

## Up to Category 4, EN 954-1 PNOZ X2.8P



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

### Approvals

|  | PNOZ X2.8P |
|--|------------|
|  | ◆          |
|  | ◆          |

### 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

- ▶ Light barriers

### Safety features

The relay meets the following safety requirements:

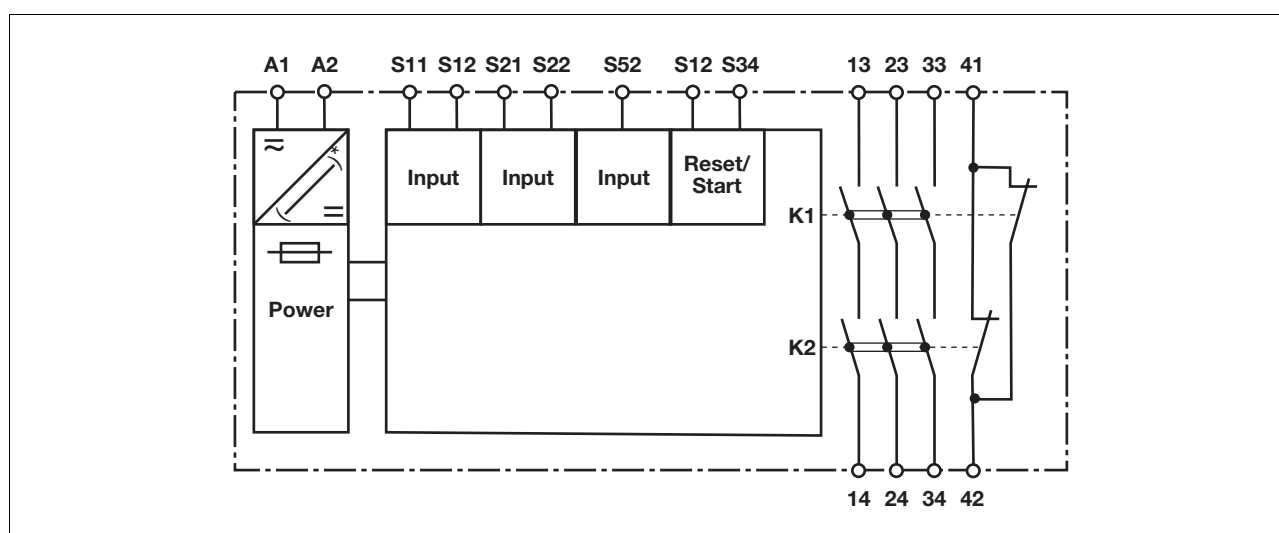
- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ The correct opening and closing of the safety function relays is tested automatically in each on-off cycle.

### 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



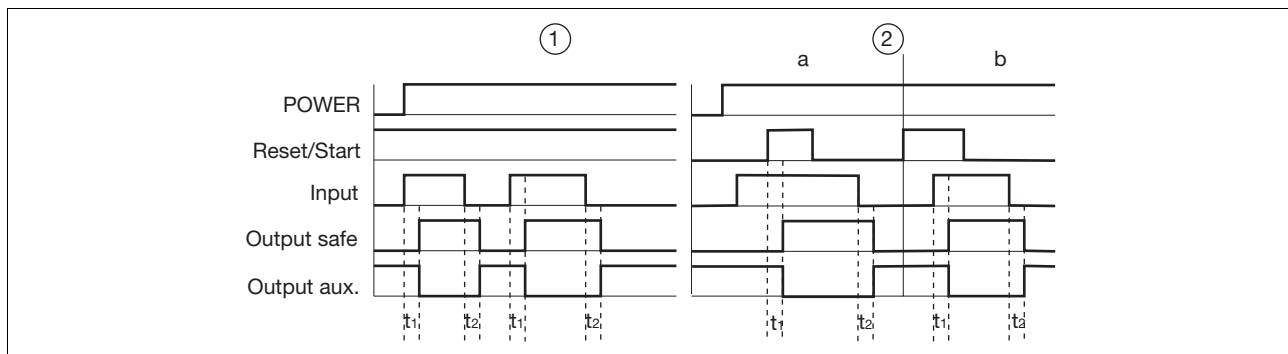
\*only with  $U_B$  24 - 240 VAC/DC

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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 contacts by connecting contact expansion modules or external contactors/relays.

