

## Up to Category 4, EN 954-1 PNOZ X4






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

### 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
- ▶ See order reference for unit types

- ▶ 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 transformer is short circuit-proof. An electronic fuse is used on a DC supply.

### Approvals

	PNOZ X4
	◆
	◆
	◆

### Unit description

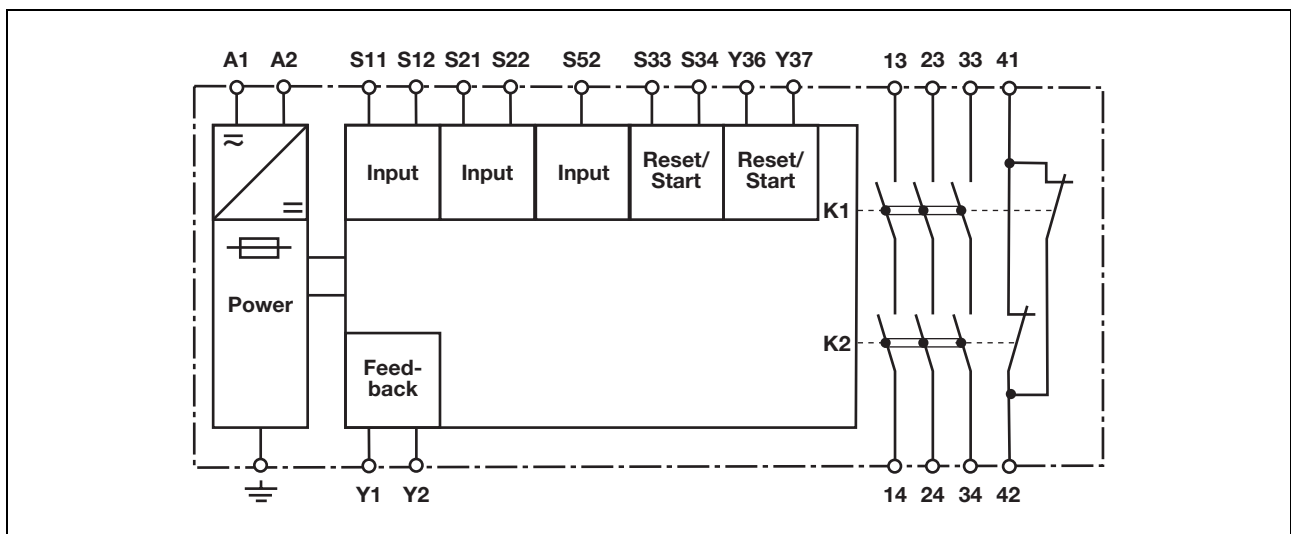
The safety relay meets the requirements of EN 60204-1 and IEC 60204-1 and may be used in applications with

- ▶ E-STOP pushbuttons
- ▶ Safety gates
- ▶ Light barriers

### Safety features

The relay conforms to the following safety criteria:

### Block diagram

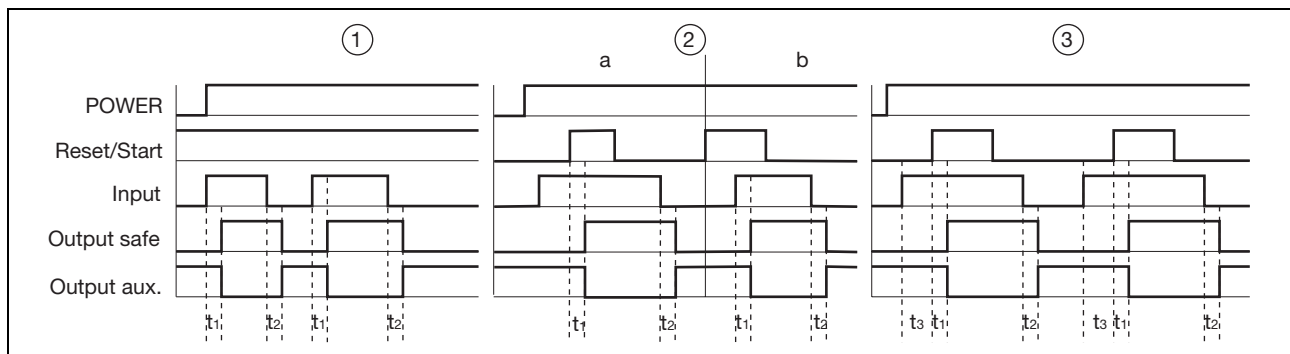


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### Function description

- ▶ 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
- ▶ Dual-channel operation with 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,
  - 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.
- ▶ Monitored reset: Unit is active once the input circuit is closed and once the reset circuit is closed after the waiting period has elapsed (see technical details).
- ▶ 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 S33-S34
- ▶ Input: Input circuits S11-S12, S21-S22, S52
- ▶ Output safe: Safety outputs 13-14, 23-24, 33-34
- ▶ Output aux: Auxiliary contacts 41-42
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ ③: Monitored 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
- ▶  $t_3$ : Waiting period

### 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  $l_{max}$  in the input circuit:

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

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

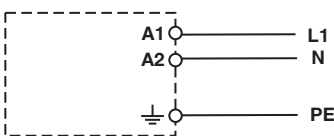
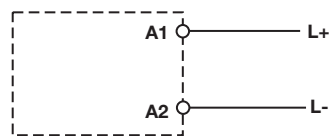
$R_l / km$  = cable resistance/km

- ▶ Use copper wire that can withstand 60/75 °C.
- ▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

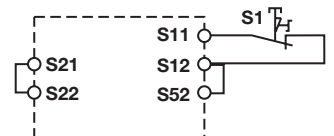
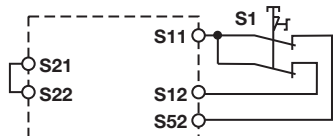
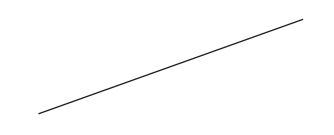
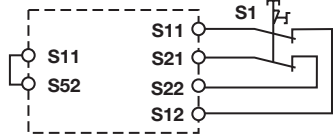
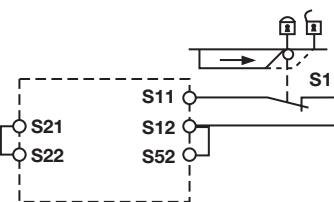
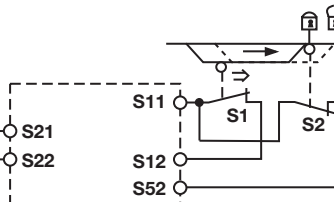
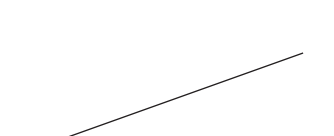
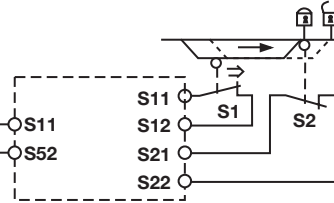
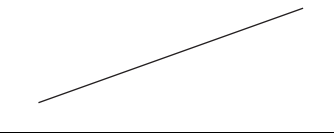
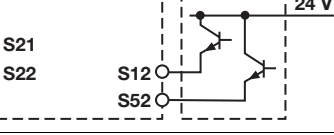
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### Preparing for operation

► Supply voltage

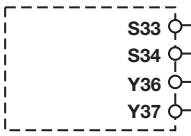
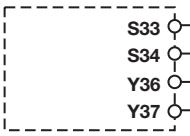
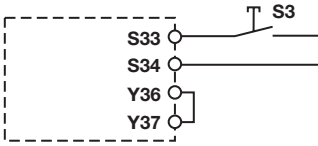
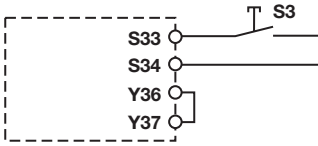
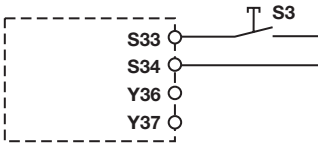
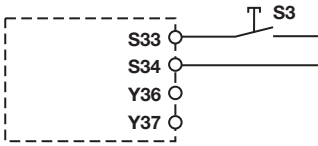
Supply voltage	AC	DC
		

