



## PNOZ s8

**PILZ**  
THE SPIRIT OF SAFETY

► Safety relays

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SD means Secure Digital

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## Introduction

### Validity of documentation

This documentation is valid for the product PNOZ s8. It is valid until new documentation is published.

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product.

### Using the documentation

This document is intended for instruction. Only install and commission the product if you have read and understood this document. The document should be retained for future reference.

### Definition of symbols

Information that is particularly important is identified as follows:



#### **DANGER!**

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



#### **WARNING!**

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



#### **CAUTION!**

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



#### **NOTICE**


This describes a situation in which the product or devices could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.

**INFORMATION**


This gives advice on applications and provides information on special features.

**Safety****Intended use**

The contact expansion module PNOZ s8 meets the requirements of EN 60947-5-1 and EN 60204-1. It is used to increase the number of instantaneous safety contacts available on a base unit. Base units are all safety relays with feedback loop.

The max. achievable safety level depends on the base unit. The expansion module may not exceed this. The safety-related characteristic values stated under [safety-related characteristic data](#) [ 20] can only be achieved if the base unit also exhibits these safety characteristic values.

The following is deemed improper use in particular

- ▶ Any component, technical or electrical modification to the product,
- ▶ Use of the product outside the areas described in this operating manual,
- ▶ Use of the product outside the technical details (see [Technical details](#) [ 16]).

**NOTICE****EMC-compliant electrical installation**

The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.

**Safety regulations****Safety assessment**

Before using a device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with EN ISO 13849 and EN 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

**Use of qualified personnel**

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by persons who are competent to do so.

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. To be able to inspect, assess and operate devices, systems and machines, the person has to be informed of the state of the art and the applicable national, European and international laws, directives and standards.

It is the company's responsibility only to employ personnel who

- ▶ Are familiar with the basic regulations concerning health and safety / accident prevention,
- ▶ Have read and understood the information provided in the section entitled Safety
- ▶ Have a good knowledge of the generic and specialist standards applicable to the specific application.

**Warranty and liability**

All claims to warranty and liability will be rendered invalid if

- ▶ The product was used contrary to the purpose for which it is intended,
- ▶ Damage can be attributed to not having followed the guidelines in the manual,
- ▶ Operating personnel are not suitably qualified,
- ▶ Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

**Disposal**

- ▶ In safety-related applications, please comply with the mission time  $T_M$  in the safety-related characteristic data.
- ▶ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

**For your safety**

The unit meets all the necessary conditions for safe operation. However, please note the following:

- ▶ Note for overvoltage category III: If voltages higher than low voltage (>50 VAC or >120 VDC) are present on the unit, connected control elements and sensors must have a rated insulation voltage of at least 250 V.

### **Unit features**

- ▶ Relay outputs:
  - 2 safety contacts (N/O), instantaneous
- ▶ 1 semiconductor output
- ▶ LED for:
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Fault
- ▶ Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- ▶ See order reference for unit types

### **Safety features**

The unit meets the following safety requirements:

- ▶ The unit monitors its own output contacts.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ Earth fault in the feedback loop:
  - Detected, depending on the base unit that is used.
- ▶ Earth fault in the input circuit:
  - The output relays de-energise and the safety contacts open.



