

Up to PL e of EN ISO 13849-1 PNOZ X2.9P



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

Approvals

PNOZ X2.9P	
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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:
 - Supply voltage
 - Switch status channel 1/2
- ▶ Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- ▶ See order reference for unit types

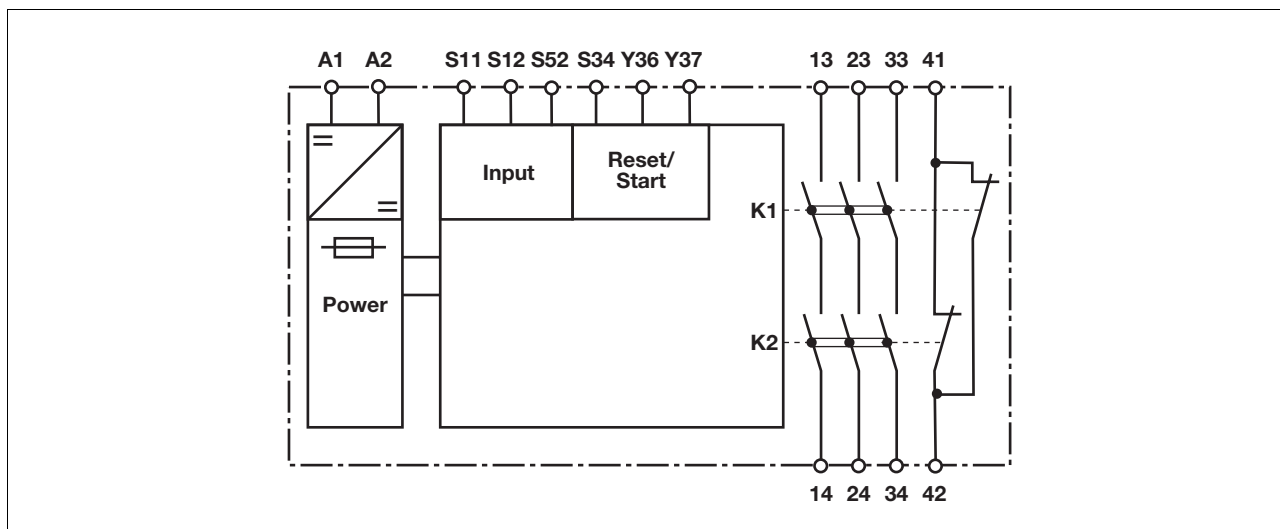
Unit description

- 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.
 - ▶ No galvanic isolation between supply voltage and input circuit

Block diagram

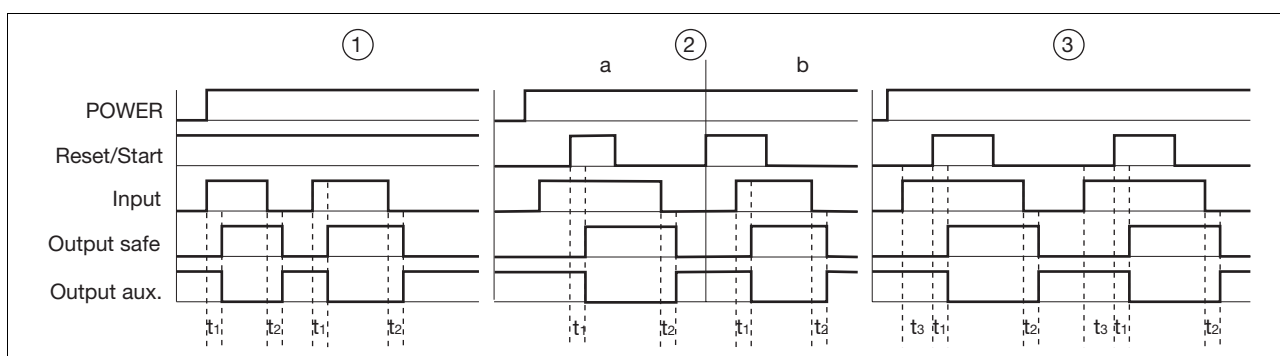


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Function description

- ▶ Single-channel operation: no redundancy in the input circuit, earth faults in the reset 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.
- ▶ 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 instantaneous safety contacts by connecting contact expansion modules or external contactors.

