**E-STOP relays, safety gate monitors**

**Up to PL e of EN ISO 13849-1**

PNOZ X2.8P

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**Unit features**

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

**Approvals**

<table>
<thead>
<tr>
<th>PNOZ X2.8P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**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
- Light beam devices

**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.

**Block diagram**

*only applicable for $U_B \leq 240$ VAC/DC*
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Function description

- Single-channel operation: no redundancy in the input circuit, earth faults in the reset and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: redundant input circuit, detects earth faults in the reset and input circuit, short circuits in the input circuit and, with a monitored reset, in the reset circuit too.
- 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 S12-S34
- Input: Input circuits S11-S12, S21-S22, S52
- Output safe: Safety contacts 13-14, 23-24, 33-34,
- Output aux: Auxiliary contacts 41-42
- a: Input circuit closes before reset circuit
- b: Reset circuit closes before input circuit
- t1: Switch-on delay
- t2: Delay-on de-energisation

Wiring

Please note:

- Information given in the “Technical details” must be followed.
- Outputs 13-14, 23-24, 33-34, are safety contacts, output 41-42 is an auxiliary contact (e.g. for display).
- To prevent contact welding, a fuse should be connected before the output contacts (see technical details).
- Calculation of the max. cable runs \( l_{\text{max}} \) in the input circuit:
  \[
  l_{\text{max}} = \frac{R_{\text{max}}}{R_I / \text{km}}
  \]
  \( R_{\text{max}} \) = max. overall cable resistance (see technical details)
  \( R_I / \text{km} \) = 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

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>24 – 240 VAC/DC</th>
<th>24 VAC/DC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A1 – L1</td>
<td>A1 – L+</td>
</tr>
<tr>
<td></td>
<td>S21 – N</td>
<td>A2 – L-</td>
</tr>
</tbody>
</table>

- Input circuit

<table>
<thead>
<tr>
<th>Input circuit</th>
<th>Single-channel</th>
<th>Dual-channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-STOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>without</td>
<td></td>
<td></td>
</tr>
<tr>
<td>detection of shorts across contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S21 – S22</td>
<td>S11 – S12</td>
<td>S11 – S12</td>
</tr>
<tr>
<td>S12 – S52</td>
<td>S12 – S52</td>
<td>S12 – S52</td>
</tr>
<tr>
<td>E-STOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with detection of shorts across contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S21 – S22</td>
<td>S11 – S12</td>
<td>S11 – S12</td>
</tr>
<tr>
<td>S12 – S52</td>
<td>S12 – S52</td>
<td>S12 – S52</td>
</tr>
<tr>
<td>Safety gate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>without</td>
<td></td>
<td></td>
</tr>
<tr>
<td>detection of shorts across contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S21 – S22</td>
<td>S11 – S12</td>
<td>S11 – S12</td>
</tr>
<tr>
<td>S12 – S52</td>
<td>S12 – S52</td>
<td>S12 – S52</td>
</tr>
<tr>
<td>Safety gate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with detection of shorts across contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S21 – S22</td>
<td>S11 – S12</td>
<td>S11 – S12</td>
</tr>
<tr>
<td>S12 – S52</td>
<td>S12 – S52</td>
<td>S12 – S52</td>
</tr>
<tr>
<td>Light beam device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>with detection of shorts across contacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(not on units with a universal power supply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S22 – S21</td>
<td>A2 – S12</td>
<td>S12 – S52</td>
</tr>
<tr>
<td>A2 – S21</td>
<td>S12 – S52</td>
<td>S12 – S52</td>
</tr>
<tr>
<td>24 V DC</td>
<td>GND</td>
<td></td>
</tr>
</tbody>
</table>

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

NSG-D-2-332-2009-09
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- Reset circuit

<table>
<thead>
<tr>
<th>Reset circuit</th>
<th>E-STOP wiring (single-channel)</th>
<th>E-STOP wiring (dual-channel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automatic reset</td>
<td><img src="Diagram1.png" alt="Diagram" /></td>
<td><img src="Diagram2.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Manual reset</td>
<td><img src="Diagram3.png" alt="Diagram" /></td>
<td><img src="Diagram4.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- Feedback circuit