### Block diagram/terminal configuration

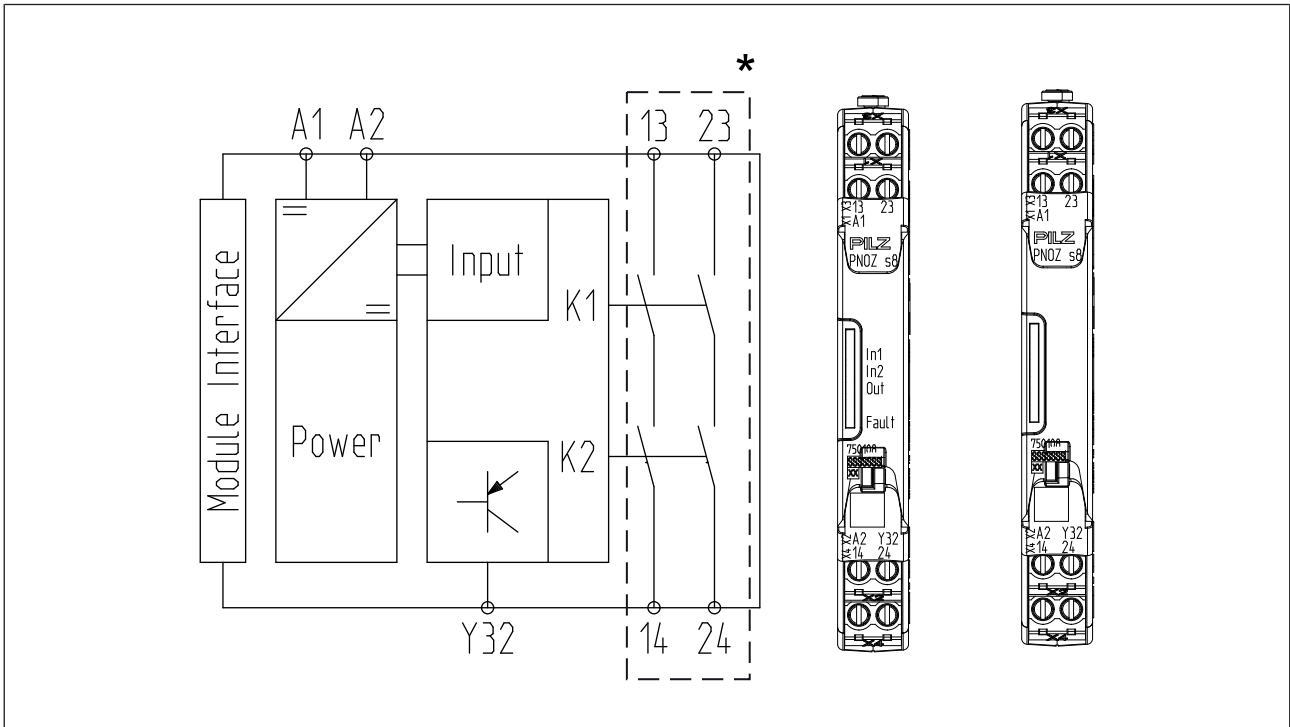


Fig.: Centre: Front view with cover, right: Front view without cover

\*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

### Function description

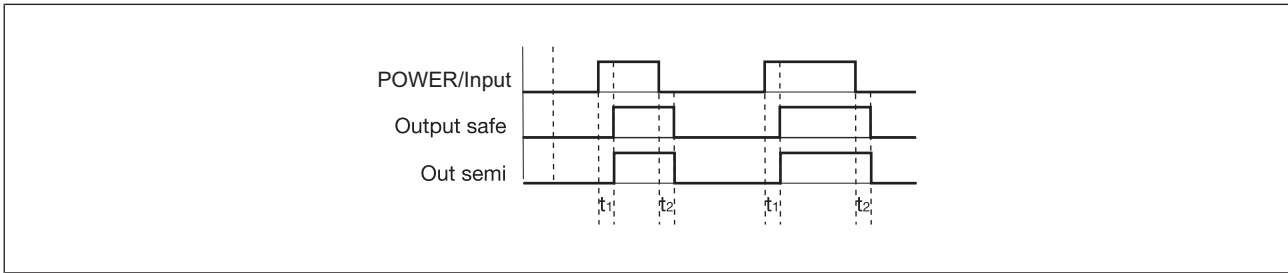
with PNOZsigma base unit:

- ▶ Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

- ▶ Single-channel operation: one input circuit affects the output relays

### Timing diagram



### Legend

- ▶ POWER/Input: Supply voltage/input
- ▶ Output safe: Safety contacts
- ▶ Out semi: Semiconductor output
- ▶  $t_1$ : Switch-on delay
- ▶  $t_2$ : Delay-on de-energisation

### Installation

#### Install contact expansion module without base unit:

- ▶ Ensure that the plug terminator is inserted at the side of the unit.

#### Connect base unit and PNOZsigma contact expansion module:

- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module
- ▶ Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

#### Control cabinet installation

- ▶ The safety relay 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 (35 mm).
- ▶ When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- ▶ Push the unit upwards or downwards before lifting it from the DIN rail.

