



## 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	
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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 cage clamp terminal or screw terminal)
- ▶ See order reference for unit types

- ▶ Light barriers

### Safety features

The relay meets the following safety requirements:

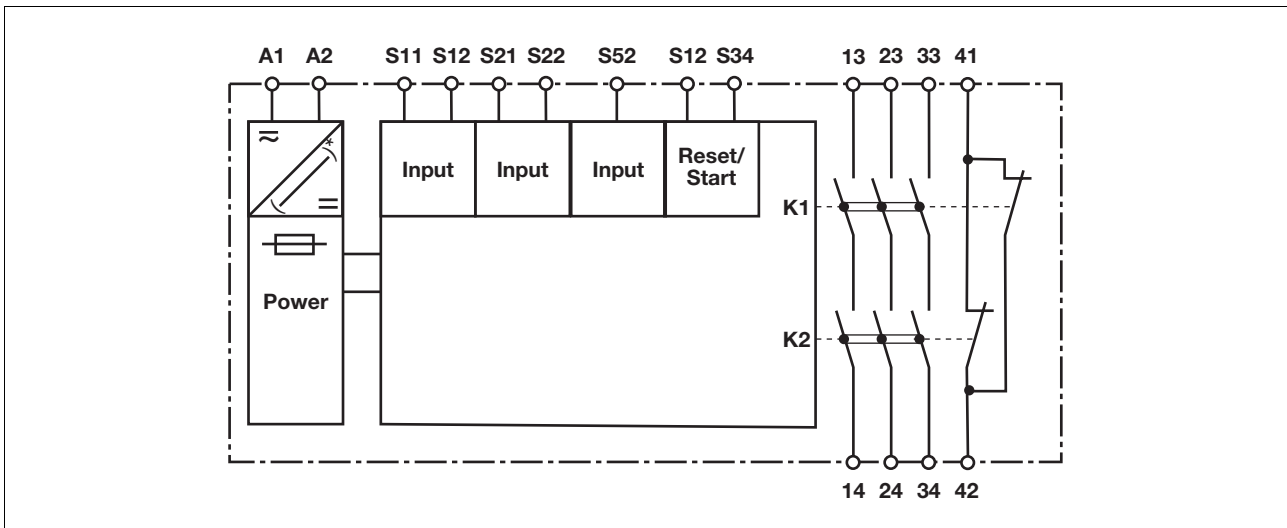
- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ The correct opening and closing of the safety function relays is tested automatically in each on-off cycle.

### 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



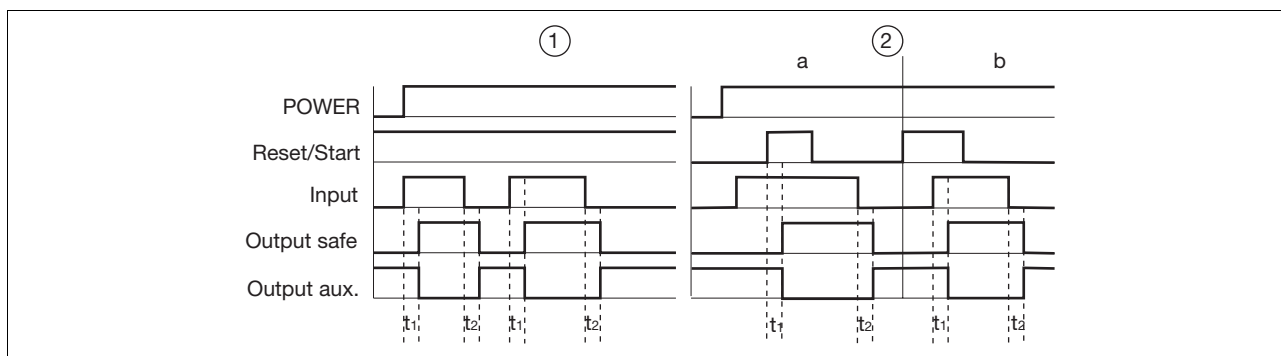
\*only with UB 24 - 240 VAC/DC

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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 expander 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  $I_{max}$  in the input circuit:

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

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

$R_l / km$  = cable resistance/km

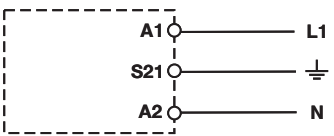
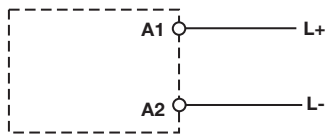
- ▶ Use copper wire that can withstand 60/75 °C.