### 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
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ a: Input circuit closes before reset circuit
- ▶ b: Reset circuit closes before input circuit
- ▶ t<sub>1</sub>: Switch-on delay
- ▶ t<sub>2</sub>: 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 I<sub>max</sub> in the input circuit:

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

R<sub>I<sub>max</sub></sub> = max. overall cable resistance (see technical details)

R<sub>l</sub> /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 | 24 – 240 V AC/DC | 24 V AC/DC |
|----------------|------------------|------------|
|                |                  |            |

#### ► Input circuit

| Input circuit                                                                                                    | Single-channel | Dual-channel |
|------------------------------------------------------------------------------------------------------------------|----------------|--------------|
| E-STOP<br><b>without</b> detection of shorts across contacts                                                     |                |              |
| E-STOP<br><b>with</b> detection of shorts across contacts                                                        |                |              |
| Safety gate<br><b>without</b> detection of shorts across contacts                                                |                |              |
| Safety gate<br><b>with</b> detection of shorts across contacts                                                   |                |              |
| Light barrier<br><b>with</b> detection of shorts across contacts<br>(not on units with a universal power supply) |                |              |

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### ► Reset circuit

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

### ► Feedback loop

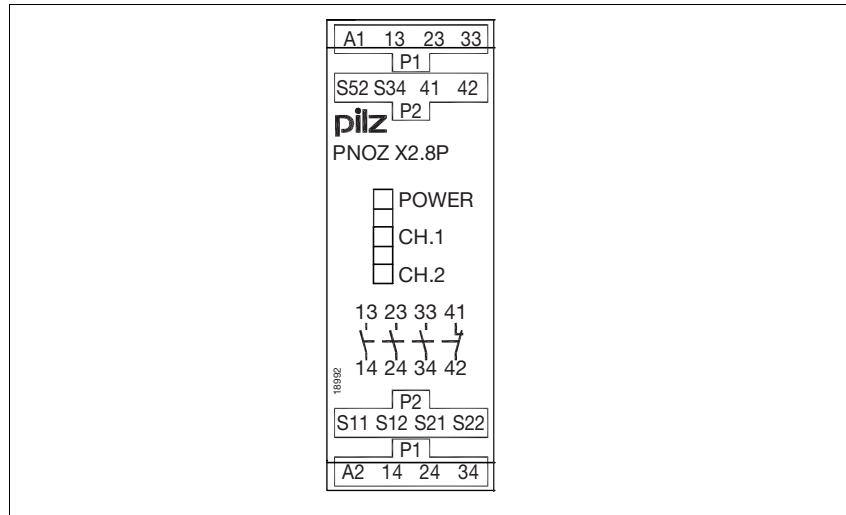
| Feedback loop                     | Automatic reset | Manual reset |
|-----------------------------------|-----------------|--------------|
| Contacts from external contactors |                 |              |

