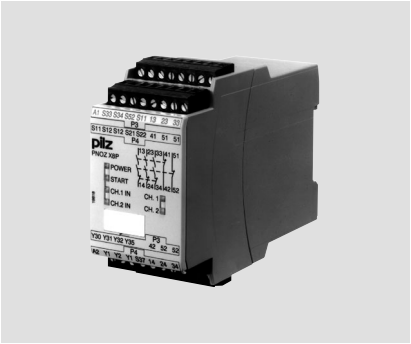
Up to PL e of EN ISO 13849-1
PNOZ X8P



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

Approvals

	PNOZ X8P
cULus LISTED	◆
TÜV	◆
CCC	◆

Unit features

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

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

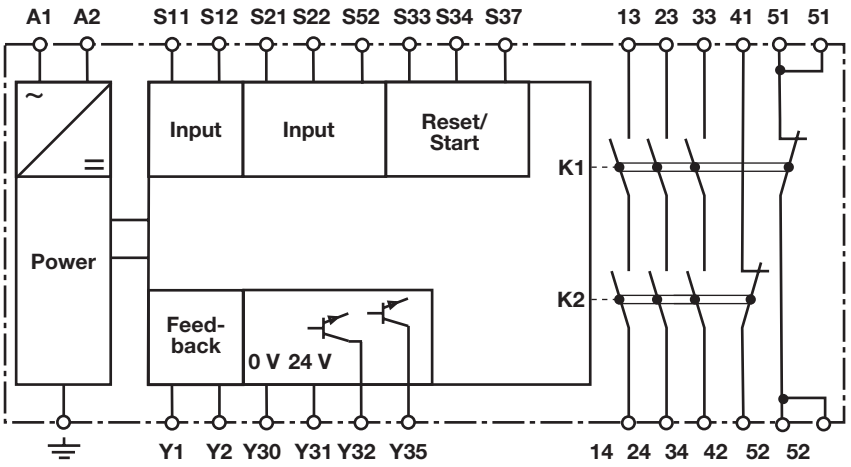
- E-STOP pushbuttons
- Safety gates
- Light beam devices

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.
- The tranformer is short circuit-proof. An electronic fuse is used on a DC supply.

Block diagram



Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
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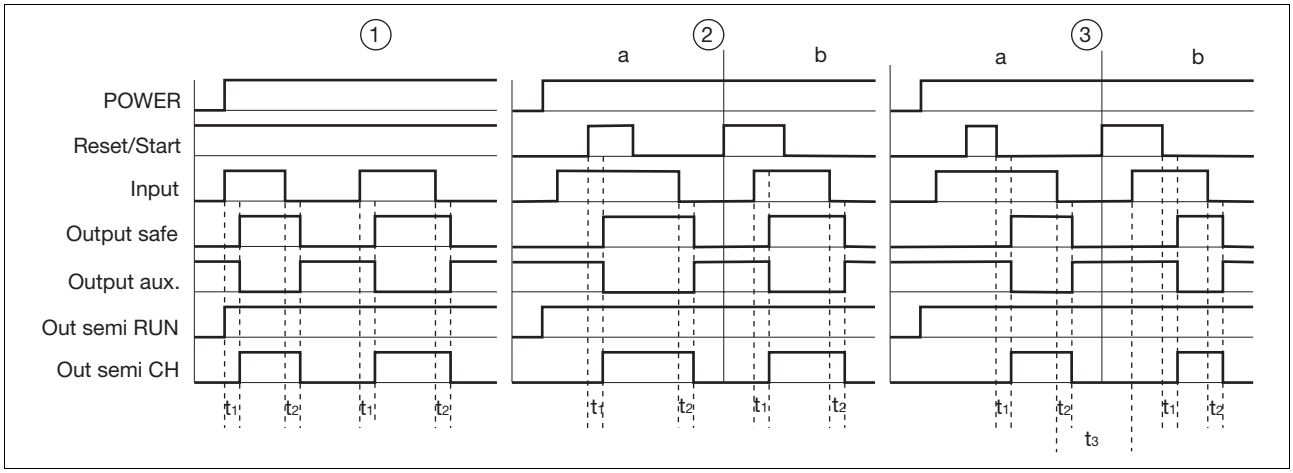
Function description

