

Up to Category 4, EN 954-1 PNOZ X8P



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

Approvals

	PNOZ X8P
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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 cage clamp 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

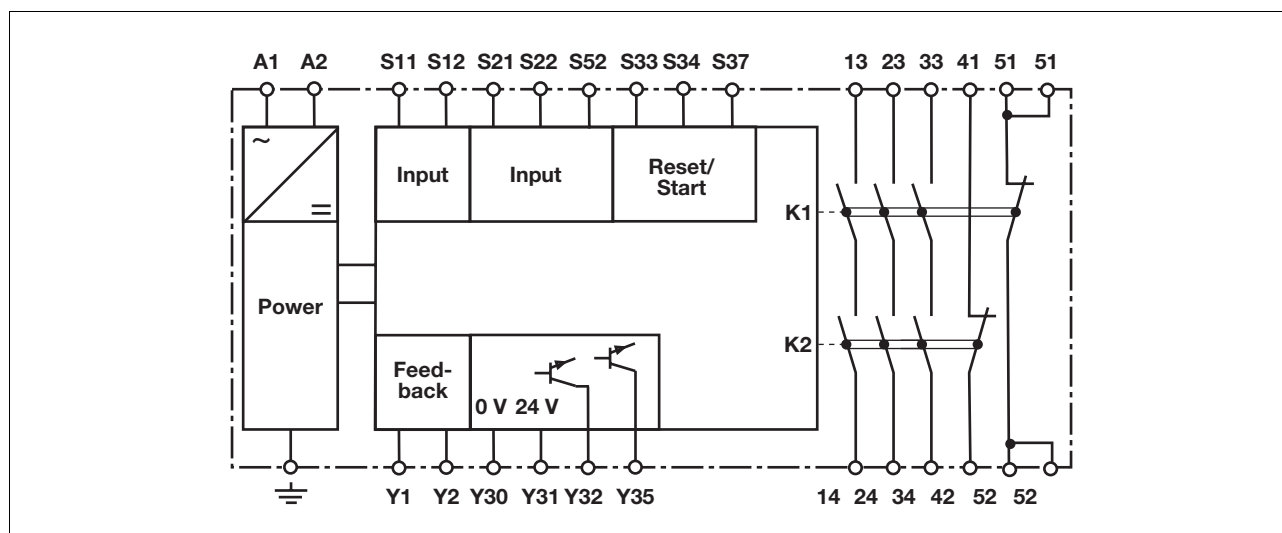
- ▶ E-STOP pushbuttons
- ▶ Safety gates
- ▶ Light barriers

