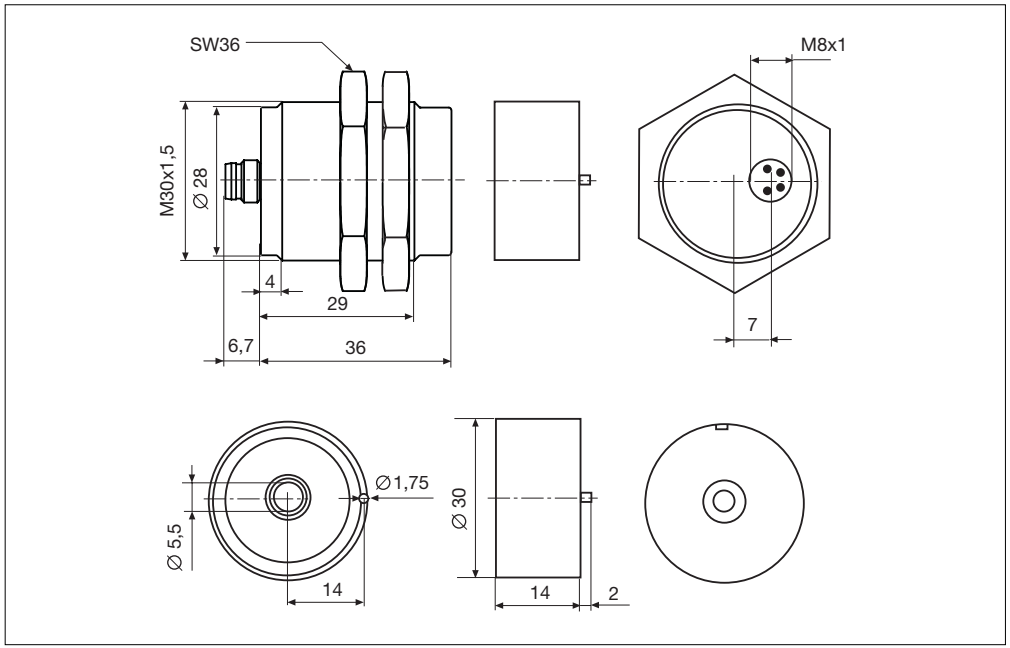
CAUTION
Please note the following when using evaluation devices with delay-on de-energisation contacts (e.g. PNOZ XV2):

- **Delay time ≤ 30 s:**
  Delay-on de-energisation contacts satisfy the requirements of category 3 in accordance with EN 954-1, 12/96 and the requirements of a PDF with single-fault tolerance (PDF-S).
- **Delay time > 30 s:**
  Delay-on de-energisation contacts satisfy the requirements of category 1 in accordance with EN 954-1, 12/96 and the requirements of a PDF with designed reliability (PDF-D).

• PNOZ p1p • PNOZ X2/X2P • PNOZ X2.1 (24 VDC only) • PNOZ X2.3P • PNOZ X2.7P/2.8P • PNOZ X2C • PNOZ X2.1C (24 VDC only) • PNOZ X4/X8P • PNOZ X9/X9P • PNOZ X10/X10.1 • PNOZ X10.11P • PNOZ Ex	
• PNOZ X5 • PNOZ X5J	
• PNOZ 11 • PNOZ 16 • PNOZ X13 • PNOZ X2.5P • PNOZ X3 • PNOZ X3.1 • PNOZ X3P • PNOZ X3.10P • PNOZ XV2 • PNOZ XV2P • PNOZ XV3 • PNOZ XV3P	
• PNOZ X6 (Y3-Y4 linked)	
• PMUT X1P	

PSEN 1.2p-20

Dimensions in mm



Technical details

Operation	Reed contacts/magnetic actuation
Switching distances	s_{ao}: > 0.5/≤ 8 mm, s_{ar}: ≥ 26 mm
Switching voltage	24 VDC
Switching current	500 mA
Breaking capacity	10 W
Max. switching frequency	Max. 1 Hz
Max. cable runs	Depends on evaluation device
Actuator	PSEN 1.2-20
Ambient temperature	-10 ... +55 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm²
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic
Dimensions L x W x H	See drawing
Weight	PSEN 1.2p-20: 28 g PSEN 1.2-20: 16 g

PSEN 1.2p-22

Intended use

The safety switch PSEN 1.2p-22 is intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switch only complies with EN 60947-5-3 in conjunction with the PSEN ix1 interface, the corresponding actuator PSEN 1.2-20 and the relevant, approved evaluation devices.
The safety switch should only be connected to the following evaluation devices:

PNOZ X:
- PNOZ 11
- PNOZ 16
- PNOZ Ex
- PMUT X1P
- PNOZ X2
- PNOZ X2.1 (24 VDC only)
- PNOZ X2P
- PNOZ X2.3P
- PNOZ X2.5P
- PNOZ X2.7P
- PNOZ X2.8P
- PNOZ X2C
- PNOZ X2.1C (24 VDC only)
- PNOZ X3, PNOZ X3.1
- PNOZ X3P
- PNOZ X3.10P
- PNOZ X4
- PNOZ X5, PNOZ X5J
- PNOZ X6
- PNOZ X8P
- PNOZ X9, PNOZ x9P
- PNOZ X10, PNOZ X10.1
- PNOZ X10.11P
- PNOZ X13
- PNOZ XV2, PNOZ XV2P
- PNOZ XV3, PNOZ XV3P

PNOZpower:
- PNOZ p1p

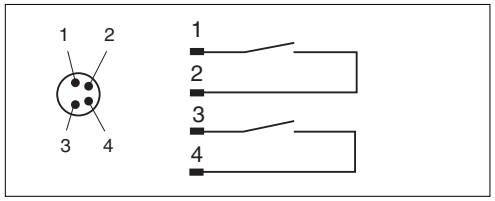
Description

The safety switch PSEN 1.1p-12 is used with the actuator PSEN 1.1-10.
The safety switch PSEN 1.1p-22 is used with the actuator PSEN 1.1-20.
Features:
- 2 reed contacts (2 N/O)
- Assured operating distance: ≤ 8 mm
- Assured release distance: ≥ 26 mm
- Connection to evaluation device only via PSEN ix1 interface
- Round design
- Works magnetically
- Switching voltage 24 VDC

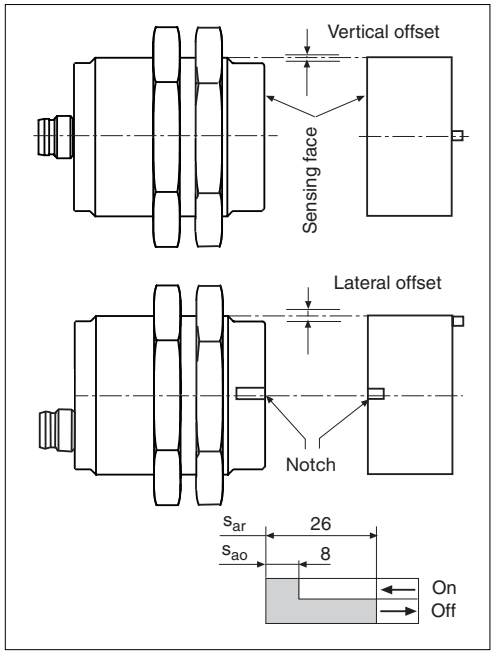
Wiring

INFORMATION
For details of how to wire the PSEN 1.1p-12, please refer to **PSEN ix1**, in this chapter.

Connections



Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

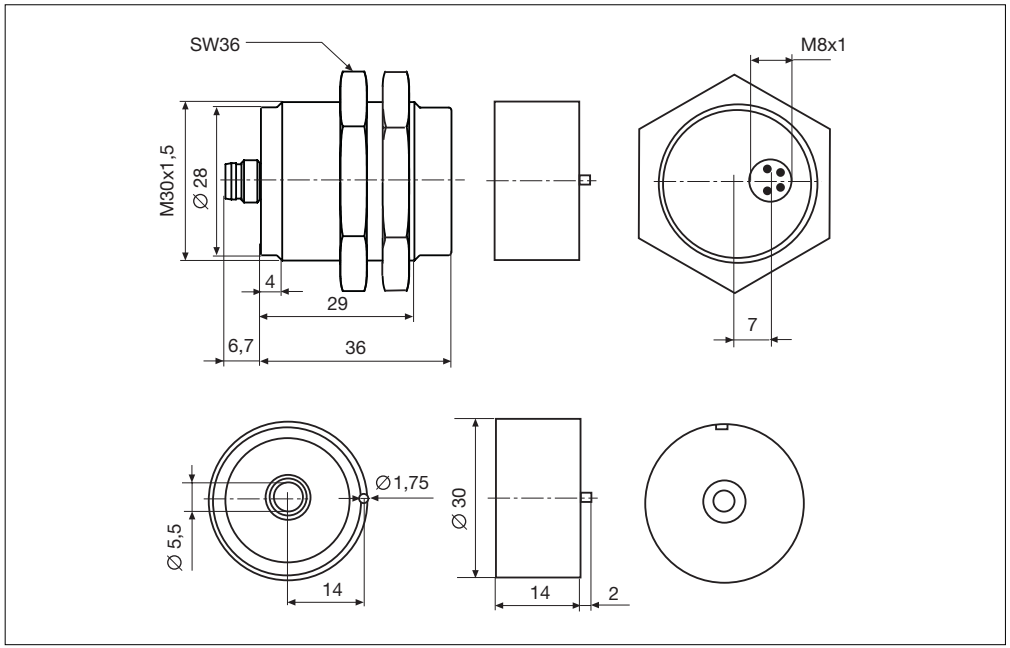
Min. operating distances s_{ao} in mm

Lateral offset in mm	Vertical offset in mm: 1.0	2.0	3.0	4.0	5.0
1.0	7.5	7.5	7.0	7.0	5.5
2.0	7.5	7.0	7.0	6.5	5.5
3.0	7.0	7.0	7.0	6.0	5.5
4.0	6.5	6.5	6.0	5.5	5.0
5.0	6.0	6.0	6.0	5.0	4.5

Max. release distance s_{ar}: max. 26 mm with all vertical and lateral offsets

PSEN 1.2p-22

Dimensions in mm



Technical details

Operation	Reed contacts/magnetic actuation
Switching distances	s_{ao}: > 0.5/≤ 8 mm s_{ar}: ≥ 26 mm
Switching voltage	24 VDC
Switching current	500 mA
Breaking capacity	10 W
Max. switching frequency	Max. 1 Hz
Max. cable runs	Depends on evaluation device
Actuator	PSEN 1.2-20
Ambient temperature	-10 ... +55 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm²
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic
Dimensions L x W x H	See drawing
Weight	PSEN 1.2p-22: 28 g PSEN 1.2-20: 16 g

PSEN 2.1p-10, PSEN 2.1p-11, PSEN 2.1p-30, PSEN 2.1p-31

Intended use

Safety switches PSEN 2.1p-10, PSEN 2.1p-11, PSEN 2.1p-30 and PSEN 2.1p-31 are intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switch only complies with EN 60947-5-3 in conjunction with the actuator PSEN 2.1-10 and the relevant, approved evaluation devices. The safety switch should only be connected to the following evaluation devices:

- PNOZ e3.1p
- PNOZ e3vp 10s
- PNOZ e3vp 300s
- PNOZ m1p
- PSS-range programmable safety system in conjunction with standard function block SB066

Description

Safety switches PSEN 2.1p-10, PSEN 2.1p-11, PSEN 2.1p-30 and PSEN 2.1p-31 are used with the actuator PSEN 2.1-10.
Features:

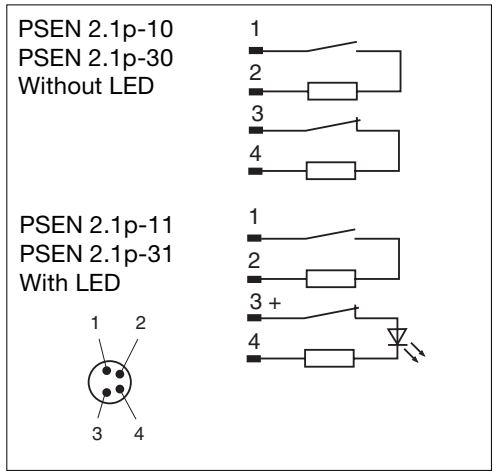
- 2 reed contacts (1 N/C / 1 N/O)
- Assured operating distance:
  - PSEN 2.1p-10, PSEN 2.1p-11: ≤ 3 mm
  - PSEN 2.1p-30, PSEN 2.1p-31: ≤ 6 mm

Assured release distance:

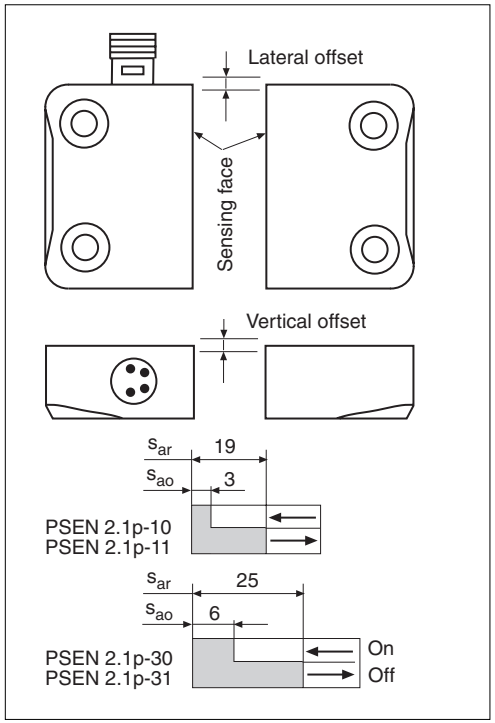
- PSEN 2.1p-10, PSEN 2.1p-11: ≥ 19 mm
- PSEN 2.1p-30, PSEN 2.1p-31: ≥ 25 mm

- Safety switches connected in series via PSEN i1 interface
- Square design
- Works magnetically
- Switching voltage 30 VDC
- PSEN 2.1p-11, PSEN 2.1p-31: with LED to display switch status

Connections



Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

PSEN 2.1p-10, PSEN 2.1p-11:
Min. operating distances s_{ao} in mm

Lateral offset in mm \ Vertical offset in mm	0.5	1.0	1.5	2.0	2.5	3.0
1.0	2.5	2.5	2.5	2.0	1.5	1.5
1.5	2.0	2.0	2.0	2.0	1.0	1.0
2.0	2.0	2.0	1.5	1.5	1.0	0.5
2.5	1.5	1.5	1.0	0.5	-	-
3.0	0.5	0.5	0.5	-	-	-

Max. release distance s_{ar}: max. 19 mm with all vertical and lateral offsets

PSEN 2.1p-10, PSEN 2.1p-11, PSEN 2.1p-30, PSEN 2.1p-31

PSEN 2.1p-30, PSEN 2.1p-31:
Min. operating distances s_{ao} in mm

Lateral offset in mm	Vertical offset in mm 1.0	2.0	3.0	4.0	5.0
1.0	5.5	4.5	4.5	4.0	3.0
2.0	5.0	4.5	4.5	3.5	2.5
3.0	4.5	4.5	3.5	2.5	0.5
4.0	4.0	-	-	-	-

Max. release distance s_{ar}: max. 25 mm with all vertical and lateral offsets

Series connection via PSENi1 interface

INFORMATION
To connect the safety switches in series you will need the PSEN i1 interface. For wiring details please refer to **PSEN i1**, in this chapter.

Direct connection to PNOZelog

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device).
The maximum permitted overall cable resistance at the inputs of a PNOZelog unit is 2 kOhms. When **one** safety switch is connected, 1760 Ohms remain for the cable.

Preparing the unit for operation:
- Connect the units from the **PNOZelog series**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

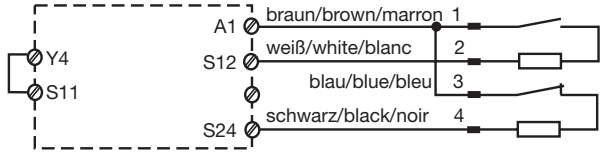
Direct connection to PNOZmulti

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device).

Preparing the unit for operation:
- Connect the units from the **PNOZmulti series**. Please refer to the operating manual for the relevant units.

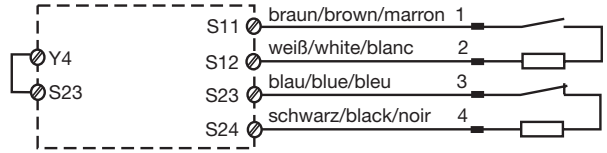
Without detection of shorts across contacts

- PNOZ e3.1p
- PNOZ e3vp 10 s
- PNOZ e3vp 300 s



With detection of shorts across contacts

- PNOZ e3.1p
- PNOZ e3vp 10 s
- PNOZ e3vp 300 s

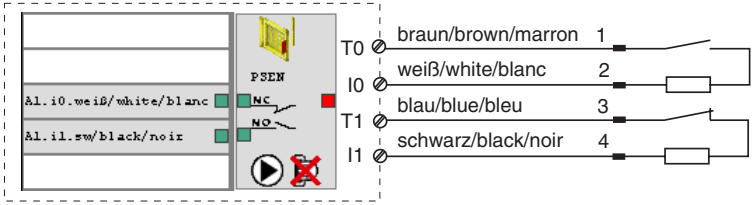


- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

Please note:
- Connect the N/O contact on the PSEN to I0
- Connect the N/C contact on the PSEN to I1

Example:
- Safety gate, switch type 2
- I0, I1: Inputs
- T0, T1: Test pulse outputs

- PNOZ m1p



PSEN 2.1p-10, PSEN 2.1p-11, PSEN 2.1p-30, PSEN 2.1p-31

Direct connection to a PSS, with or without SafetyBUS p

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device).