## Wiring

Please note:

- ▶ Information given in the "[Technical details \[16\]](#)" must be followed.
- ▶ Outputs 13-14 and 23-24 are safety contacts, the semiconductor output Y32 is an auxiliary output (e.g. for display).
- ▶ Semiconductor output Y32 should **not** be used for safety circuits!
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see [Technical details \[16\]](#)).
- ▶ Calculation of the max. cable length  $l_{\max}$  in the input circuit:

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

$R_{l_{\max}}$  = max. overall cable resistance (see [Technical details \[16\]](#))

$R_l / \text{km}$  = cable resistance/km

- ▶ Use copper wiring with a temperature stability of 75 °C.
- ▶ To prevent EMC interferences (particularly common-mode interferences) the measures described in EN 60204-1 must be executed. This includes the separate routing of cables of the control circuits (input, start and feedback loop) from other cables for energy transmission or the shielding of cables, for example.
- ▶ Adequate protection must be provided on all output contacts with capacitive and inductive loads.
- ▶ The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

### Preparing for operation

Supply voltage	AC	DC
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

#### Feedback loop

▶ **with PNOZsigma base unit:**

The feedback loop is connected and evaluated via the connector.

▶ **without PNOZsigma base unit:**

Feedback loop does not need to be monitored because the contact expansion block monitors its own output contacts.

**Semiconductor output**

\*Connect together the 0V connections on all the external power supplies



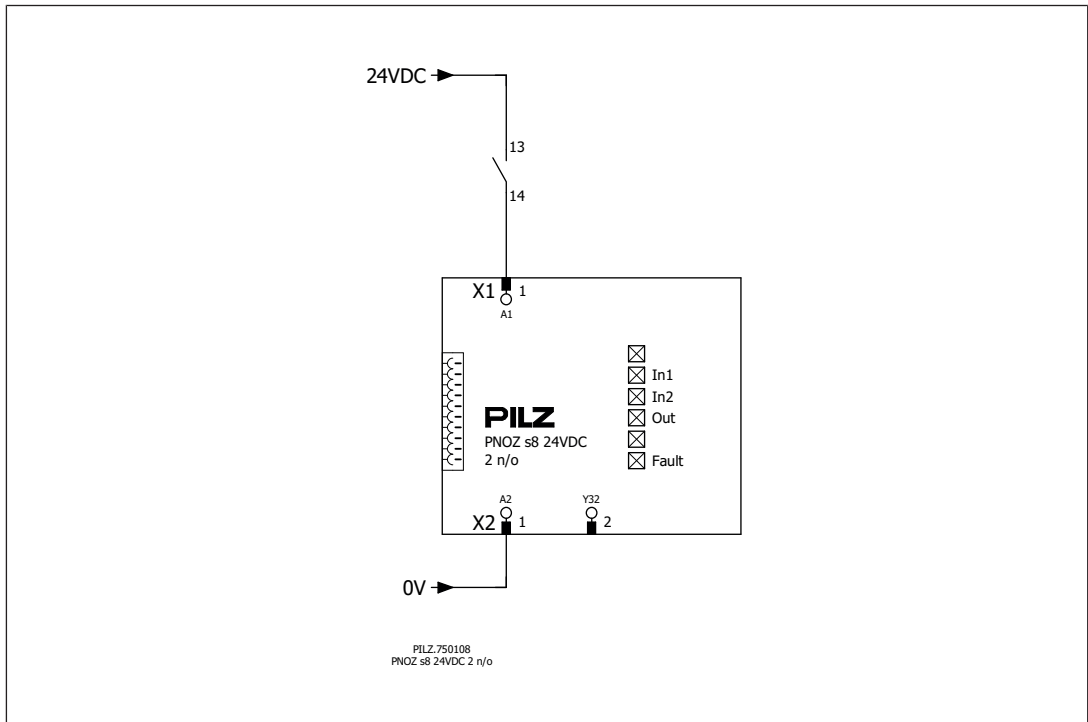
**INFORMATION**

If a base unit and a contact expansion module from the PNOZsigma range are linked via the connector, no additional wiring is necessary. Do not connect A1/A2 to the contact expansion module!