### ► Key

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

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### Terminal configuration

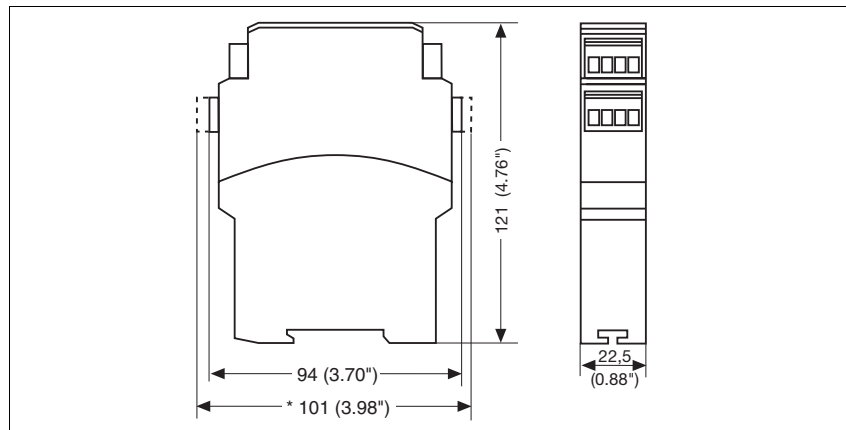


### Installation

- ▶ 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



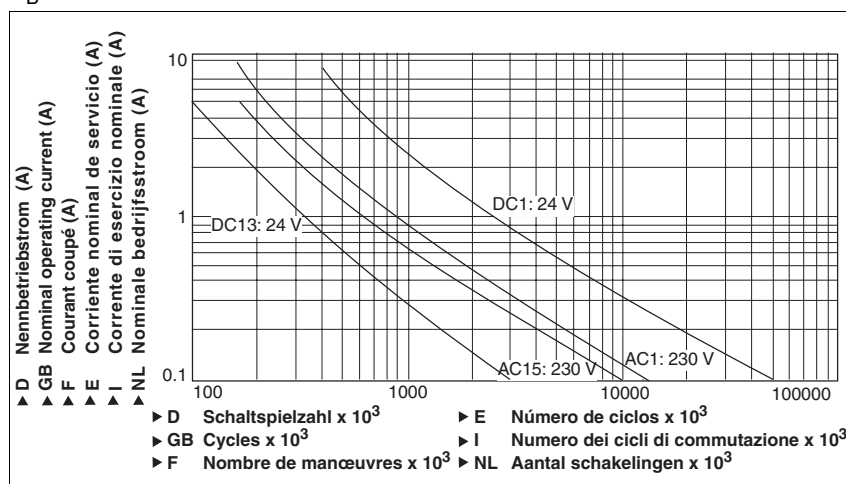
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### Notice

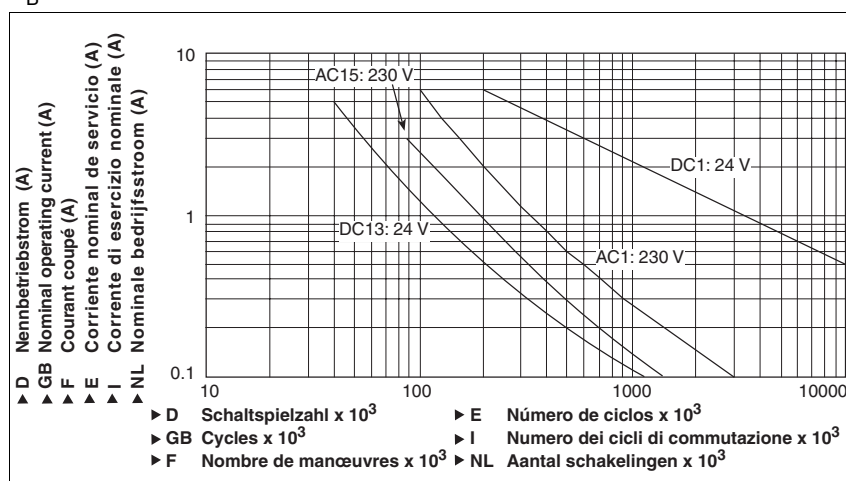
This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

### Service life graph

$U_B$  24 VAC/DC



$U_B$  24 - 240 VAC/DC



### Technical details

#### Electrical data

|                                 |                                                                                      |
|---------------------------------|--------------------------------------------------------------------------------------|
| Supply voltage                  |                                                                                      |
| Supply voltage $U_B$ AC/DC      | <b>24 - 240 V, 24 V</b>                                                              |
| Voltage tolerance               | <b>-15 %/+10 %</b>                                                                   |
| Power consumption at $U_B$ AC   | <b>4.5 VA</b> Order no.: 777302, 787302<br><b>5.5 VA</b> Order no.: 777301, 787301   |
| Power consumption at $U_B$ DC   | <b>2.0 W</b> Order no.: 777302, 787302<br><b>2.5 W</b> Order no.: 777301, 787301     |
| Frequency range AC              | <b>50 - 60 Hz</b>                                                                    |
| Residual ripple DC              | <b>160 %</b>                                                                         |
| Voltage and current at          |                                                                                      |
| Input circuit DC: <b>24.0 V</b> | <b>25.0 mA</b> Order no.: 777302, 787302<br><b>45.0 mA</b> Order no.: 777301, 787301 |
| Reset circuit DC: <b>24.0 V</b> | <b>50.0 mA</b> Order no.: 777302, 787302<br><b>75.0 mA</b> Order no.: 777301, 787301 |
| Feedback loop DC: <b>24.0 V</b> | <b>50.0 mA</b> Order no.: 777302, 787302<br><b>75.0 mA</b> Order no.: 777301, 787301 |

