

## Up to PL e of EN ISO 13849-1 PNOZ X2.5P



Safety relay for monitoring E-STOP pushbuttons and safety gates.

### Approvals

	PNOZ X2.5P
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### Unit features

- ▶ Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
- ▶ 1 semiconductor output
- ▶ Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
- ▶ LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
  - Semiconductor output
- ▶ Semiconductor output signals:
  - Switch status channel 1/2
- ▶ Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- ▶ See order reference for unit types

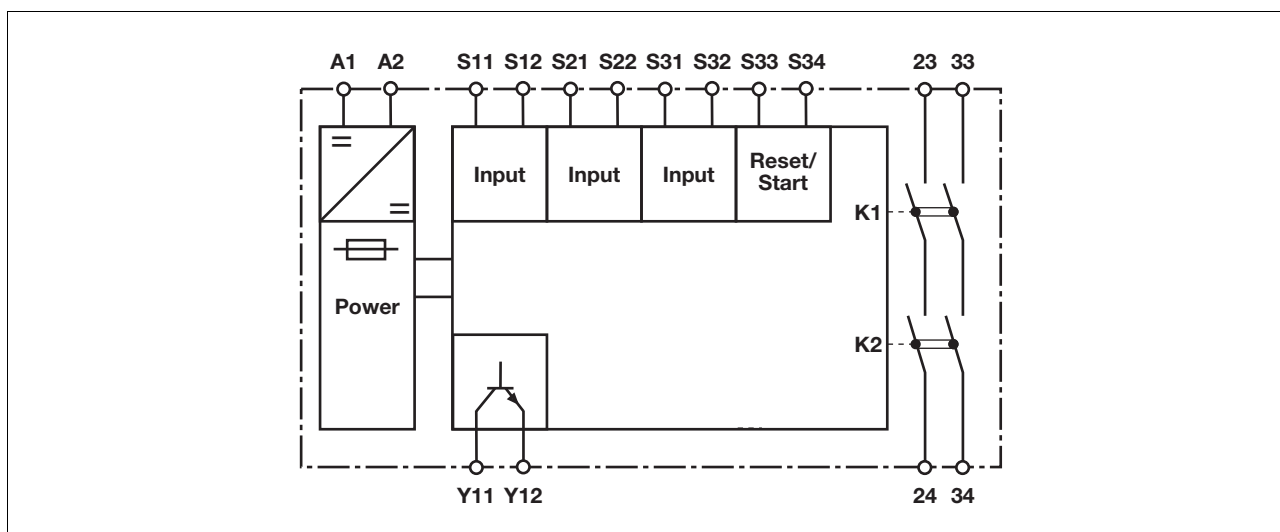
### Safety features

- The relay meets the following safety requirements:
- ▶ The circuit is redundant with built-in self-monitoring.
  - ▶ The safety function remains effective in the case of a component failure.
  - ▶ The correct opening and closing of the safety function relays is tested automatically in each on-off cycle.
  - ▶ The unit has an electronic fuse.

### Unit description

- The safety relay meets the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1 and may be used in applications with
- ▶ E-STOP pushbuttons
  - ▶ Safety gates