## Application examples

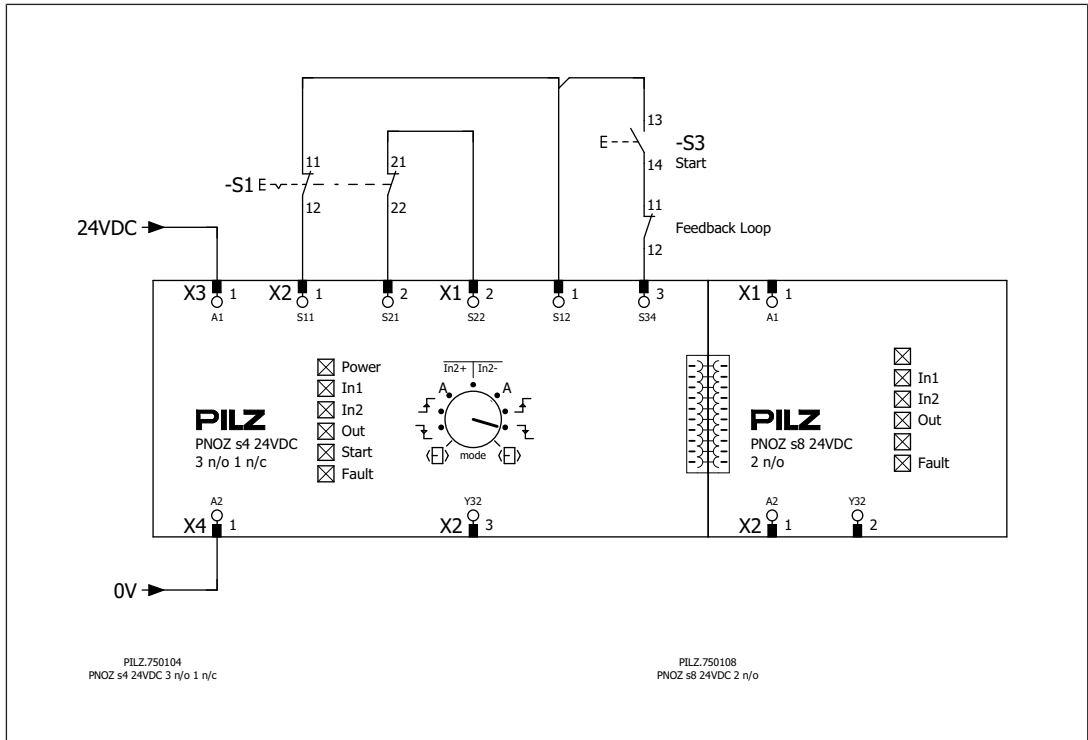
### Single device

- ▶ Single-channel
- ▶ Driven via safety relay with safety contacts
- ▶ Safety contacts PNOZ s8 only PLC



**Contact expansion for PNOZ s4**

- ▶ Emergency stop
- ▶ Dual-channel
- ▶ with detection of shorts across contacts
- ▶ Monitored start
- ▶ falling edge with feedback loop monitoring
- ▶ Safety contacts PNOZ s8 only PLC



## Operation

When the relay outputs are switched on, the mechanical contact on the relay cannot be tested automatically. Depending on the operational environment, measures to detect the non-opening of switching elements may be required under some circumstances.

When the product is used in accordance with the European Machinery Directive, a check must be carried out to ensure that the safety contacts on the relay outputs open correctly. Open the safety contacts (switch off output) and start the device again for SIL CL 2/PL c at least 1 x per year, so that the internal diagnostics can check that the safety contacts open correctly.



### NOTICE

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

LEDs indicate the status and errors during operation:



LED on



LED flashes

### Status indicators



#### IN1

Channel 1 actuated.



#### IN2

Channel 2 actuated.



#### IN1, IN2, OUT

Safety contacts are closed.

