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
c UL us LISTED	◆
	◆

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

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

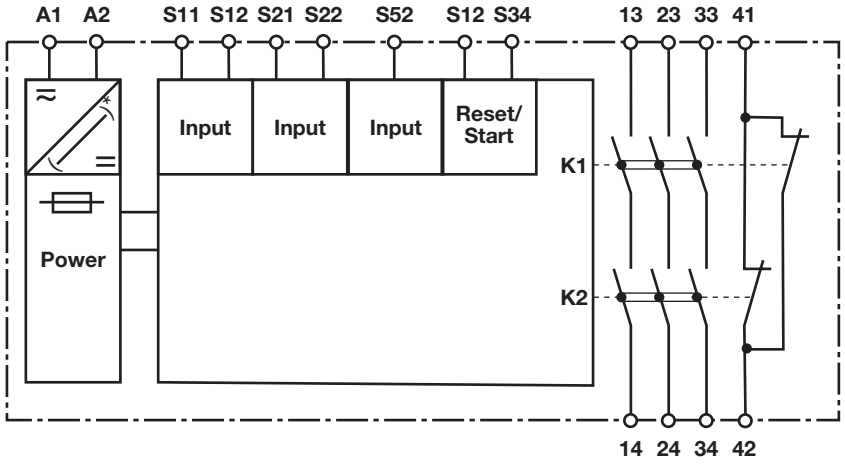
- E-STOP pushbuttons
- Safety gates
- Light barriers

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.

Block diagram



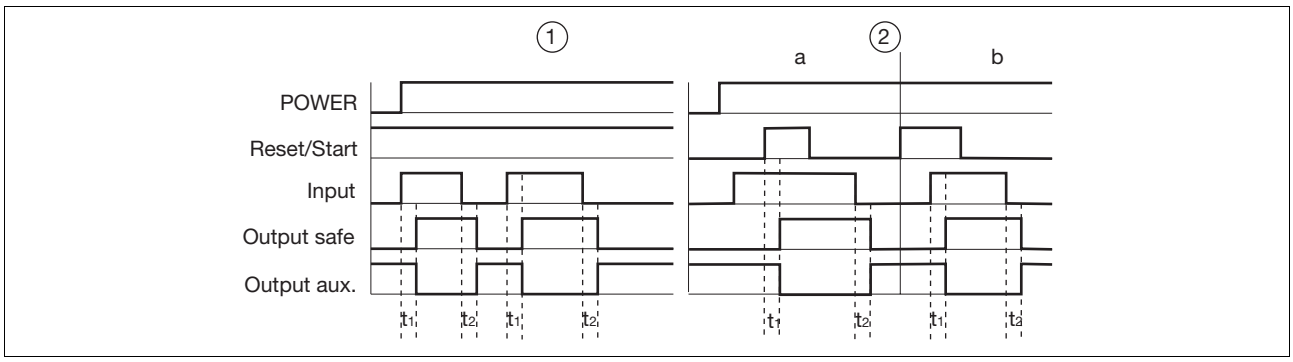
*only with U_B 24 - 240 VAC/DC

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

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_1: Switch-on delay
- t_2: 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_{max} in the input circuit:

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

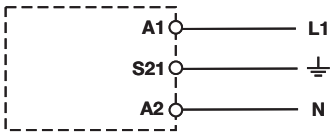
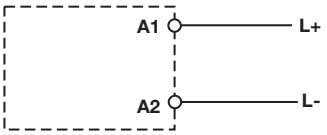
  R_{lmax} = max. overall cable resistance (see technical details)
  R_l /km = cable resistance/km
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