- 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 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 then the reset circuit is closed and opened again.
  - the reset circuit is closed and then opened again once the input 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, Y1-S37
- Input: Input circuits S21-22, S11-S12, S52
- Output safe: Safety contacts 13-14, 23-24, 33-34
- Output aux: Auxiliary contacts 41-42, 51-52
- Out semi RUN: Semiconductor output supply voltage Y35
- Out semi CH: Semiconductor output switch status Y32
- 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: Recovery time

Wiring

Please note:

- Information given in the “Technical details” must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts, outputs 41-42, 51-52 are auxiliary contacts (e.g. for display).
- To prevent contact welding, a fuse should be connected before the output contacts (see technical details).
- Calculation of the max. cabling 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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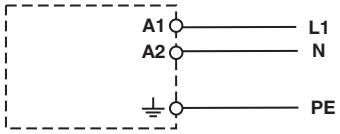
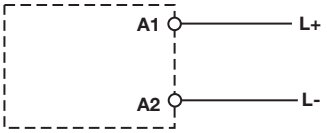
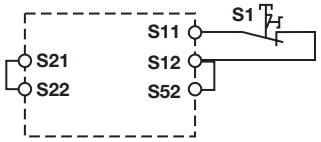
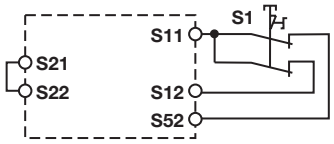
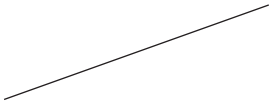
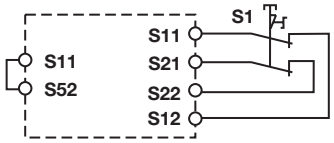
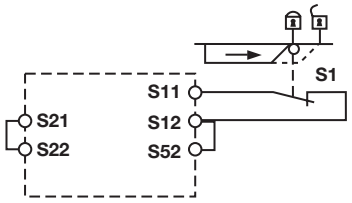
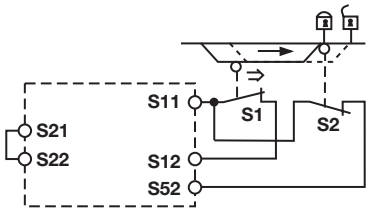
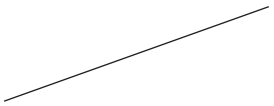
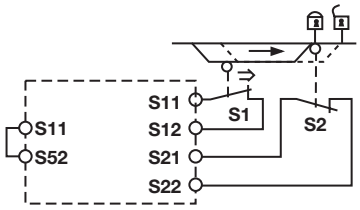
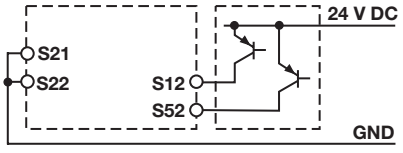
Preparing for operation

- Supply voltage

Supply voltage	AC	DC
		

- Input circuit

Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
E-STOP **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Safety gate **with** detection of shorts across contacts		
Light beam device **with** detection of shorts across contacts via ESPE		

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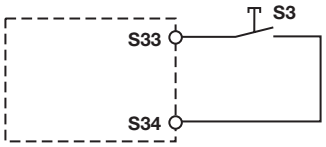
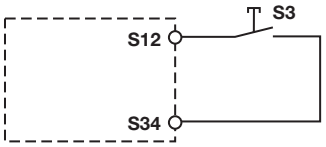
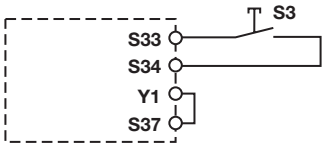
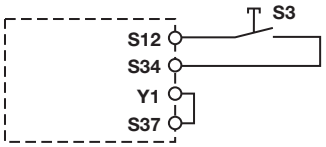
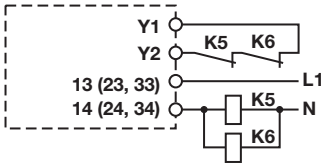
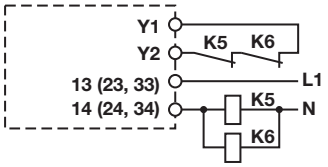
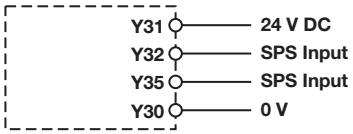
Reset circuit

