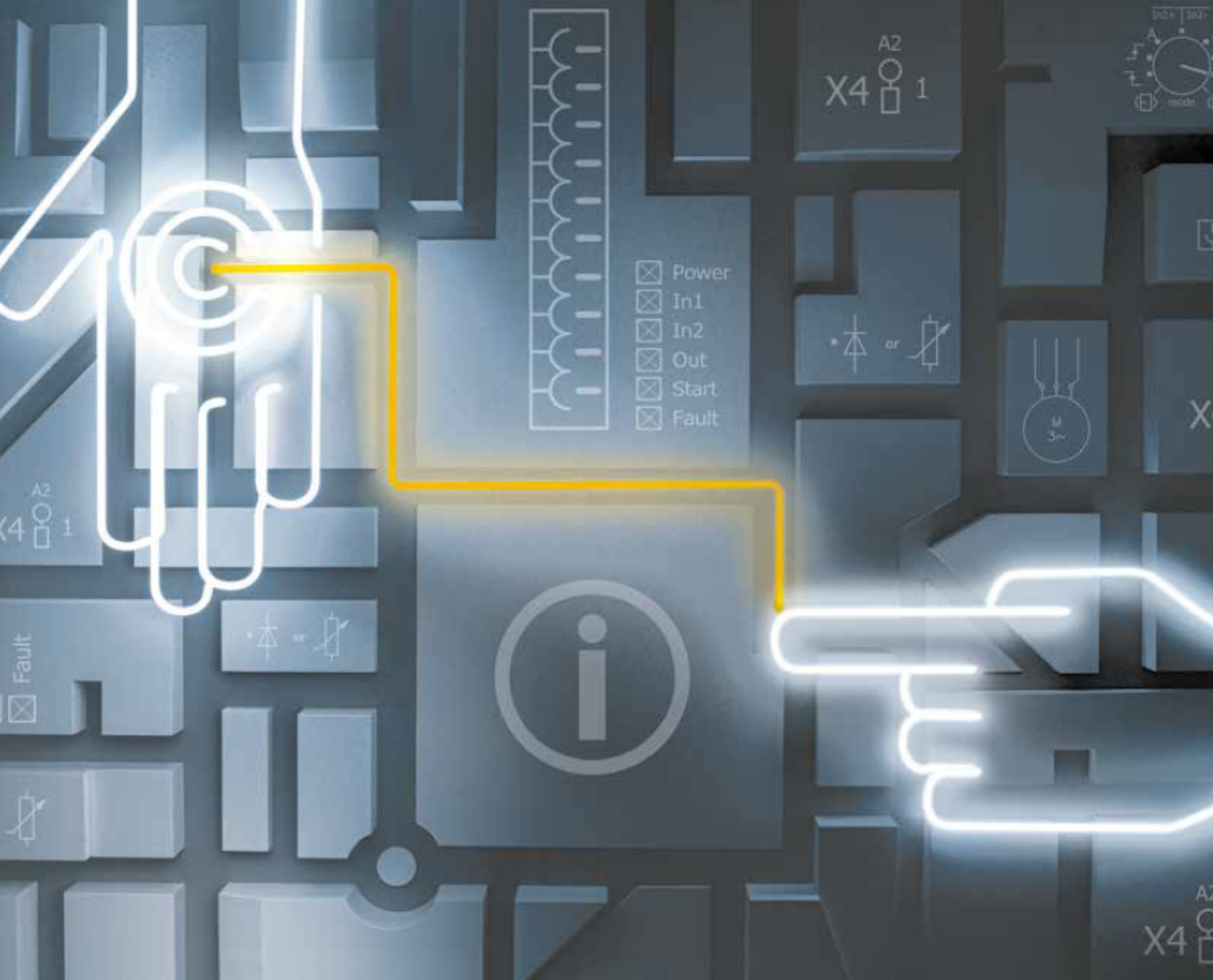




► PNOZ s8

PILZ
THE SPIRIT OF SAFETY

Operating Manual-21400-EN-15
- Safety relays



This document is the original document.

Where unavoidable, for reasons of readability, the masculine form has been selected when formulating this document. We do assure you that all persons are regarded without discrimination and on an equal basis.

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SD means Secure Digital

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Introduction

Validity of documentation

This documentation is valid for the product 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.

Improper use

The following is deemed improper use in particular:

- ▶ Any component, technical or electrical modification to the product,
- ▶ Use of the product outside the areas described in this operating manual,
- ▶ Use of the product outside the technical details (see chapter entitled [Technical Details](#) [ 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 IEC 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall plant/machine's required safety functions, each safety function needs to be considered separately.

