Up to PL e of EN ISO 13849-1
PNOZ X3



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

Approvals

	PNOZ X3
c UL us LISTED	◆
TÜV SÜD	◆
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
- LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
- Semiconductor output signals:
  - Switch status channel 1/2
- See order reference for unit types

Unit description

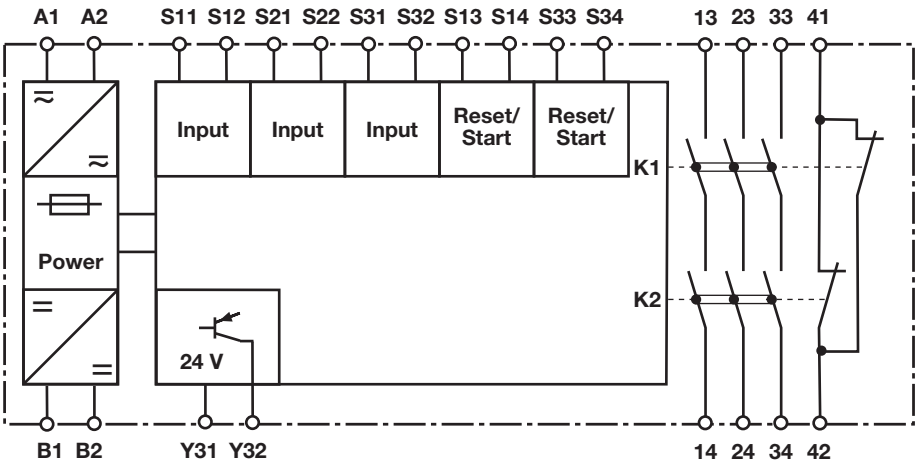
The safety relay meets the requirements of EN 60947-5-1, EN 60204-1 and VDE 0113-1 and may be used in applications with
- E-STOP pushbuttons
- Safety gates

and as safety component in accordance with the Lift Directive 95/16/EC and EN 81-1.

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

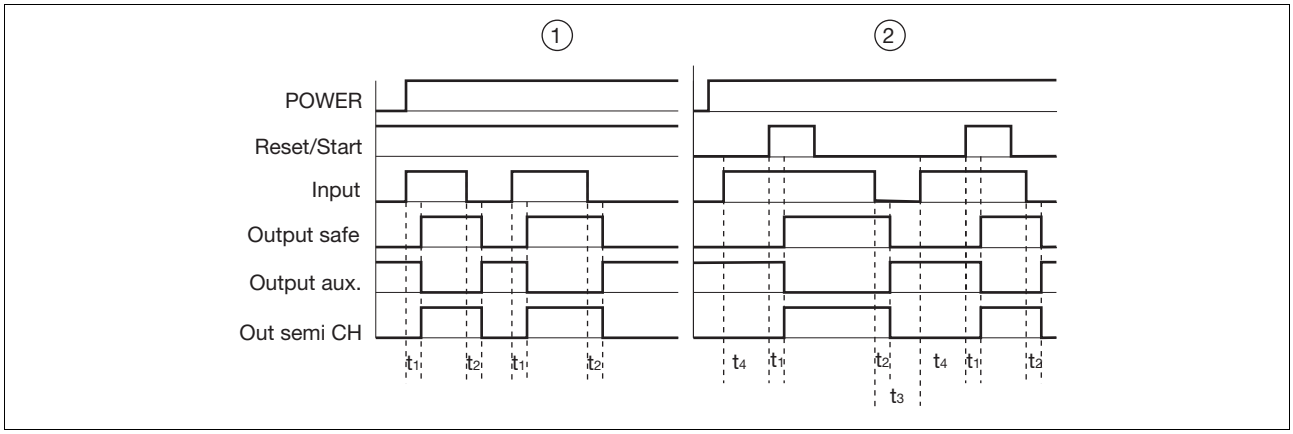


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Function description

- Single-channel operation: no redundancy in the input circuit, earth faults in the reset and input circuit are detected.
- Dual-channel operation 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 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

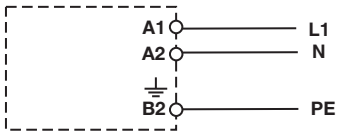
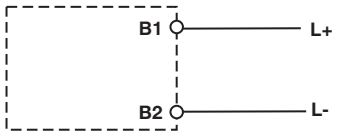
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

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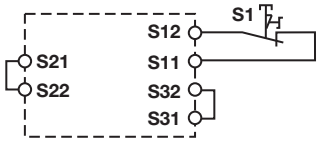
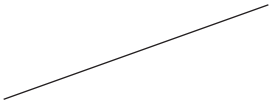
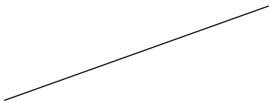
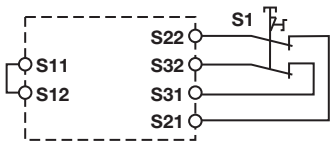
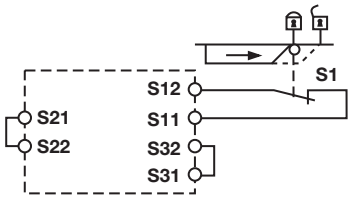
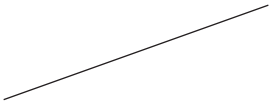
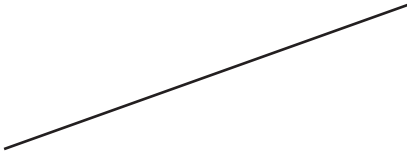
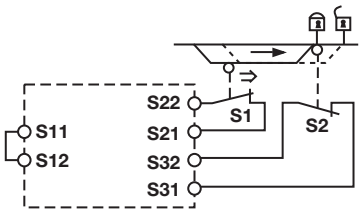
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Preparing for operation