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

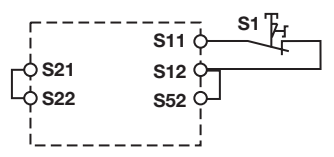
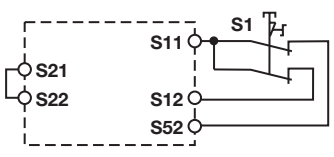
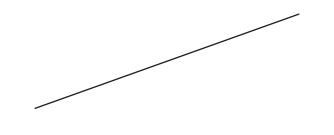
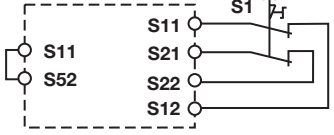
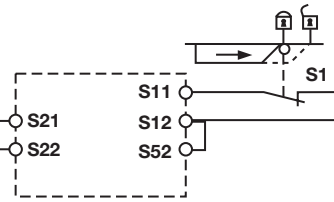
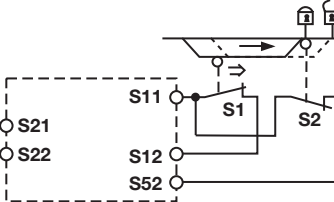
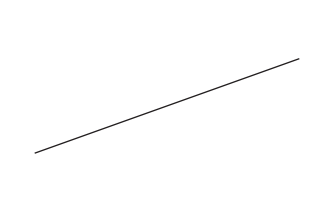
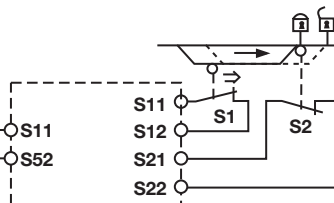
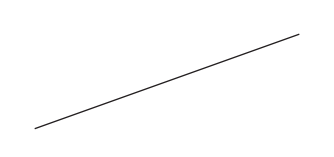
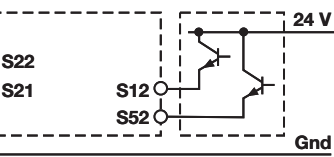
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### Preparing for operation

#### ► Supply voltage

Supply voltage	24 – 240 V AC/DC	24 V 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		
Light barrier <b>with</b> detection of shorts across contacts		

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### ▶ 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		

### ▶ Feedback loop

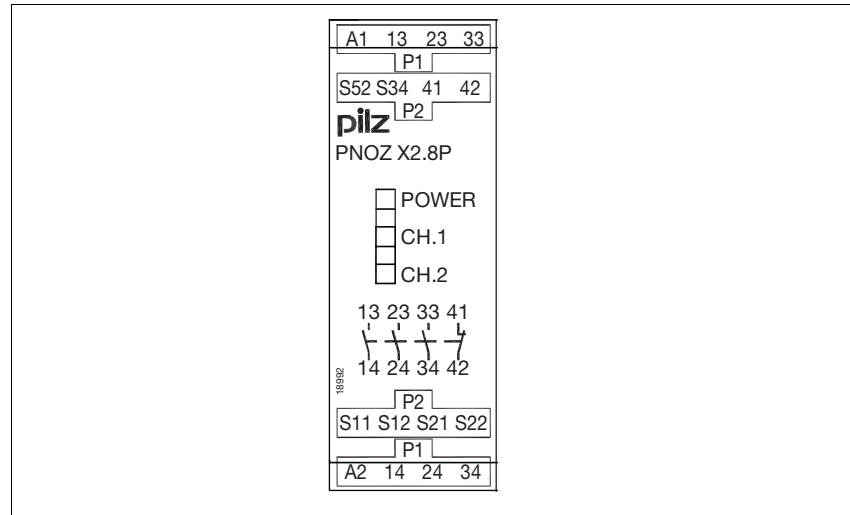
Feedback loop	Automatic reset	Manual reset
Contacts from external contactors		