<table>
<thead>
<tr>
<th>Feedback circuit</th>
<th>Automatic reset</th>
<th>Manual reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contacts from external contactors</td>
<td><img src="Diagram5.png" alt="Diagram" /></td>
<td><img src="Diagram6.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- Key

<table>
<thead>
<tr>
<th>S1/S2</th>
<th>E-STOP/safety gate switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3</td>
<td>Reset button</td>
</tr>
<tr>
<td><img src="Switch.png" alt="Switch operated" /></td>
<td>Switch operated</td>
</tr>
<tr>
<td><img src="GateOpen.png" alt="Gate open" /></td>
<td>Gate open</td>
</tr>
<tr>
<td><img src="GateClosed.png" alt="Gate closed" /></td>
<td>Gate closed</td>
</tr>
</tbody>
</table>
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).

* with spring-loaded terminals
Notice

This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

Service life graph

Technical details

**Electrical data**

Supply voltage

Supply voltage $U_B$ AC/DC: 24 - 240 V; 24 V

Voltage tolerance: -15 %/+10 %

Power consumption at $U_B$ AC:

- 4.5 VA Order no.: 777302, 787302
- 5.5 VA Order no.: 777301, 787301

Power consumption at $U_B$ DC:

- 2.0 W Order no.: 777302, 787302
- 2.5 W Order no.: 777301, 787301

Frequency range AC: 50 - 60 Hz

Residual ripple DC: 160 %

Voltage and current at

- Input circuit DC: 24.0 V
  - 25.0 mA Order no.: 777302, 787302
  - 30.0 mA Order no.: 777301, 787301
- Reset circuit DC: 24.0 V
  - 40.0 mA Order no.: 777302, 787302
  - 50.0 mA Order no.: 777301, 787301
- Feedback loop DC: 24.0 V
  - 40.0 mA Order no.: 777302, 787302
  - 50.0 mA Order no.: 777301, 787301
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Electrical data

Number of output contacts
Safety contacts (S) instantaneous: 3
Auxiliary contacts (N/C): 1

Utilisation category in accordance with EN 60947-4-1

Safety contacts: AC1 at 240 V
I_{\text{min}}: 0.01 \text{ A}, I_{\text{max}}: 6.0 \text{ A} Order no.: 777302, 787302
P_{\text{max}}: 1500 VA Order no.: 777302, 787302
8.0 A Order no.: 777301, 787301

Safety contacts: DC1 at 24 V
I_{\text{min}}: 0.01 \text{ A}, I_{\text{max}}: 6.0 \text{ A} Order no.: 777302, 787302
8.0 A Order no.: 777301, 787301
P_{\text{max}}: 150 W Order no.: 777302, 787302
200 W Order no.: 777301, 787301

Auxiliary contacts: AC1 at 240 V
I_{\text{min}}: 0.01 \text{ A}, I_{\text{max}}: 6.0 \text{ A} Order no.: 777302, 787302
8.0 A Order no.: 777301, 787301
P_{\text{max}}: 1500 VA Order no.: 777302, 787302
2000 VA Order no.: 777301, 787301

Auxiliary contacts: DC1 at 24 V
I_{\text{min}}: 0.01 \text{ A}, I_{\text{max}}: 6.0 \text{ A} Order no.: 777302, 787302
8.0 A Order no.: 777301, 787301
P_{\text{max}}: 150 W Order no.: 777302, 787302
200 W Order no.: 777301, 787301

Utilisation category in accordance with EN 60947-5-1

Safety contacts: AC15 at 230 V
I_{\text{max}}: 3.0 \text{ A} Order no.: 777302, 787302
6.0 A Order no.: 777301, 787301

Safety contacts: DC13 at 24 V (6 cycles/min)
I_{\text{max}}: 4.0 \text{ A} Order no.: 777302, 787302
5.0 A Order no.: 777301, 787301

Auxiliary contacts: AC15 at 230 V
I_{\text{max}}: 3.0 \text{ A} Order no.: 777302, 787302
6.0 A Order no.: 777301, 787301

Auxiliary contacts: DC13 at 24 V (6 cycles/min)
I_{\text{max}}: 4.0 \text{ A} Order no.: 777302, 787302
5.0 A Order no.: 777301, 787301

Contact material
AgCuNi + 0.2 \mu m Au

External contact fuse protection (I_{\text{K}} = 1 \text{ kA}) to EN 60947-5-1
Blow-out fuse, quick
Safety contacts: 10 A Order no.: 777302, 787302
6 A Order no.: 777301, 787301
Auxiliary contacts: 10 A Order no.: 777302, 787302
6 A Order no.: 777301, 787301

Blow-out fuse, slow
Safety contacts: 4 A Order no.: 777302, 787302
6 A Order no.: 777301, 787301
Auxiliary contacts: 4 A Order no.: 777302, 787302
6 A Order no.: 777301, 787301

Circuit breaker 24 VAC/DC, characteristic B/C
Safety contacts: 4 A Order no.: 777302, 787302
6 A Order no.: 777301, 787301
Auxiliary contacts: 4 A Order no.: 777302, 787302
6 A Order no.: 777301, 787301

Max. overall cable resistance R_{\text{max}}
input circuits, reset circuits
single-channel at U_{\text{B}} DC 30 \text{ Ohm} Order no.: 777302, 787302
45 \text{ Ohm} Order no.: 777302, 787302

single-channel at U_{\text{B}} AC 100 \text{ Ohm} Order no.: 777302, 787302
45 \text{ Ohm} Order no.: 777302, 787302

dual-channel without detect. of shorts across contacts at U_{\text{B}} DC 50 \text{ Ohm} Order no.: 777302, 787302
80 \text{ Ohm} Order no.: 777302, 787302

dual-channel without detect. of shorts across contacts at U_{\text{B}} AC 100 \text{ Ohm} Order no.: 777302, 787302
80 \text{ Ohm} Order no.: 777302, 787302

dual-channel with detect. of shorts across contacts at U_{\text{B}} DC 15 \text{ Ohm}

dual-channel with detect. of shorts across contacts at U_{\text{B}} AC 15 \text{ Ohm}
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<tr>
<th>Safety-related characteristic data</th>
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<tbody>
<tr>
<td>PL in accordance with EN ISO 13849-1</td>
<td>PL e (Cat. 4)</td>
</tr>
<tr>
<td>Category in accordance with EN 954-1</td>
<td>Cat. 4</td>
</tr>
<tr>
<td>SIL CL in accordance with EN IEC 62061</td>
<td>SIL CL 3</td>
</tr>
<tr>
<td>PFH in accordance with EN IEC 62061</td>
<td>2.31E-09</td>
</tr>
<tr>
<td>SIL in accordance with IEC 61511</td>
<td>SIL 3</td>
</tr>
<tr>
<td>PFD in accordance with IEC 61511</td>
<td>2.03E-06</td>
</tr>
<tr>
<td>$t_M$ in years</td>
<td>20</td>
</tr>
</tbody>
</table>

### Times

**Switch-on delay**

- with automatic reset typ. 250 ms Order no.: 777301, 787301
- 340 ms Order no.: 777302, 787302
- with automatic reset max. 400 ms Order no.: 777301, 787301
- 450 ms Order no.: 777302, 787302
- with automatic reset after power on typ. 250 ms Order no.: 777301, 787301
- 600 ms Order no.: 777302, 787302
- with automatic reset after power on max. 450 ms Order no.: 777301, 787301
- 800 ms Order no.: 777302, 787302
- with manual reset typ. 125 ms Order no.: 777301, 787301
- 180 ms Order no.: 777302, 787302
- with manual reset max. 400 ms Order no.: 777301, 787301
- 450 ms Order no.: 777302, 787301

**Delay-on de-energisation**

- with E-STOP typ. 10 ms Order no.: 777301, 787301
- 15 ms Order no.: 777301, 787301
- with E-STOP max. 20 ms Order no.: 777301, 787301
- 30 ms Order no.: 777301, 787301
- with power failure typ. 60 ms Order no.: 777301, 787301
- 100 ms Order no.: 777301, 787301
- with power failure max. 180 ms Order no.: 777302, 787302
- 230 ms Order no.: 777302, 787302
- with power failure typ. $U_B$ AC/DC: 24 V Order no.: 777302, 787302
- 1,100 ms Order no.: 777302, 787302
- with power failure max. $U_B$ AC/DC: 24 V Order no.: 777302, 787302
- 1500 ms Order no.: 777302, 787302

**Recovery time at max. switching frequency 1/s**

- after E-STOP 50 ms
- after power failure 200 ms Order no.: 777301, 787301
- 250 ms Order no.: 777302, 787302
- after power failure on universal power supply 1500 ms Order no.: 777302, 787302

**Min. start pulse duration with a monitored reset**

- with rising edge 30 ms

**Simultaneity, channel 1 and 2**

- ∞

**Supply interruption before de-energisation**

- 20 ms

### Environmental data

<table>
<thead>
<tr>
<th>EMC</th>
<th>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration to</td>
<td>EN 60068-2-6</td>
</tr>
<tr>
<td>Frequency</td>
<td>10 - 55 Hz</td>
</tr>
<tr>
<td>Amplitude</td>
<td>0.35 mm</td>
</tr>
<tr>
<td>Climatic suitability</td>
<td>EN 60068-2-78</td>
</tr>
<tr>
<td>Airgap creepage</td>
<td>EN 60947-1</td>
</tr>
<tr>
<td>Pollution degree</td>
<td>2</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III</td>
</tr>
<tr>
<td>Rated insulation voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated impulse withstand voltage</td>
<td>4.0 kV</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-10 - 55 °C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 - 85 °C</td>
</tr>
</tbody>
</table>
# E-STOP relays, safety gate monitors

## Up to PL e of EN ISO 13849-1

### PNOZ X2.8P

#### Environmental data
- **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 mm², 24 - 12 AWG
  - 2 core, same cross section, flexible:
    - with crimp connectors, without insulating sleeve: 0.25 - 1.00 mm², 24 - 16 AWG
    - without crimp connectors or with TWIN crimp connectors: 0.20 - 1.50 mm², 24 - 16 AWG

- **Torque setting with screw terminals**: 0.50 Nm

- **Cross section of external conductors with spring-loaded terminals**: Flexible with/without crimp connectors: 0.20 - 1.50 mm², 24 - 16 AWG

- **Spring-loaded terminals: Terminal points per connection**: 2

- **Stripping length**: 8 mm

- **Dimensions**
  - Height: 101.0 mm
  - Width: 22.5 mm
  - Depth: 121.0 mm
  - Weight: 190 g

#### Conventional thermal current

<table>
<thead>
<tr>
<th>Number of contacts</th>
<th>( I_{th} ) (A) at ( U_B ) DC</th>
<th>( I_{th} ) (A) at ( U_B ) AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.00 A Order no.: 777302, 787302</td>
<td>6.00 A Order no.: 777301, 787301</td>
</tr>
<tr>
<td></td>
<td>8.00 A Order no.: 777301, 787301</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6.00 A Order no.: 777301, 787302</td>
<td>4.00 A Order no.: 777301, 787301</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.00 A Order no.: 777302, 787302</td>
</tr>
<tr>
<td>3</td>
<td>4.50 A Order no.: 777302, 787302</td>
<td>3.50 A Order no.: 777301, 787301</td>
</tr>
<tr>
<td></td>
<td>5.00 A Order no.: 777301, 787301</td>
<td>4.50 A Order no.: 777302, 787302</td>
</tr>
</tbody>
</table>

#### Order reference

<table>
<thead>
<tr>
<th>Type</th>
<th>Features</th>
<th>Terminals</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNOZ X2.8P C</td>
<td>24 VAC</td>
<td>24 VDC</td>
<td>787301</td>
</tr>
<tr>
<td>PNOZ X2.8P</td>
<td>24 VAC</td>
<td>24 VDC</td>
<td>777301</td>
</tr>
<tr>
<td>PNOZ X2.8P C</td>
<td>24 - 240 VAC</td>
<td>24 - 240 VDC</td>
<td>787302</td>
</tr>
<tr>
<td>PNOZ X2.8P</td>
<td>24 - 240 VAC</td>
<td>24 - 240 VDC</td>
<td>777302</td>
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</table>