Up to PL e of EN ISO 13849-1
PNOZ X3P



Safety relay for monitoring E-STOP pushbuttons, safety gates and light beam devices

Approvals

	PNOZ X3P
cULus LISTED	◆
TÜV SÜDDEUTSCHLAND	◆
CCC	◆

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- 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 output signals:
  - Switch status channel 1/2
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)

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

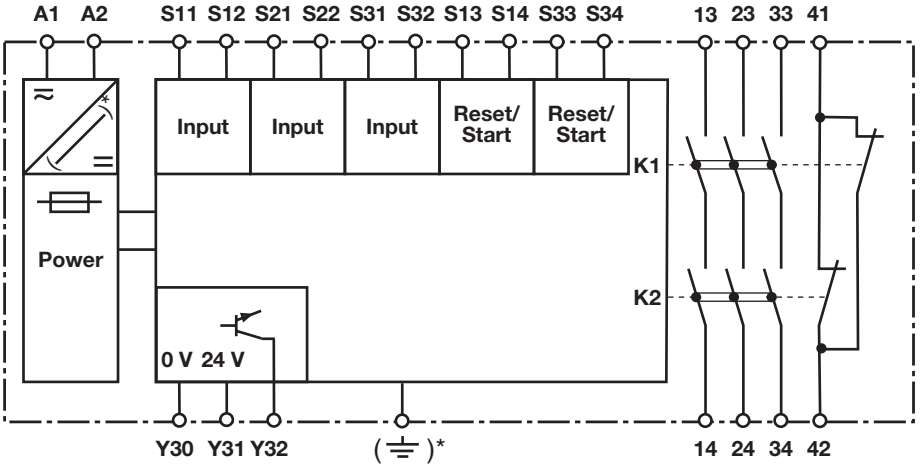
- E-STOP pushbuttons
- Safety gates
- Light beam devices

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.

Block diagram



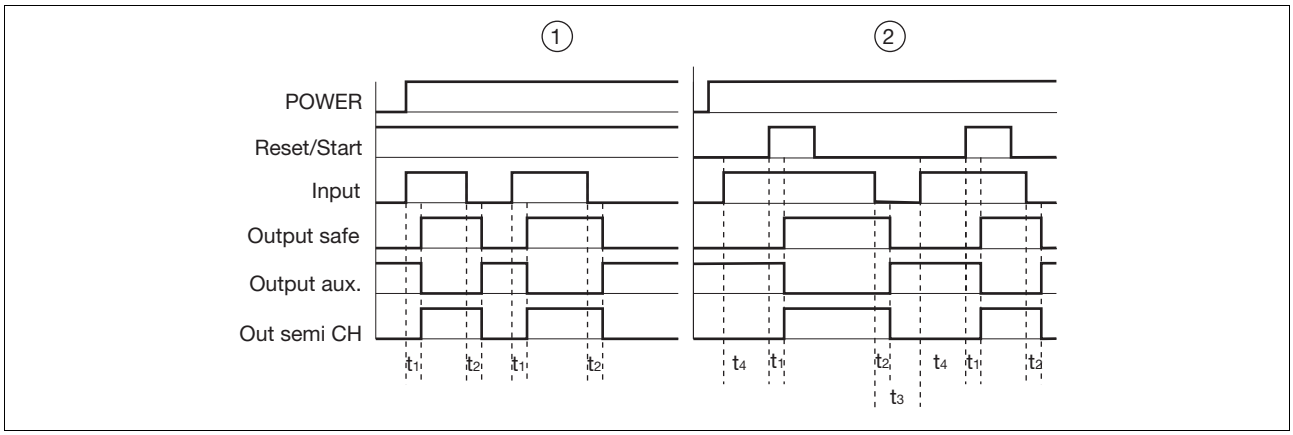
*only with U_B 24 - 240 VAC/DC

Up to PL e of EN ISO 13849-1
PNOZ X3P

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.
- 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 instantaneous safety contacts by connecting contact expansion modules or external contactors.