### Block diagram

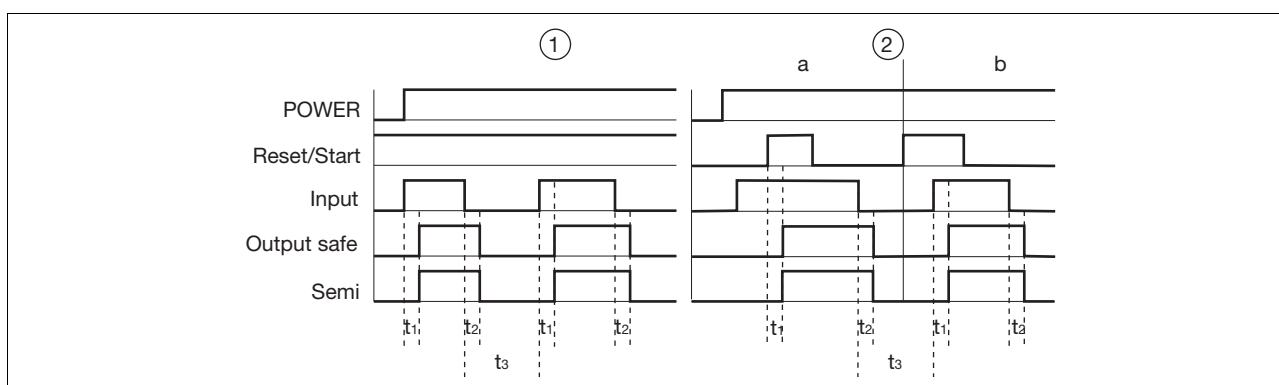


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### Function description

- ▶ Single-channel operation: no redundancy in the input circuit, earth faults in the reset circuit are detected.
- ▶ Dual-channel operation with detection of shorts across contacts: redundant input circuit, detects
  - earth faults in the reset and input circuit,
  - short circuits and shorts between contacts in the input circuit.
- ▶ Automatic start: Unit is active once the input circuit has been closed.
- ▶ Manual reset: Unit is active once the input circuit is closed and then the reset circuit is closed.
- ▶ Increase in the number of available instantaneous safety contacts by connecting contact expansion modules or external contactors.

### Timing diagram



### Key

- ▶ Power: Supply voltage
- ▶ Reset/Start: Reset circuit S33-S34
- ▶ Input: Input circuits S11-S12, S21-S22, S31-S32
- ▶ Output safe: Safety contacts 23-24, 33-34
- ▶ Semi: Semiconductor output
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ a: Input circuit closes before reset circuit
- ▶ b: Reset circuit closes before input circuit
- ▶  $t_1$ : Switch-on delay
- ▶  $t_2$ : Delay on de-energisation
- ▶  $t_3$ : Recovery time

### Wiring

#### Please note:

- ▶ Information given in the “Technical details” must be followed.
- ▶ Outputs 23-24, 33-34 are safety contacts.
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see technical details).
- ▶ Calculation of the max. cable runs  $I_{max}$  in the input circuit:

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

$R_{lmax}$  = max. overall cable resistance (see technical details)

$R_l / km$  = cable resistance/km

- ▶ Use copper wire that can withstand 60/75 °C.

- ▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

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### Preparing for operation

#### ► Supply voltage

Supply voltage	AC	DC

#### ► Input circuit

Input circuit	Single-channel	Dual-channel
E-STOP <b>without</b> detection of shorts across contacts		
E-STOP <b>with</b> detection of shorts across contacts		
Safety gate <b>without</b> detection of shorts across contacts		
Safety gate <b>with</b> detection of shorts across contacts		

#### ► Reset circuit

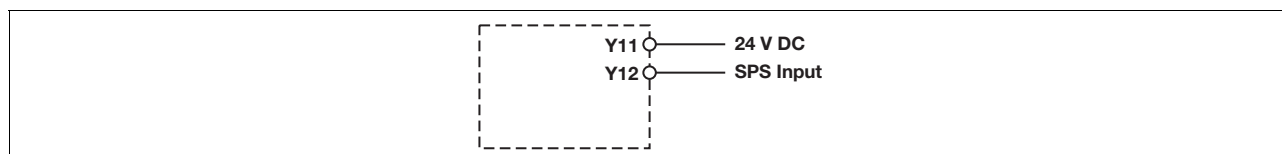
Reset circuit	E-STOP wiring (single-channel) Safety gate (single-channel)	E-STOP wiring (dual-channel) Safety gate (dual-channel)
Automatic reset		
Manual reset		

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### ▶ Feedback loop

Feedback loop	Automatic reset	Manual reset
Contacts from external contactors		

### ▶ Semiconductor output

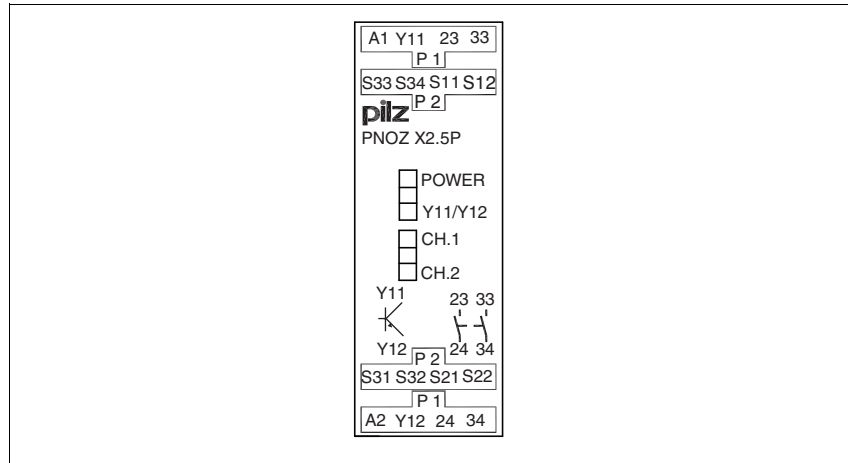


### ▶ Key

S1/S2	E-STOP/safety gate switch
S3	Reset button
	Switch operated
	Gate open
	Gate closed