Reset circuit	E-STOP/safety gate wiring (single-channel and dual-channel without shorts across contacts)	E-STOP/safety gate wiring (dual-channel with shorts across contacts)
Automatic reset		
Manual reset		
Monitored reset		

Feedback circuit

Feedback circuit	Automatic reset	Monitored reset
Contacts from external contactors		

Semiconductor output



Key

S1	E-STOP pushbutton
S3	Reset button
	Switch operated
	Gate open
	Gate closed

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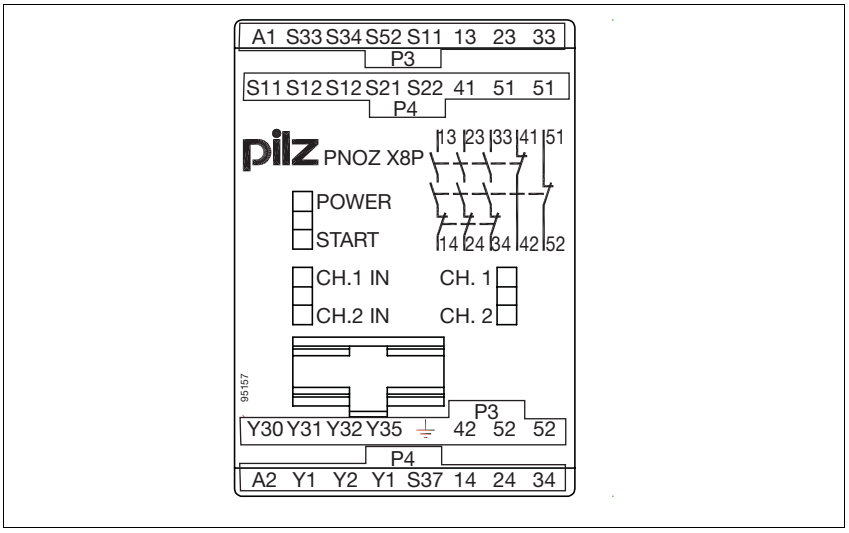
Terminal configuration