### ▶ Key

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

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### Terminal configuration

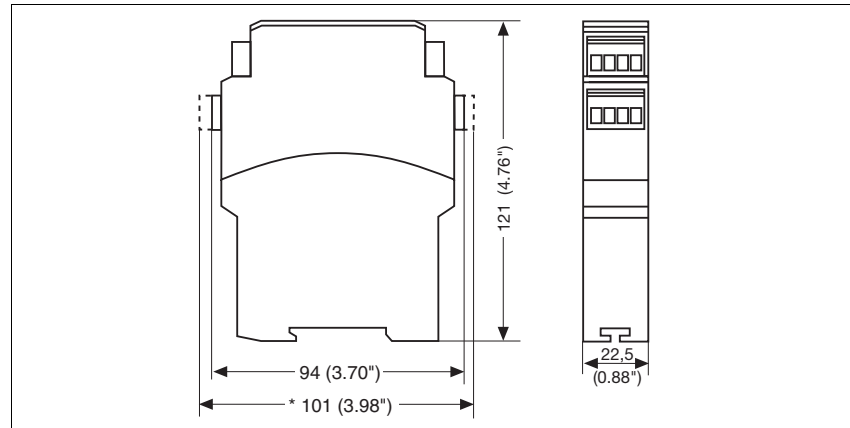


### Installation

- ▶ 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 cage clamp terminals



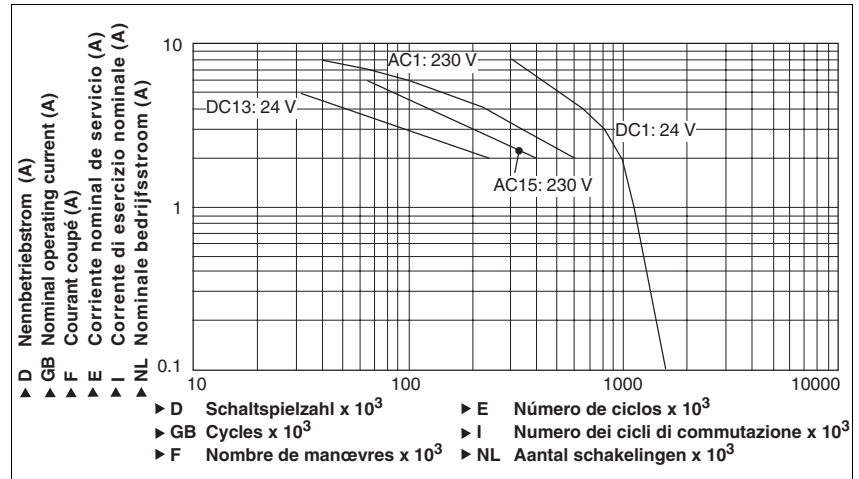
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### Notice

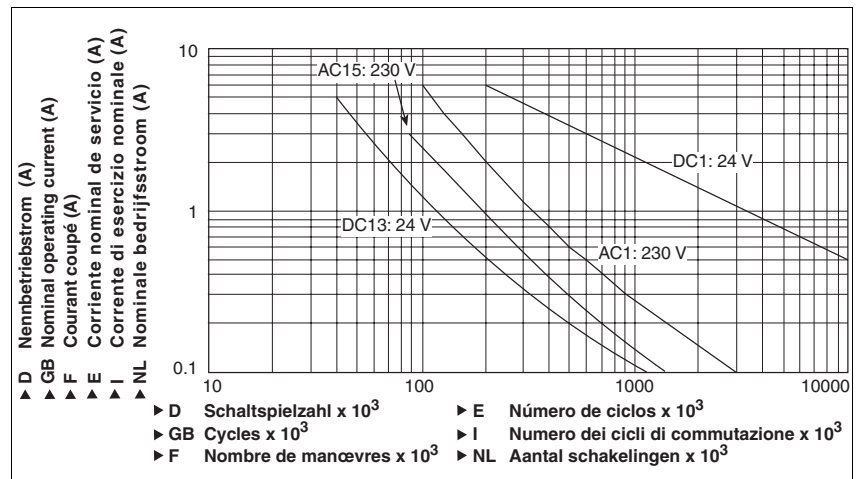
This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