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### Terminal configuration

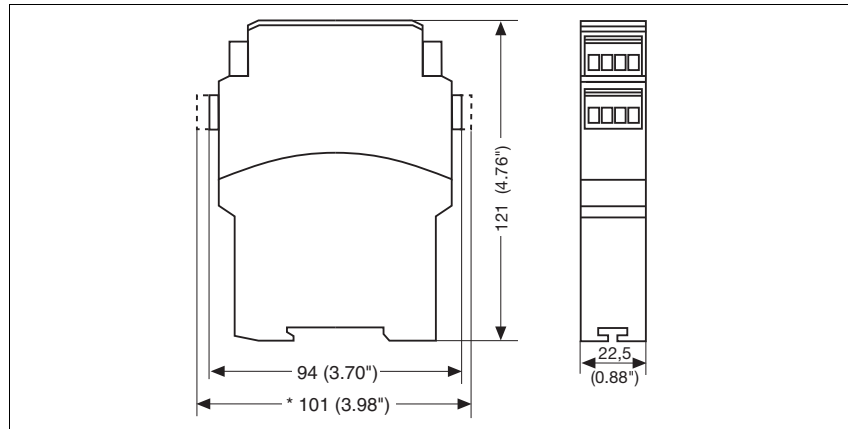


### Installation

- ▶ 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.
- ▶ Ensure the unit is mounted securely on a vertical DIN rail (35 mm) by using a fixing element (e.g. retaining bracket or an end angle).

### Dimensions

\* with spring-loaded terminals



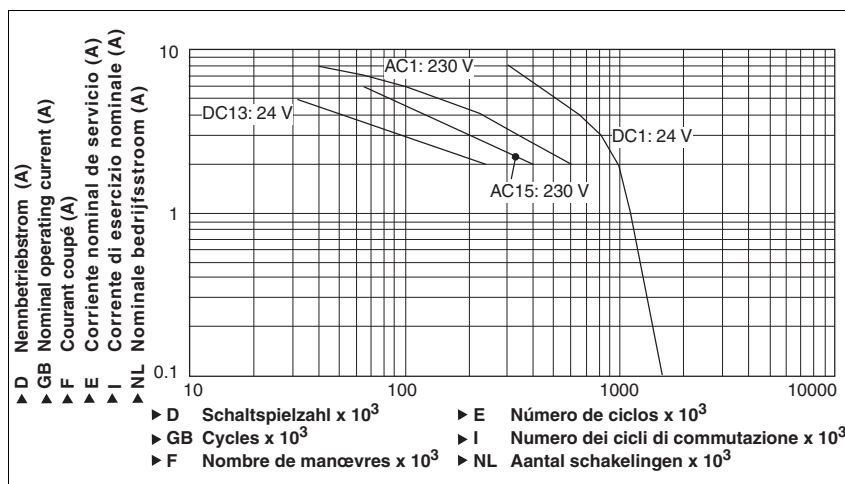
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### Notice

This data sheet is only intended for use during configuration. Please refer to the operating manual for installation and operation.

### Service life graph

The service life graphs indicate 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.



### Example

- ▶ Inductive load: 2 A
  - ▶ Utilisation category: AC15
  - ▶ Contact service life: 400 000 cycles
- Provided the application requires fewer than 400 000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

### Technical details

#### Electrical data

Supply voltage	
Supply voltage $U_B$ DC	<b>24 V</b>
Voltage tolerance	<b>-15 %/+10 %</b>
Power consumption at $U_B$ DC	<b>1.5 W</b>
Residual ripple DC	<b>20 %</b>
Voltage and current at	
Input circuit DC: <b>24.0 V</b>	<b>25.0 mA</b>
Reset circuit DC: <b>24.0 V</b>	<b>50.0 mA</b>
Feedback loop DC: <b>24.0 V</b>	<b>50.0 mA</b>
Number of output contacts	
Safety contacts (S) instantaneous:	<b>2</b>