Timing diagram



Key

- Power: Supply voltage
- Reset/Start: Reset circuit S13-S14, S33-S34
- Input: Input circuits S11-S12, S21-S22, S31-S32
- Output safe: Safety contacts 13-14, 23-24, 33-34
- Output aux: Auxiliary contacts 41-42
- Out semi CH: Semiconductor output switch status channel 1/2
- ①: Automatic reset
- ②: Monitored reset
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time
- t_4: 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 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

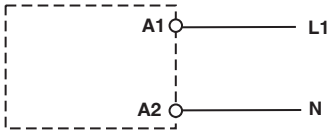
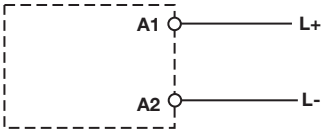
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

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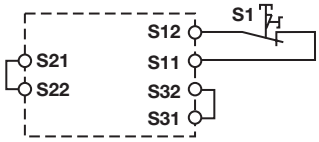
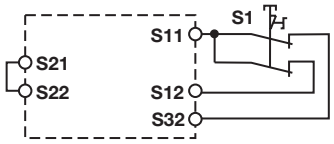
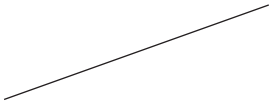
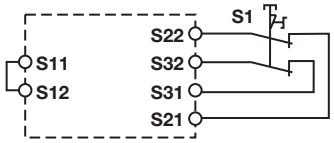
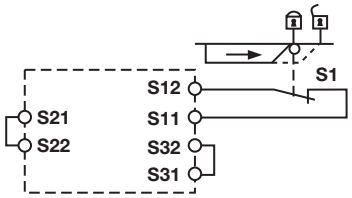
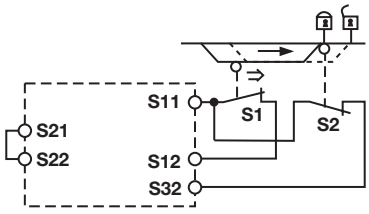
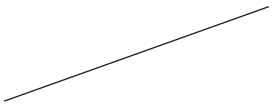
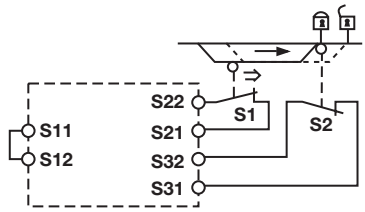
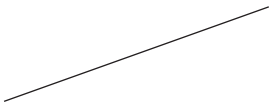
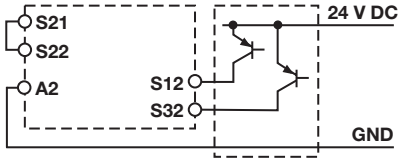
Up to PL e of EN ISO 13849-1
PNOZ X3P

Preparing for operation

- Supply voltage

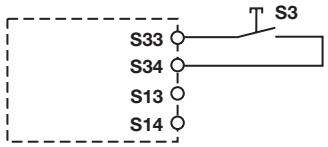
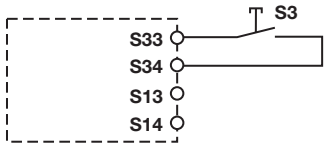
Supply voltage	AC	DC
		

- Input circuit

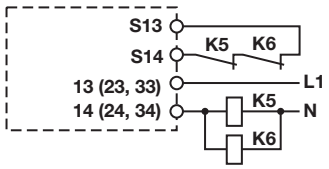
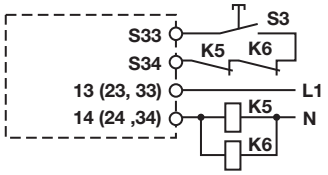
Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
E-STOP **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Safety gate **with** detection of shorts across contacts		
Light beam device **with**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

Up to PL e of EN ISO 13849-1
PNOZ X3P

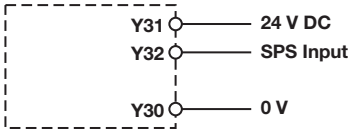
▸ Reset circuit

Reset circuit	E-STOP wiring (single-channel) Safety gate (single-channel)	E-STOP wiring (dual-channel) Safety gate (dual-channel)
Automatic reset		
Monitored reset		

▸ Feedback circuit

Feedback circuit	Automatic reset	Monitored reset
Contacts from external contactors		