### Error indicators



#### FAULT

Diagnostics: Internal error, unit defective

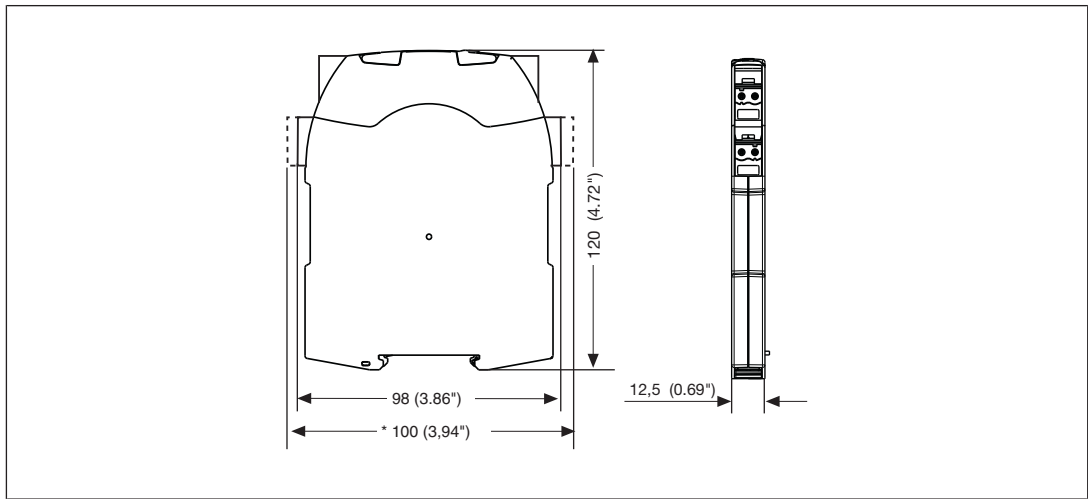
- ▶ Remedy: Switch supply voltage off and then on again, change unit if necessary.

### Faults - malfunctions

- ▶ Contact malfunctions: If the contacts have welded, reactivation will not be possible after the input circuit has opened.

### Dimensions in mm

\*with spring-loaded terminals



### Technical details

General	750108	751108
Certifications	CCC, CE, EAC, KOSHA, TÜV, cULus Listed	CCC, CE, EAC, KOSHA, TÜV, cULus Listed
Electrical data	750108	751108
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	2 W	2 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Inputs	750108	751108
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	65 mA	65 mA
Max. inrush current impulse		
Current pulse, input circuit	0,6 A	0,6 A
Pulse duration, input circuit	15 ms	15 ms
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Semiconductor outputs	750108	751108
Number	1	1
Voltage	24 V	24 V



<b>Semiconductor outputs</b>	<b>750108</b>	<b>751108</b>
Current	<b>20 mA</b>	<b>20 mA</b>
Residual current at "0" signal	<b>0,1 mA</b>	<b>0,1 mA</b>
Max. internal voltage drop	<b>5 V</b>	<b>5 V</b>
Conditional rated short circuit current	<b>100 A</b>	<b>100 A</b>
Lowest operating current	<b>0 mA</b>	<b>0 mA</b>
Utilisation category in accordance with EN 60947-1	<b>DC-12</b>	<b>DC-12</b>
<b>Relay outputs</b>	<b>750108</b>	<b>751108</b>
Number of output contacts		
Safety contacts (N/O), instantaneous	<b>2</b>	<b>2</b>
Max. short circuit current IK	<b>1 kA</b>	<b>1 kA</b>
Utilisation category		
In accordance with the standard	<b>EN 60947-4-1</b>	<b>EN 60947-4-1</b>
Utilisation category of safety contacts		
AC1 at	<b>240 V</b>	<b>240 V</b>
Min. current	<b>0,02 A</b>	<b>0,02 A</b>
Max. current	<b>3 A</b>	<b>3 A</b>
Max. power	<b>720 VA</b>	<b>720 VA</b>
DC1 at	<b>24 V</b>	<b>24 V</b>
Min. current	<b>0,02 A</b>	<b>0,02 A</b>
Max. current	<b>3 A</b>	<b>3 A</b>
Max. power	<b>72 W</b>	<b>72 W</b>
Utilisation category		
In accordance with the standard	<b>EN 60947-5-1</b>	<b>EN 60947-5-1</b>
Utilisation category of safety contacts		
AC15 at	<b>230 V</b>	<b>230 V</b>
Max. current	<b>1,5 A</b>	<b>1,5 A</b>
DC13 (6 cycles/min) at	<b>24 V</b>	<b>24 V</b>
Max. current	<b>1,5 A</b>	<b>1,5 A</b>
Utilisation category in accordance with UL		
Voltage	<b>240 V AC G. U.</b>	<b>240 V AC G. U.</b>
With current	<b>3 A</b>	<b>3 A</b>
Voltage	<b>24 V DC G. U.</b>	<b>24 V DC G. U.</b>
With current	<b>3 A</b>	<b>3 A</b>
Pilot Duty	<b>B300, R300</b>	<b>B300, R300</b>