### 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>3.5 VA</b> Order no.: 777301, 787301 <b>4.5 VA</b> Order no.: 777302, 787302
Power consumption at $U_B$ DC	<b>2.0 W</b>
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 <b>30.0 mA</b> Order no.: 777301, 787301
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>3</b>
Auxiliary contacts (N/C):	<b>1</b>

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Electrical data	
Category of output contacts in accordance with <b>EN 954-1</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> $P_{max}$ : <b>1500 VA</b>
Safety contacts: DC1 at <b>24 V</b>	$I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> $P_{max}$ : <b>150 W</b>
Auxiliary contacts: AC1 at <b>240 V</b>	$I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> $P_{max}$ : <b>1500 VA</b>
Auxiliary contacts: DC1 at <b>24 V</b>	$I_{min}$ : <b>0.01 A</b> , $I_{max}$ : <b>6.0 A</b> $P_{max}$ : <b>150 W</b>
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 <b>5.0 A</b> Order no.: 777301, 787301
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	$I_{max}$ : <b>4.0 A</b>
Auxiliary contacts: AC15 at <b>230 V</b>	$I_{max}$ : <b>3.0 A</b> Order no.: 777302, 787302 <b>5.0 A</b> Order no.: 777301, 787301
Auxiliary contacts: DC13 at <b>24 V</b> (6 cycles/min)	$I_{max}$ : <b>4.0 A</b>
Contact material	<b>AgCuNi + 0.2 µm Au</b> Order no.: 777302, 787302 <b>AgSnO2 + 0.2 µm Au</b> Order no.: 777301, 787301
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>
Auxiliary contacts:	<b>6 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>4 A</b>
Auxiliary contacts:	<b>4 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>4 A</b>
Auxiliary contacts:	<b>4 A</b>
Max. overall cable resistance $R_{lmax}$ input circuits, reset circuits	
single-channel at $U_B$ DC	<b>30 Ohm</b> Order no.: 777301, 787301 <b>45 Ohm</b> Order no.: 777302, 787302
single-channel at $U_B$ AC	<b>120 Ohm</b> Order no.: 777301, 787301 <b>45 Ohm</b> Order no.: 777302, 787302
dual-channel without detect. of shorts across contacts at $U_B$ DC	<b>60 Ohm</b> Order no.: 777301, 787301 <b>80 Ohm</b> Order no.: 777302, 787302
dual-channel without detect. of shorts across contacts at $U_B$ AC	<b>170 Ohm</b> Order no.: 777301, 787301 <b>80 Ohm</b> Order no.: 777302, 787302
dual-channel with detect. of shorts across contacts at $U_B$ DC	<b>15 Ohm</b>
dual-channel with detect. of shorts across contacts at $U_B$ AC	<b>15 Ohm</b> Order no.: 777302, 787302 <b>25 Ohm</b> Order no.: 777301, 787301
Times	
Switch-on delay	
with automatic reset typ.	<b>250 ms</b> Order no.: 777301, 787301 <b>340 ms</b> Order no.: 777302, 787302
with automatic reset max.	<b>400 ms</b> Order no.: 777302, 787302 <b>450 ms</b> Order no.: 777301, 787301
with automatic reset after power on typ.	<b>250 ms</b> Order no.: 777301, 787301 <b>600 ms</b> Order no.: 777302, 787302
with automatic reset after power on max.	<b>450 ms</b> Order no.: 777301, 787301 <b>800 ms</b> Order no.: 777302, 787302
with manual reset typ.	<b>125 ms</b> Order no.: 777301, 787301 <b>180 ms</b> Order no.: 777302, 787302
with manual reset max.	<b>350 ms</b> Order no.: 777301, 787301 <b>400 ms</b> Order no.: 777302, 787302