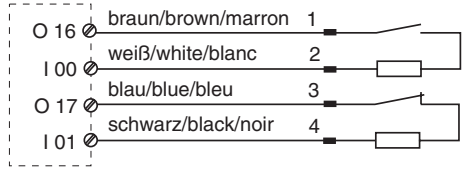
Preparing the unit for operation:

- Connect the **PSS**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

Example:

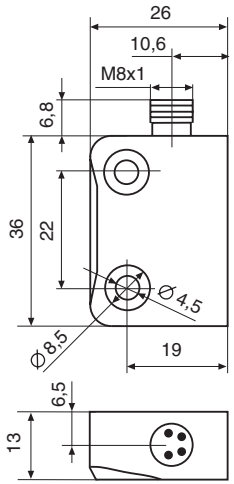
- Safety gate
- I00, I01: PSS inputs
- O16, O17: Test pulse outputs

CAUTION
The safety switches may only be operated on a PSS in conjunction with standard function block SB066.

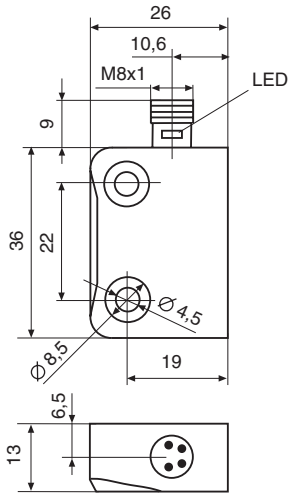


Dimensions in mm

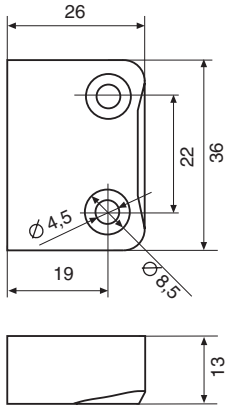
PSEN 2.1p-10
PSEN 2.1p-30



PSEN 2.1p-11
PSEN 2.1p-31



PSEN 2.1-10



Technical details

Operation	Reed contacts/magnetic actuation
Switching distances	
PSEN 2.1p-10, PSEN 2.1p-11	s_{ao}: > 0.5/≤ 3 mm, s_{ar}: ≥ 19 mm
PSEN 2.1p-30, PSEN 2.1p-31	s_{ao}: > 0.5/≤ 6 mm, s_{ar}: ≥ 25 mm
Switching voltage	30 VDC
Switching current	10 mA
Breaking capacity	0.3 W
Max. switching frequency	Max. 5 Hz
Actuator	PSEN 2.1-10
Ambient temperature	-25 ... +70 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm²
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic
Dimensions L x W x H	36 x 26 x 13 mm (1.41" x 1.02" x 0.51")
Weight	PSEN 2.1p: 15 g PSEN 2.1-10: 15 g

PSEN 2.2p-20, PSEN 2.2p-21

Intended use

Safety switches PSEN 2.2p-20 and PSEN 2.2p-21 are intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switch only complies with EN 60947-5-3 in conjunction with the actuator PSEN 2.2-20 and the relevant, approved evaluation devices. The safety switch should only be connected to the following evaluation devices:

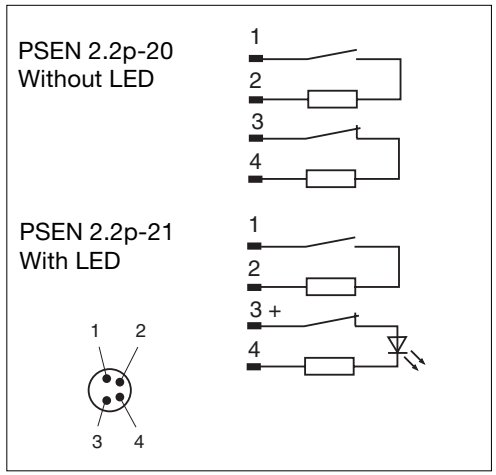
- PNOZ e3.1p
- PNOZ e3vp 10s
- PNOZ e3vp 300s
- PNOZ m1p
- PSS-range programmable safety system in conjunction with standard function block SB066

Description

The safety switch PSEN 2.2p-20 and PSEN 2.2p-21 are used with the actuator PSEN 2.2-20.
Features:

- 2 reed contacts (1 N/C / 1 N/O)
- Assured operating distance: ≤ 8 mm
- Assured release distance: ≥ 26 mm
- Series connection via PSEN ix interface
- Round design
- Works magnetically
- Switching voltage 30 VDC
- PSEN 2.2p-21: with LED to display switch status

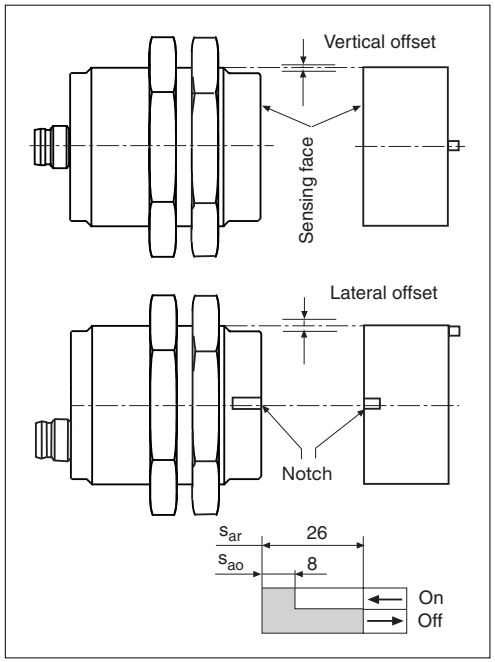
Connections



Wiring

INFORMATION
For details of how to connect the safety switch directly to an approved evaluation device, please refer to **PSEN 2.1p-10, PSEN 2.1p-11, PSEN 2.1p-30, PSEN 2.1p-31**, in this chapter.
To connect the safety switches in series you will need the PSEN i1 interface. For wiring details please refer to **PSEN i1**, in this chapter.

Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

Min. operating distances s_{ao} in mm

Lateral offset in mm	Vertical offset in mm 0.5	1.0
1.0	7.5	7.5
2.0	7.0	7.0
3.0	6.5	6.5
4.0	6.0	6.0
5.0	5.0	5.0
6.0	4.5	4.5

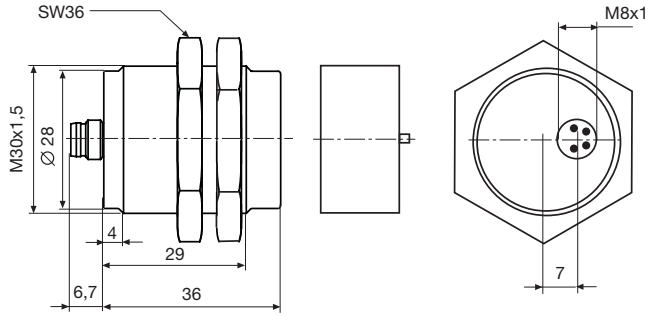
Max. release distance s_{ar}: max. 26 mm with all vertical and lateral offsets

NOTICE
The details given in the table “Max. lateral and vertical offset” apply when the notches on the safety sensor and actuator are positioned on top.

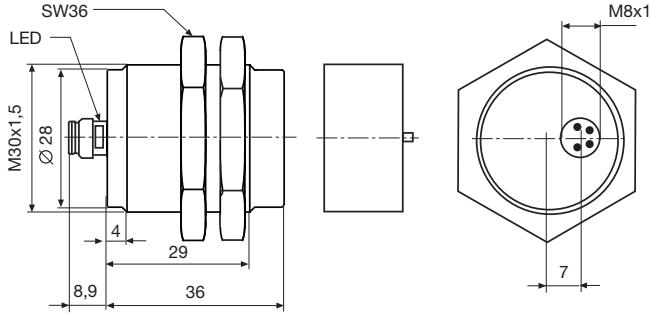
PSEN 2.2p-20, PSEN 2.2p-21

Dimensions in mm

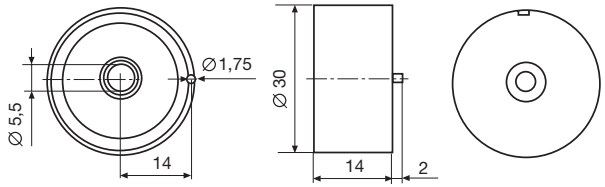
PSEN 2.2p-20



PSEN 2.2p-21



PSEN 2.2-20



Technical details

Operation	Reed contacts/magnetic actuation
Switching distances	s_{ao}: > 0.5/≤ 8 mm, s_{ar}: ≥ 26 mm
Switching voltage	30 VDC
Switching current	10 mA
Breaking capacity	0.3 W
Max. switching frequency	Max. 5 Hz
Status display	Red LED (PSEN 2-2p-21 only)
Actuator	Magnet PSEN 2.2-20
Ambient temperature	-25 ... +70 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm²
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic, signal yellow
Dimensions	See drawing
Weight	PSEN 2.2p-20/-21: 28 g PSEN 2.2-20: 16 g

PSEN 2.2p-24 ATEX

Intended use

The safety switch PSEN 2.2p-24 ATEX is intended for use in safety circuits in accordance with EN 60204-1 (VDE 0113-1), 03/00 and IEC 60204-1, 10/97 (position monitoring of movable safety devices).
The safety switch PSEN 2.2p-24 ATEX is approved for use in potentially explosive atmospheres in accordance with EN 50021, 02/00, Ex area Category 3, Zone 2 (gas) and 22 (dust), (II 3GD EEx nC IIC T6).
The safety switch only complies with EN 60947-5-3 and EN 50021 in conjunction with the actuator PSEN 2.2-20 and the relevant, approved evaluation devices. The safety switch should only be connected to the following evaluation devices:

PNOZelog:
- PNOZ e3.1p
- PNOZ e3vp 10s
- PNOZ e3vp 300s

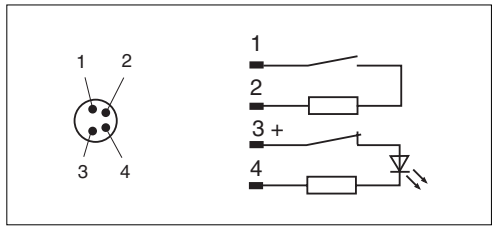
PNOZmulti:
- PMOZ m1p
- PNOZ mi1p

PSS in conjunction with standard function block SB066:
- PSS DI
- PSS(1) DI 2
- PSS(1) DIF2
- PSS(1) DIO T
- PSS(1) DIO Z
- PSS(1) DI2O T
- PSS(1) DI2O Z
- PSS 3032
- PSS 3046
- PSS 3056
- PSS 3074
- PSS SB2 3006-3 CN-A
- PSS SB2 3006-3 DP-S
- PSS SB 3006-3
- PSS SB 3006
- PSS SB 3056
- PSS SB DI16
- PSS SB DI8O8
- PSS SB DI8OZ4

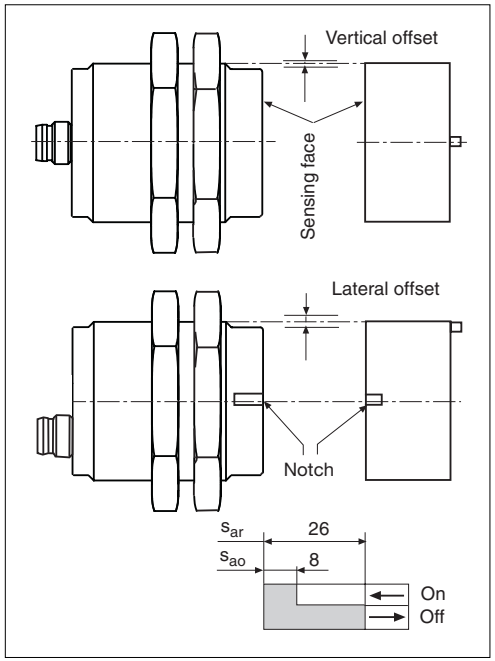
Description

The safety switch PSEN 2.2p-24 ATEX is used with the actuator PSEN 2.2-20.
Features:
- 2 reed contacts (1 N/C / 1 N/O)
- Assured operating distance: ≤ 8 mm
- Assured release distance: ≥ 26 mm
- Round design
- Works magnetically
- Switching voltage 30 VDC
- with LED to display switch status

Connections



Switching distances



Vertical and lateral offset

The stated switching distances (see Technical details) only apply when the safety switch and actuator are installed facing each other in parallel. Switching distances may deviate if other arrangements are used. Please note the maximum permitted lateral and vertical offset. The stated values are valid at a temperature of 20°C.

Min. operating distances s_{ao} in mm

Lateral offset in mm	Vertical offset in mm 0.5	1.0
1.0	7.5	7.5
2.0	7.0	7.0
3.0	6.5	6.5
4.0	6.0	6.0
5.0	5.0	5.0
6.0	4.5	4.5

Max. release distance s_{ar}: max. 26 mm with all vertical and lateral offsets

NOTICE
The details given in the table “Max. lateral and vertical offset” apply when the notches on the safety sensor and actuator are positioned on top.

PSEN 2.2p-24 ATEX

Please observe the following when wiring:
- The evaluation devices approved for use with the safety switch PSEN 2.2p-24 ATEX are listed under “Intended use”.
- The safety switch is installed in the Ex area, the corresponding evaluation device in the non-Ex area.

NOTICE
Connections 1 and 3 of the safety switch must be connected to test pulse outputs.

CAUTION
Risk of explosion! Within the Ex area, only insert and unplug the safety switch connector when the supply voltage is switched off.

Direct connection to PNOZelog

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device):
The maximum permitted overall cable resistance at the inputs of a PNOZelog unit is 2 kOhms.

Preparing the unit for operation:
- Connect the units from the **PNOZelog series**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

Direct connection to PNOZmulti

Preparing the unit for operation:
- Connect the units from the **PNOZmulti series**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

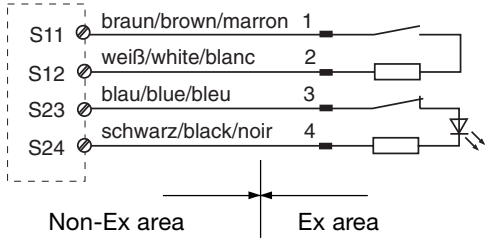
Direct connection to a PSS, with or without SafetyBUS p

Preparing the unit for operation:
- Connect the **PSS**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the safety switches to the input circuits of the evaluation devices in accordance with the table.

CAUTION
The safety switch may only be operated on a PSS in conjunction with standard function block SB066.

PNOZelog

S12, S24: Inputs
S11, S23: Test pulse outputs

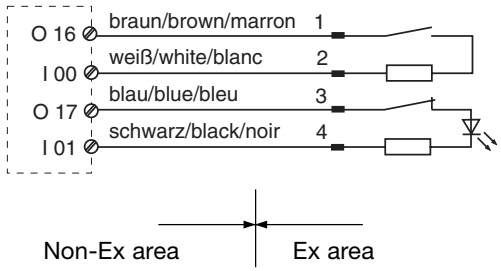


PNOZmulti

Please note:
- Connect the N/O contact on the PSEN to I0
- Connect the N/C contact on the PSEN to I1

PSS with and without SafetyBUS p

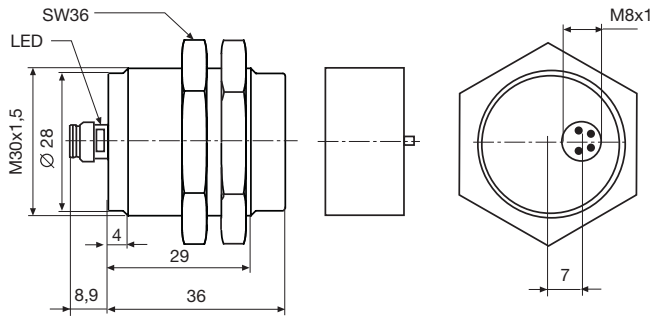
I 00, I 01: Inputs
O 16, O17: Test pulse outputs



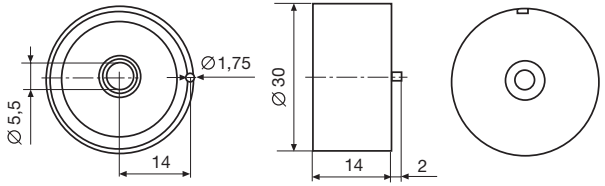
PSEN 2.2p-24 ATEX

Dimensions in mm

PSEN 2.2p-24
ATEX



PSEN 2.2-20



Technical details

ATEX category	II 3GD EEx nC IIC T6
Operation	Reed contacts/magnetic actuation
Switching distances	s_{ao}: > 0.5/≤ 8 mm, s_{ar}: ≥ 26 mm
Switching voltage	30 VDC
Switching current	10 mA
Breaking capacity	0.3 W
Max. switching frequency	Max. 5 Hz
Status display	Red LED
Actuator	Magnet PSEN 2.2-20
Ambient temperature	-25 ... +70 °C
Temperature class/max. surface temperature	T6/max. 85 °C
Vibration in accordance with 60947-5-2, 08/00	Frequency: 10 ... 55 Hz Amplitude: 1 mm
Shock	30g, 11 ms
Connection type	4 pin M8 male connector
Cable	LiYY 4 x 0.25 mm²
Protection type depends on cable	IP65/IP67
Housing material	PBT plastic
Dimensions	See drawing
Weight	PSEN 2.2p-24: 28 g PSEN 2.2-20: 16 g

PSEN i1

Intended use

The PSEN i1 interface enables several safety switches or position switches to be connected to safety gate monitors or programmable safety systems and evaluated.
The following may be connected to the PSEN i1:

- Safety switches from the PSEN 2 series (e.g. PSEN 2.1p-10, PSEN 2.1p-11)
- Position switch with N/C / N/O combination

The PSEN i1 may be connected to:

- Safety gate monitors from the PNOZ e3p series from the PNOZelog product range (e.g. PNOZ e3.1p, PNOZ e3vp)
- Compact programmable safety systems from the PSS-range
- Modular programmable safety systems from the PSS-range with centralised input module
- SafetyBUS p-compatible programmable safety systems from the PSS-range and decentralised input module (I/OD)

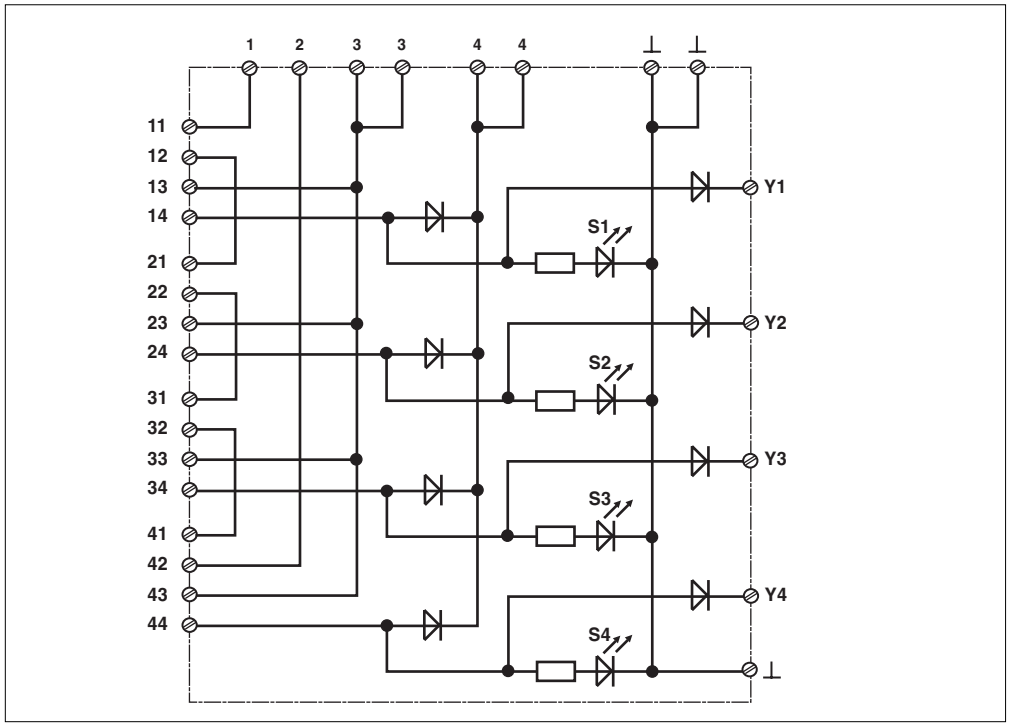
NOTICE
Use of the PSEN i1 reduces the classification to EN 60947-5-3 from PDF-M to PDF-S.