▸ Semiconductor output



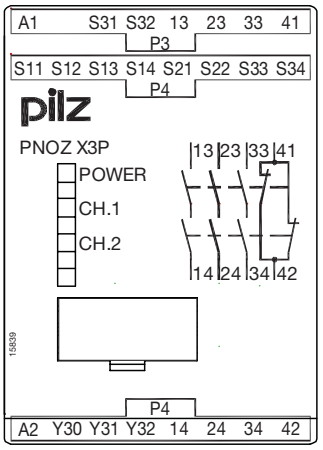
▸ Key

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

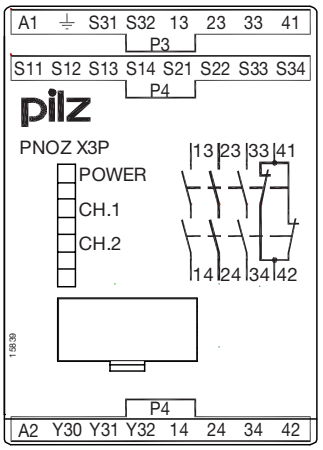
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PNOZ X3P

Terminal configuration

U_B 24 VAC/DC



U_B 24 – 240 VAC/DC

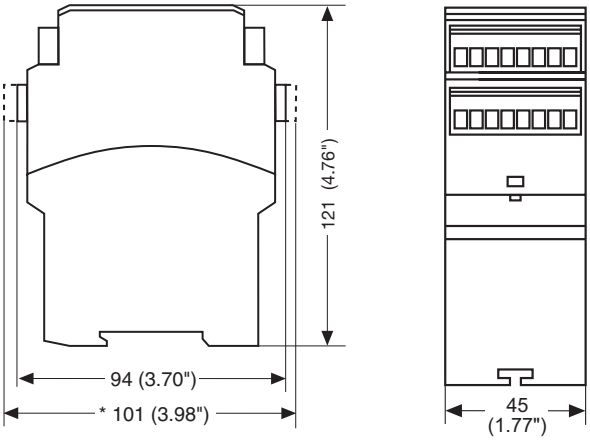


Installation

- 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

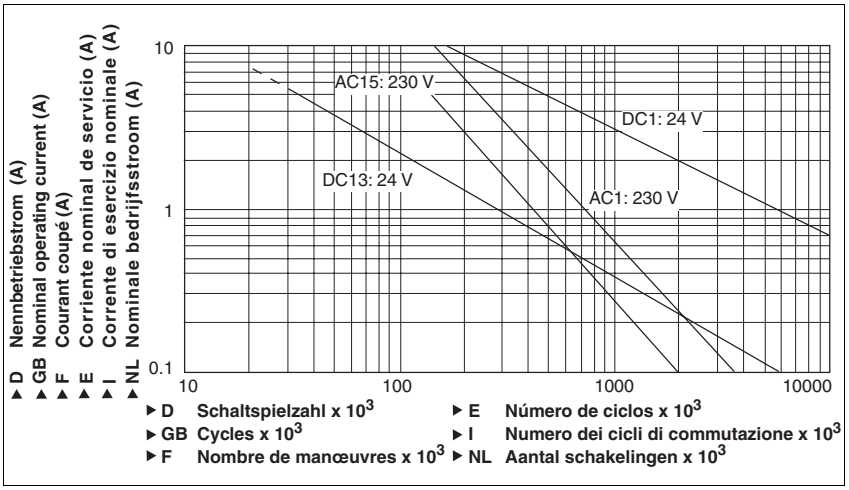


Up to PL e of EN ISO 13849-1
PNOZ X3P

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/DC	**24 - 240 V**, **24 V**
Voltage tolerance	**-15 %/+10 %**
Power consumption at U_B AC	**5.0 VA**
Power consumption at U_B DC	**2.5 W**
Frequency range AC	**50 - 60 Hz**
Residual ripple DC	**160 %**
Voltage and current at	
Input circuit DC: **24.0 V**	**35.0 mA** Order no.: 777313, 787313 **40.0 mA** Order no.: 777310, 787310
Reset circuit DC: **24.0 V**	**50.0 mA** Order no.: 777313, 787313 **70.0 mA** Order no.: 777310, 787310
Feedback loop DC: **24.0 V**	**20.0 mA**
Number of output contacts	
Safety contacts (S) instantaneous:	**3**
Auxiliary contacts (N/C):	**1**
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}: **6.0 A**
Auxiliary contacts: AC15 at **230 V**	I_{max}: **5.0 A**
Auxiliary contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **6.0 A**
Contact material	**AgSnO2 + 0.2 µm Au**