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| Electrical data                                                                       |                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of output contacts                                                             |                                                                                                                                                                                                                              |
| Safety contacts (S) instantaneous:                                                    | <b>3</b>                                                                                                                                                                                                                     |
| Auxiliary contacts (N/C):                                                             | <b>1</b>                                                                                                                                                                                                                     |
| <b>Category</b> of output contacts in accordance with <b>EN 954-1, EN ISO 13849-1</b> |                                                                                                                                                                                                                              |
| Safety contacts (S) instantaneous:                                                    | <b>4</b>                                                                                                                                                                                                                     |
| Utilisation category in accordance with <b>EN 60947-4-1</b>                           |                                                                                                                                                                                                                              |
| Safety contacts: AC1 at <b>240 V</b>                                                  | $I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> Order no.: 777302, 787302<br><b>8.0 A</b> Order no.: 777301, 787301<br>$P_{max}$ : <b>1500 VA</b> Order no.: 777302, 787302<br><b>2000 VA</b> Order no.: 777301, 787301 |
| Safety contacts: DC1 at <b>24 V</b>                                                   | $I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> Order no.: 777302, 787302<br><b>8.0 A</b> Order no.: 777301, 787301<br>$P_{max}$ : <b>150 W</b> Order no.: 777302, 787302<br><b>200 W</b> Order no.: 777301, 787301     |
| Auxiliary contacts: AC1 at <b>240 V</b>                                               | $I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> Order no.: 777302, 787302<br><b>8.0 A</b> Order no.: 777301, 787301<br>$P_{max}$ : <b>1500 VA</b> Order no.: 777302, 787302<br><b>2000 VA</b> Order no.: 777301, 787301 |
| Auxiliary contacts: DC1 at <b>24 V</b>                                                | $I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> Order no.: 777302, 787302<br><b>8.0 A</b> Order no.: 777301, 787301<br>$P_{max}$ : <b>150 W</b> Order no.: 777302, 787302<br><b>200 W</b> Order no.: 777301, 787301     |
| Utilisation category in accordance with <b>EN 60947-5-1</b>                           |                                                                                                                                                                                                                              |
| Safety contacts: AC15 at <b>230 V</b>                                                 | $I_{max}$ : <b>3.0 A</b> Order no.: 777302, 787302<br><b>6.0 A</b> Order no.: 777301, 787301                                                                                                                                 |
| Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)                                   | $I_{max}$ : <b>4.0 A</b> Order no.: 777302, 787302<br><b>5.0 A</b> Order no.: 777301, 787301                                                                                                                                 |
| Auxiliary contacts: AC15 at <b>230 V</b>                                              | $I_{max}$ : <b>3.0 A</b> Order no.: 777302, 787302<br><b>6.0 A</b> Order no.: 777301, 787301                                                                                                                                 |
| Auxiliary contacts: DC13 at <b>24 V</b> (6 cycles/min)                                | $I_{max}$ : <b>4.0 A</b> Order no.: 777302, 787302<br><b>5.0 A</b> Order no.: 777301, 787301                                                                                                                                 |
| Contact material                                                                      | <b>AgCuNi + 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>10 A</b> Order no.: 777301, 787301<br><b>6 A</b> Order no.: 777302, 787302                                                                                                                                                |
| Auxiliary contacts:                                                                   | <b>10 A</b> Order no.: 777301, 787301<br><b>6 A</b> Order no.: 777302, 787302                                                                                                                                                |
| Blow-out fuse, slow                                                                   |                                                                                                                                                                                                                              |
| Safety contacts:                                                                      | <b>4 A</b> Order no.: 777302, 787302<br><b>6 A</b> Order no.: 777301, 787301                                                                                                                                                 |
| Auxiliary contacts:                                                                   | <b>4 A</b> Order no.: 777302, 787302<br><b>6 A</b> Order no.: 777301, 787301                                                                                                                                                 |
| Circuit breaker 24 VAC/DC, characteristic B/C                                         |                                                                                                                                                                                                                              |
| Safety contacts:                                                                      | <b>4 A</b> Order no.: 777302, 787302<br><b>6 A</b> Order no.: 777301, 787301                                                                                                                                                 |
| Auxiliary contacts:                                                                   | <b>4 A</b> Order no.: 777302, 787302<br><b>6 A</b> Order no.: 777301, 787301                                                                                                                                                 |