Description

The PSEN i1 switches the 4 N/C circuits of the connected safety switches/position switches in parallel and the 4 N/O circuits in series. A status indicator lights when the N/O circuit is closed. Diagnostic outputs are used to evaluate the switch status of the N/C circuits via external LEDs or a PLC
When using

- PNOZ e3.1p and PNOZ e3vp, a max. of 12 (from October 2003: max. 24) safety switches/position switches can be connected by linking a max. of 6 PSEN i1s in series.
- A compact programmable safety system from the PSS-range, a modular programmable safety system from the PSS-range with centralised input module or a SafetyBUS p-compatible PSS with decentralised input module, a max. of 6 safety switches/position switches (from October 2003: max. 12) can be connected by linking a max. of 4 PSEN i1s in series.

Internal wiring diagram



PSEN i1

Series connection to PNOZelog via PSEN i1 interface

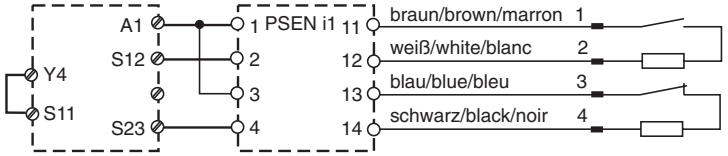
Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device).
When 24 safety switches are connected, the maximum permitted overall cable resistance between the evaluation device and the safety switch is 400 Ohms per channel.

Preparing for operation

- Connect the units from the **PNOZelog series**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the PSEN i1 to the input circuits of the evaluation devices in accordance with the table.
- Wire the safety switches to the PSEN i1 in accordance with the table. Please refer to the operating manual for the PSEN i1.

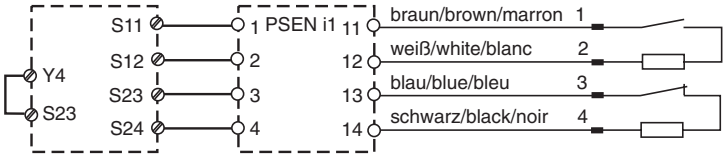
Without detection of shorts across contacts

- PNOZ e3.1p
- PNOZ e3vp 10 s
- PNOZ e3vp 300 s



With detection of shorts across contacts

- PNOZ e3.1p
- PNOZ e3vp 10 s
- PNOZ e3vp 300 s



Series connection to PNOZmulti via PSEN i1 interface

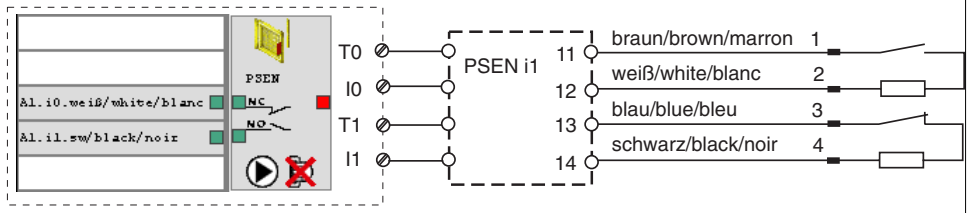
Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device).

Preparing for operation

- Connect the units from the **PNOZmulti series**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit.**
- Wire the PSEN i1 to the input circuits of the evaluation devices in accordance with the table.
- Wire the safety switches to the PSEN i1 in accordance with the table. Please refer to the operating manual for the PSEN i1.

NOTICE
When connecting fewer than 4 safety switches to a PSEN i1, please note: **Link out the free inputs for N/O contacts** on the PSEN i1.

- PNOZ m1p



PSEN i1

Series connection to a PSS via a PSEN i1 interface, with or without SafetyBUS p

Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device).

Preparing the unit for operation:
- Connect the units from the **PNOZmulti series**. Please refer to the operating manual for the relevant units.
- Establish the operating mode with/ without detection of shorts across contacts through the wiring of the **input circuit**.
- Wire the PSEN ix1 to the input circuits of the evaluation devices in accordance with the table.
- Wire the safety switches to the PSEN i1 in accordance with the table. Please refer to the operating manual for the PSEN i1.

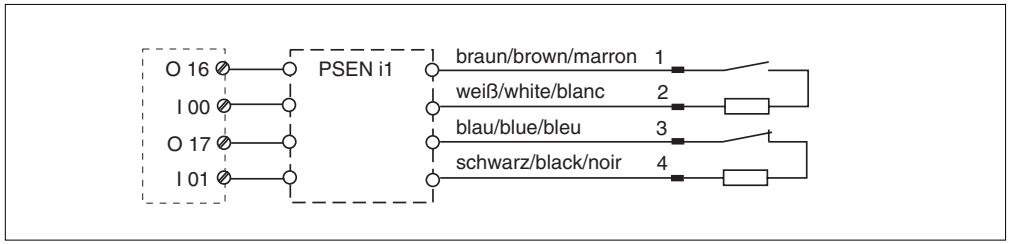
NOTICE
When connecting fewer than 4 safety switches/position switches, please note: **Link out the free inputs for N/O contacts** on the PSEN i1.

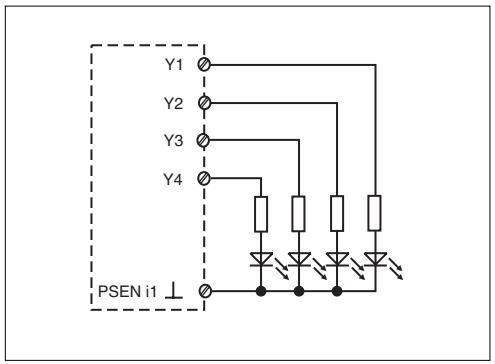
Example:
- Safety gate
- I00, I01: PSS inputs
- O16, O17: Test pulse outputs

CAUTION
The safety switches may only be operated on a PSS in conjunction with standard function block SB066.

Connecting the diagnostic outputs:
- If required, connect the diagnostic outputs Y1 ... Y4 of the PSEN i1.

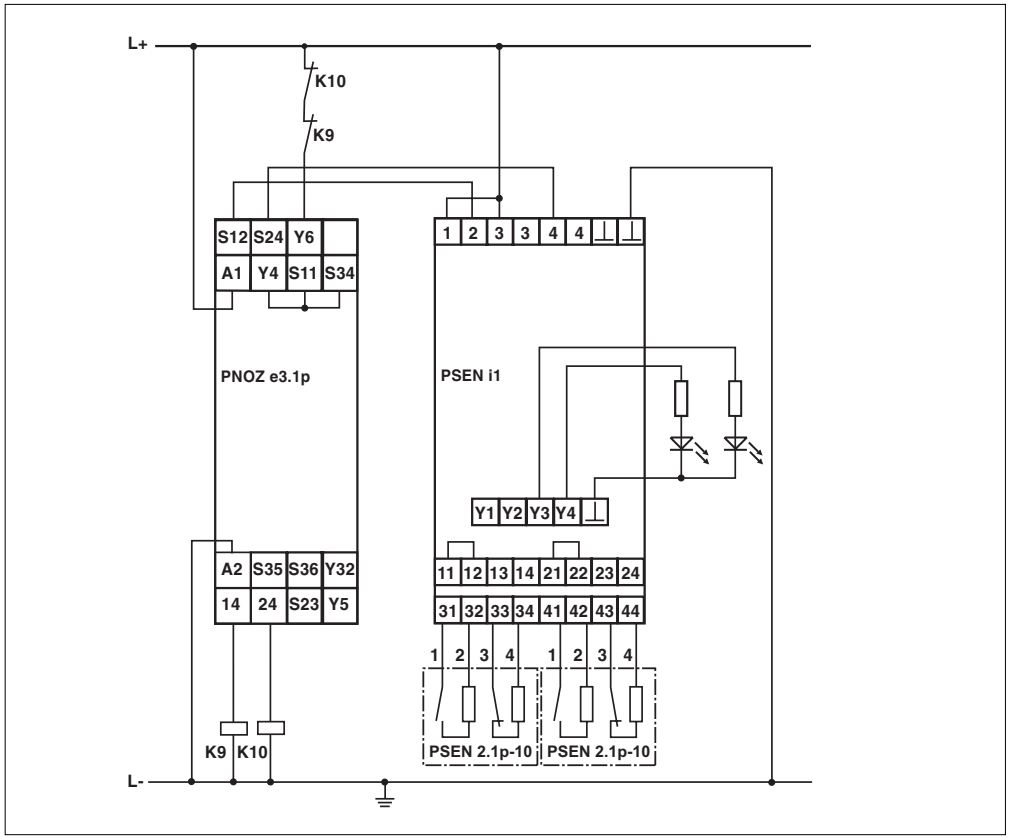
INFORMATION
When connecting the diagnostic outputs to a PLC, please note: use the operating mode **without** detection of shorts across contacts.





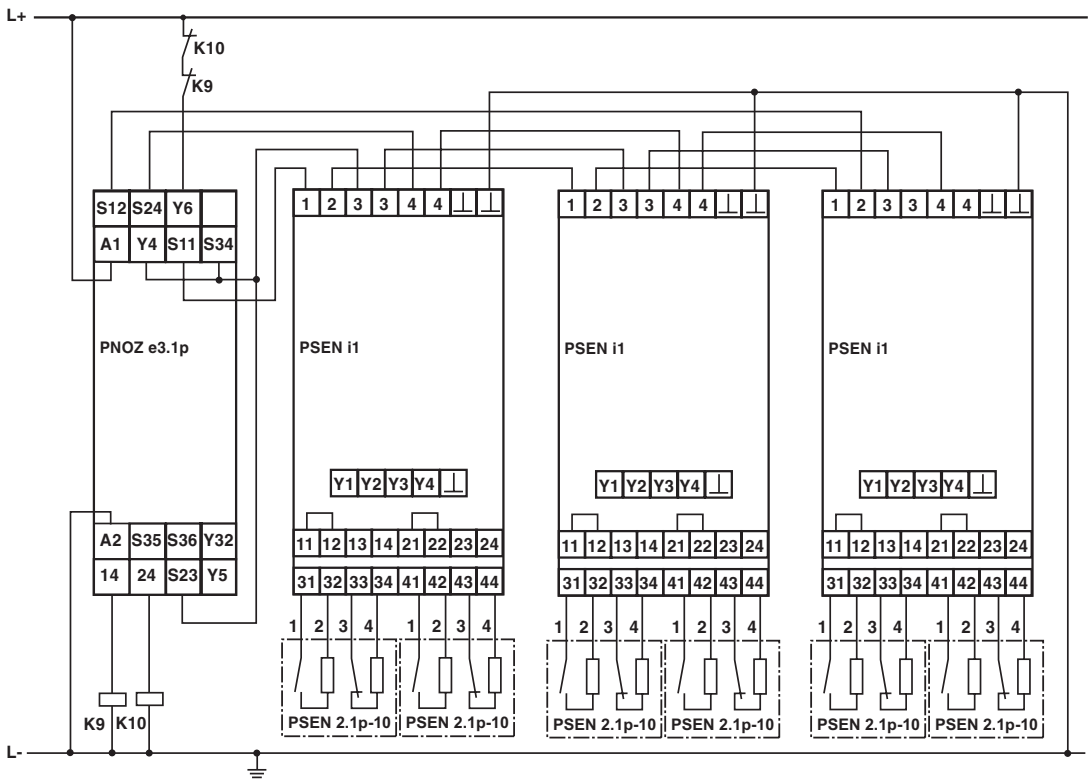
PSEN i1

Example 1
Evaluation (PNOZ e3.1p) of 2 safety switches PSEN 2.1p-10



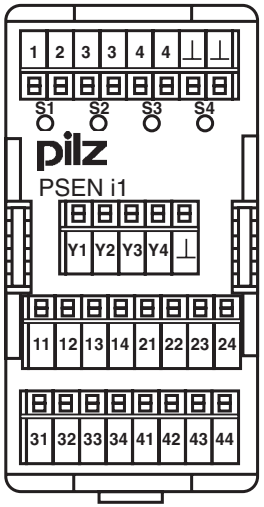
PSEN i1

Example 2:
Evaluation (PNOZ e3.1p) of 6 safety switches via 3 PSEN i1 units connected in series. **Link out the free inputs for N/O contacts**.

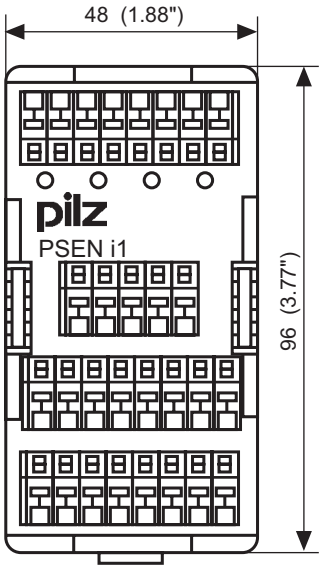


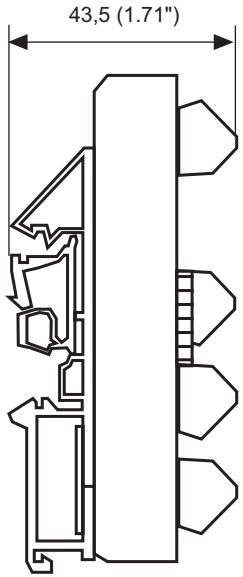
PSEN i1

Terminal configuration



Dimensions in mm





pilz
more than automation
safe automation

PSEN i1

Technical details

Supply voltage U_B	From PNOZ or PSS
Voltage tolerance	80...125%
Power consumption at U_B without load	Max 0.4 W
Residual ripple U_B	DC: 20%
Voltage and current at Y1, Y2, Y3, Y4	24V/50 mA
Airgap creepage	DIN VDE 0110-1, 04/97
Climate suitability	DIN IEC 60068-2-3, 12/86
EMC	EN 60947-5-3, 05/99
Vibration to	EN 60068-2-6, 04/95
Frequency	10...55 Hz
Amplitude	0.35 mm
Ambient temperature	-10 ... +55 °C
Storage temperature	-25 ...+70 °C
Protection type	
Mounting (e.g. control cabinet)	IP54
Housing	IP20
Terminals	IP20
Connection type	Spring-loaded terminals
Cross section of external conductors	
1 core flexible	0.08 ... 2.5 mm^2
2 core, same cross section	
flexible with crimp connectors, no plastic sleeve	0.08 ... 1 mm^2
flexible without crimp connectors or with TWIN crimp connectors	0.08 ... 1.5 mm^2
Housing material	
Housing	PA 6 UL 94-HB
Base	PA 66 UL 94-V2
Dimensions H x W x D	96 x 48 x 43.5 mm (3.77" x 1.88" X 1.71")
Weight	90 g

PSEN ix1

Intended use

The PSEN ix1 interface enables several safety switches or position switches to be connected to safety relays from the PNOZ series and evaluated.
The following may be connected to the PSEN ix1:

- Safety sensors
  - PSEN 1.1p-12
  - PSEN 1.1p-22
  - PSEN 1.2p-22
- Position switch with N/O / N/O combination
- E-STOP button with N/C / N/C combination

The PSEN ix1 should only be connected to the following evaluation devices:

PNOZ X:

- PMUT X1P
- PNOZ X2
- PNOZ X2.1 (24 VDC only)
- PNOZ X2P
- PNOZ X2.3P
- PNOZ X2.7P
- PNOZ X2.8P
- PNOZ X2C
- PNOZ X2.1C (24 VDC only)
- PNOZ X4
- PNOZ X5, PNOZ X5J
- PNOZ 11
- PNOZ 16
- PNOZ X13
- PNOZ X2.5P
- PNOZ X3, PNOZ X3.1
- PNOZ X3P
- PNOZ X3.10P
- PNOZ XV2, PNOZ XV2P
- PNOZ XV3, PNOZ XV3P
- PNOZ X5, X5J
- PNOZ X6
- PNOZ X8P
- PNOZ X9, PNOZ x9P
- PNOZ X10, PNOZ X10.1
- PNOZ X10.11P
- PNOZ Ex

PNOZpower:

- PNOZ p1p

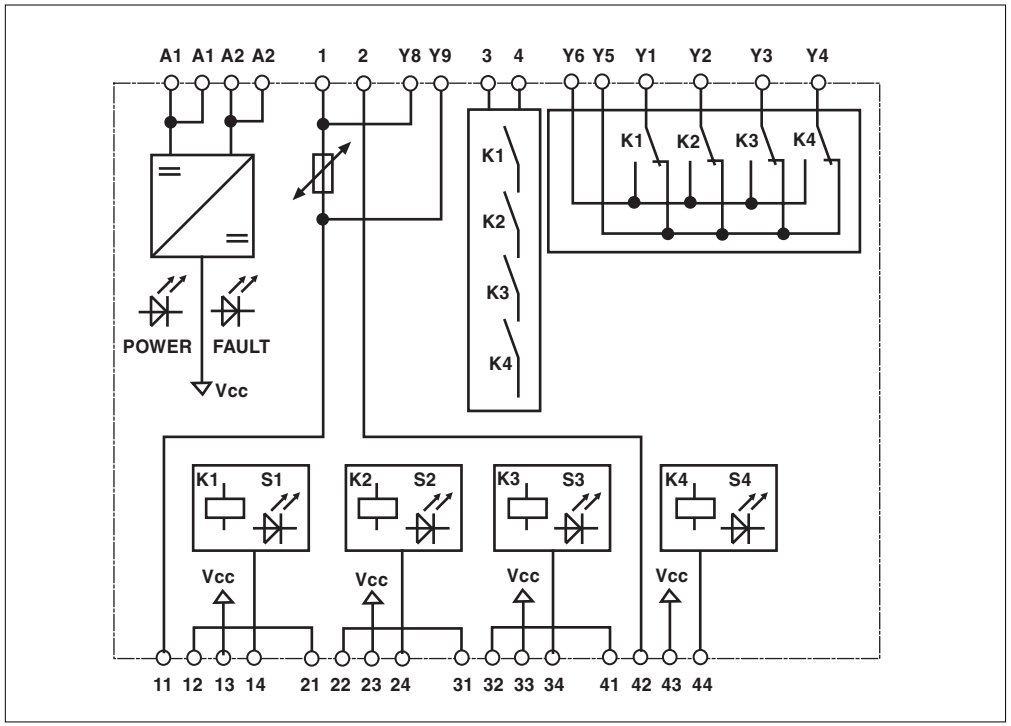
NOTICE
Use of the PSEN ix1 reduces the classification to EN 60947-5-3 from PDF-M to PDF-S.