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Times	
Delay-on de-energisation with E-STOP typ.	<b>10 ms</b> Order no.: 777302, 787302 <b>12 ms</b> Order no.: 777301, 787301
with E-STOP max.	<b>20 ms</b> Order no.: 777302, 787302 <b>30 ms</b> Order no.: 777301, 787301
with power failure typ.	<b>50 ms</b> Order no.: 777301, 787301
with power failure max.	<b>60 ms</b> Order no.: 777301, 787301
with power failure typ. $U_B$ AC/DC: <b>24 V</b>	Order no.: 777302, 787302 <b>180 ms</b> Order no.: 777302, 787302
with power failure max. $U_B$ AC/DC: <b>24 V</b>	Order no.: 777302, 787302 <b>230 ms</b> Order no.: 777302, 787302
with power failure typ. $U_B$ AC : <b>240 V</b>	<b>1,100 ms</b> Order no.: 777302, 787302
with power failure max. $U_B$ AC : <b>240 V</b>	<b>1500 ms</b> Order no.: 777302, 787302
Recovery time at max. switching frequency 1/s after E-STOP	<b>50 ms</b>
after power failure	<b>100 ms</b> Order no.: 777301, 787301 <b>250 ms</b> Order no.: 777302, 787302
after power failure on universal power supply	<b>1500 ms</b> Order no.: 777302, 787302
Min. start pulse duration with a monitored reset with rising edge	<b>30 ms</b>
Simultaneity, channel 1 and 2	$\infty$
Supply interruption before de-energisation	<b>10 ms</b> Order no.: 777301, 787301 <b>20 ms</b> Order no.: 777302, 787302
Environmental data	
EMC	<b>EN 60947-5-1, EN 61000-6-2, EN 61000-6-4</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>
Airgap creepage	<b>VDE 0110-1</b>
Ambient temperature	<b>-10 - 55 °C</b>
Storage temperature	<b>-40 - 85 °C</b>
Protection type	
Mounting (e.g. cabinet)	<b>IP54</b>
Housing	<b>IP40</b>
Terminals	<b>IP20</b>
Mechanical data	
Housing material	
Housing	<b>PPO UL 94 V0</b>
Front	<b>ABS UL 94 V0</b>
Max. cross section of external conductors with screw terminals	
1 core flexible	<b>0.25 - 2.50 mm<sup>2</sup>, 24 - 12 AWG</b> Order no.: 777301, 777302
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	<b>0.25 - 1.00 mm<sup>2</sup>, 24 - 16 AWG</b> Order no.: 777301, 777302
without crimp connectors or with TWIN crimp connectors	<b>0.20 - 1.50 mm<sup>2</sup>, 24 - 16 AWG</b> Order no.: 777301, 777302
Torque setting with screw terminals	<b>0.50 Nm</b> Order no.: 777301, 777302
Max. cross section of external conductors with cage clamp terminals/spring-loaded terminals: Flexible without crimp connectors	<b>0.20 - 1.50 mm<sup>2</sup>, 24 - 16 AWG</b> Order no.: 787301, 787302
Cage clamp terminals/spring-loaded terminals: Terminal points per connection	<b>2</b> Order no.: 787301, 787302
Stripping length	<b>8 mm</b> Order no.: 787301, 787302
Dimensions	
Height	<b>101.0 mm</b> Order no.: 787301, 787302 <b>94.0 mm</b> Order no.: 777301, 777302
Width	<b>22.5 mm</b>
Depth	<b>121.0 mm</b>
Weight	<b>195 g</b> Order no.: 777301, 787301 <b>205 g</b> Order no.: 787302 <b>210 g</b> Order no.: 777302



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The standards current on **11/03** apply.

Conventional thermal current		
Number of contacts	$I_{th}$ (A) at $U_B$ DC	$I_{th}$ (A) at $U_B$ AC
1	<b>6.00 A</b>	<b>6.00 A</b>
2	<b>6.00 A</b>	<b>6.00 A</b>
3	<b>4.50 A</b> Order no.: 777302, 787302 <b>5.00 A</b> Order no.: 777301, 787301	<b>4.50 A</b> Order no.: 777302, 787302 <b>5.00 A</b> Order no.: 777301, 787301

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