<b>Relay outputs</b>	<b>750108</b>	<b>751108</b>
External contact fuse protection, safety contacts		
In accordance with the standard	<b>EN 60947-5-1</b>	<b>EN 60947-5-1</b>
Blow-out fuse, quick	<b>4 A</b>	<b>4 A</b>
Blow-out fuse, slow	<b>2 A</b>	<b>2 A</b>
Blow-out fuse, gG	<b>4 A</b>	<b>4 A</b>
Circuit breaker 24V AC/DC, characteristic B/C	<b>2 A</b>	<b>2 A</b>
Conventional thermal current	<b>3 A</b>	<b>3 A</b>
Contact material	<b>AgSnO2</b>	<b>AgSnO2</b>
<b>Times</b>	<b>750108</b>	<b>751108</b>
Switch-on delay		
With automatic start after power on typ.	<b>100 ms</b>	<b>100 ms</b>
With automatic start after power on max.	<b>150 ms</b>	<b>150 ms</b>
Delay-on de-energisation		
With E-STOP typ.	<b>30 ms</b>	<b>30 ms</b>
With E-STOP max.	<b>40 ms</b>	<b>40 ms</b>
With power failure typ.	<b>30 ms</b>	<b>30 ms</b>
With power failure max.	<b>40 ms</b>	<b>40 ms</b>
<b>Environmental data</b>	<b>750108</b>	<b>751108</b>
Climatic suitability		
Ambient temperature	<b>EN 60068-2-78</b>	<b>EN 60068-2-78</b>
Temperature range	<b>-10 - 55 °C</b>	<b>-10 - 55 °C</b>
Storage temperature		
Temperature range	<b>-40 - 85 °C</b>	<b>-40 - 85 °C</b>
Climatic suitability		
Humidity	<b>93 % r. h. at 40 °C</b>	<b>93 % r. h. at 40 °C</b>
Condensation during operation	<b>Not permitted</b>	<b>Not permitted</b>
EMC		
	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1</b>	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1</b>
Vibration		
In accordance with the standard	<b>EN 60068-2-6</b>	<b>EN 60068-2-6</b>
Frequency	<b>10 - 55 Hz</b>	<b>10 - 55 Hz</b>
Amplitude	<b>0,35 mm</b>	<b>0,35 mm</b>
Airgap creepage		
In accordance with the standard	<b>EN 60947-1</b>	<b>EN 60947-1</b>
Overvoltage category	<b>III / II</b>	<b>III / II</b>
Pollution degree	<b>2</b>	<b>2</b>
Rated insulation voltage	<b>250 V</b>	<b>250 V</b>
Rated impulse withstand voltage	<b>4 kV</b>	<b>4 kV</b>

<b>Environmental data</b>	<b>750108</b>	<b>751108</b>
Protection type		
Housing	<b>IP40</b>	<b>IP40</b>
Terminals	<b>IP20</b>	<b>IP20</b>
Mounting area (e.g. control cabinet)	<b>IP54</b>	<b>IP54</b>
<b>Mechanical data</b>	<b>750108</b>	<b>751108</b>
Mounting position	<b>Any</b>	<b>Any</b>
Mechanical life	<b>5,000,000 cycles</b>	<b>5,000,000 cycles</b>
Material		
Bottom	<b>PC</b>	<b>PC</b>
Front	<b>PC</b>	<b>PC</b>
Top	<b>PC</b>	<b>PC</b>
Connection type	<b>Screw terminal</b>	<b>Spring-loaded terminal</b>
Mounting type	<b>plug-in</b>	<b>plug-in</b>
Conductor cross section with screw terminals		
1 core flexible	<b>0,25 - 2,5 mm<sup>2</sup>, 24 - 12 AWG</b>	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	<b>0,25 - 1 mm<sup>2</sup>, 24 - 16 AWG</b>	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	<b>0,2 - 1,5 mm<sup>2</sup>, 24 - 16 AWG</b>	–
Torque setting with screw terminals	<b>0,5 Nm</b>	–
Stripping length with screw terminals	<b>8 mm</b>	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	<b>0,2 - 2,5 mm<sup>2</sup>, 24 - 12 AWG</b>
Spring-loaded terminals: Terminal points per connection	–	<b>2</b>
Stripping length with spring-loaded terminals	–	<b>9 mm</b>
Dimensions		
Height	<b>98 mm</b>	<b>100 mm</b>
Width	<b>12,5 mm</b>	<b>12,5 mm</b>
Depth	<b>120 mm</b>	<b>120 mm</b>
Weight	<b>105 g</b>	<b>105 g</b>