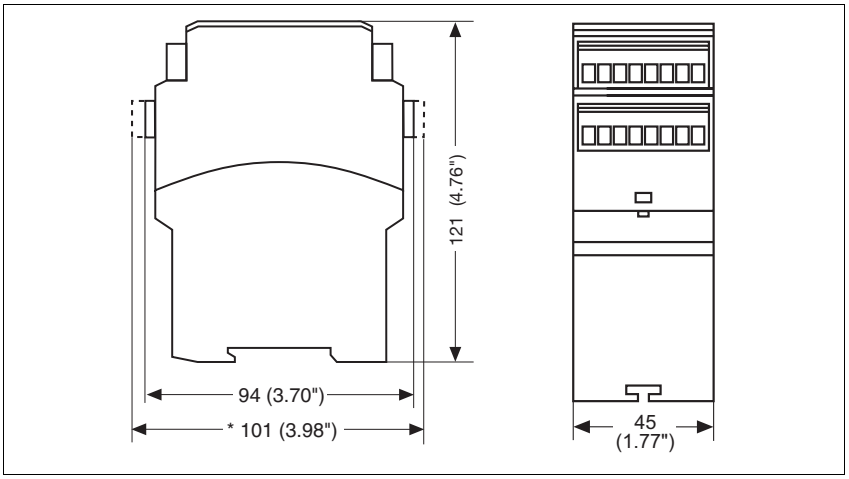


Installation

- 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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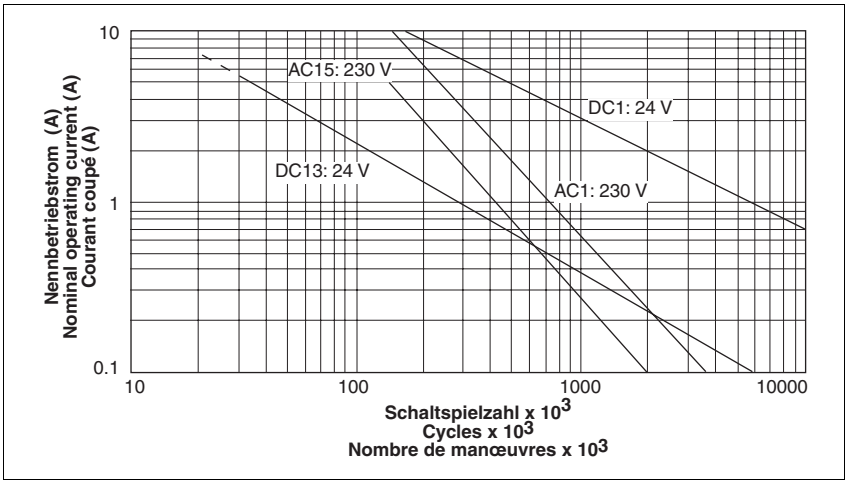
Notice

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



Technical details

Electrical data	
Supply voltage	
Supply voltage U_B AC	**24 V**, **110 V**, **115 V**, **120 V**, **230 V**
Supply voltage U_B DC	**24 V**
Voltage tolerance	**-15 %/+10 %**
Power consumption at U_B AC	**6.5 VA** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
Power consumption at U_B DC	**2.5 W** Order no.: 777760, 787760
Frequency range AC	**50 - 60 Hz**
Residual ripple DC	**160 %**
Voltage and current at	
Input circuit DC: **24.0 V**	**40.0 mA** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770 **45.0 mA** Order no.: 777760, 787760
Reset circuit DC: **24.0 V**	**50.0 mA** Order no.: 777760, 787760 **60.0 mA** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
Feedback loop DC: **24.0 V**	**50.0 mA** Order no.: 777760, 787760 **60.0 mA** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
Number of output contacts	
Safety contacts (S) instantaneous:	**3**
Auxiliary contacts (N/C):	**2**
Utilisation category in accordance with **EN 60947-4-1**	
Safety contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **8.0 A** P_{max}: **2000 VA**
Safety contacts: DC1 at **24 V**	I_{min}: **0.01 A** , I_{max}: **8.0 A** P_{max}: **200 W**
Auxiliary contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **8.0 A** P_{max}: **2000 VA**
Auxiliary contacts: DC1 at **24 V**	I_{min}: **0.01 A** , I_{max}: **8.0 A** P_{max}: **200 W**
Utilisation category in accordance with **EN 60947-5-1**	
Safety contacts: AC15 at **230 V**	I_{max}: **5.0 A**
Safety contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **7.0 A**
Auxiliary contacts: AC15 at **230 V**	I_{max}: **5.0 A**
Auxiliary contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **7.0 A**

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Electrical data	
Contact material	**AgSnO2 + 0.2 µm Au**
External contact fuse protection (I_K = 1 kA) to **EN 60947-5-1**	
Blow-out fuse, quick	
Safety contacts:	**10 A**
Auxiliary contacts:	**10 A**
Blow-out fuse, slow	
Safety contacts:	**6 A**
Auxiliary contacts:	**6 A**
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	**6 A**
Auxiliary contacts:	**6 A**
Semiconductor outputs (short circuit proof)	**24.0 V** DC,**50 mA**
External supply voltage	**24.0 V** DC
Voltage tolerance	**-20 %/+20 %**
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	**100 Ohm** Order no.: 777760, 787760
single-channel at U_B AC	**100 Ohm** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
dual-channel without detect. of shorts across contacts at U_B DC	**200 Ohm** Order no.: 777760, 787760
dual-channel without detect. of shorts across contacts at U_B AC	**200 Ohm** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
dual-channel with detect. of shorts across contacts at U_B DC	**16 Ohm** Order no.: 777760, 787760
dual-channel with detect. of shorts across contacts at U_B AC	**28 Ohm** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
Safety-related characteristic data	
PL in accordance with **EN ISO 13849-1**	**PL e** (**Cat. 4**)
Category in accordance with **EN 954-1**	**Cat. 4**
SIL CL in accordance with **EN IEC 62061**	**SIL CL 3**
PFH in accordance with **EN IEC 62061**	**2.31E-09**
SIL in accordance with **IEC 61511**	**SIL 3**
PFD in accordance with **IEC 61511**	**2.03E-06**
t_M in years	**20**
Times	
Switch-on delay	
with automatic reset typ.	**160 ms** Order no.: 777760, 787760 **175 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
with automatic reset max.	**200 ms** Order no.: 777760, 787760 **220 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
with automatic reset after power on typ.	**185 ms** Order no.: 777760, 787760 **200 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
with automatic reset after power on max.	**220 ms** Order no.: 777760, 787760 **250 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
with manual reset typ.	**190 ms**
with manual reset max.	**250 ms**
on monitored reset with rising edge typ.	**130 ms**
on monitored reset with rising edge max.	**180 ms**