Description

The PSEN ix1 connects the PSEN 1.1p-12, PSEN 1.1p-22, PSEN 1.2p-22 safety switches or position switches in series.

- Max. of 13 PSEN ix1 units can be connected in series
- Connection option for:
  - max. 50 safety switches or position switches with N/O / N/O combination
  - or max. 50 E-STOP buttons with N/C / N/C combination
- Status indicators for the switch status of the N/O circuits of the connected safety switches
- 4 diagnostic outputs to display or evaluate the switch status of the N/O circuits via external LEDs or a PLC

Internal wiring diagram



PSEN ix1

Series connection via PSEN ix1 interface

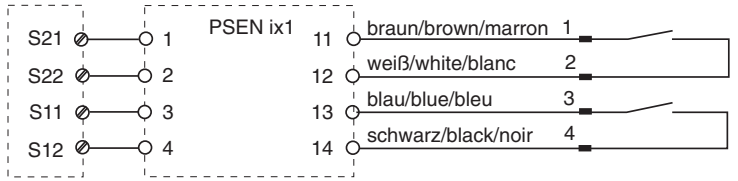
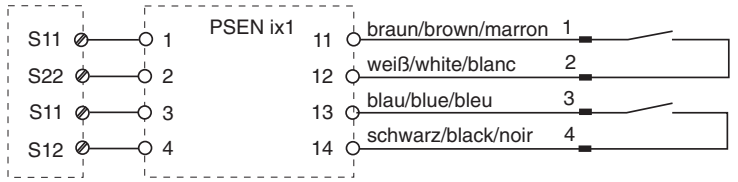
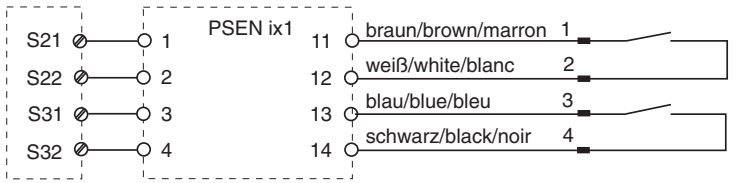
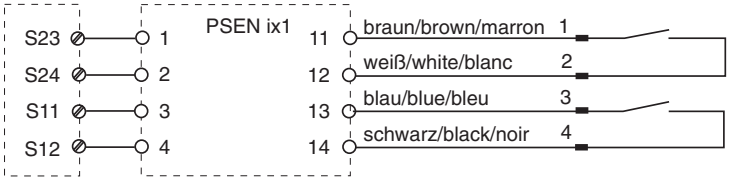
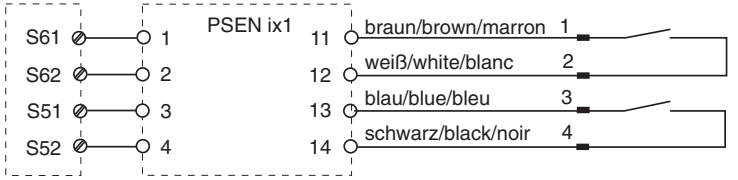
Before commissioning, check that shorts across contacts are detected (see operating manual for the evaluation device):

- The maximum permitted overall cable resistance is **30 Ohms** per channel
- For details of how to perform the test for shorts across the contacts, please refer to the operating manual for the relevant evaluation device.

Preparing for operation

- Connect the supply voltage to the PSEN ix1:
  Terminal **A1** : +24 VDC
  Terminal **A2** : 0 V
- Connect the units from the **PNOZ X or PNOZpower series**. Please refer to the operating manual for the relevant units.
- Wire the PSEN ix1 to the input circuits of the evaluation devices in accordance with the table.
- Wire the safety switches to the PSEN ix1 in accordance with the table. Please refer to the operating manual for the PSEN ix1.

NOTICE
When connecting fewer than 4 safety switches to a PSEN ix1, please note: **Link out the free inputs for N/O contacts** (see example 2).

• PNOZ p1p • PNOZ X2/X2P • PNOZ X2.1 (24 VDC only) • PNOZ X2.3P • PNOZ X2.7P/2.8P • PNOZ X2C • PNOZ X2.1C (24 VDC only) • PNOZ X4/X8P • PNOZ X9/X9P • PNOZ X10/X10.1 • PNOZ X10.11P • PNOZ Ex		PSEN 1.1p-12 PSEN 1.1p-22 PSEN 1.2p-22
• PNOZ X5 • PNOZ X5J		PSEN 1.1p-12 PSEN 1.1p-22 PSEN 1.2p-22
• PNOZ 11 • PNOZ 16 • PNOZ X13 • PNOZ X2.5P • PNOZ X3 • PNOZ X3.1 • PNOZ X3P • PNOZ X3.10P • PNOZ XV2 • PNOZ XV2P • PNOZ XV3 • PNOZ XV3P		PSEN 1.1p-12 PSEN 1.1p-22 PSEN 1.2p-22
• PNOZ X6 (Y3-Y4 linked)		PSEN 1.1p-12 PSEN 1.1p-22 PSEN 1.2p-22
• PMUT X1P		PSEN 1.1p-12 PSEN 1.1p-22 PSEN 1.2p-22

PSEN ix1

CAUTION
Please note the following when using evaluation devices with delay-on de-energisation contacts (e.g. PNOZ XV2):

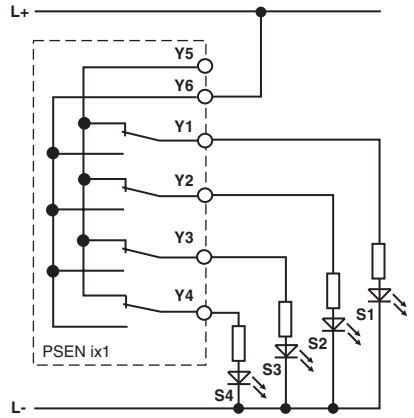
- **Delay time ≤ 30 s:**
  Delay-on de-energisation contacts satisfy the requirements of category 3 in accordance with EN 954-1, 12/96 and the requirements of a PDF with single-fault tolerance (PDF-S).
- **Delay time > 30 s:**
  Delay-on de-energisation contacts satisfy the requirements of category 1 in accordance with EN 954-1, 12/96 and the requirements of a PDF with designed reliability (PDF-D).

Connecting the diagnostic outputs:

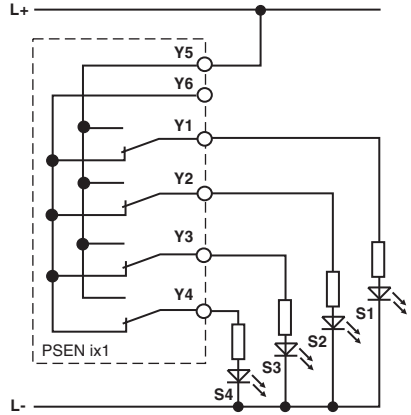
- If required, connect the diagnostic outputs Y1 ... Y4 of the PSEN ix1.

INFORMATION
Connect either Y5 **or** Y6. By connecting Y5 or Y6 you define whether the N/O or N/C contact is to be evaluated.

LED lights when the safety gate is open

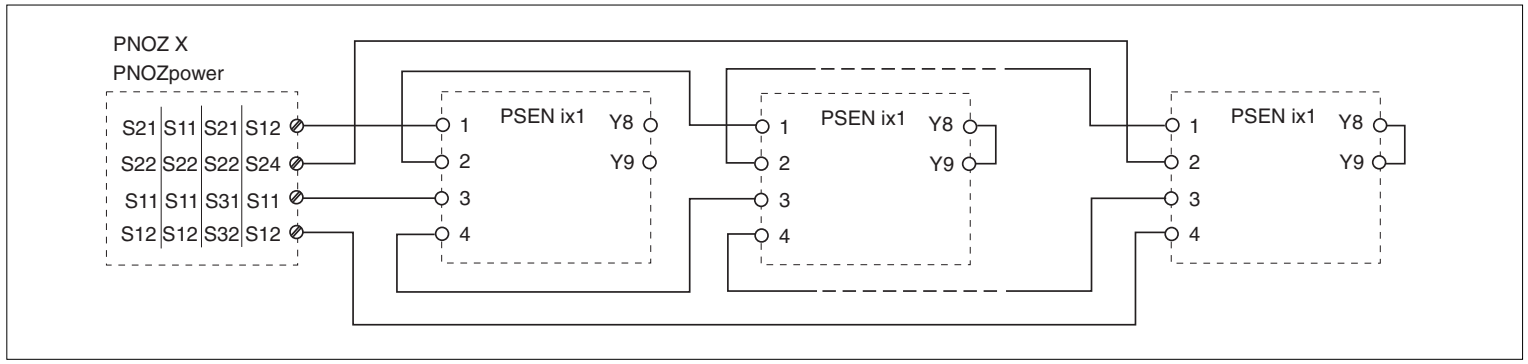


LED lights when the safety gate is closed



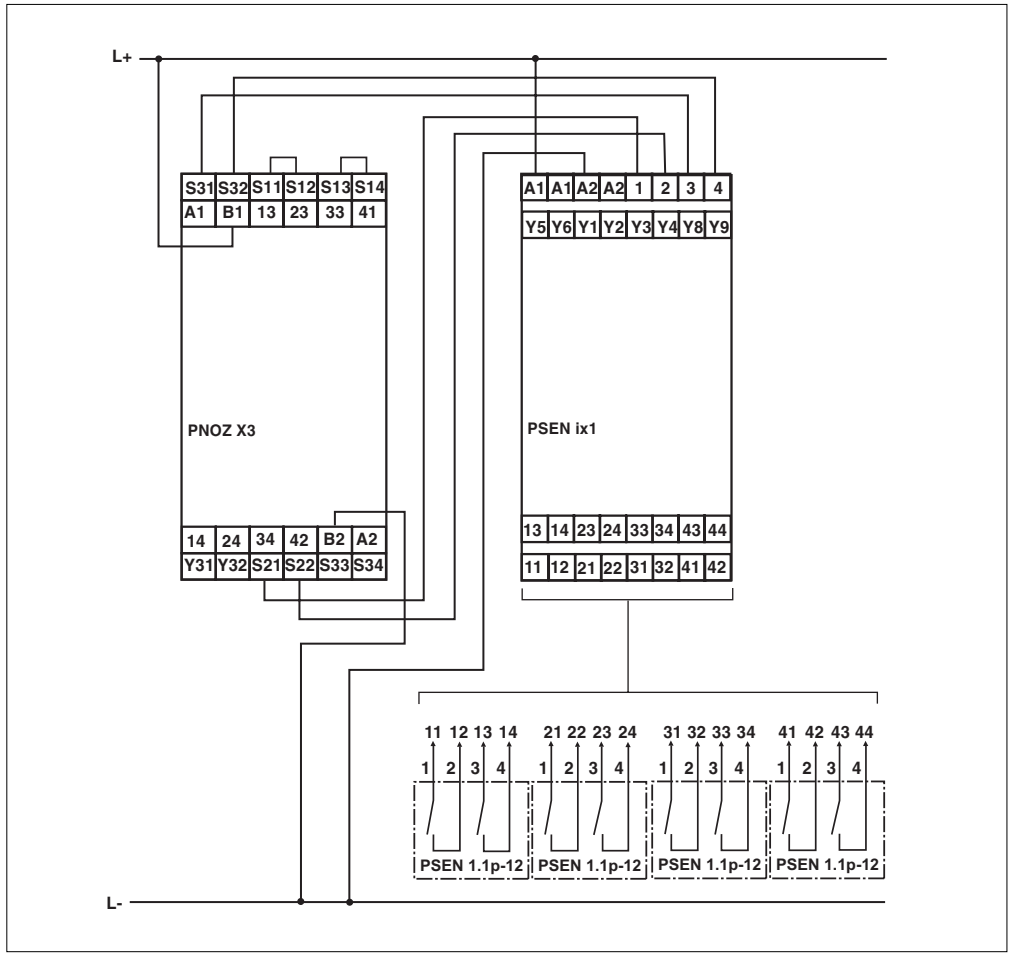
Series connection of PSEN ix1

When connecting more than 4 safety switches: connect PNOZ ix1 in series (see diagram: “Series connection of PSEN”).
After the second PSEN ix1, link Y8-Y9



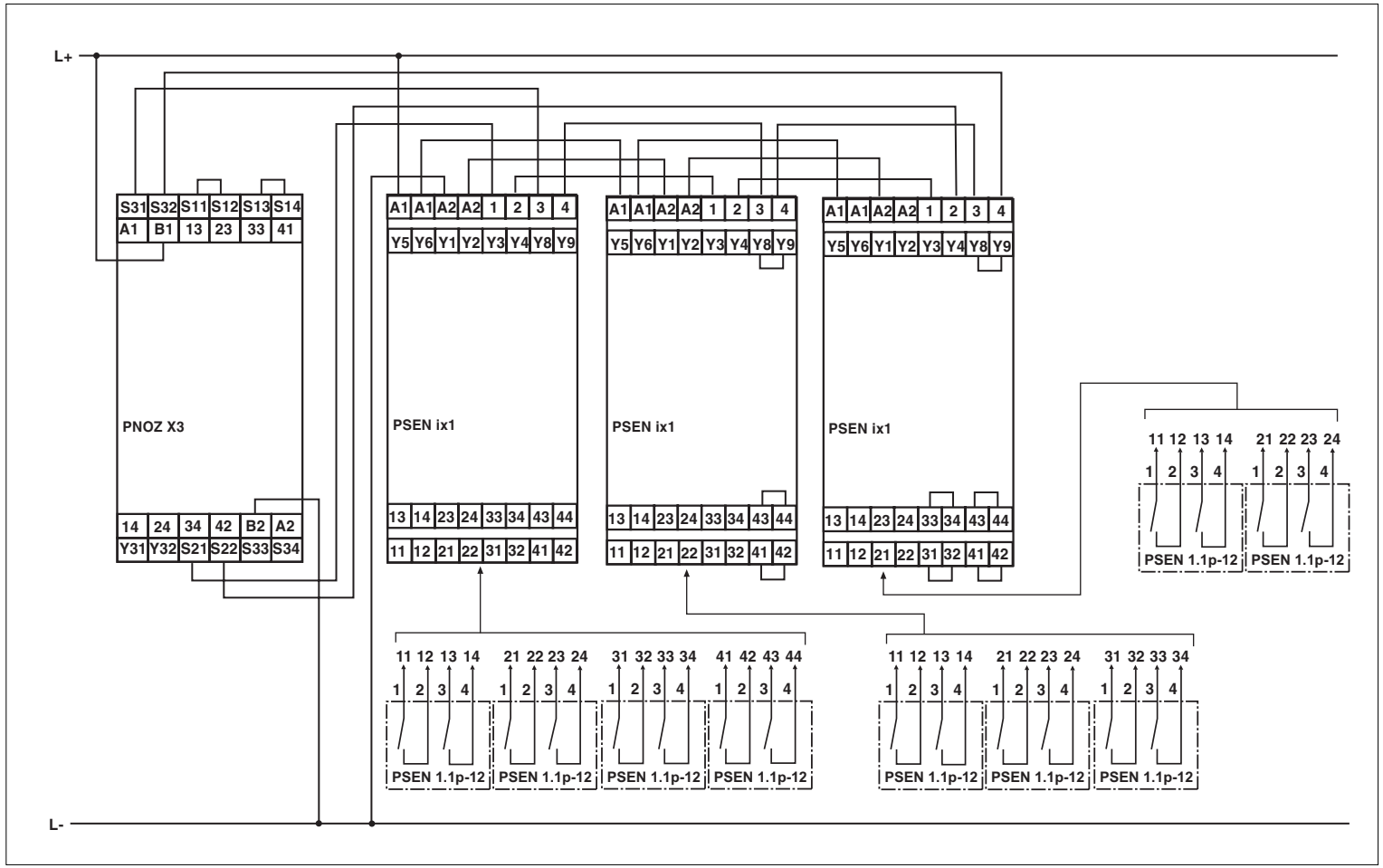
PSEN ix1

Example 1
Evaluation (PNOZ X3) of 4 PSEN 1.1p-12 safety sensors



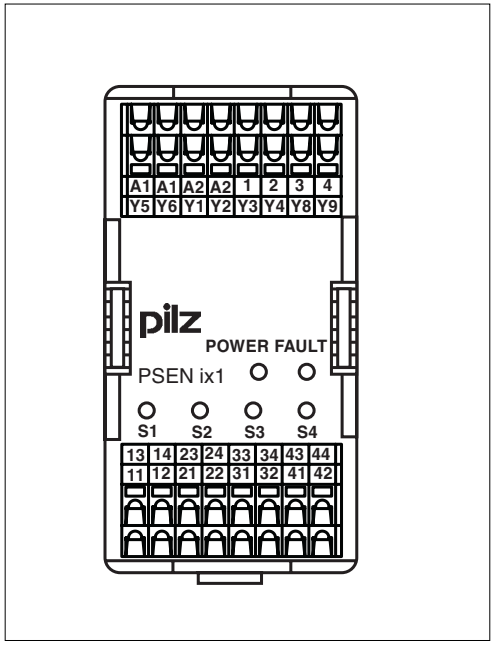
PSEN ix1

Example 2
Evaluation (PNOZ X3) of 9 safety switches via 3 PSEN ix1 units connected in series.
With a series connection, link Y8-Y9 after the second PSEN ix1
Link out the free inputs for N/O contacts.