► Input circuit

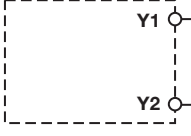
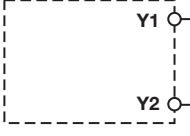
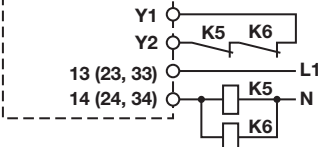
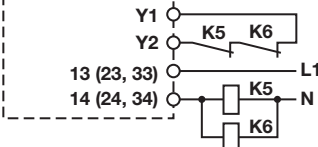
Input circuit	Single-channel	Dual-channel
E-STOP <b>without</b> detection of shorts across contacts		
E-STOP <b>with</b> detection of shorts across contacts		
Safety gate <b>without</b> detection of shorts across contacts		
Safety gate <b>with</b> detection of shorts across contacts		
Light barrier 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

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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		
Monitored reset		

### ▶ Feedback loop

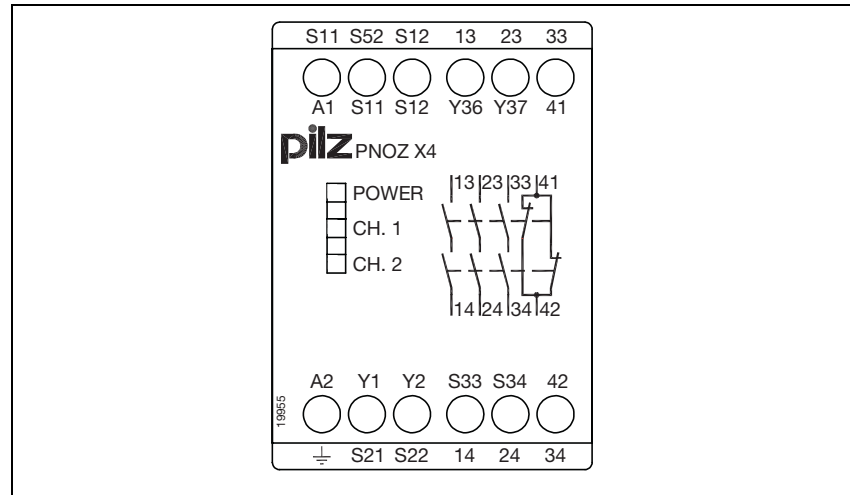
Feedback loop	Automatic reset	Manual/monitored reset
Link		
Contacts from external contactors		

### ▶ Key

S1/S2	Two-hand button
S3	Reset button
	Switch operated
	Gate open
	Gate closed

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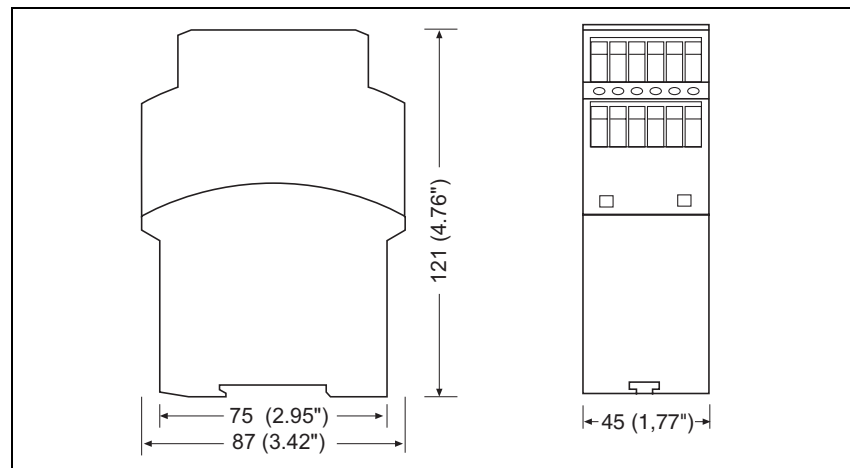
### Terminal configuration