Up to PL e of EN ISO 13849-1
PNOZ X3P

Electrical data	
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,**20 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	**150 Ohm** Order no.: 777310, 787310 **200 Ohm** Order no.: 777313, 787313
single-channel at U_B AC	**180 Ohm** Order no.: 777310, 787310 **200 Ohm** Order no.: 777313, 787313
dual-channel without detect. of shorts across contacts at U_B DC	**300 Ohm** Order no.: 777310, 787310 **400 Ohm** Order no.: 777313, 787313
dual-channel without detect. of shorts across contacts at U_B AC	**360 Ohm** Order no.: 777310, 787310 **400 Ohm** Order no.: 777313, 787313
dual-channel with detect. of shorts across contacts at U_B DC	**15 Ohm** Order no.: 777310, 787310 **30 Ohm** Order no.: 777313, 787313
dual-channel with detect. of shorts across contacts at U_B AC	**30 Ohm**
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.	**250 ms** Order no.: 777310, 787310 **330 ms** Order no.: 777313, 787313
with automatic reset max.	**450 ms** Order no.: 777313, 787313 **500 ms** Order no.: 777310, 787310
with automatic reset after power on typ.	**280 ms** Order no.: 777310, 787310 **750 ms** Order no.: 777313, 787313
with automatic reset after power on max.	**1,000 ms** Order no.: 777313, 787313 **550 ms** Order no.: 777310, 787310
on monitored reset with rising edge typ.	**35 ms**
on monitored reset with rising edge max.	**50 ms**
Delay-on de-energisation	
with E-STOP typ.	**15 ms** Order no.: 777310, 787310 **25 ms** Order no.: 777313, 787313
with E-STOP max.	**30 ms**
with power failure typ.	**50 ms** Order no.: 777310, 787310
with power failure max.	**70 ms** Order no.: 777310, 787310
with power failure typ. U_B AC/DC: **24 V** Order no.: 777313, 787313	**150 ms** Order no.: 777313, 787313
with power failure max. U_B AC/DC: **24 V** Order no.: 777313, 787313	**180 ms** Order no.: 777313, 787313
with power failure typ. U_B AC : **240 V**	**1,500 ms** Order no.: 777313, 787313
with power failure max. U_B AC : **240 V**	**2200 ms** Order no.: 777313, 787313

Up to PL e of EN ISO 13849-1
PNOZ X3P

Times	
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms**
after power failure	**100 ms** Order no.: 777310, 787310
	200 ms Order no.: 777313, 787313
after power failure on universal power supply	**2250 ms** Order no.: 777313, 787313
Waiting period with a monitored reset	
with rising edge	**200 ms** Order no.: 777313, 787313
	300 ms Order no.: 777310, 787310
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 61000-6-3**
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	**4.00 kV**
Ambient temperature	**-20 - 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.: 777310, 777313
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** Order no.: 777310, 777313
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 777310, 777313
Torque setting with screw terminals	**0.50 Nm** Order no.: 777310, 777313
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 787310, 787313
Spring-loaded terminals: Terminal points per connection	**2** Order no.: 787310, 787313
Stripping length	**8 mm** Order no.: 787310, 787313
Dimensions	
Height	**101.0 mm** Order no.: 787310, 787313
	94.0 mm Order no.: 777310, 777313
Width	**45.0 mm**
Depth	**121.0 mm**
Weight	**270 g** Order no.: 787310
	280 g Order no.: 777310
	300 g Order no.: 787313
	310 g Order no.: 777313

The standards current on **2007-09** apply.

Up to PL e of EN ISO 13849-1
PNOZ X3P

Conventional thermal current

Number of contacts	I_{th} (A) at U_B DC	I_{th} (A) at U_B AC
1	**8.00 A**	**8.00 A**
2	**7.00 A** Order no.: 777313, 787313 **8.00 A** Order no.: 777310, 787310	**7.00 A**
3	**6.00 A** Order no.: 777313, 787313 **7.00 A** Order no.: 777310, 787310	**6.00 A**

Order reference

Type	Features	Terminals	Order no.
PNOZ X3P C	24 VAC/DC	Spring-loaded terminals	787 310
PNOZ X3P	24 VAC/DC	Screw terminals	777 310
PNOZ X3P C	24 - 240 VAC/DC	Spring-loaded terminals	787 313
PNOZ X3P	24 - 240 VAC/DC	Screw terminals	777 313