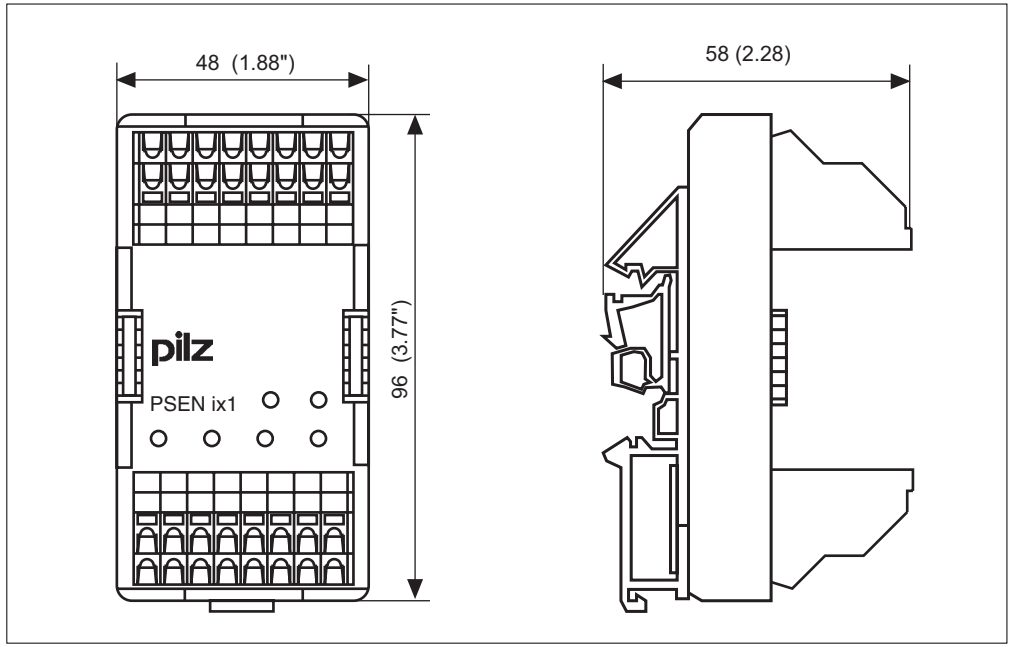


PSEN ix1

Terminal configuration



Dimensions in mm



PSEN ix1

Technical details

Supply voltage U_B	24 VDC
Voltage tolerance	85...110 %
Power consumption at U_B without load	Max 1.5 W
Residual ripple U_B	DC: 20%
Voltage and current at Y1, Y2, Y3, Y4	24V/500 mA
Airgap creepage	DIN VDE 0110-1, 04/97
Climate suitability	DIN IEC 60068-2-3, 12/86
EMC	EN 60947-5-3, 05/99
Vibration in accordance with	EN 60068-2-6, 04/95
Frequency	10...55 Hz
Amplitude	0.35 mm
Ambient temperature	-10 ...+55 °C
Storage temperature	-25 ...+70 °C
Protection type	
Mounting (e.g. control cabinet)	IP54
Housing	IP20
Terminals	IP20
Connection type	Spring-loaded terminals
Cross section of external conductors	
1 core flexible	0.08 ... 2.5 mm^2
2 core with the same cross section	
flexible with crimp connectors, no plastic sleeve	0.08 ... 1 mm^2
flexible without crimp connectors or with TWIN crimp connectors	0.08 ... 1.5 mm^2
Housing material	
Housing	PA 6 UL 94-HB
Base	PA 66 UL 94-V2
Dimensions H x W x D	96 x 48 x 58 mm (3.77" x 1.88" X 2.28")
Weight	100 g

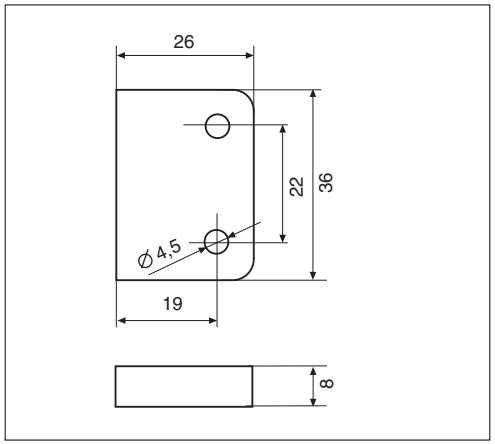
PSEN accessories

Spacer for safety switch

Description:
If a safety switch is to be installed on top of ferromagnetic material, the spacer provides the necessary distance. The spacer has a height of 8 mm.

The spacer is suitable for safety switches with a square design.

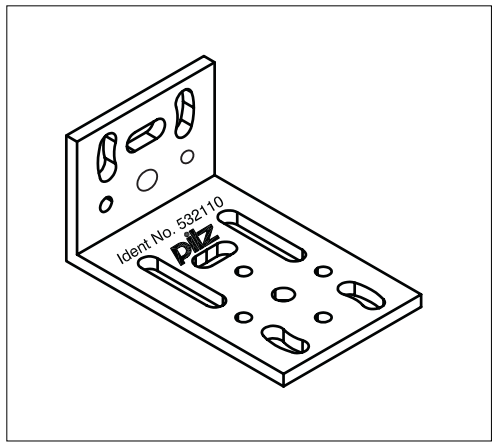
Dimensions in mm



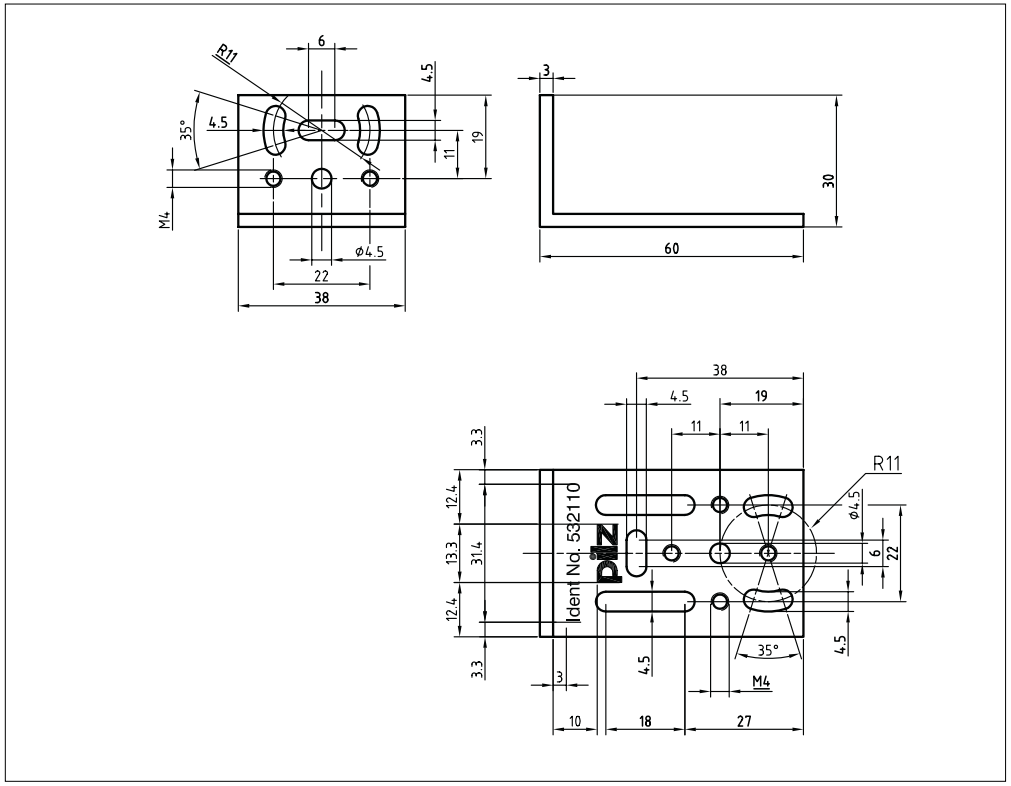
Bracket for safety switch

Description:
The bracket is suitable for installing safety switches at a right-angle. The bracket has slots, ensuring that the mounting position can be varied.

The bracket is suitable for safety switches with a square design.



Dimensions in mm



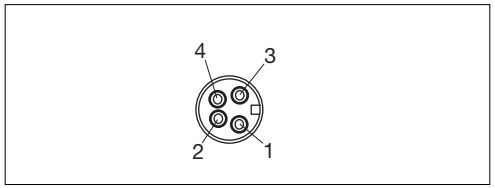
PSEN accessories

Cable for safety switch

Description:
The cable is suitable for connecting safety switches to an evaluation device.

Features:
- Straight or angled connector
- 4 pin M8x1 male connector
- Screw-on, with lock
- Cable runs: 2, 5, 10 m

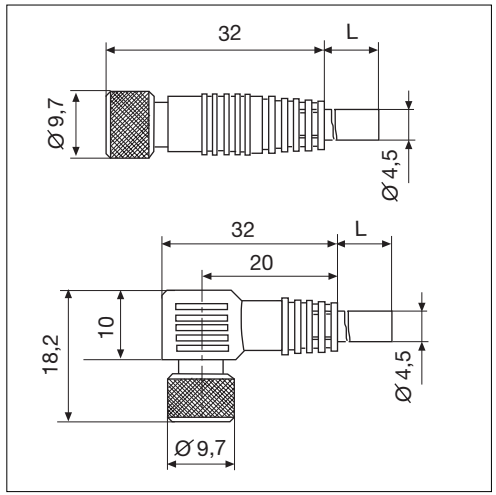
Plug connection



Colour marking on the cable ends

- 1 = brown
- 2 = white
- 3 = blue
- 4 = black

Dimensions in mm



Safety

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).

PSEN 2.1p-10

Safety gate and E-STOP, Category 4, EN 954-1

Features

- 1 E-STOP button
- 2 safety gates
- Dual-channel with detection of shorts across contacts
- 1 PLC enabling signal
- 1 instantaneous load shutdown

Description

Two safety gates are used to protect a hazardous area. The machine's motor will only start if:

- Both safety gates are closed and
- The E-STOP button has not been operated and
- The PLC enabling signal (not safety-related) is present.

If one of these conditions is not met, the signal at outputs A4.o4 and A4.o5 will switch from high to low and the motor will be switched off.

Feedback loop

N/C contacts K3 and K4 on contactors K3 and K4 are connected to the feedback loop input A4.i9.

Reset

E-STOP and safety gate monitoring must be activated through the reset button S11 (monitored reset). If the conditions for starting the motor have been met and the feedback loop is closed, operation of the plant is enabled.

Safety assessment

- The PNOZ m1p and contactors K3 and K4 must be installed in a single location.
- If a switch contact (A4.i0 ... A4.i5) is overridden, this will be detected as an error at the next operation. Safety outputs A4.o4 and A4.o5 will carry a low signal.
- A short circuit between 24 VDC and inputs A4.i0 ... A4.i5 will be detected as an error. All the safety outputs will carry a low signal.
- A short circuit between 24 VDC and the reset circuit input A4.i8 will be detected. The unit cannot be started.
- A short circuit between 24 VDC and a safety output will be detected and all the safety outputs will carry a low signal.

Pilz units

Number	Type	Features	Order number
1	PNOZ m1p	24 VDC	773 100
1	PSEN 2.1p-10/PSEN 2.1-10		502 210

Drawing file:

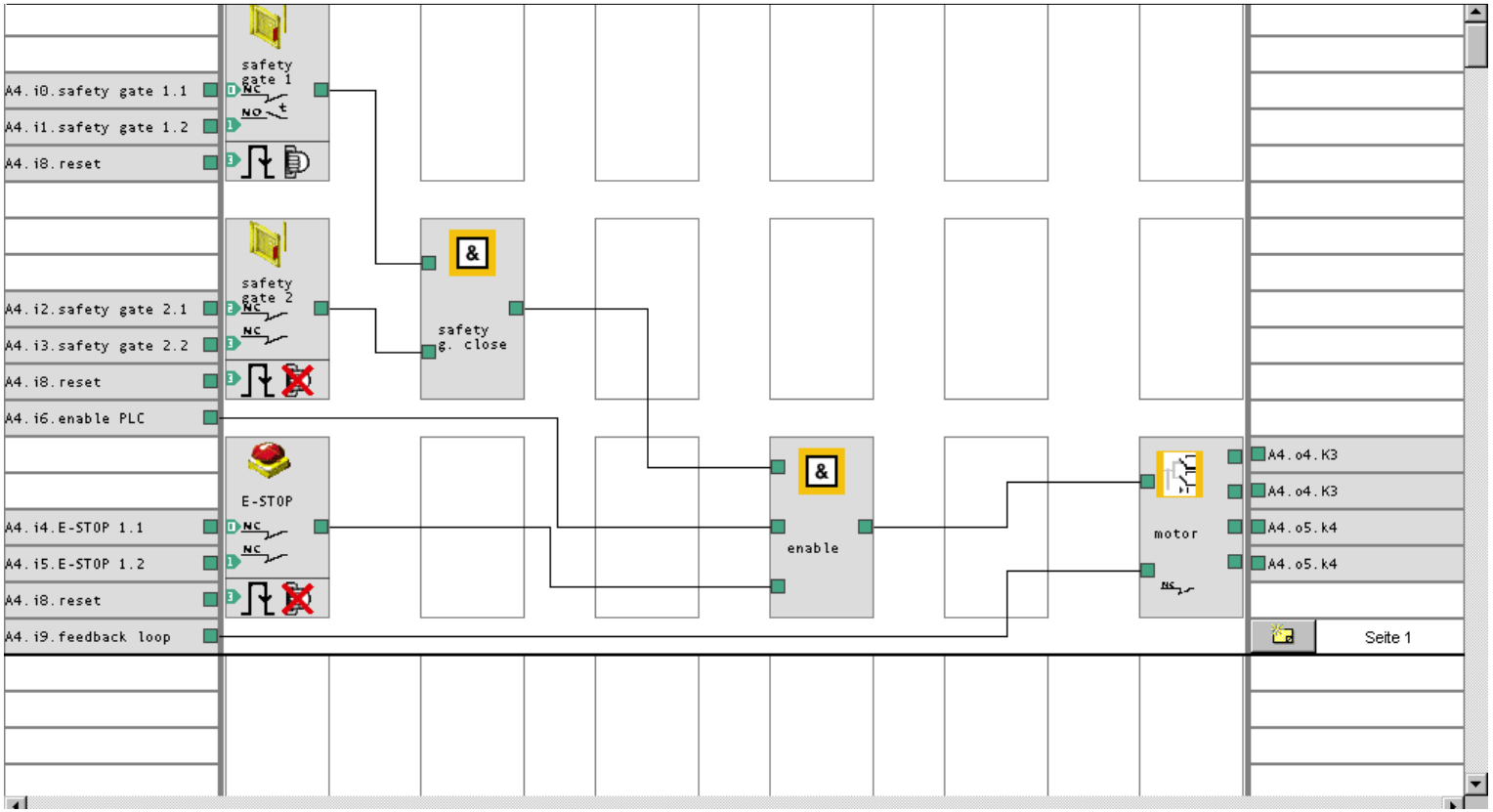
Page 4 and 5 in the project EPLAN4/Pilz/SE32002