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| Electrical data                                                                                          |                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Max. overall cable resistance $R_{lmax}$<br>input circuits, reset circuits<br>single-channel at $U_B$ DC | 45 Ohm Order no.: 777302, 787302<br>50 Ohm Order no.: 777301, 787301                                                                      |
| single-channel at $U_B$ AC                                                                               | 100 Ohm Order no.: 777301, 787301<br>45 Ohm Order no.: 777302, 787302                                                                     |
| dual-channel without detect. of shorts across contacts at $U_B$ DC                                       | 50 Ohm Order no.: 777301, 787301<br>80 Ohm Order no.: 777302, 787302                                                                      |
| dual-channel without detect. of shorts across contacts at $U_B$ AC                                       | 100 Ohm Order no.: 777301, 787301<br>80 Ohm Order no.: 777302, 787302                                                                     |
| dual-channel with detect. of shorts across contacts at $U_B$ DC                                          | 15 Ohm                                                                                                                                    |
| dual-channel with detect. of shorts across contacts at $U_B$ AC                                          | 15 Ohm                                                                                                                                    |
| Times                                                                                                    |                                                                                                                                           |
| Switch-on delay<br>with automatic reset typ.                                                             | 250 ms Order no.: 777301, 787301<br>340 ms Order no.: 777302, 787302                                                                      |
| with automatic reset max.                                                                                | 400 ms Order no.: 777302, 787302<br>450 ms Order no.: 777301, 787301                                                                      |
| with automatic reset after power on typ.                                                                 | 250 ms Order no.: 777301, 787301<br>600 ms Order no.: 777302, 787302                                                                      |
| with automatic reset after power on max.                                                                 | 450 ms Order no.: 777301, 787301<br>800 ms Order no.: 777302, 787302                                                                      |
| with manual reset typ.                                                                                   | 125 ms Order no.: 777301, 787301<br>180 ms Order no.: 777302, 787302                                                                      |
| with manual reset max.                                                                                   | 400 ms Order no.: 777302, 787302<br>450 ms Order no.: 777301, 787301                                                                      |
| Delay-on de-energisation<br>with E-STOP typ.                                                             | 10 ms Order no.: 777302, 787302<br>15 ms Order no.: 777301, 787301                                                                        |
| with E-STOP max.                                                                                         | 20 ms Order no.: 777302, 787302<br>30 ms Order no.: 777301, 787301<br>60 ms Order no.: 777301, 787301<br>100 ms Order no.: 777301, 787301 |
| with power failure typ.                                                                                  | 180 ms Order no.: 777302, 787302                                                                                                          |
| with power failure max.                                                                                  | 230 ms Order no.: 777302, 787302                                                                                                          |
| with power failure typ. $U_B$ AC/DC: <b>24 V</b> Order no.: 777302, 787302                               |                                                                                                                                           |
| with power failure max. $U_B$ AC/DC: <b>24 V</b> Order no.: 777302, 787302                               |                                                                                                                                           |
| with power failure typ. $U_B$ AC : <b>240 V</b>                                                          | 1,100 ms Order no.: 777302, 787302                                                                                                        |
| with power failure max. $U_B$ AC : <b>240 V</b>                                                          | 1500 ms Order no.: 777302, 787302                                                                                                         |
| Recovery time at max. switching frequency 1/s<br>after E-STOP                                            | 50 ms                                                                                                                                     |
| after power failure                                                                                      | 200 ms Order no.: 777301, 787301<br>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<br>with rising edge                                     | 30 ms                                                                                                                                     |
| Simultaneity, channel 1 and 2                                                                            | ∞                                                                                                                                         |
| Supply interruption before de-energisation                                                               | 20 ms                                                                                                                                     |
| Environmental data                                                                                       |                                                                                                                                           |
| EMC                                                                                                      | EN 60947-5-1, EN 61000-6-2, EN 61000-6-4                                                                                                  |
| Vibration to <b>EN 60068-2-6</b>                                                                         |                                                                                                                                           |
| Frequency                                                                                                | 10 - 55 Hz                                                                                                                                |
| Amplitude                                                                                                | 0.35 mm                                                                                                                                   |
| Climatic suitability                                                                                     | EN 60068-2-78                                                                                                                             |
| Airgap creepage in accordance with <b>EN 60947-1</b>                                                     |                                                                                                                                           |
| Pollution degree                                                                                         | 2                                                                                                                                         |
| Rated insulation voltage                                                                                 | 250 V                                                                                                                                     |
| Rated impulse withstand voltage                                                                          | 4.0 kV                                                                                                                                    |
| Ambient temperature                                                                                      | -10 - 55 °C                                                                                                                               |