### 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

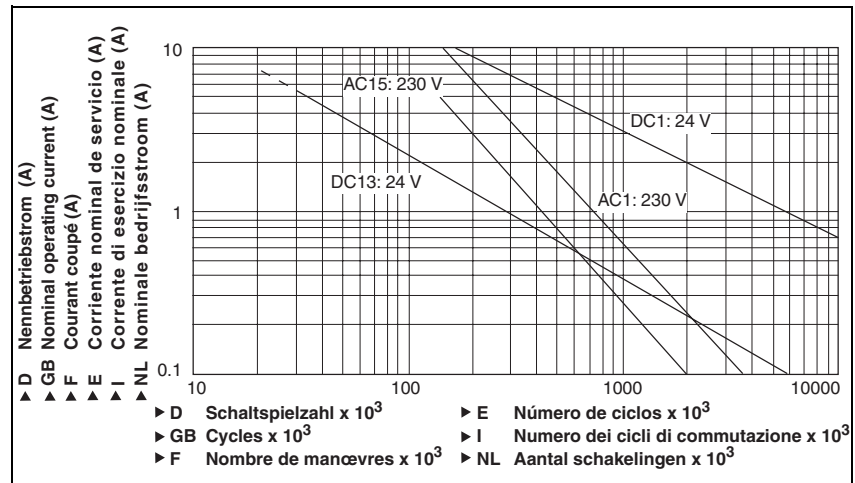


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### Notice

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



### Technical details

#### Electrical data

Supply voltage	
Supply voltage U <sub>B</sub> AC	<b>24 V, 110 V, 115 V, 120 V, 230 V, 240 V</b>
Supply voltage U <sub>B</sub> DC	<b>24 V</b>
Voltage tolerance	<b>-15 %/+10 %</b>
Power consumption at U <sub>B</sub> AC	<b>5.0 VA</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
Power consumption at U <sub>B</sub> DC	<b>2.5 W</b> Order no.: 774730
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>40.0 mA</b>
reset circuit DC: <b>24.0 V</b>	<b>70.0 mA</b> Order no.: 774730 <b>90.0 mA</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
feedback loop DC: <b>24.0 V</b>	<b>70.0 mA</b> Order no.: 774730 <b>90.0 mA</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
Output contacts in accordance with <b>EN 954-1</b> Category <b>4</b>	Safety contacts (N/O): <b>3</b> Auxiliary contacts (N/C): <b>1</b>
Utilisation category in accordance with <b>EN 60947-4-1</b>	
Safety contacts: AC1 at <b>240 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>8.0 A</b> P <sub>max</sub> : <b>2000 VA</b>
Safety contacts: DC1 at <b>24 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>8.0 A</b> P <sub>max</sub> : <b>200 W</b>
Auxiliary contacts: AC1 at <b>240 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>8.0 A</b> P <sub>max</sub> : <b>2000 VA</b>
Auxiliary contacts: DC1 at <b>24 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>8.0 A</b> P <sub>max</sub> : <b>200 W</b>
Utilisation category in accordance with <b>EN 60947-5-1</b>	
Safety contacts: AC15 at <b>230 V</b>	I <sub>max</sub> : <b>5.0 A</b>
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	I <sub>max</sub> : <b>7.0 A</b>
Auxiliary contacts: AC15 at <b>230 V</b>	I <sub>max</sub> : <b>5.0 A</b>
Auxiliary contacts: DC13 at <b>24 V</b> (6 cycles/min)	I <sub>max</sub> : <b>7.0 A</b>
Contact material	<b>AgSnO2 + 0.2 µm Au</b>