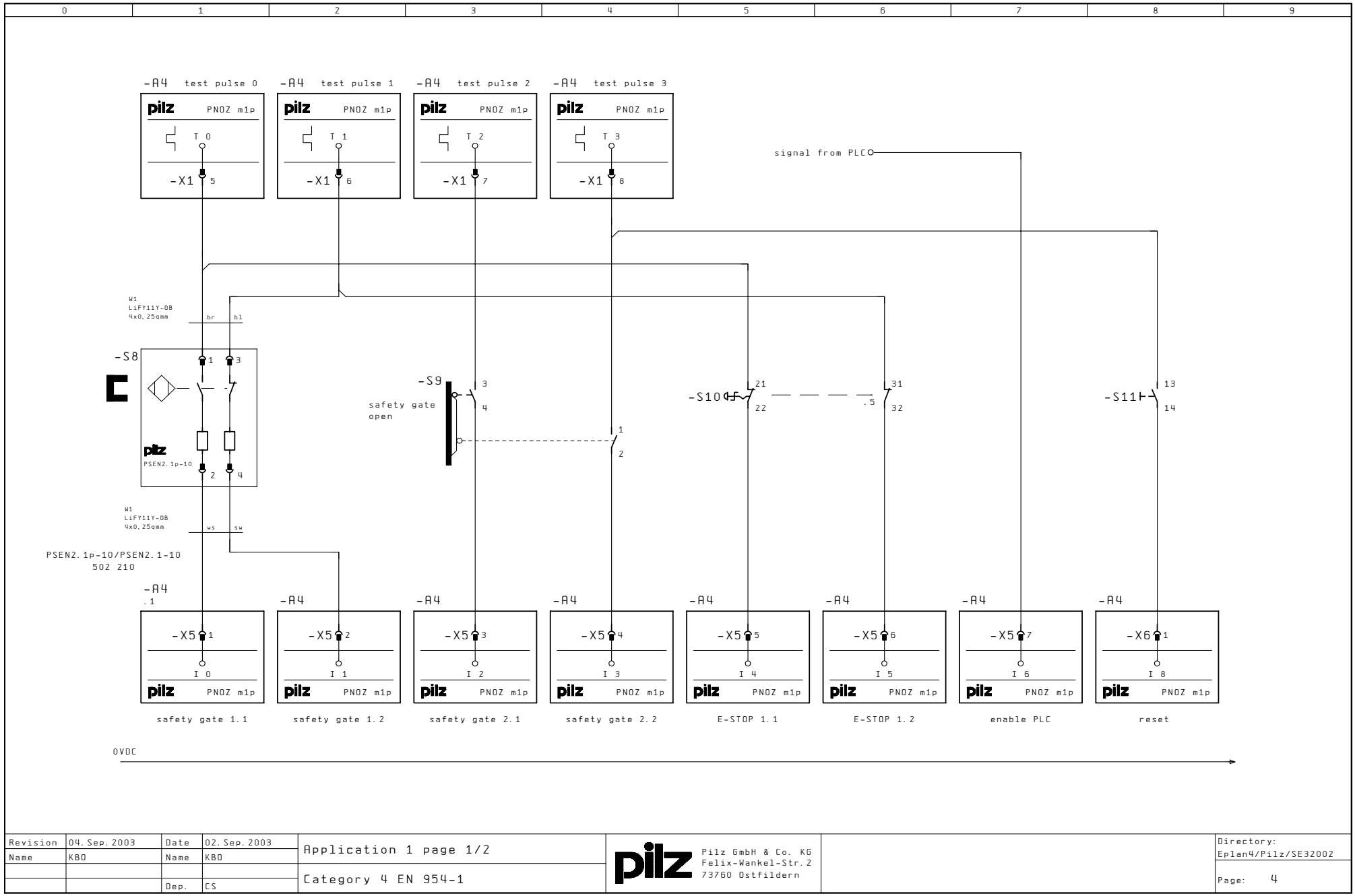
PSEN 2.1p-10

Safety gate and E-STOP, Category 4, EN 954-1

Configuration

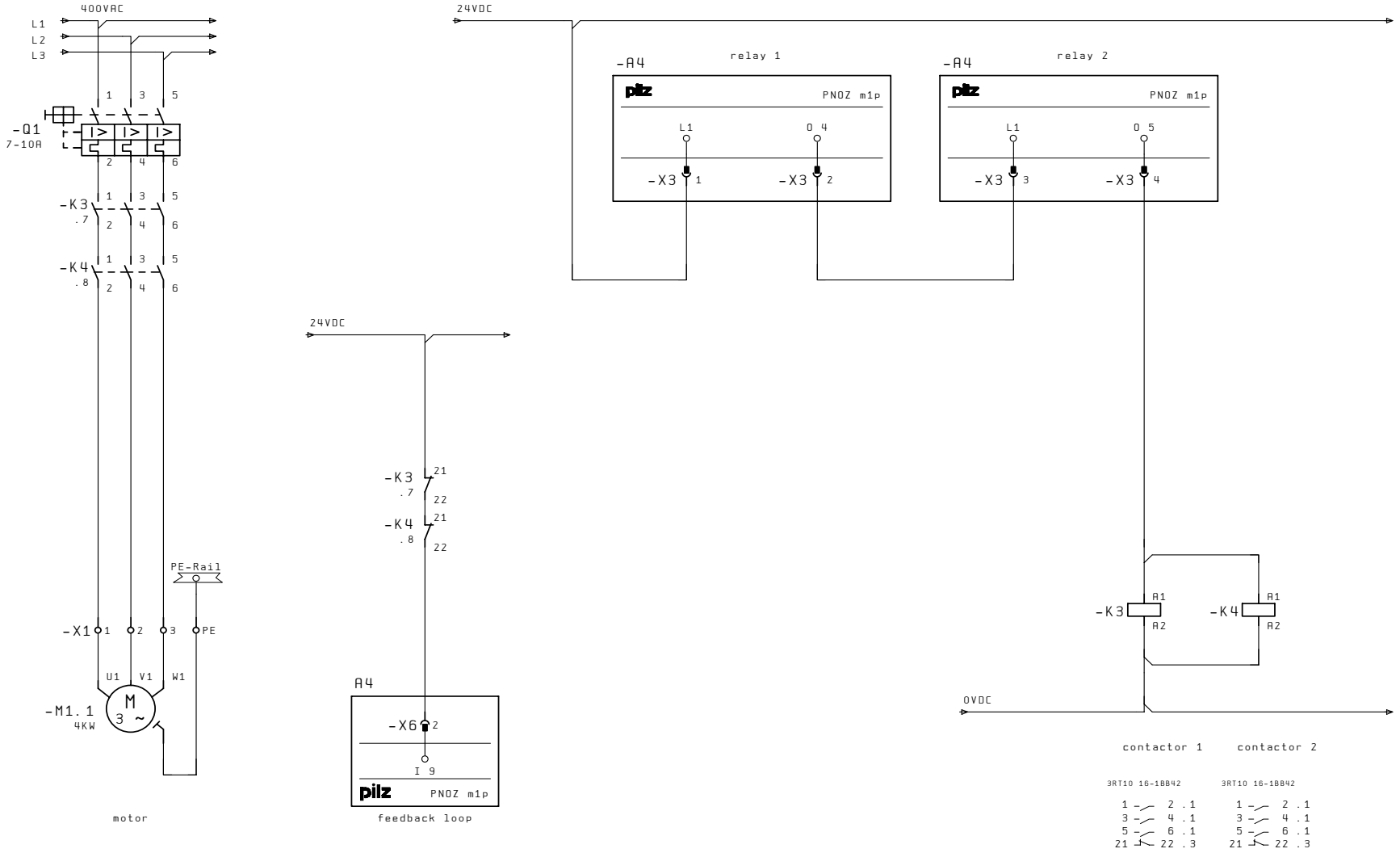
- Safety gate 1
  - Switch type 2 with simultaneity monitoring (N/C - N/O)
  - Detection of shorts between contacts (A4.i0 - test pulse 0, A4.i1 - test pulse 1)
  - Monitored reset (A4.i8 - test pulse 3)
  - Start-up test
- Safety gate 2
  - Switch type 3 (2 N/C)
  - Detection of shorts between contacts (A4.i2 - test pulse 2, A4.i3 - test pulse 3)
  - Monitored reset (A4.i8 - test pulse 3)
- E-STOP
  - Switch type 3 (2 N/C)
  - Detection of shorts between contacts (A4.i4 - test pulse 0, A4.i5 - test pulse 1)
  - Monitored reset (A4.i8 - test pulse 3)
- AND element
  - 2 inputs
- AND element
  - 3 inputs
- Outputs
  - Safety output, relay type
  - Redundant
  - Use feedback loop





Revision	04. Sep. 2003	Date	02. Sep. 2003	Application 1 page 1/2	Directory: Eplan4/Pilz/SE32002
Name	KBO	Name	KBO	Category 4 EN 954-1	Page: 4
		Dep.	CS		

Pilz GmbH & Co. KG
Felix-Wankel-Str. 2
73760 Ostfildern



Revision	03. Sep. 2003	Date	02. Sep. 2003	Application 1 page 2/2	pilz Pilz GmbH & Co. KG Felix-Wankel-Str. 2 73760 Ostfildern		Directory: Eplan4/Pilz/SE32002
Name	KBO	Name	KBO				
				Category 4 EN 954-1			Page: 5
		Dep.	CS				

PSEN 2.1p-10

Override safety gate with enable switch, Category 4, EN 954-1

Features

- 1 E-STOP button
- 1 safety gate with PSEN 2.1p-10 safety sensor
- 1 enable switch
- 1 operating mode selector switch
- Dual-channel with detection of shorts across contacts
- 1 instantaneous load shutdown

Description

A safety gate is used to protect a hazardous area. The motor of the machine in the hazardous area will only be switched on if:

- The E-STOP button has not been operated
  and
- The operating mode selector switch is in position “0” and the safety gate is closed
  or
  the operating mode selector switch is in position “1” and the enable switch is operated.

If one of these conditions is not met, the signal at outputs A5.o4 and A5.o5 will switch from high to low and the motor will be switched off. Outputs A5.o0 and A5.o1 indicate the status of the operating mode selector switch. There will be a high signal at output A5.o0 if the operating mode selector switch is in position “0”; there will be a high signal at output A5.o1 if the operating mode selector switch is in position “1”.

Feedback loop

N/C contacts K5 and K6 on contactors K5 and K6 are connected to the feedback loop input A5.i9.

Reset

Safety gate monitoring starts as the gates close. If the conditions for starting the motor have been met and the feedback loop is closed, the unit is ready to start.
Plant operation is not enabled until the reset button S15 has been operated and then released (monitored reset).

Safety assessment

- The drive may not be started via the enable switch. This should be prevented via the reset module with reset button S15.
- The two-hand control elements and the enable switch must be installed in such a way that only one of the two elements can be connected.
- The PNOZ m1p and contactors K5 and K6 must be installed in a single location.
- If a switch contact (A5.i0 ... A5.i5) is overridden, this will be detected as an error at the next operation. The safety outputs will carry a low signal.
- A short circuit between 24 VDC and inputs A5.i0 ... A5.i5 will be detected as an error. The safety outputs will carry a low signal.
- A short circuit between 24 VDC and the reset input A5.i8 will be detected. The unit cannot be started.
- A short circuit between 24 VDC and a safety output will be detected and the safety outputs will carry a low signal.

Pilz units

Number	Type	Features	Order number
1	PNOZ m1p	24 VDC	773 100
1	PSEN 2.1p-10/PSEN 2.1-10		502 210

Drawing file:

Page 6 ... 8 in the project EPLAN4/Pilz/SE32002

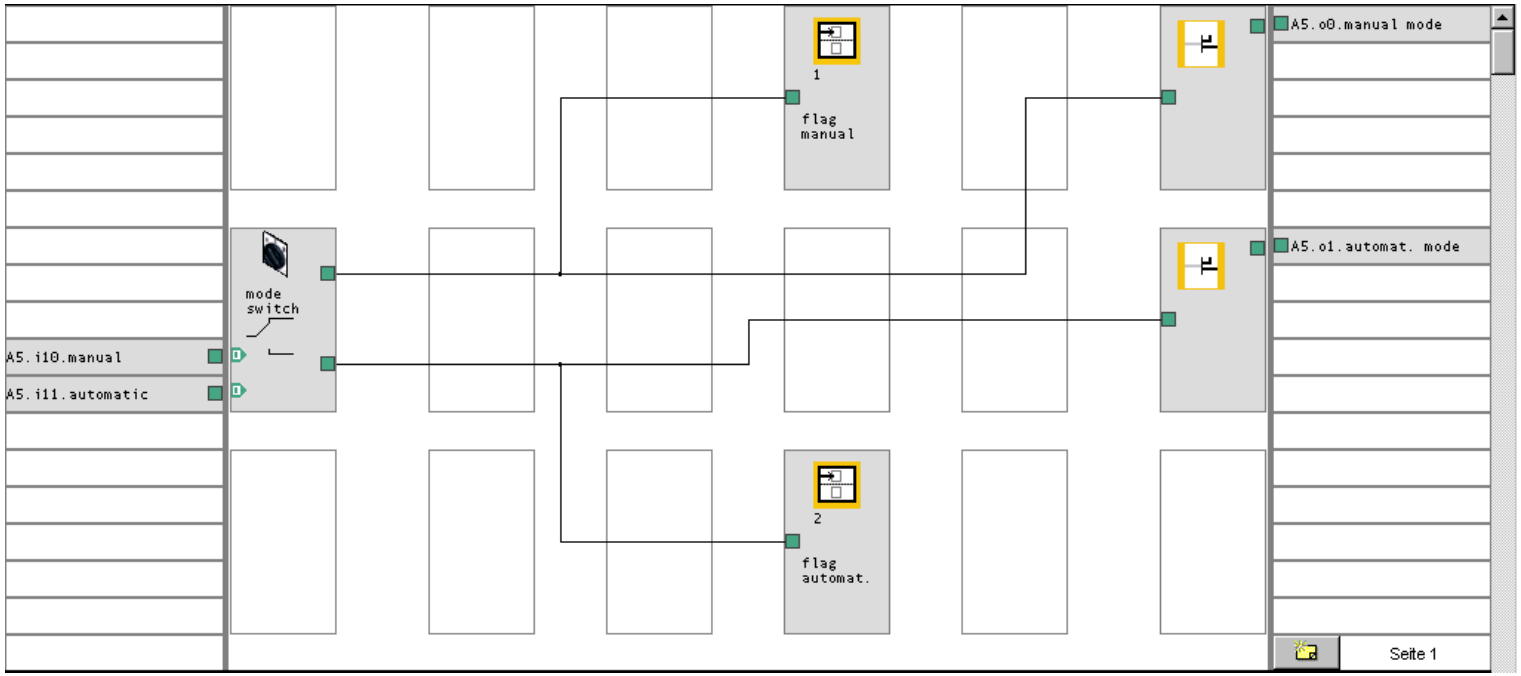
PSEN 2.1p-10

Override safety gate with enable switch, Category 4, EN 954-1

Configuration, page 1

- Operating mode selector switch
  - Select switch type 9
  - Detection of shorts between contacts (A5.i10 - test pulse 0, A5.i11 - test pulse 0)
- 2 connection point elements
  - Source connection point 1 and source connection point 2
- Manual mode output
  - Safety output, semiconductor type
  - Single-pole
- Automatic mode output
  - Safety output, semiconductor type
  - Single-pole