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| Environmental data                                                                                        |                                                                                       |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 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 Order no.: 777301, 777302                   |
| 2 core, same cross section, flexible:                                                                     |                                                                                       |
| with crimp connectors, without insulating sleeve                                                          | 0.25 - 1.00 mm <sup>2</sup> , 24 - 16 AWG Order no.: 777301, 777302                   |
| without crimp connectors or with TWIN crimp connectors                                                    | 0.20 - 1.50 mm <sup>2</sup> , 24 - 16 AWG Order no.: 777301, 777302                   |
| Torque setting with screw terminals                                                                       | 0.50 Nm Order no.: 777301, 777302                                                     |
| 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 Order no.: 787301, 787302                   |
| Spring-loaded terminals: Terminal points per connection                                                   | 2 Order no.: 787301, 787302                                                           |
| Stripping length                                                                                          | 8 mm Order no.: 787301, 787302                                                        |
| Dimensions                                                                                                |                                                                                       |
| Height                                                                                                    | 101.0 mm Order no.: 787301, 787302<br>94.0 mm Order no.: 777301, 777302               |
| Width                                                                                                     | 22.5 mm                                                                               |
| Depth                                                                                                     | 121.0 mm                                                                              |
| Weight                                                                                                    | 185 g Order no.: 777301, 787301<br>205 g Order no.: 787302<br>210 g Order no.: 777302 |

The standards current on **2008-08** apply.

| Conventional thermal current |                                                                      |                                                                      |
|------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
| Number of contacts           | I <sub>th</sub> (A) at U <sub>B</sub> DC                             | I <sub>th</sub> (A) at U <sub>B</sub> AC                             |
| 1                            | 6.00 A Order no.: 777302, 787302<br>8.00 A Order no.: 777301, 787301 | 6.00 A                                                               |
| 2                            | 6.00 A                                                               | 4.00 A Order no.: 777301, 787301<br>6.00 A Order no.: 777302, 787302 |
| 3                            | 4.50 A Order no.: 777302, 787302<br>5.00 A Order no.: 777301, 787301 | 3.50 A Order no.: 777301, 787301<br>4.50 A Order no.: 777302, 787302 |

| Order reference |              |              |                         |           |
|-----------------|--------------|--------------|-------------------------|-----------|
| Type            | Features     |              | Terminals               | Order no. |
| PNOZ X2.8P C    | 24 VAC       | 24 VDC       | Spring-loaded terminals | 787 301   |
| PNOZ X2.8P      | 24 VAC       | 24 VDC       | Screw terminals         | 777 301   |
| PNOZ X2.8P C    | 24 - 240 VAC | 24 - 240 VDC | Spring-loaded terminals | 787 302   |
| PNOZ X2.8P      | 24 - 240 VAC | 24 - 240 VDC | Screw terminals         | 777 302   |