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Times	
Delay-on de-energisation	
with E-STOP typ.	**15 ms**
with E-STOP max.	**30 ms**
with power failure typ.	**100 ms** Order no.: 777760, 787760 **160 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
with power failure max.	**150 ms** Order no.: 777760, 787760 **220 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms**
after power failure	**180 ms** Order no.: 777760, 787760 **250 ms** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
Min. start pulse duration with a monitored reset	
with rising edge	**30 ms**
Simultaneity, channel 1 and 2	**150 ms**
Supply interruption before de-energisation	**35 ms**
Environmental data	
EMC	**EN 60947-5-1**, **EN 61000-6-2**
Vibration to **EN 60068-2-6**	
Frequency	**10 - 55 Hz**
Amplitude	**0.35 mm**
Climatic suitability	**EN 60068-2-78**
Airgap creepage in accordance with **EN 60947-1**	
Pollution degree	**2**
Overvoltage category	**III**
Rated insulation voltage	**250 V**
Rated impulse withstand voltage	**4.0 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 mm² , 24 - 12 AWG** Order no.: 777760, 777764, 777765, 777766, 777768, 777770
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** Order no.: 777760, 777764, 777765, 777766, 777768, 777770
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 777760, 777764, 777765, 777766, 777768, 777770
Torque setting with screw terminals	**0.50 Nm** Order no.: 777760, 777764, 777765, 777766, 777768, 777770
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 787760, 787764, 787765, 787766, 787768, 787770
Spring-loaded terminals: Terminal points per connection	**2** Order no.: 787760, 787764, 787765, 787766, 787768, 787770
Stripping length	**8 mm** Order no.: 787760, 787764, 787765, 787766, 787768, 787770

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Mechanical data	
Dimensions	
Height	**101.0 mm** Order no.: 787760, 787764, 787765, 787766, 787768, 787770 **94.0 mm** Order no.: 777760, 777764, 777765, 777766, 777768, 777770
Width	**45.0 mm**
Depth	**121.0 mm**
Weight	**310 g** Order no.: 787760 **320 g** Order no.: 777760 **410 g** Order no.: 787764, 787765, 787766, 787768, 787770 **420 g** Order no.: 777764, 777765, 777766, 777768, 777770

The standards current on **2006-06** apply.

Conventional thermal current

Number of contacts	I_{th} (A) at U_B DC	I_{th} (A) at U_B AC
1	**8.00 A** Order no.: 777760, 787760	**8.00 A** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
2	**8.00 A** Order no.: 777760, 787760	**7.30 A** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770
3	**7.00 A** Order no.: 777760, 787760	**6.00 A** Order no.: 777764, 777765, 777766, 777768, 777770, 787764, 787765, 787766, 787768, 787770

Order reference

Type	Features	Terminals	Order no.
PNOZ X8P C	24 VDC	Spring-loaded terminals	787 760
PNOZ X8P	24 VDC	Screw terminals	777 760
PNOZ X8P C	110 VAC	Spring-loaded terminals	787 764
PNOZ X8P	110 VAC	Screw terminals	777 764
PNOZ X8P C	115 VAC	Spring-loaded terminals	787 765
PNOZ X8P	115 VAC	Screw terminals	777 765
PNOZ X8P C	120 VAC	Spring-loaded terminals	787 766
PNOZ X8P	120 VAC	Screw terminals	777 766
PNOZ X8P C	230 VAC	Spring-loaded terminals	787 768
PNOZ X8P	230 VAC	Screw terminals	777 768
PNOZ X8P C	24 VAC	Spring-loaded terminals	787 770
PNOZ X8P	24 VAC	Screw terminals	777 770