- Supply voltage

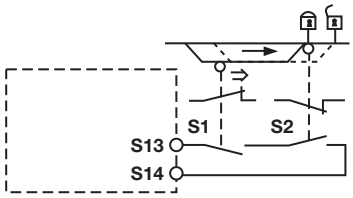
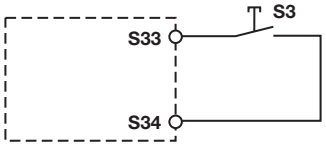
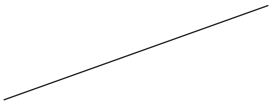
Supply voltage	AC	DC
		

- Input circuit

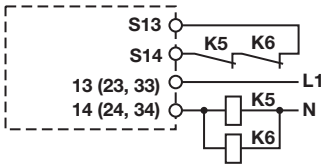
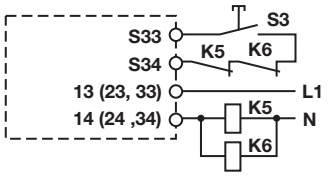
Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
E-STOP **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Safety gate **with** detection of shorts across contacts		

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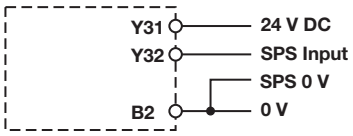
Reset circuit

Reset circuit	E-STOP wiring Safety gate without position monitoring	Safety gate with position monitoring
Automatic reset		
Monitored reset		

Feedback loop

Feedback loop	Automatic reset	Monitored reset
Contacts from external contactors		

Semiconductor output

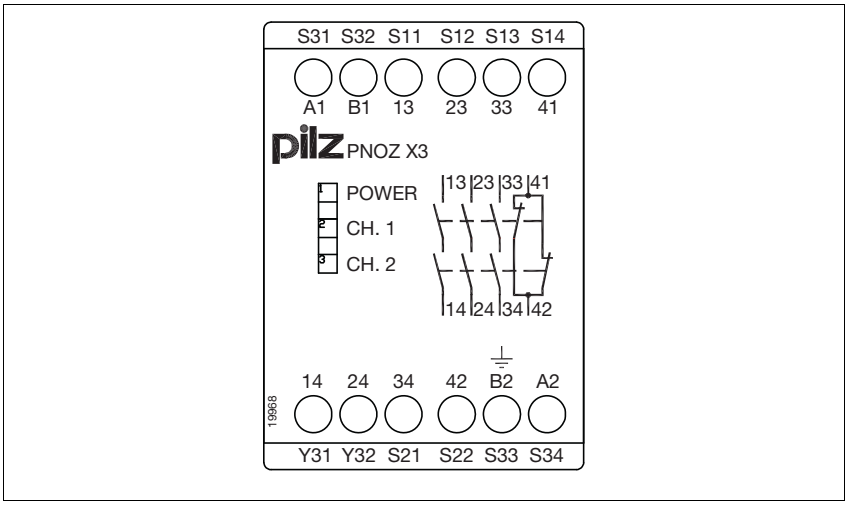


Key

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

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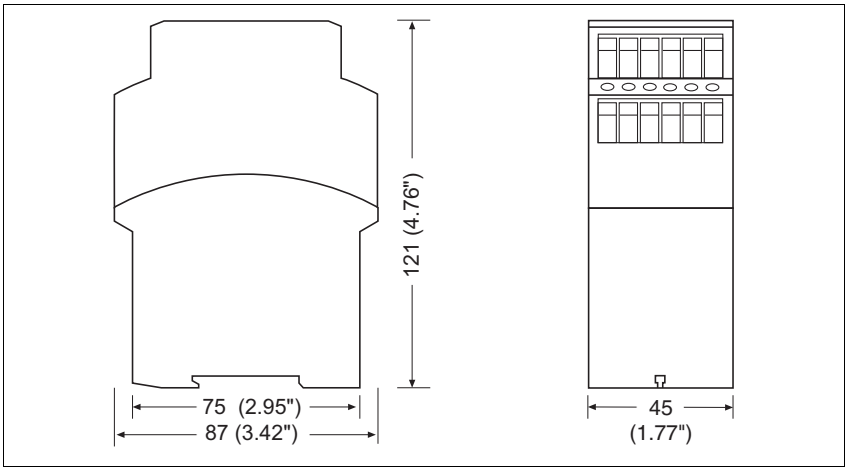
Terminal configuration