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Electrical data	
External contact fuse protection to <b>EN 60947-5-1</b>	
Blow-out fuse, quick	
Safety contacts:	<b>10 A</b>
Auxiliary contacts:	<b>10 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>6 A</b>
Auxiliary contacts:	<b>6 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>6 A</b>
Auxiliary contacts:	<b>6 A</b>
Max. overall cable resistance $R_{lmax}$ input circuits, reset circuits	
single-channel at $U_B$ DC	<b>20 Ohm</b> Order no.: 774730
single-channel at $U_B$ AC	<b>150 Ohm</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
dual-channel without detect. of shorts across contacts at $U_B$ DC	<b>20 Ohm</b> Order no.: 774730
dual-channel without detect. of shorts across contacts at $U_B$ AC	<b>150 Ohm</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
dual-channel with detect. of shorts across contacts at $U_B$ DC	<b>15 Ohm</b> Order no.: 774730
dual-channel with detect. of shorts across contacts at $U_B$ AC	<b>100 Ohm</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
Times	
Switch-on delay	
with automatic reset typ.	<b>210 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>270 ms</b> Order no.: 774730
with automatic reset max.	<b>350 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>600 ms</b> Order no.: 774730
with automatic reset after power on typ.	<b>240 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>270 ms</b> Order no.: 774730
with automatic reset after power on max.	<b>390 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>600 ms</b> Order no.: 774730
with manual reset typ.	<b>55 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>70 ms</b> Order no.: 774730
with manual reset max.	<b>350 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>600 ms</b> Order no.: 774730
with monitored reset typ.	<b>30 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>40 ms</b> Order no.: 774730
with monitored reset max.	<b>50 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
	<b>70 ms</b> Order no.: 774730
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>50 ms</b> Order no.: 774730
	<b>55 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
with power failure max.	<b>70 ms</b> Order no.: 774730
	<b>80 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
Recovery time at max. switching frequency 1/s	
after E-STOP	<b>50 ms</b>
after power failure	<b>100 ms</b>

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Times	
Waiting period with a monitored reset	<b>150 ms</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739 <b>250 ms</b> Order no.: 774730
Min. start pulse duration with a monitored reset	<b>30 ms</b>
Simultaneity, channel 1 and 2	∞
Supply interruption before de-energisation	<b>20 ms</b>
Environmental data	
EMC	<b>EN 60947-5-1, EN 61000-6-2</b>
Vibration in accordance with <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. control 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>0.20 - 4.00 mm<sup>2</sup>, 24 - 10 AWG</b>
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	<b>0.20 - 2.50 mm<sup>2</sup>, 24 - 14 AWG</b>
without crimp connectors or with TWIN crimp connectors	<b>0.20 - 2.50 mm<sup>2</sup>, 24 - 14 AWG</b>
Torque setting with screw terminals	<b>0.60 Nm</b>
Dimensions	
Height	<b>87.0 mm</b>
Width	<b>45.0 mm</b>
Depth	<b>121.0 mm</b>
Weight	
	<b>270 g</b> Order no.: 774730 <b>370 g</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739

The standards current on **09/00** apply.

Max. continuous current		
Number of contacts	$I_{\max}$ (A) at $U_B$ DC	$I_{\max}$ (A) at $U_B$ AC
1	<b>8.00 A</b> Order no.: 774730, 774732	<b>8.00 A</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
2	<b>8.00 A</b> Order no.: 774730, 774732	<b>7.50 A</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739
3	<b>7.00 A</b> Order no.: 774730, 774732	<b>6.50 A</b> Order no.: 774731, 774734, 774735, 774736, 774738, 774739

Order reference			
Type	Features	Terminals	Order no.
PNOZ X4	24 VAC	Screw terminals	774 731
PNOZ X4	110 VAC	Screw terminals	774 734
PNOZ X4	115 VAC	Screw terminals	774 735



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Type	Features	Terminals	Order no.
PNOZ X4	120 VAC	Screw terminals	774 736
PNOZ X4	230 VAC	Screw terminals	774 738
PNOZ X4	240 VAC	Screw terminals	774 739
PNOZ X4	24 VDC	Screw terminals	774 730