Use of qualified personnel

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

A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with the state of the art and the applicable national, European and international laws, directives and standards.

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

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

Warranty and liability

All claims to warranty and liability will be rendered invalid if

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

Disposal

- ▶ In safety-related applications, please comply with the mission time T_M stated 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

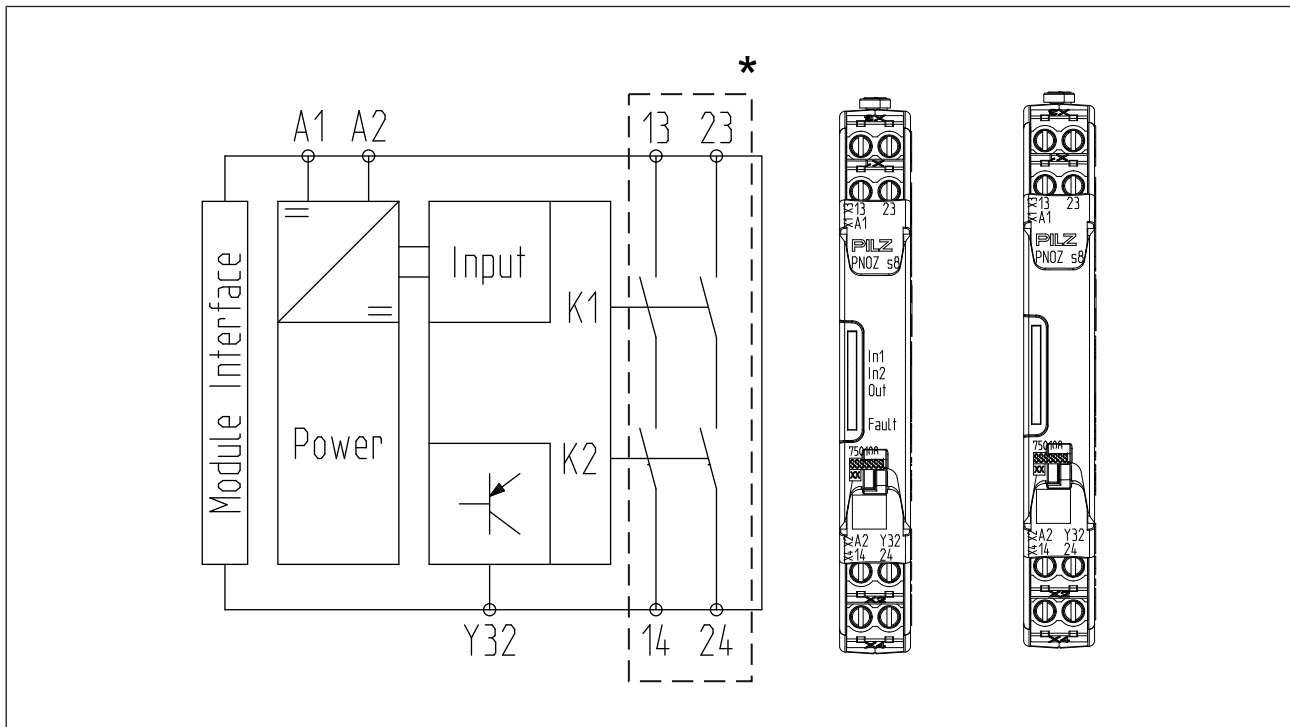


Fig.: Centre: Front view with cover, right: Front view without cover

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

Function description

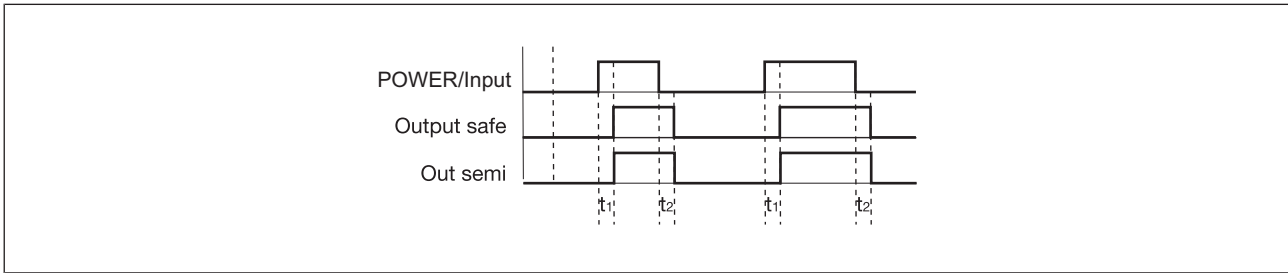
with PNOZsigma base unit:

- 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

- ▶ Install the safety relay 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 !\[\]\(0551a83d441798e532995956b603f604_img.jpg\) 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 !\[\]\(54ee180c0037b66a36ce2219a481afde_img.jpg\) 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 !\[\]\(a03a7eb2f4046e1d3c76772003e549ea_img.jpg\) 16](#))

R_l / 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 circuit 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



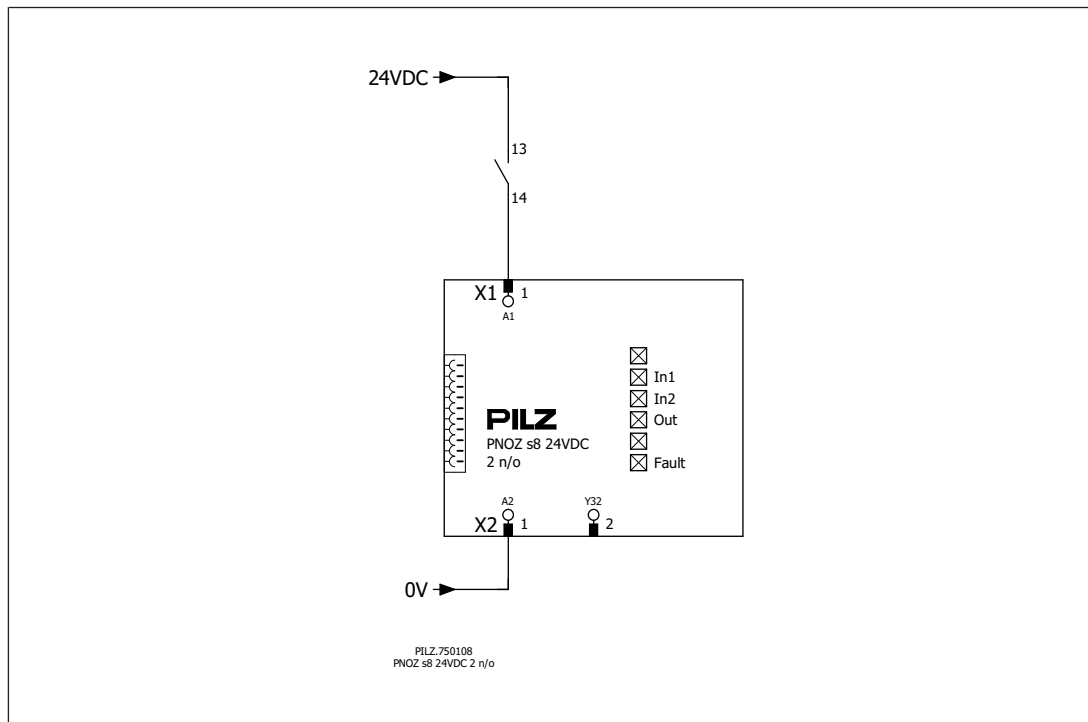
INFORMATION

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

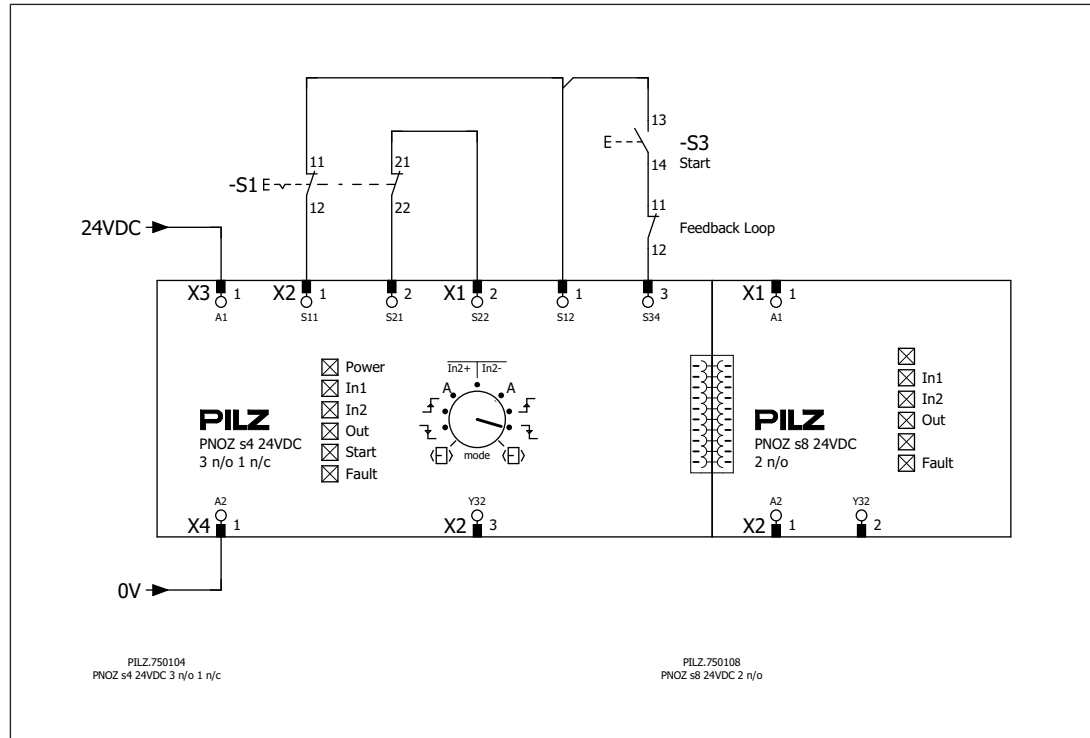
Single device

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

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

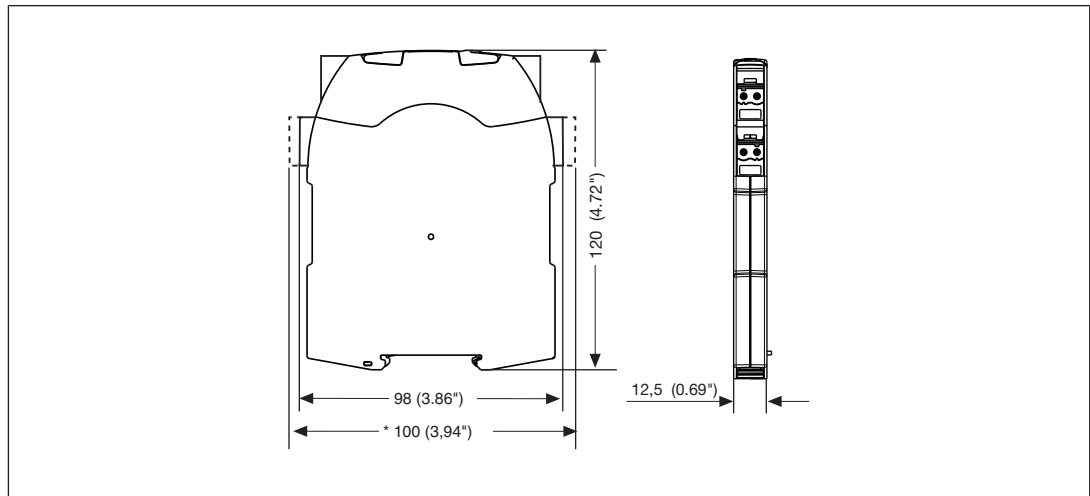
- Remedy: Switch supply voltage off and then on again, change unit if necessary.

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

Where standards are undated, the 2022-09 valid editions apply.

General	750108	751108
Certifications	CCC, CE, EAC, KOSHA, TÜV, UKCA, cULus Listed	CCC, CE, EAC, KOSHA, TÜV, UKCA, 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
Quantity	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 RI-max		
Single-channel at UB DC	30 Ohm	30 Ohm

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

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

Environmental data	750108	751108
Protection type		
Housing	IP40	IP40
Terminals	IP20	IP20
Mounting area (e.g. control cabinet)	IP54	IP54
Mechanical data	750108	751108
Mounting position	Any	Any
Mechanical life	5,000,000 cycles	5,000,000 cycles
Material		
Bottom	PC	PC
Front	PC	PC
Top	PC	PC
Connection type	Screw terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in
Conductor cross section with screw terminals		
1 core flexible	0,25 - 2,5 mm², 24 - 12 AWG	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm², 24 - 16 AWG	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm², 24 - 16 AWG	–
Torque setting with screw terminals	0,5 Nm	–
Stripping length with screw terminals	7 mm	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	0,2 - 2,5 mm², 24 - 12 AWG
Spring-loaded terminals: Terminal points per connection	–	2
Stripping length with spring-loaded terminals	–	9 mm
Dimensions		
Height	98 mm	100 mm
Width	12,5 mm	12,5 mm
Depth	120 mm	120 mm
Weight	105 g	105 g