Continued overleaf

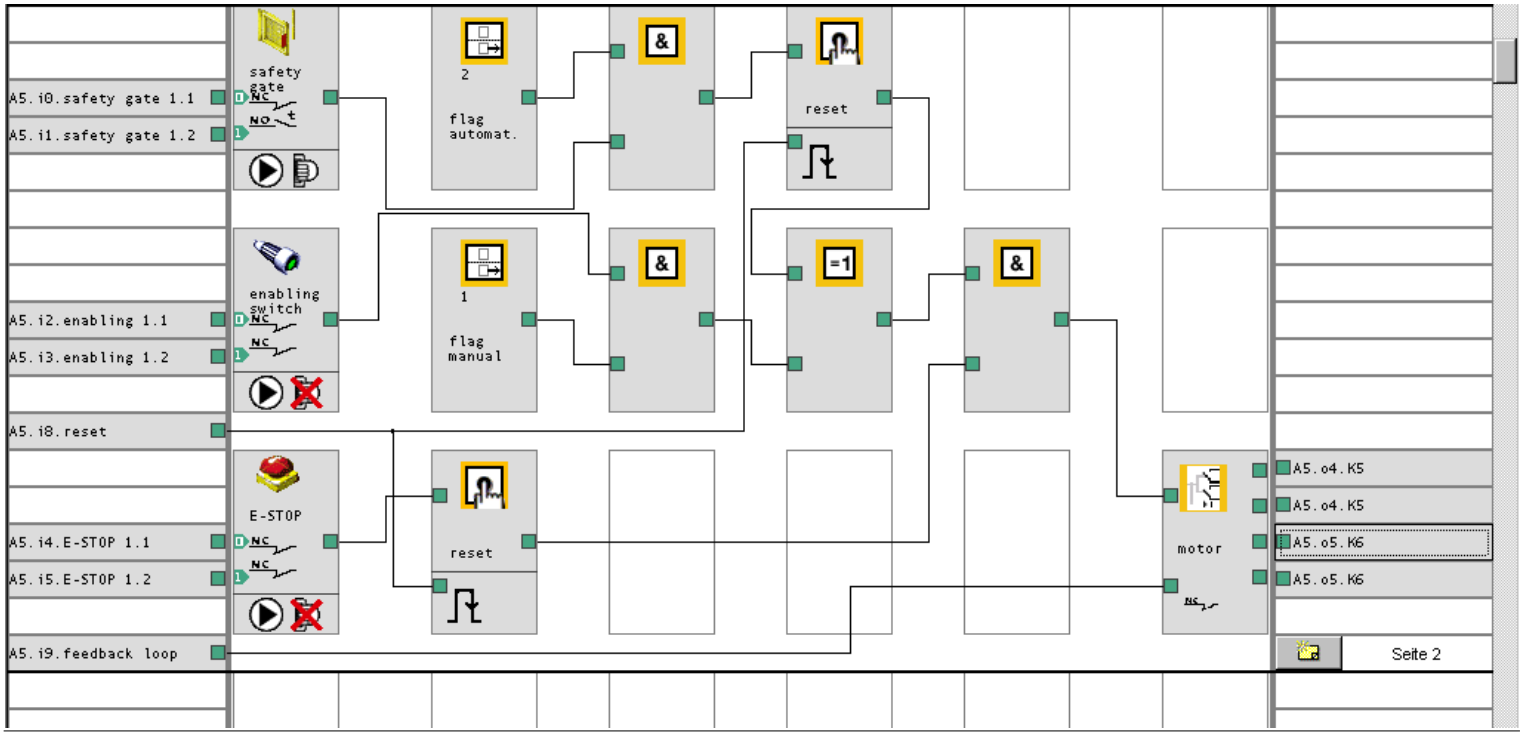


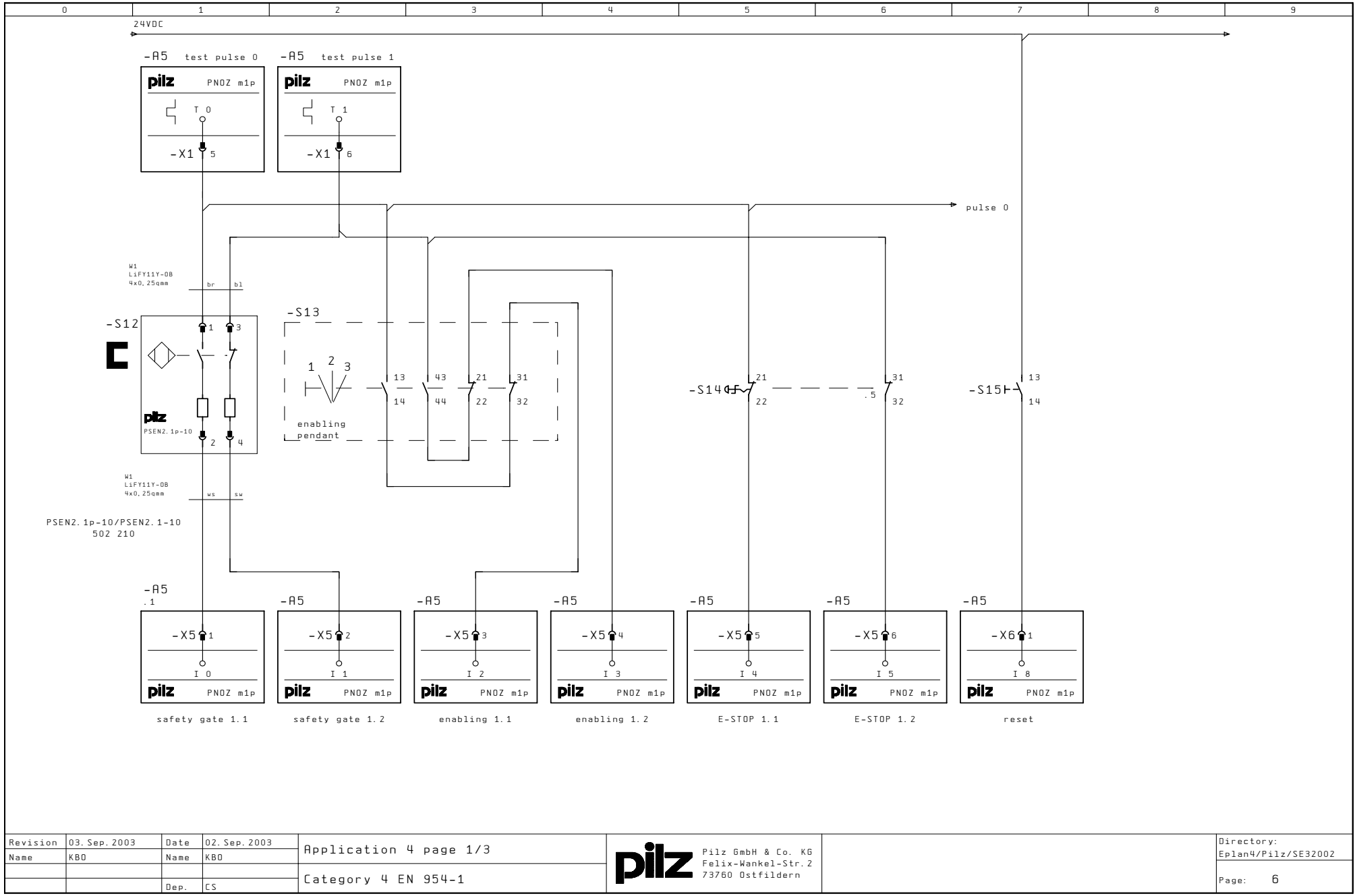
PSEN 2-1p-10

Override safety gate with enable switch, Category 4, EN 954-1

Configuration, page 2

- Safety gate 1
  - Switch type 2 with simultaneity monitoring (N/C - N/O)
  - Detection of shorts between contacts (A5.i0 - test pulse 0, A5.i1 - test pulse 1)
  - Automatic reset
  - Start-up test
- Enable switch
  - Switch type 3 (2 N/C)
  - Detection of shorts between contacts (A5.i2 - test pulse 0, A5.i3 - test pulse 1)
  - Automatic reset
- E-STOP
  - Switch type 3 (2 N/C)
  - Detection of shorts between contacts (A5.i4 - test pulse 0, A5.i5 - test pulse 1)
  - Automatic reset
- 2 connection point elements
  - Destination connection point 1 and destination connection point 2
- Exclusive OR element
  - 2 inputs
- 3 AND elements
  - 2 inputs
- Reset element
  - 2 inputs
  - Monitored reset
- Motor output
  - Safety output, relay type
  - Redundant
  - Use feedback loop





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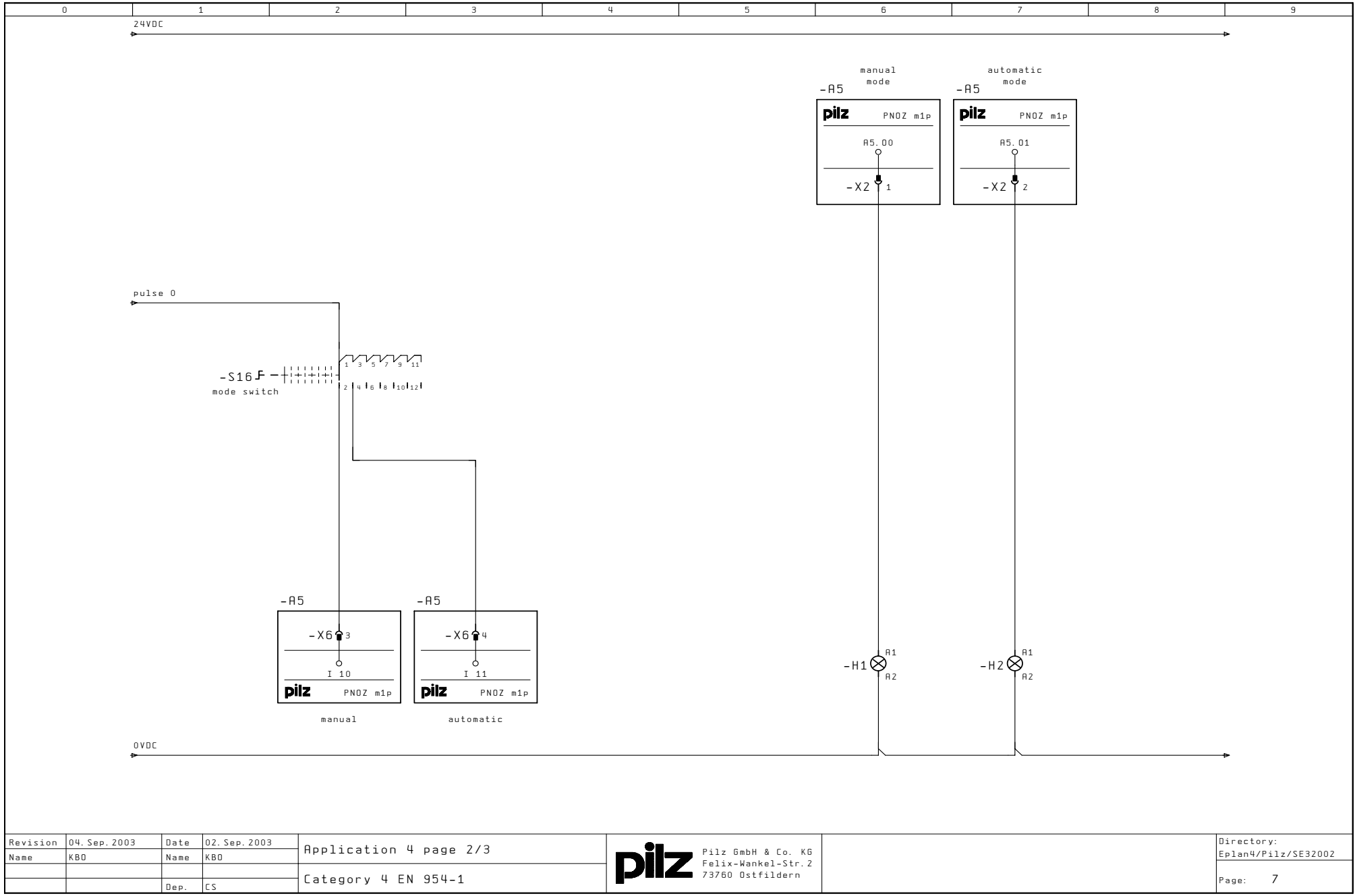

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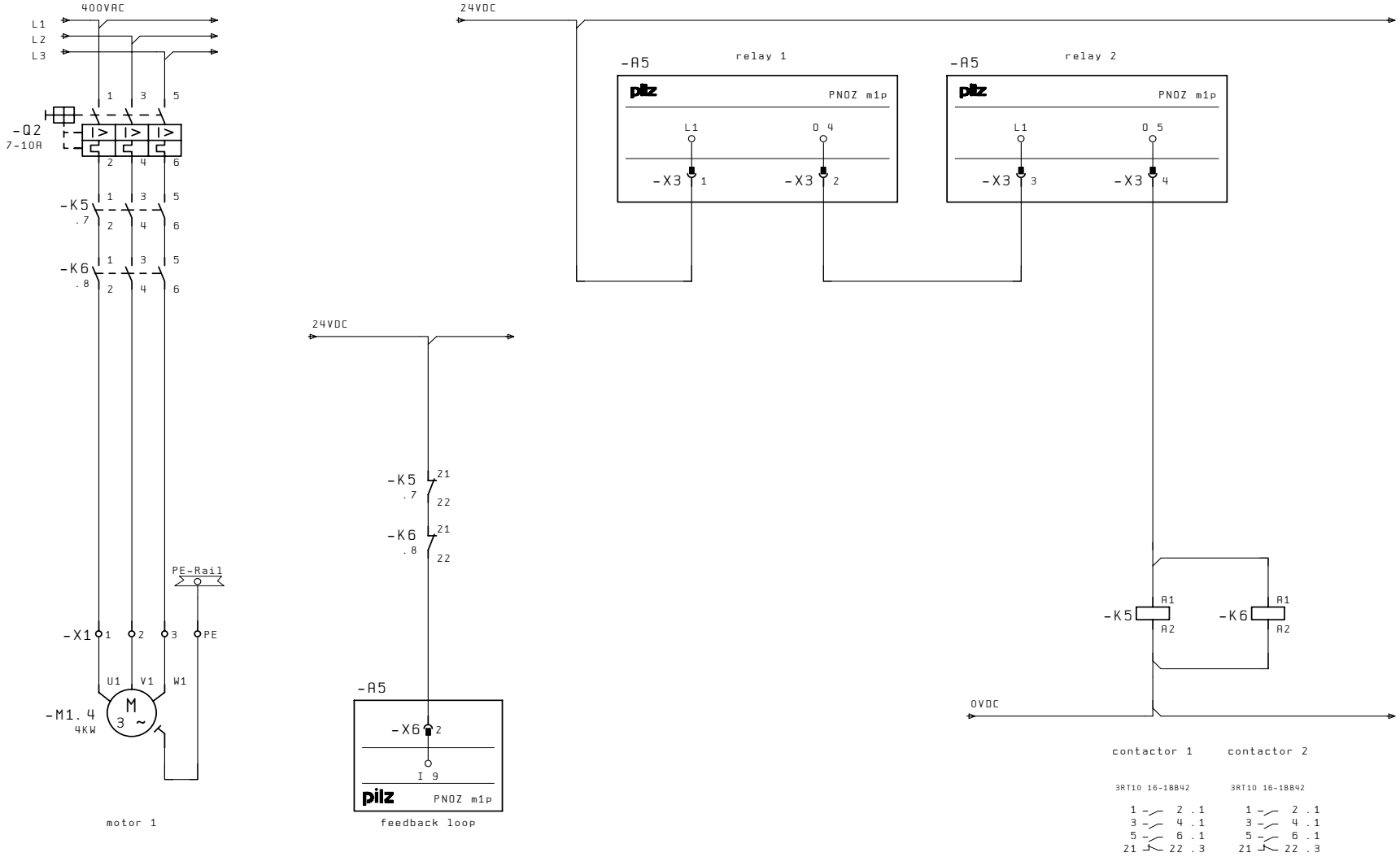

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PSEN 2.1p-10

Machine hoods with 3 x 2 safety switches, Category 3, EN 954-1

Features

- 3 interlinked safety gates with detection of shorts across contacts
- 1 instantaneous load shutdown

Description

Monitoring function
3 machine hoods are fitted on a machine for service reasons. The machine is shut down as soon as one of the 3 machine hoods is opened.
Each machine hood has 2 safety switches. The PSEN i1 interface switches the N/C contacts on the sensors in parallel and the N/O contacts in series. The PNOZ e3.1p switches the machine on or off, depending on the status of the safety switches.
If all the machine hoods are closed, safety outputs 14 and 24 will carry a high signal. If a machine hood is opened, the output signals will switch from high to low and contactors K1 and K2 will de-energise.
The unit is to use both contactors K1 and K2 at safety outputs 14 and 24 to switch a single load.

Feedback loop
The unit has a separate feedback loop. The N/C contacts on the contactors are connected to the feedback loop input Y6. When the unit is started, a test is carried out to check whether both N/C contacts are closed, i.e. whether the contactors have de-energised. If one of the contacts is open, the safety outputs will retain the low signal. The unit will not be ready for operation again until the feedback loop is closed and the input circuits have been opened and then closed again.
If the signal at the safety outputs switches from high to low, the N/C contacts must close within a max. of 150 ms. If one contactor fails to de-energise, the corresponding N/C contact will remain open; an error is detected and is displayed as a flashing pulse (1, 8). It will not be possible to switch the unit back on until the error has been rectified and the supply voltage has been switched off and then on again.

Reset
If all the machine hoods are closed and the feedback loop is closed, the unit can be started by pressing the reset button S7 (monitored reset).

PSEN 2.1p-10

Machine hoods with 3 x 2 safety switches, Category 3, EN 954-1

Safety assessment

- The PNOZe3.1p and contactors K1 and K2 do **not** have to be installed in a single location.
- Errors within the safety gate series connection may remain undetected when
  - the safety gates are opened simultaneously.
  - the sequence in which the safety gates open is unfavourable.

NOTICE
In order to detect every fault, only one safety gate may be opened at a time or each safety gate must be tested individually.

- If a switch contact in the input circuit is overridden, this will be detected as an error the next time the PNOZelog is operated. Safety outputs 14 and 24 will carry a low signal. The error is reset by operating another switch contact; after a restart the safety outputs will again carry a high signal.
- A short circuit between 24 VDC and the input circuits (S12, S24) will be detected as an error after the next operation of the affected input circuits, depending on the location of the error. Safety outputs 14 and 24 will carry a low signal.
- A short circuit between 24 VDC and a safety output will be detected and the safety outputs will carry a low signal. The load will be switched off via the second safety output.

Pilz units

Number	Type	Features	Order number
1	PNOZ e3.1p	24 VDC	774 139
6	PSEN 2.1p-10/PSEN 2.1p-11		502 210
2	PSEN i1		535 110

Drawing file:

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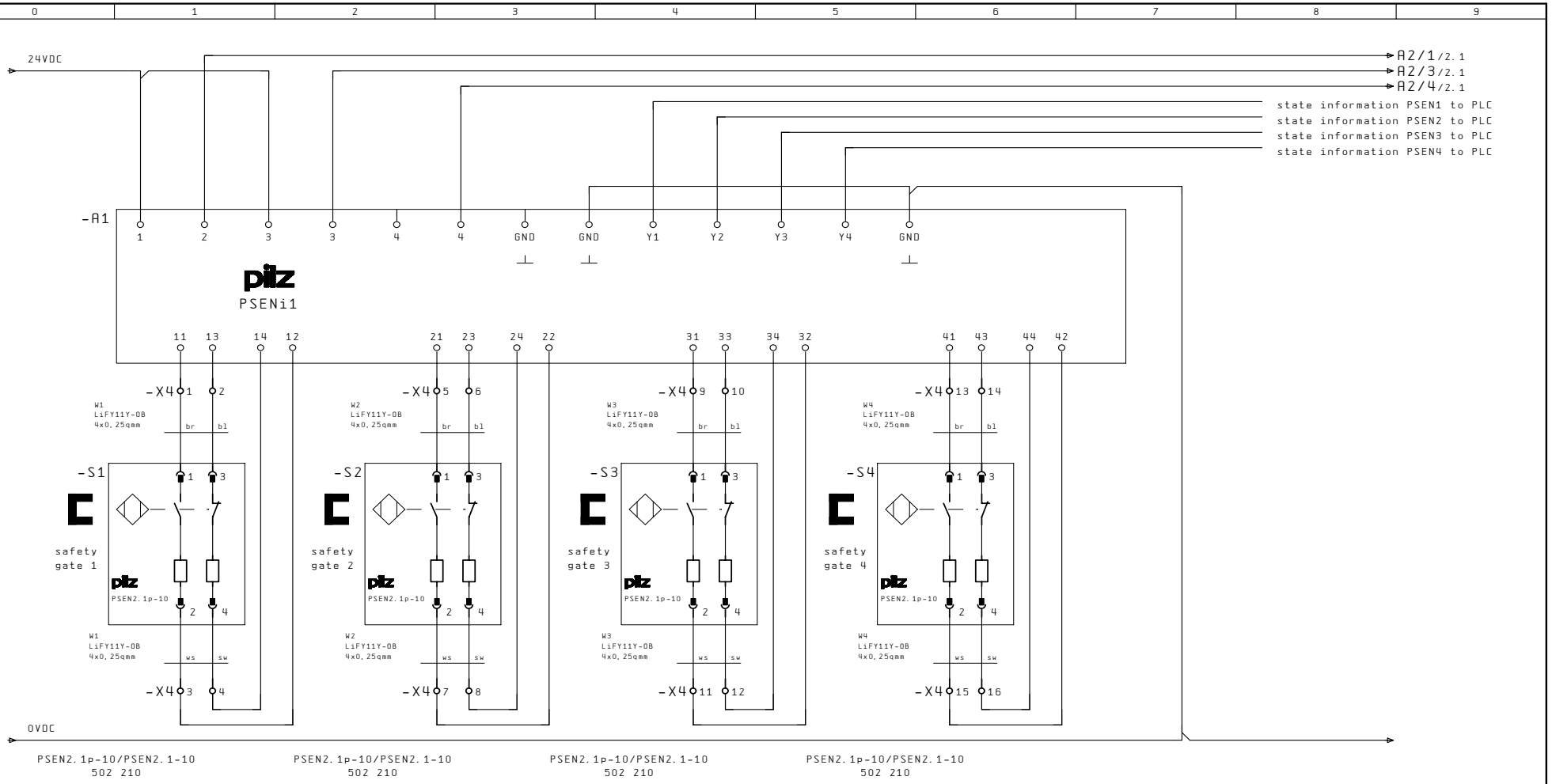