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

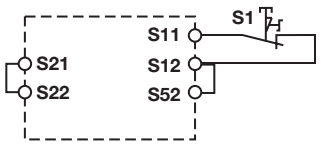
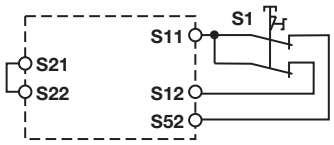
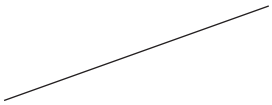
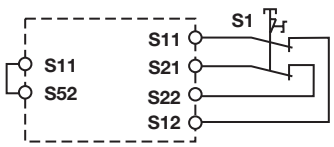
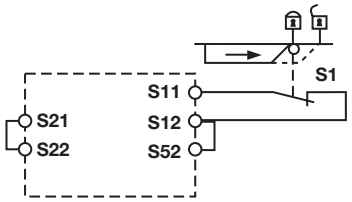
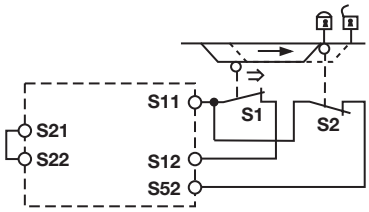
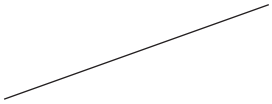
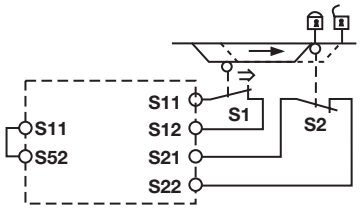
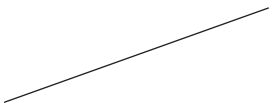
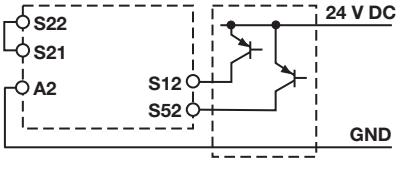
Up to Category 4, EN 954-1
PNOZ X2.8P

Preparing for operation

- Supply voltage

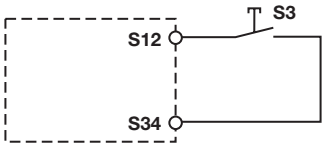
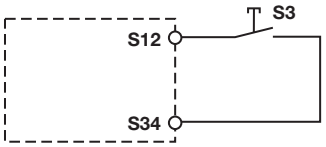
Supply voltage	24 – 240 V AC/DC	24 V AC/DC
		

- Input circuit

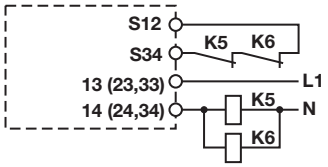
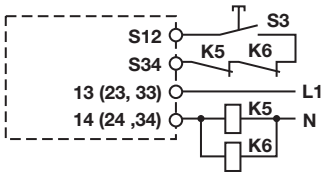
Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
E-STOP **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Safety gate **with** detection of shorts across contacts		
Light barrier **with** detection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

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

▸ 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

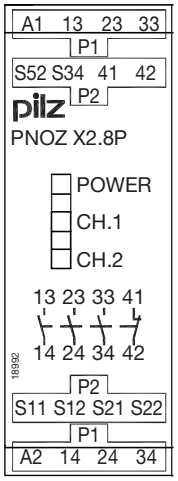
Feedback loop	Automatic reset	Manual reset
Contacts from external contactors		