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



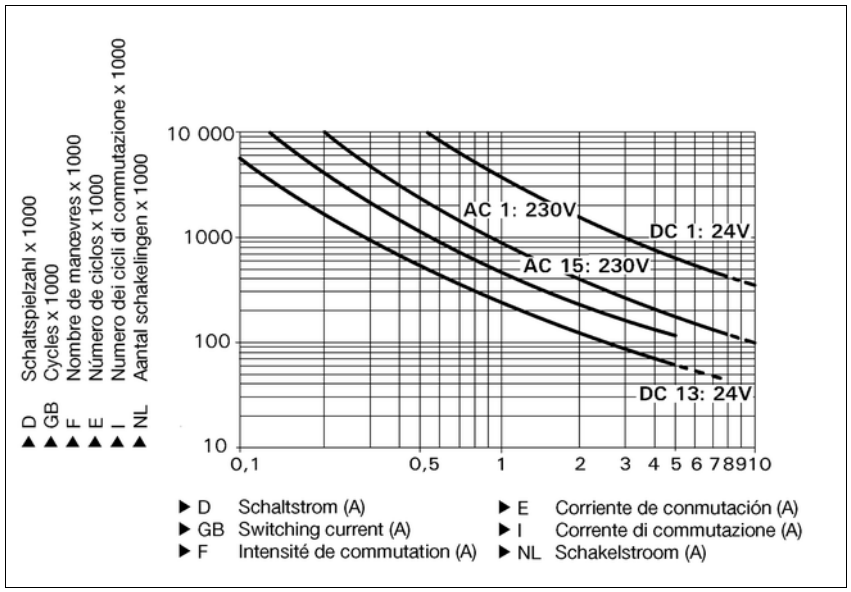
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Notice

This data sheet is only intended for use during configuration. Please refer to the operating manual for installation and operation.

Service life graph

The service life graphs indicate the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.



Example
- Inductive load: 0,2 A
- Utilisation category: AC15
- Contact service life: 4,000,000 cycles

Provided the application requires fewer than 4,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

Technical details

Electrical data	
Supply voltage	
Supply voltage U_B AC	**24 V**, **42 V**, **48 V**, **110 V**, **115 V**, **120 V**, **230 V**, **240 V**
Supply voltage U_B DC	**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**	**50.0 mA**
Reset circuit DC: **24.0 V**	**35.0 mA**
Feedback loop DC: **24.0 V**	**20.0 mA**

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Electrical data	
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**
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**
single-channel at U_B AC	**180 Ohm**
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	**30 Ohm**
Min. input resistance when switching on	**130 Ohm**
Safety-related characteristic data	
PL in accordance with **EN ISO 13849-1: 2006**	**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 [year] in accordance with **EN ISO 13849-1: 2006**	**20**
Times	
Switch-on delay	
with automatic reset typ.	**250 ms**
with automatic reset max.	**500 ms**
with automatic reset after power on typ.	**280 ms**
with automatic reset after power on max.	**550 ms**
on monitored reset with rising edge typ.	**35 ms**
on monitored reset with rising edge max.	**50 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.	**50 ms**
with power failure max.	**70 ms**
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms**
after power failure	**100 ms**
Waiting period with a monitored reset	
with rising edge	**300 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 12015**, **EN 12016**, **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	**3**
Overvoltage category	**III / II**
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	**0.20 - 4.00 mm² , 24 - 10 AWG**
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.20 - 2.50 mm² , 24 - 14 AWG**
without crimp connectors or with TWIN crimp connectors	**0.20 - 2.50 mm² , 24 - 14 AWG**
Torque setting with screw terminals	**0.60 Nm**
Dimensions	
Height	**87.0 mm**
Width	**45.0 mm**
Depth	**121.0 mm**
Weight	**375 g**

No. stands for order number.

It is essential to consider the relay's service life graphs. The relay outputs' safety-related characteristic data is only valid if the values in the service life graphs are met.
The PFH value depends on the switching frequency and the load on the relay output.

If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

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All the units used within a safety function must be considered when calculating the safety characteristic data.

INFORMATION
A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

The standards current on **2010-07** apply.

Conventional thermal current while loading several contacts

Number of contacts	I_{th} at U_B DC	I_{th} at U_B AC
1	**8.00 A**	**8.00 A**
2	**8.00 A**	**7.50 A**
3	**7.00 A**	**6.50 A**

Order reference

Type	Features		Terminals	Order no.
PNOZ X3	24 VAC	24 VDC	Screw terminals	774 310
PNOZ X3	42 VAC	24 VDC	Screw terminals	774 311
PNOZ X3	48 VAC	24 VDC	Screw terminals	774 312
PNOZ X3	110 VAC	24 VDC	Screw terminals	774 314
PNOZ X3	115 VAC	24 VDC	Screw terminals	774 315
PNOZ X3	120 VAC	24 VDC	Screw terminals	774 316
PNOZ X3	230 VAC	24 VDC	Screw terminals	774 318
PNOZ X3	240 VAC	24 VDC	Screw terminals	774 319