Where standards are undated, the 2020-07 latest editions shall apply.

**Safety characteristic data**



**NOTICE**

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

Operating mode	EN ISO 13849-1: 2015	EN ISO 13849-1: 2015	EN 62061 SIL CL	EN 62061 PFH <sub>D</sub> [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015
	PL	Category					T <sub>M</sub> [year]

Safety contacts, instantaneous

PL c	Cat. 3	SIL CL 2	2,00E-07	SIL 2	6,35E-03	20
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Explanatory notes for the safety-related characteristic data:

- ▶ The SIL CL value in accordance with EN 62061 corresponds to the SIL value in accordance with EN 61508.
- ▶ T<sub>M</sub> is the maximum mission time in accordance with EN ISO 13849-1. The value also applies as the retest interval in accordance with EN 61508-6 and IEC 61511 and as the proof test interval and mission time in accordance with EN 62061.

All the units used within a safety function must be considered when calculating the safety characteristic data.



**INFORMATION**

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

### Classification according to ZVEI, CB24I

The following tables describe the classes and specific values of the product interface and the classes of interfaces compatible with it. The classification is described in the ZVEI position paper "Classification of Binary 24 V Interfaces - Functional Safety aspects covered by dynamic testing".

<b>Input</b>	
<b>Interfaces</b>	
Drain	
Interface	<b>Module</b>
Class	<b>C2</b>
Source	
Interface	<b>Sensor</b>
Class	<b>C2, C3</b>
<b>Drain parameters</b>	
Max. test pulse duration	<b>0,5 ms</b>
Min. input resistance	<b>0,4 kOhm</b>
Max. capacitive load	<b>10 nF</b>
<b>Relay outputs</b>	
<b>Interfaces</b>	
Source	
Interface	<b>Module</b>
Class	<b>A</b>
Drain	
Interface	<b>Actuator</b>
Class	<b>A</b>
<b>Source parameters</b>	
Min. switching voltage	<b>24 V</b>
Max. switching voltage	<b>250 V</b>
Min. switching current	<b>0,02 A</b>
Max. switching current	<b>3 A</b>
Potential isolation	<b>yes</b>

## Supplementary data



### CAUTION!

It is essential to consider the values in the relays' service life table. The relay outputs' safety-related characteristic data is only valid if the values in the service life table are met.

The PFH value depends on the switch frequency and the load of the relay output. If the values of the service life tables are not accessible, the stated PFH value can be used irrespective of the switch frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

### Service life table

The service life table indicates the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.

Load type	Switching current	Number of cycles
DC1	3 A	200,000
DC13	1.5 A	75,000
AC1	3 A	50,000
AC15	1.5 A	50,000

**Permitted operating height in accordance with EN 60664-1**

The values stated in the technical details apply to the use of the device in operating heights up to max. 2000 m above sea level. When used in greater heights, constraints have to be taken into account:

- ▶ Permitted maximum operating height 5000 m
- ▶ Reduction of rated insulation voltage and rated impulse withstand voltage for applications with safe separation:

Maximum operation height	Rated insulation voltage	Overvoltage category	Max. rated impulse withstand voltage
3000 m	150 V	II	2.5 kV
	100 V	III	2.5 kV
4000 m	150 V	II	2.5 kV
	100 V	III	2.5 kV
5000 m	100 V	II	1.5 kV
	24 V	III	0.8 kV