▸ Key

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

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

Terminal configuration

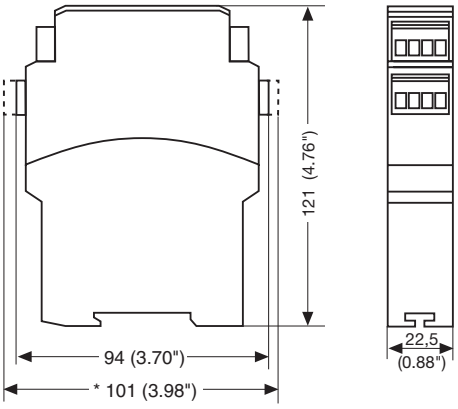


Installation

- 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



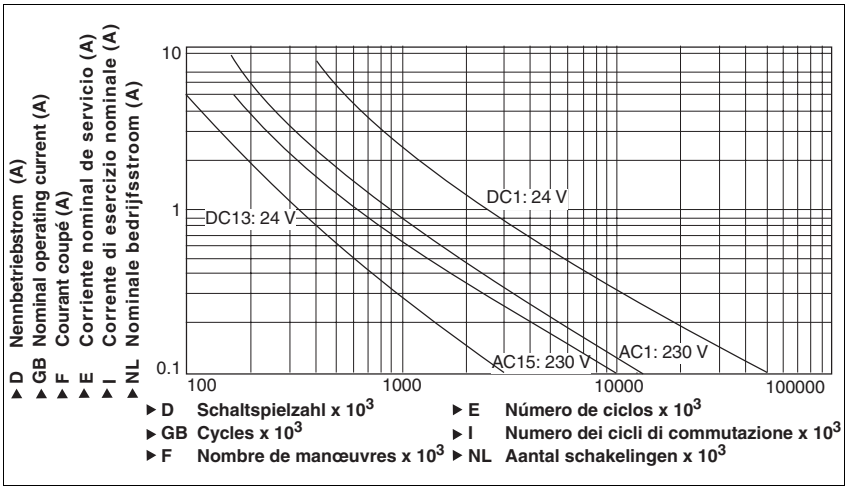
Up to Category 4, EN 954-1
PNOZ X2.8P

Notice

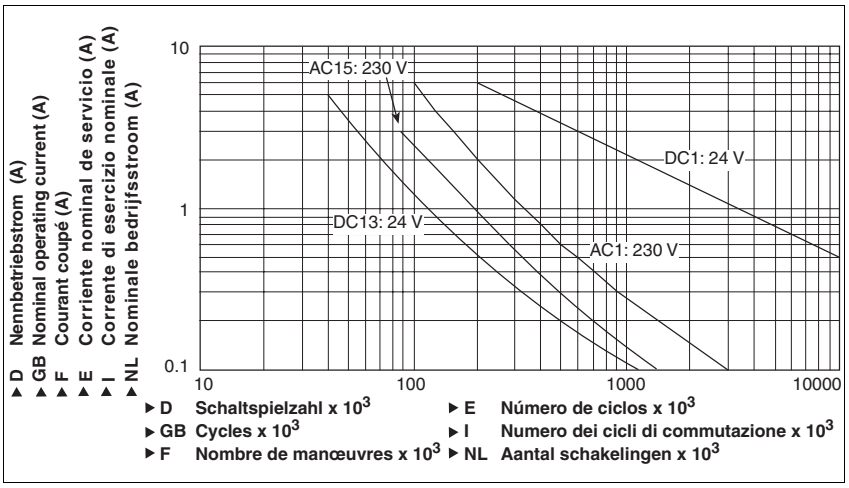
This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

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	**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 **45.0 mA** Order no.: 777301, 787301
Reset circuit DC: **24.0 V**	**50.0 mA** Order no.: 777302, 787302 **75.0 mA** Order no.: 777301, 787301
Feedback loop DC: **24.0 V**	**50.0 mA** Order no.: 777302, 787302 **75.0 mA** Order no.: 777301, 787301