Timing diagram



Key

- ▶ Power: Supply voltage
- ▶ Reset/start: Reset circuit S12-S34, Y36-Y37
- ▶ Input: Input circuits S11, S12, 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:

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

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

▶ Feedback circuit

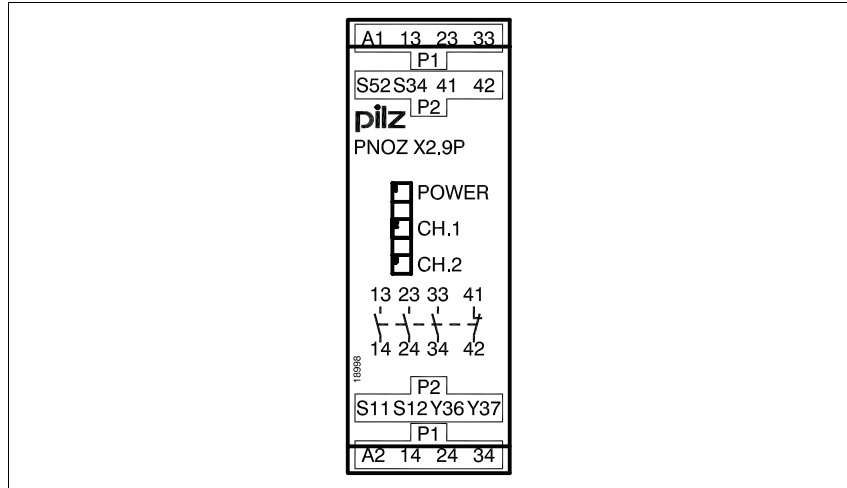
Feedback circuit	Automatic reset	Manual reset
Contacts from external contactors		

▶ Key

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

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Terminal configuration

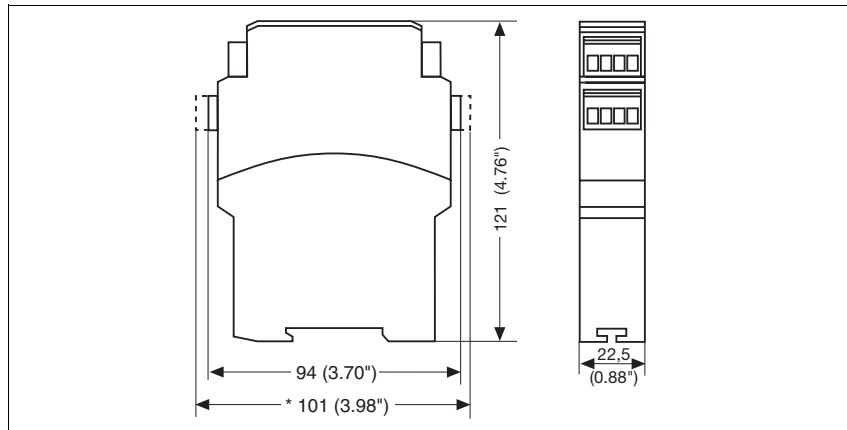


Installation

- ▶ 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 in mm (")