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

Block diagram

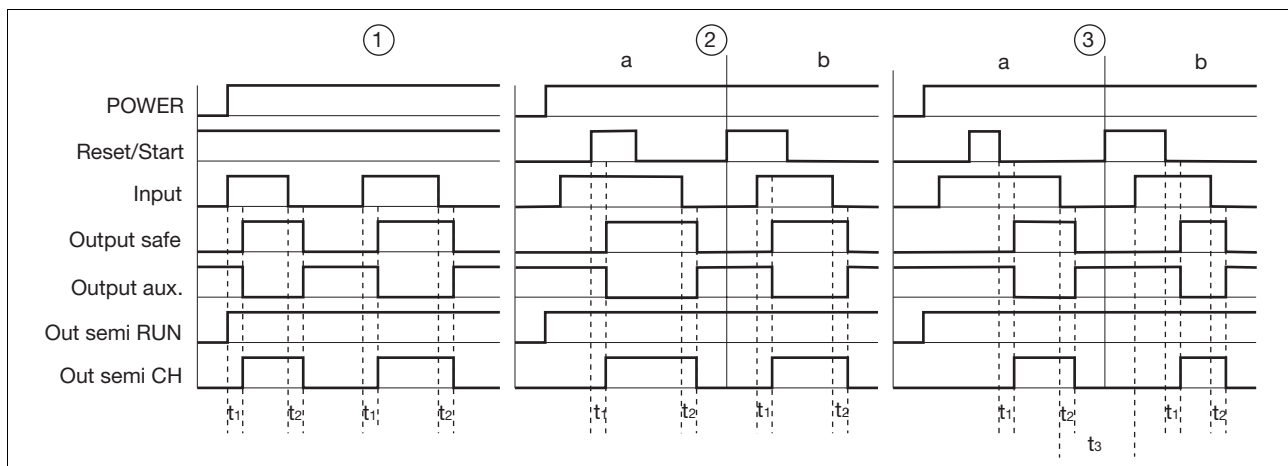


Up to Category 4, EN 954-1 PNOZ X8P

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,
 - shorts between contacts in the input circuit.
- ▶ Automatic start: Unit is active once the input circuit has been closed.
- ▶ 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.
- ▶ 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 contacts by connecting contact expander modules or external contactors/relays.

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.

Up to Category 4, EN 954-1 PNOZ X8P

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 barrier with detection of shorts across contacts via ESPE		

Up to Category 4, EN 954-1 PNOZ X8P

Reset circuit

Reset circuit	E-STOP/safety gate wiring (single 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 loop

Feedback loop	Automatic reset	Monitored reset
Contacts from external contactors		

Semiconductor output

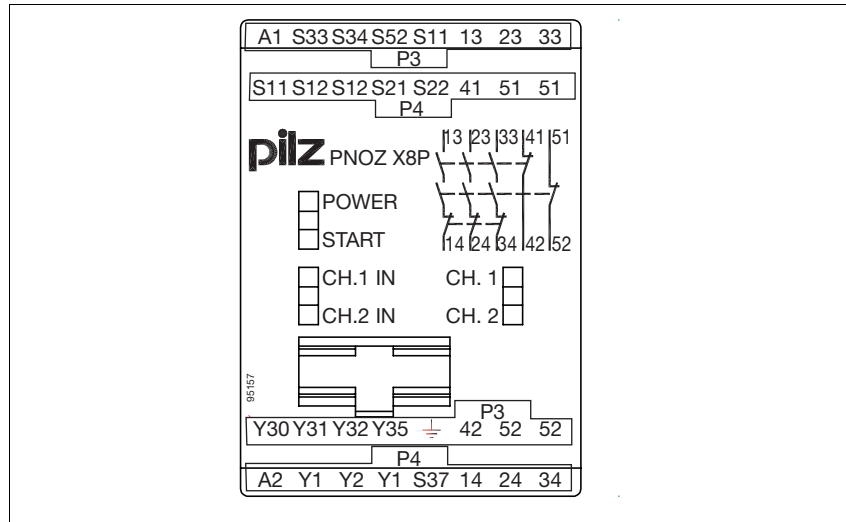
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Key