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 IEC 62061 SIL CL/max. SIL	EN IEC 62061 61508 PFH [1/h]	EN/IEC 61511 61508 SIL	EN/IEC 61511 61508 PFD	EN ISO 13849-1: 2015 T_M [year]
PL		Category					

Safety con-
tacts, in-
stantaneous

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

- T_M is the maximum mission time in accordance with EN ISO 13849-1. The value also applies as the retest interval in accordance with EN/IEC 61508-6 and EN/IEC 61511 and as the proof test interval and mission time in accordance with EN IEC 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 products used and may differ from these.

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".

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

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

Operating height in accordance with EN 60664-1

The values stated in the technical details apply to the use of the product 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

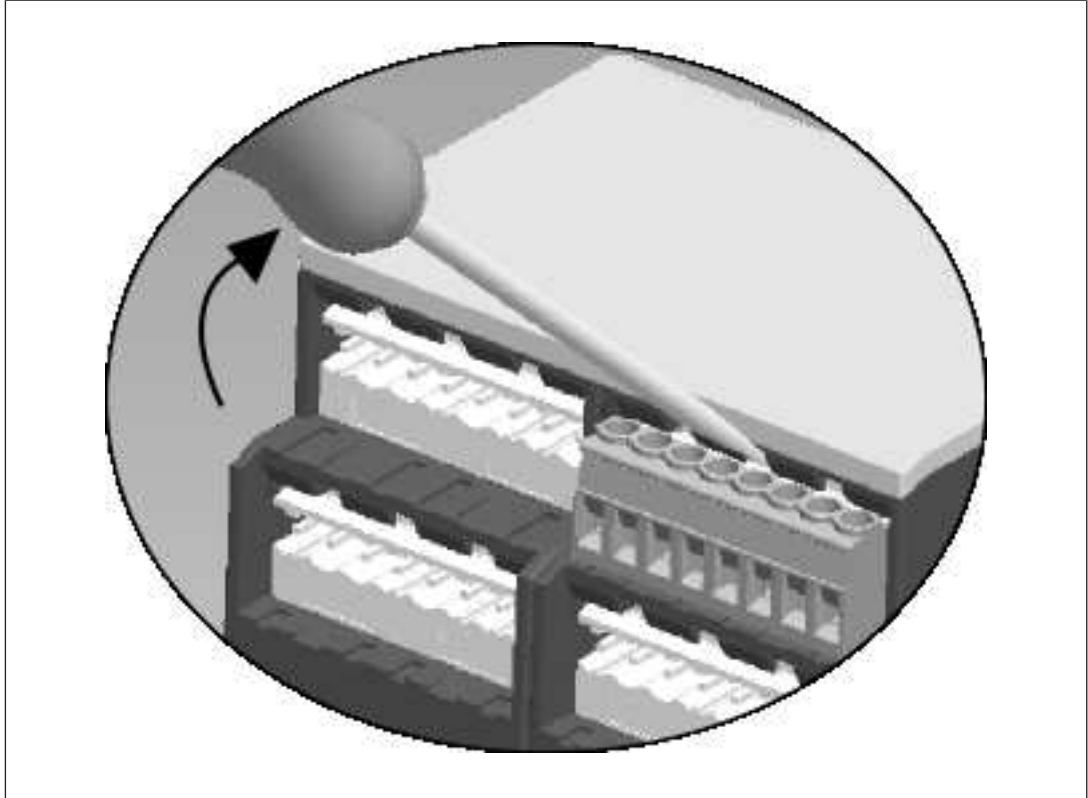
- ▶ From an operating height of 2000 m the max. permitted ambient temperature is reduced by 0.5 °C/100 m

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

Remove plug-in terminals

Procedure

- ▶ Insert a suitable screwdriver into the housing recess behind the terminal.
- Do **not** remove the terminals by pulling the cables!
- ▶ Lever the terminal out.



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 on 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.

Representative: Pilz GmbH & Co. KG, Felix-Wankel-Str. 2, 73760 Ostfildern, Germany

UKCA-Declaration of Conformity

This product(s) complies with following UK legislation: Supply of Machinery (Safety) Regulation 2008.

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

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

Support

Technical support is available from Pilz round the clock.

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