* with spring-loaded terminals

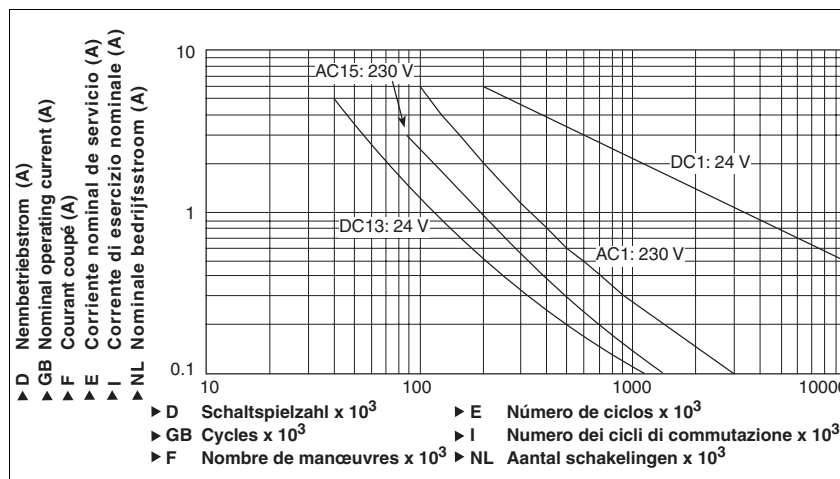


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Notice

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 DC	24 V
Voltage tolerance	-15 %/+10 %
Power consumption at U_B DC	2.0 W
Residual ripple DC	160 %
Voltage and current at	
Input circuit DC: 24.0 V	30.0 mA
Reset circuit DC: 24.0 V	60.0 mA
Feedback loop DC: 24.0 V	60.0 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	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 1500 VA$
Safety contacts: DC1 at 24 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 150 W$
Auxiliary contacts: AC1 at 240 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 1500 VA$
Auxiliary contacts: DC1 at 24 V	$I_{min}: 0.01 A, I_{max}: 6.0 A$ $P_{max}: 150 W$
Utilisation category in accordance with EN 60947-5-1	
Safety contacts: AC15 at 230 V	$I_{max}: 3.0 A$
Safety contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 4.0 A$
Auxiliary contacts: AC15 at 230 V	$I_{max}: 3.0 A$
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	$I_{max}: 4.0 A$
Contact material	AgSnO2 + 0.2 µm Au

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Electrical data	
External contact fuse protection ($I_K = 1 \text{ kA}$) to EN 60947-5-1	
Blow-out fuse, quick	
Safety contacts:	6 A
Auxiliary contacts:	6 A
Blow-out fuse, slow	
Safety contacts:	4 A
Auxiliary contacts:	4 A
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	4 A
Auxiliary contacts:	4 A
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	50 Ohm
dual-channel without detect. of shorts across contacts at U_B DC	80 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.	200 ms
with automatic reset max.	400 ms
with automatic reset after power on typ.	200 ms
with automatic reset after power on max.	400 ms
with manual reset typ.	100 ms
with manual reset max.	400 ms
on monitored reset with rising edge typ.	30 ms
on monitored reset with rising edge max.	50 ms
Delay-on de-energisation	
with E-STOP typ.	10 ms
with E-STOP max.	20 ms
with power failure typ.	70 ms
with power failure max.	120 ms
Recovery time at max. switching frequency 1/s	
after E-STOP	50 ms
after power failure	150 ms
Waiting period with a monitored reset	
with rising edge	200 ms
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
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

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Environmental data	
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 mm ² , 24 - 12 AWG Order no.: 777300
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm ² , 24 - 16 AWG Order no.: 777300
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm ² , 24 - 16 AWG Order no.: 777300
Torque setting with screw terminals	0.50 Nm Order no.: 777300
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	0.20 - 1.50 mm ² , 24 - 16 AWG Order no.: 787300
Spring-loaded terminals: Terminal points per connection	2 Order no.: 787300
Stripping length	8 mm Order no.: 787300
Dimensions	
Height	101.0 mm Order no.: 787300 94.0 mm Order no.: 777300
Width	22.5 mm
Depth	121.0 mm
Weight	175 g Order no.: 787300 180 g Order no.: 777300

The standards current on **2005-02** apply.

Conventional thermal current	
I_{th} (A) at U_B DC	
1 contact	6.00 A
2 contacts	6.00 A
3 contacts	4.50 A

Order reference			
Type	Features	Terminals	Order no.
PNOZ X2.9P C	24 VDC	Spring-loaded terminals	787 300
PNOZ X2.9P	24 VDC	Screw terminals	777 300