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

Up to Category 4, EN 954-1 PNOZ X8P

Terminal configuration

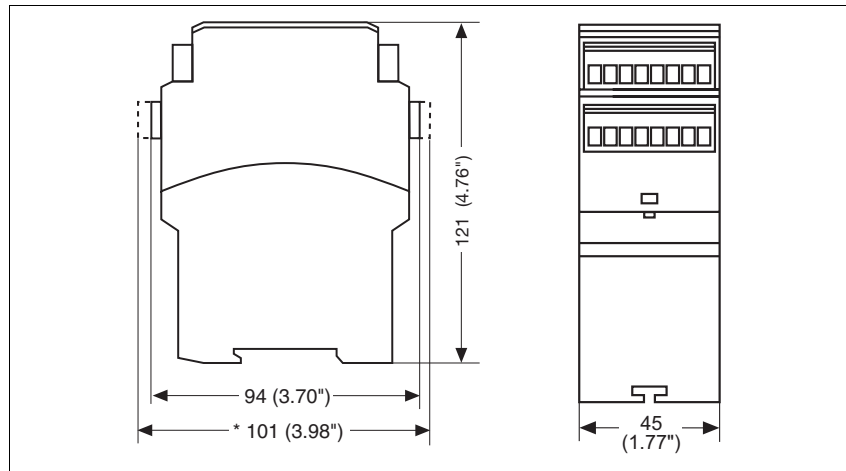


Installation

- ▶ 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

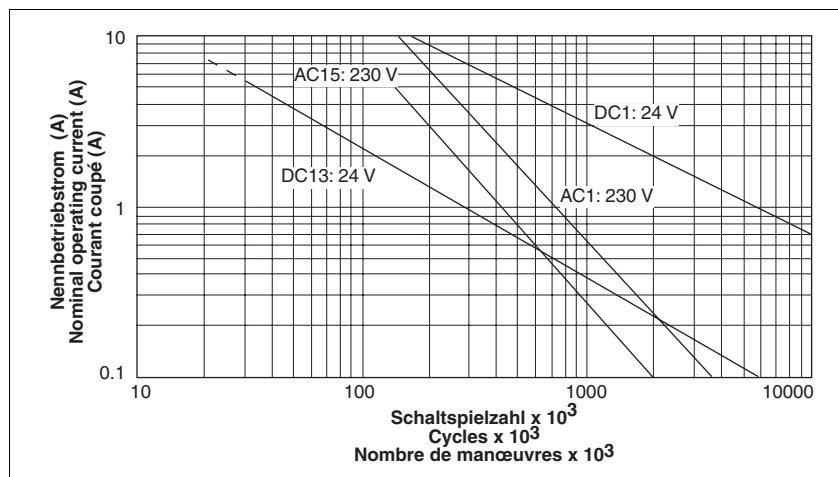


Up to Category 4, EN 954-1 PNOZ X8P

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	24 V, 110 V, 115 V, 120 V, 230 V
Supply voltage U _B AC	24 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
Category of output contacts in accordance with EN 954-1	
Safety contacts (S) instantaneous:	4

Up to Category 4, EN 954-1 PNOZ X8P

Electrical data	
Utilisation category in accordance with EN 60947-4-1	
Safety contacts: AC1 at 240 V	$I_{min}: 0.01 \text{ A}$, $I_{max}: 8.0 \text{ A}$ $P_{max}: 2000 \text{ VA}$
Safety contacts: DC1 at 24 V	$I_{min}: 0.01 \text{ A}$, $I_{max}: 8.0 \text{ A}$ $P_{max}: 200 \text{ W}$
Auxiliary contacts: AC1 at 240 V	$I_{min}: 0.01 \text{ A}$, $I_{max}: 8.0 \text{ A}$ $P_{max}: 2000 \text{ VA}$
Auxiliary contacts: DC1 at 24 V	$I_{min}: 0.01 \text{ A}$, $I_{max}: 8.0 \text{ A}$ $P_{max}: 200 \text{ W}$
Utilisation category in accordance with EN 60947-5-1	
Safety contacts: AC15 at 230 V	$I_{max}: 5.0 \text{ A}$
Safety contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 7.0 \text{ A}$
Auxiliary contacts: AC15 at 230 V	$I_{max}: 5.0 \text{ A}$
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 7.0 \text{ A}$
Contact material	AgSnO2 + 0.2 µm Au
External contact fuse protection ($I_K = 1 \text{ kA}$) 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
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

Up to Category 4, EN 954-1 PNOZ X8P

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
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
Max. 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
Max. cross section of external conductors with cage clamp terminals/spring-loaded terminals: Flexible without crimp connectors	0.20 - 1.50 mm², 24 - 16 AWG Order no.: 787760, 787764, 787765, 787766, 787768, 787770
Cage clamp terminals/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

Up to Category 4, EN 954-1 PNOZ X8P

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	Cage clamp terminals	787 760
PNOZ X8P	24 VDC	Screw terminals	777 760
PNOZ X8P C	110 VAC	Cage clamp terminals	787 764
PNOZ X8P	110 VAC	Screw terminals	777 764
PNOZ X8P C	115 VAC	Cage clamp terminals	787 765
PNOZ X8P	115 VAC	Screw terminals	777 765
PNOZ X8P C	120 VAC	Cage clamp terminals	787 766
PNOZ X8P	120 VAC	Screw terminals	777 766
PNOZ X8P C	230 VAC	Cage clamp terminals	787 768
PNOZ X8P	230 VAC	Screw terminals	777 768
PNOZ X8P C	24 VAC	Cage clamp terminals	787 770
PNOZ X8P	24 VAC	Screw terminals	777 770