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<b>Electrical data</b>	
Utilisation category in accordance with <b>EN 60947-4-1</b>	
Safety contacts: AC1 at <b>240 V</b>	$I_{\min}$ : 0.01 A , $I_{\max}$ : 6.0 A $P_{\max}$ : 1500 VA
Safety contacts: DC1 at <b>24 V</b>	$I_{\min}$ : 0.01 A , $I_{\max}$ : 6.0 A $P_{\max}$ : 150 W
Utilisation category in accordance with <b>EN 60947-5-1</b>	
Safety contacts: AC15 at <b>230 V</b>	$I_{\max}$ : 5.0 A
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	$I_{\max}$ : 4.0 A
Conventional thermal current	<b>6.0 A</b>
Contact material	<b>AgSnO<sub>2</sub> + 0.2 µm Au</b>
External contact fuse protection ( $I_k = 1$ kA) to <b>EN 60947-5-1</b>	
Blow-out fuse, quick	
Safety contacts:	<b>6 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>4 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>4 A</b>
Semiconductor outputs (short circuit proof)	<b>24.0 V DC, 100 mA</b>
External supply voltage	<b>24.0 V DC</b>
Voltage tolerance	<b>-20 %/+20 %</b>
Max. overall cable resistance $R_{i\max}$ input circuits, reset circuits	
single-channel at $U_B$ DC	<b>50 Ohm</b>
dual-channel with detect. of shorts across contacts at $U_B$ DC	<b>20 Ohm</b>
Min. input resistance when switching on	<b>64 Ohm</b>
<b>Safety-related characteristic data</b>	
PL in accordance with <b>EN ISO 13849-1: 2006</b>	<b>PL e (Cat. 4)</b>
Category in accordance with <b>EN 954-1</b>	<b>Cat. 4</b>
SIL CL in accordance with <b>EN IEC 62061</b>	<b>SIL CL 3</b>
PFH in accordance with <b>EN IEC 62061</b>	<b>2.31E-09</b>
SIL in accordance with <b>IEC 61511</b>	<b>SIL 3</b>
PFD in accordance with <b>IEC 61511</b>	<b>2.03E-06</b>
$T_M$ [year] in accordance with <b>EN ISO 13849-1: 2006</b>	<b>20</b>
<b>Times</b>	
Switch-on delay	
with automatic reset typ.	<b>90 ms</b>
with automatic reset max.	<b>180 ms</b>
with automatic reset after power on typ.	<b>90 ms</b>
with automatic reset after power on max.	<b>180 ms</b>
with manual reset typ.	<b>35 ms</b>
with manual reset max.	<b>180 ms</b>
Delay-on de-energisation	
with E-STOP typ.	<b>15 ms</b>
with E-STOP max.	<b>30 ms</b>
with power failure typ.	<b>60 ms</b>
with power failure max.	<b>90 ms</b>
Recovery time at max. switching frequency 1/s after E-STOP	<b>50 ms</b>
after power failure	<b>150 ms</b>
Simultaneity, channel 1 and 2	$\infty$
Supply interruption before de-energisation	<b>20 ms</b>
<b>Environmental data</b>	
EMC	<b>EN 60947-5-1, EN 61000-6-2</b>
Vibration to <b>EN 60068-2-6</b>	
Frequency	<b>10 - 55 Hz</b>
Amplitude	<b>0.35 mm</b>
Climatic suitability	<b>EN 60068-2-78</b>

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Environmental data	
Airgap creepage in accordance with EN 60947-1	
Pollution degree	2
Overvoltage category	III / II
Rated insulation voltage	250 V
Rated impulse withstand voltage	4.00 kV
Ambient temperature	-10 - 55 °C
Storage temperature	-40 - 85 °C
Protection type	
Mounting (e.g. cabinet)	IP54
Housing	IP40
Terminals	IP20
Mechanical data	
Housing material	
Housing	PPO UL 94 V0
Front	ABS UL 94 V0
Cross section of external conductors with screw terminals	
1 core flexible	0.25 - 2.50 mm <sup>2</sup> , 24 - 12 AWG No. 777308
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm <sup>2</sup> , 24 - 16 AWG No. 777308
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm <sup>2</sup> , 24 - 16 AWG No. 777308
Torque setting with screw terminals	0.50 Nm No. 777308
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	0.20 - 1.50 mm <sup>2</sup> , 24 - 16 AWG No. 787308
Spring-loaded terminals: Terminal points per connection	2 No. 787308
Stripping length	8 mm No. 787308
Dimensions	
Height	101.0 mm No. 787308 94.0 mm No. 777308
Width	22.5 mm
Depth	121.0 mm
Weight	185 g No. 787308 190 g No. 777308

No. stands for order number.

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

The PFH value depends on the switching frequency and the load on the relay output.  
If the service life graphs are not accessible, the stated PFH value can be

used irrespective of the switching 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.

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.

The standards current on **2008-02** apply.



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**Order reference**

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Type	Features	Terminals	Order no.
PNOZ X2.5P C	24 VDC	Spring-loaded terminals	787 308
PNOZ X2.5P	24 VDC	Screw terminals	777 308