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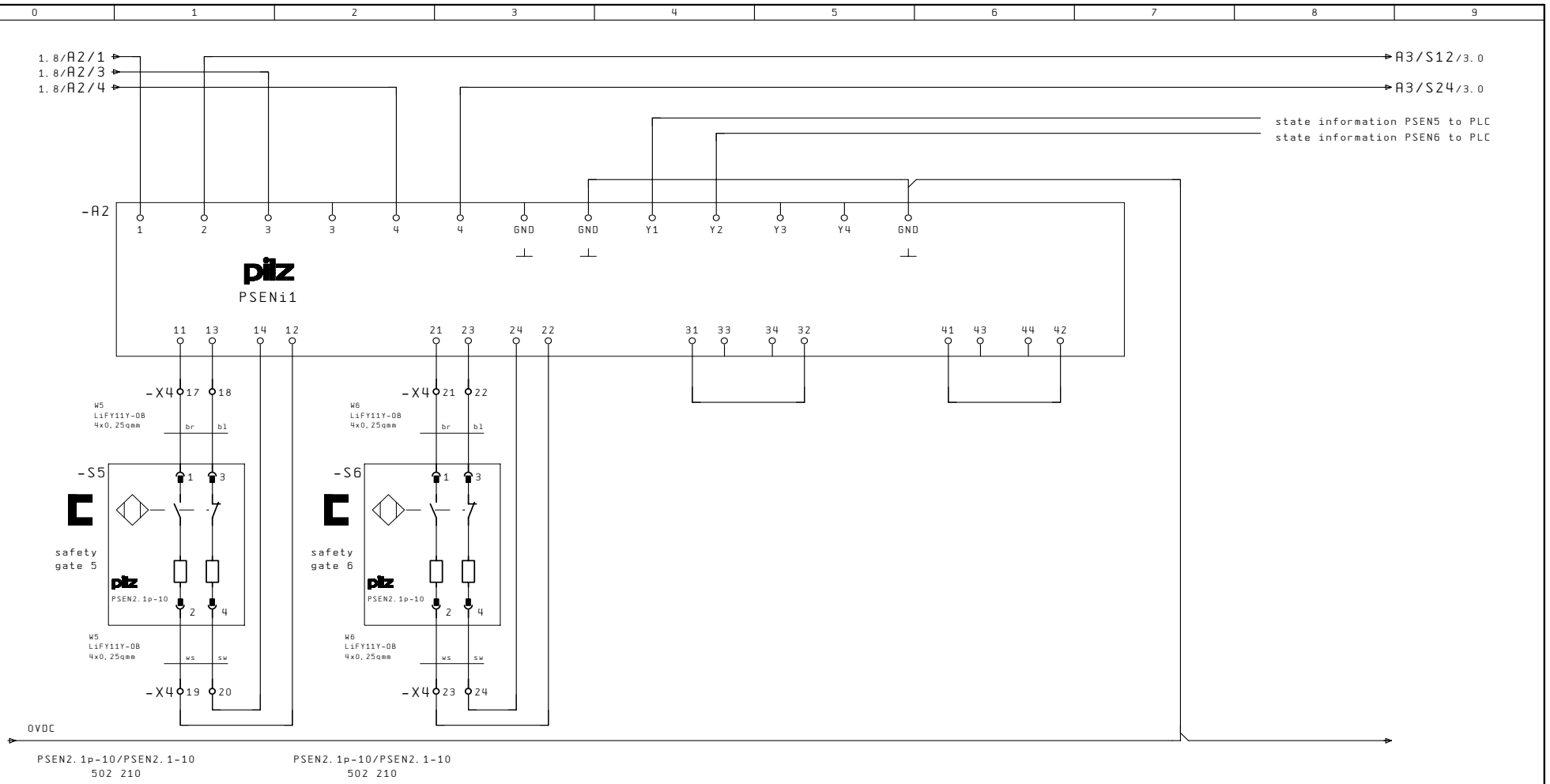

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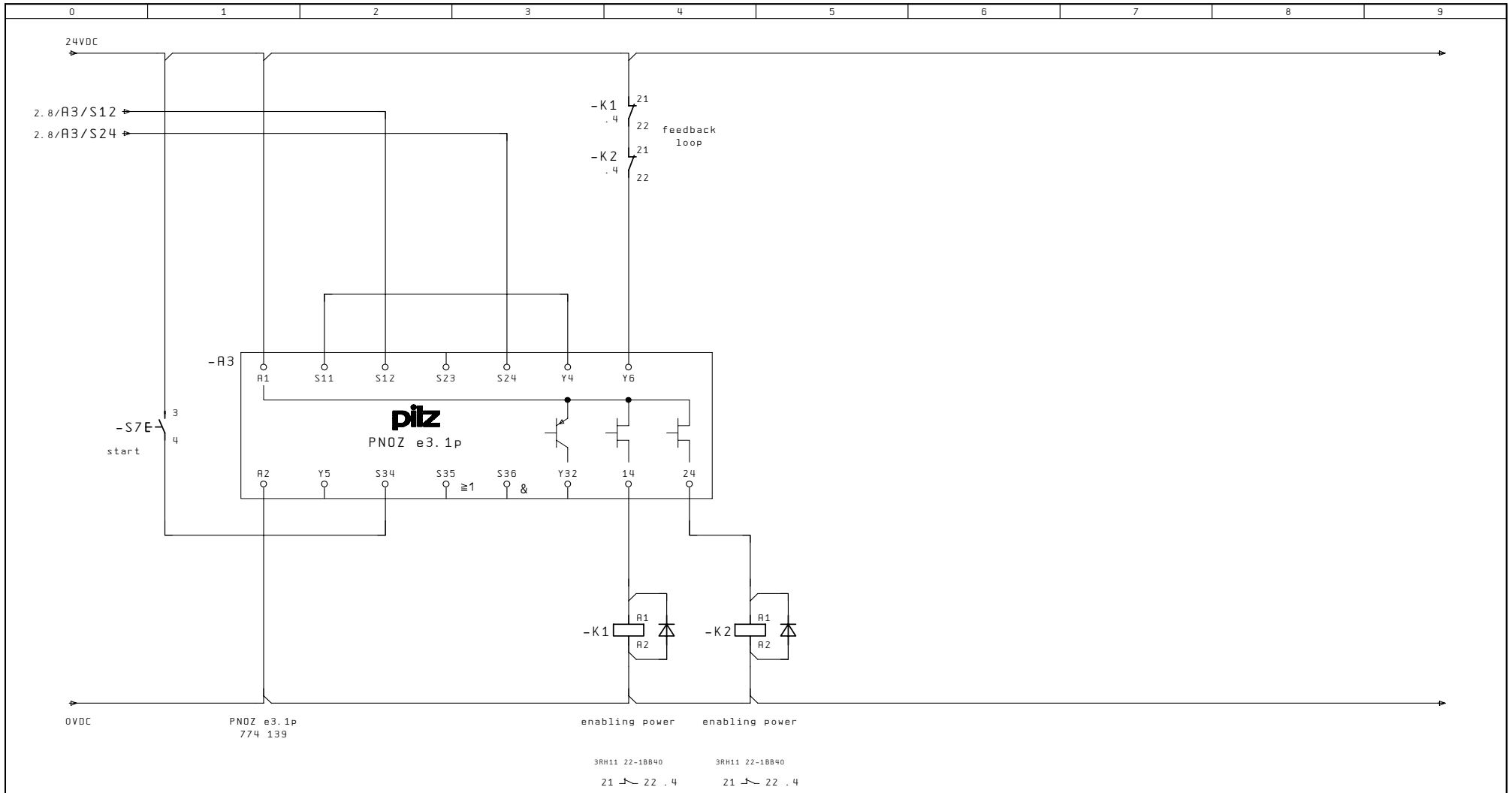

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PSEN product range

Chemical resistance, housing material of the PSEN safety switches

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.

Resistance level index:
A = resistant
B = resistant under certain conditions
C = non-resistant
D = soluble

Resistance to	Resistance level
Acetaldehyde (ethanal)	A
Acetic anhydride	A
Acetic ester	B
Acetic ether	B
Acetone	B
Allyl alcohol (2 propene 1-cl)	A
Aluminium hydroxide	A
Aluminium nitrate	A
Aminobenzene (aniline)	A
Ammonia 30%	A
Ammonia (aqueous) (liquid ammonia)	A
Ammonium bicarbonate (sal volatile)	A
Ammonium chloride (salmiac)	A
Ammonium hydroxide (aqueous ammonia)	A
Ammonium nitrate (fertiliser)	A
Ammonium phosphate (fertiliser)	B
Amyl alcohol (pentanol, pentyl alcohol)	A
Anethole	A
Aniline (aminobenzene)	A
Argon	A
Barium chloride	A
Barium sulphate (baryte)	A
Barium sulphide	A
Benzaldehyde (bitter almond oil)	A
Benzine, lead-free	A
Benzine, super	A
Benzoic acid	A
Benzoyl	A
Benzyl alcohol (phenylcarbinol)	A

Resistance to	Resistance level
Benzyl chloride (d-chlorotoluene)	A
Blue vitriol (copper sulphate)	A
Borax	A
Boric acid	A
Brake fluid (DIN 53521)	A
Butane, liquid	A
Butanol (butyl alcohol)	B
Butanone-2	A
Butyl acetate	A
Butyl alcohol (butanol)	B
Butyl glycol	A
Butyl glycol ether	A
Calcium carbonate (chalk)	A
Calcium chloride, aqueous	A
Calcium hydroxide	B
Calcium hypochlorite (bleaching powder)	A
Calcium sulphate (gypsum)	A
Carbolic acid (phenol)	C
Carbonic acid (carbon dioxide)	A
Carbon tetrachloride (tetrachloromethane)	A
Castor oil	A
Caustic potash (potassium hydroxide)	B
Caustic soda (sodium hydroxide)	B
Cellulose acetate	A
Cetylic alcohol (1 hexadecanol)	A
Chlorobenzoyl	A
Chloroform (trichloromethane)	B
Chlorothene (trichloroethene)	A
Chromic acid 50 %	A

Resistance to	Resistance level
Chromic acid anhydride (chromium trioxide)	A
Citric acid	A
Copper nitrate, aqueous	A
Crude oil	A
Cyclohexanol (hexalin)	A
Dextrin	A
Diacetone alcohol (Pyranton, Dial, DA)	A
Dibutyl ether (butyl ether)	A
Dibutylphthalate	A
Dibutylsebacate	A
Dichloroethane	C
Dichloroethylene	B
Dichloromethane (methylene chloride)	D
Diethyl ether (ether)	A
Dimethylbenzoyl (xylol)	A
Dimethyl ether	A
Dimethyl formamide DMF	B
Dioxan	A
Ethanol (acetaldehyde)	A
Ethanol (ethyl alcohol, spirit)	A
Ether (diethyl)	A
Ethyl acetate (acetic ether, acetic ester)	B
Ethyl alcohol (ethanol, spirit)	A
Ethyl chloride (chloroethane)	A
Ethylene chloride (1.2 dichlorethane)	C
Ethylene glycol (cellosolve)	A
Ethylene glycol (glycol, 1.2 ethanediol)	A
Ethyl ether (ether, diethyl)	A

PSEN product range

Resistance to	Resistance level
Fat, mineral	A
Fat (salad oil)	A
Fatty acids above C_6	A
Fluosilicic acid (hydrofluosilicic acid)	B
Formaldehyde (formalin) (methanal)	A
Formamide	A
Formic acid	A
Freon 11 (fluorotrichloromethane)	A
Freon 12 (dichlorodifluoromethane)	A
Freon 22 (chlorodifluoromethane)	A
Freon 113 (trichlorofluoroethane)	A
Furfuryl alcohol (furfuryl aldehyde, furfural)	A
Gasoline	A
Glucose (grape sugar)	A
Glycerin /glycerol	A
Glycol (ethylene glycol)	A
Heptane	A
Hexahydrobenzene (cyclohexane)	A
Hexalin (cyclohexanol)	A
Hexane	A
Hydrochloric acid	A
Hydrochloric acid 10 %	A
Hydrochloric acid, concentrated	A
Hydrofluoric acid	B
Hydrogen peroxide	A
Hydrogen sulphide	C

Resistance to	Resistance level
Isopropanol (persprit)	A
Javel water (12.5% Cl2)	A
Javel water (sodium hypochloride)	A
Kerosene	A
Lanolin (wool fat)	A
Laughing gas (nitric oxide)	A
Lighting gas	A
Linseed oil	A
Magnesium carbonate	A
Magnesium nitrate	A
Magnesium sulphate (Epsom salts)	A
Menthol	A
Mercury	A
Methanal (formaldehyde)	A
Methane alcohol	A
Methane (pit gas, natural gas)	A
Methanol (methane alcohol, wood spirit)	A
Methyl acetate	A
Methylbenzoyl (toluene)	A
Methylcellosolve (methyl glycol)	A
Methylchloride	D
Methylchloroform (trichloroethene, chlorothene)	A
Methylene chloride (dichloromethane)	D
Methyl ethyl ketone	A
Methyl glycol (methyl cellosolve)	A
Mineral oils	A
Monochloracetic acid (chlorobenzoyl)	A
Myristil alcohol (myristic alcohol)	A

Resistance to	Resistance level
Naphtha / crude oil	A
Naphthalene (mineral oil)	A
Natural gas	A
Nickel sulphate	A
Nitrating acid	B
Nitric acid	A
Nitric acid, concentrated (aqua fortis)	B
Nitric acid, fuming	B
Nitrobenzoyl (mirbane)	D
Nitrogen	A
Nitrohydrochloric acid (HNO3/HCl)	C
Octane	A
Oleic acid	A
Oleum (fuming sulphuric acid)	C
Oxygen	A
Ozone	A
Paraffin	B
Pentanol (pentyl alcohol, amyl alcohol)	A
Perchloric acid	A
Perchloroethylene (tetrachloroethylene)	A
Petroleum, kerosene	A
Phenol (carbolic acid)	C
Phenylcarbinol (benzyl carbinol)	A
Phosphoric acid	A
Polyglycol	A
Potassium carbonate (potash)	A
Potassium chloride (sylvine)	A
Potassium hydroxide (caustic potash, caustic potash solution)	B

Resistance to	Resistance level
Potassium hypochloride	A
Potassium manganate 10 %	A
Potassium nitrate (potash nitre)	A
Propanol (propyl alcohol)	A
Propanone (acetone)	B
Propyl alcohol	A
Pure acetic acid (100% acetic acid)	A
Salad oil/fat	A
Seawater	A
Silicic acid	A
Silicone oil	A
Silver nitrate	A
Soda, aqueous (sodium carbonate)	A
Sodium bicarbonate	A
Sodium bisulphate	A
Sodium borate	A
Sodium borate (borax)	A
Sodium carbonate	A
Sodium chloride (salt)	A
Sodium hydroxide (caustic soda, sodium hydrate)	B
Sodium hypochlorite (Javel water)	A
Sodium nitrate (Chile salpetre)	A
Sodium sulphate (mirabilite)	A
Sodium sulphide	A
Spirits	A
Stearyl alcohol (1-octadecanol)	A
Styrene (vinylbenzene, phenylethylene)	C

PSEN product range

Resistance to	Resistance level
Sulphur	A
Sulphur chloride (disulphur dichloride)	C
Sulphurdichloride	C
Sulphur dioxide (sulphuric acid)	B
Sulphuric acid 10%	A
Sulphuric acid 60%	B
Sulphuric acid 95%	C
Sulphuric acid, fuming (oleum)	C
Sulphuric ether (diethyl)	A
Sulphur trioxide	C
Tetrachloroethylene (perchloroethylene)	A
Tetrachloromethane (carbon tetrachloride)	A
Tetrahydrofurane (diethylene oxide, tetramethyloxide)	A
Tetrahydronaphthalene (tetralin)	A
Toluene (methylbenzoyl)	A
Trichloroethylene (chlorothene)	A
Trichloroethylene (trichloroethene)	A
Trichloromethane (chloroform)	B
Turpentine oil	A
Urine	A
Vaseline oil	A
Vinegar (wine vinegar)	A
Vinylidene chloride (dichlorethylene)	B
Water, spring water	A
Water, carbonated	A
Xylol (dimethylbenzoyl)	A

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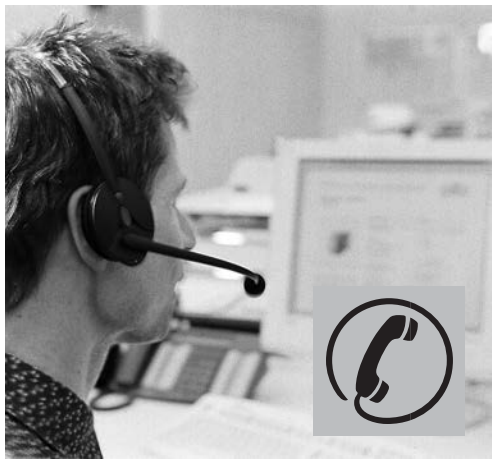
Pre-sales/after sales

Services, concepts and solutions



We are happy to advise you, in the configuration phase or during commissioning.

Safety advice
As you design your machine or on-site atyour installation, Pilz can provide professional advice on safety, based on current standards.

Risk analysis
Our application engineers can perform a risk assessment for you, based on current standards.

Safety concepts
If the risk assessment shows you need to reduce the risk, appropriate protective measures can be selected and a safety concept drawn up.

Safety check
Pilz will assess your application, plant or machinewith regard to the necessary safety aspects.

System supplier
and project management
If required, Pilz can undertake all tasks from the generation of documentation and control cabinet design right through to completion - the whole system from one source.

Application support
When configuring and commissioning both hardware and software, our application engineers can provide support based on expertise gained from international projects.

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 areas and industrial sectors and are happy to answer your queries at any time.

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techsupport@pilz.de

Telephone:
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Hotline
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From a fast, economical repair through to a long supply guarantee to safeguard your investment - always expect more from Pilz.

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

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Pilz GmbH & Co. KG, Sichere Automation, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany, Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

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533 130	Cable, 10 m with angled plug	1	2-7-36
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535 110	PSEN i1		2.7-21
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Terms and Conditions

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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