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

Electrical data	
Number of output contacts	
Safety contacts (S) instantaneous:	**3**
Auxiliary contacts (N/C):	**1**
Category of output contacts in accordance with **EN 954-1**, **EN ISO 13849-1**	
Safety contacts (S) instantaneous:	**4**
Utilisation category in accordance with **EN 60947-4-1**	
Safety contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **6.0 A** Order no.: 777302, 787302 **8.0 A** Order no.: 777301, 787301 P_{max}: **1500 VA** Order no.: 777302, 787302 **2000 VA** Order no.: 777301, 787301
Safety contacts: DC1 at **24 V**	I_{min}: **0.01 A** , I_{max}: **6.0 A** Order no.: 777302, 787302 **8.0 A** Order no.: 777301, 787301 P_{max}: **150 W** Order no.: 777302, 787302 **200 W** Order no.: 777301, 787301
Auxiliary contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **6.0 A** Order no.: 777302, 787302 **8.0 A** Order no.: 777301, 787301 P_{max}: **1500 VA** Order no.: 777302, 787302 **2000 VA** Order no.: 777301, 787301
Auxiliary contacts: DC1 at **24 V**	I_{min}: **0.01 A** , I_{max}: **6.0 A** Order no.: 777302, 787302 **8.0 A** Order no.: 777301, 787301 P_{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_{max}: **3.0 A** Order no.: 777302, 787302 **6.0 A** Order no.: 777301, 787301
Safety contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **4.0 A** Order no.: 777302, 787302 **5.0 A** Order no.: 777301, 787301
Auxiliary contacts: AC15 at **230 V**	I_{max}: **3.0 A** Order no.: 777302, 787302 **6.0 A** Order no.: 777301, 787301
Auxiliary contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **4.0 A** Order no.: 777302, 787302 **5.0 A** Order no.: 777301, 787301
Contact material	**AgCuNi + 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** Order no.: 777301, 787301 **6 A** Order no.: 777302, 787302
Auxiliary contacts:	**10 A** Order no.: 777301, 787301 **6 A** Order no.: 777302, 787302
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

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

Electrical data	
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	**45 Ohm** Order no.: 777302, 787302 **50 Ohm** Order no.: 777301, 787301
single-channel at U_B AC	**100 Ohm** Order no.: 777301, 787301 **45 Ohm** Order no.: 777302, 787302
dual-channel without detect. of shorts across contacts at U_B DC	**50 Ohm** Order no.: 777301, 787301 **80 Ohm** Order no.: 777302, 787302
dual-channel without detect. of shorts across contacts at U_B AC	**100 Ohm** Order no.: 777301, 787301 **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	
with automatic reset typ.	**250 ms** Order no.: 777301, 787301 **340 ms** Order no.: 777302, 787302
with automatic reset max.	**400 ms** Order no.: 777302, 787302 **450 ms** Order no.: 777301, 787301
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.: 777302, 787302 **450 ms** Order no.: 777301, 787301
Delay-on de-energisation	
with E-STOP typ.	**10 ms** Order no.: 777302, 787302 **15 ms** Order no.: 777301, 787301
with E-STOP max.	**20 ms** Order no.: 777302, 787302 **30 ms** Order no.: 777301, 787301
with power failure typ.	**60 ms** Order no.: 777301, 787301
with power failure max.	**100 ms** Order no.: 777301, 787301
with power failure typ. U_B AC/DC: **24 V** Order no.: 777302, 787302	**180 ms** Order no.: 777302, 787302
with power failure max. U_B AC/DC: **24 V** Order no.: 777302, 787302	**230 ms** Order no.: 777302, 787302
with power failure typ. U_B AC : **240 V**	**1,100 ms** Order no.: 777302, 787302
with power failure max. U_B AC : **240 V**	**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	
EMC	**EN 60947-5-1**, **EN 61000-6-2**, **EN 61000-6-4**
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**
Rated insulation voltage	**250 V**
Rated impulse withstand voltage	**4.0 kV**
Ambient temperature	**-10 - 55 °C**

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

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 mm² , 24 - 12 AWG** Order no.: 777301, 777302
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** Order no.: 777301, 777302
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 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 mm² , 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 **94.0 mm** Order no.: 777301, 777302
Width	**22.5 mm**
Depth	**121.0 mm**
Weight	**185 g** Order no.: 777301, 787301 **205 g** Order no.: 787302 **210 g** Order no.: 777302

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

Conventional thermal current

Number of contacts	I_{th} (A) at U_B DC	I_{th} (A) at U_B AC
1	**6.00 A** Order no.: 777302, 787302 **8.00 A** Order no.: 777301, 787301	**6.00 A**
2	**6.00 A**	**4.00 A** Order no.: 777301, 787301 **6.00 A** Order no.: 777302, 787302
3	**4.50 A** Order no.: 777302, 787302 **5.00 A** Order no.: 777301, 787301	**3.50 A** Order no.: 777301, 787301 **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