- ▶ Reduction of rated insulation voltage and rated impulse withstand voltage for applications with basic insulation:

Maximum operation height	Rated insulation voltage	Overvoltage category	Max. rated impulse withstand voltage
3000 m	250 V	II	2.5 kV
	150 V	III	2.5 kV
4000 m	250 V	II	2.5 kV
	150 V	III	2.5 kV
5000 m	150 V	II	1.5 kV
	100 V	III	1.5 kV

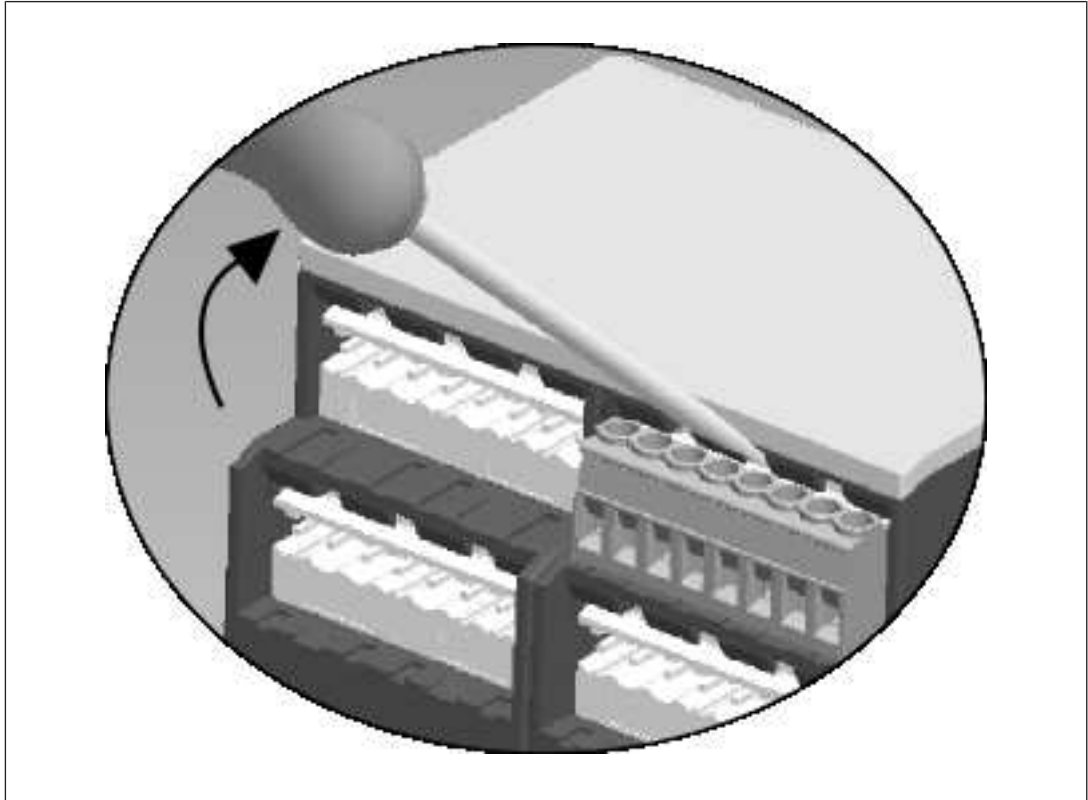
- ▶ From an operating height of 2000 m the max. permitted ambient temperature is reduced by 0.5 °C/100 m

Operating height	Permitted ambient temperature
3000 m	50 °C
4000 m	45 °C
5000 m	40 °C

## Remove plug-in terminals

Procedure: Insert the screwdriver into the housing recess behind the terminal and lever the terminal out.

Do **not** remove the terminals by pulling the cables!



## Order reference

Product type	Features	Connection type	Order no.
PNOZ s8	24 V DC	Screw terminals	750108
PNOZ s8 C	24 V DC	Spring-loaded terminals	751108

## EC declaration of conformity

This product/these products meet the requirements of the directive 2006/42/EC for machinery of the European Parliament and of the Council. The complete EC Declaration of Conformity is available on the Internet at [www.pilz.com/downloads](http://www.pilz.com/downloads).

Authorised representative: Norbert Fröhlich, Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany



