




## Up to Category 4, EN 954-1 PNOZ 16



Safety relay for monitoring emergency stop pushbuttons, safety gates, safety mats and safe edges

### Approvals

	PNOZ 16
	◆
	◆
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### Unit features

- ▶ Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
- ▶ Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
  - Safe edges
  - Safety mats
- ▶ LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
  - Detection of shorts across contacts on safety mat "EXT. FAULT"
- ▶ See order reference for unit types

The safety relay is not suitable for non-contact barriers because

- ▶ a dynamic start is not possible
- ▶ the unit can be started during the delay-on de-energisation time.

### Safety features

The relay conforms to the following safety criteria:

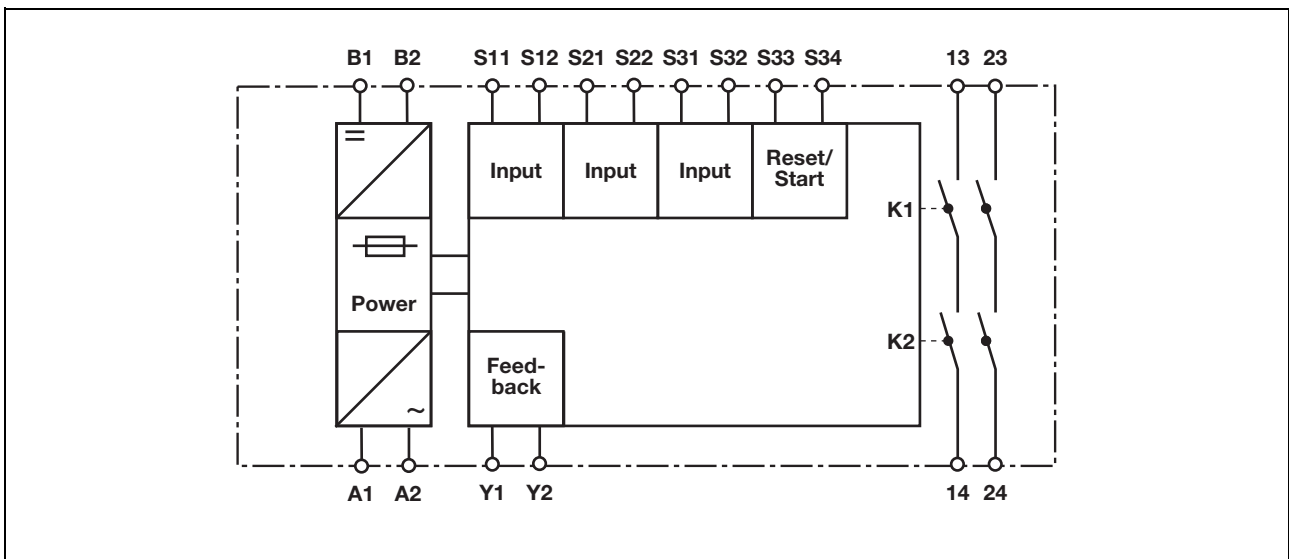
- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ The correct opening and closing of the safety function relays is tested automatically in each on-off cycle.
- ▶ The transformer is short circuit-proof. An electronic fuse is used on a DC supply.

### Unit description

The safety relay meets the requirements of EN 60204-1, IEC 60204-1 and EN 1760-1 and may be used in applications with

- ▶ E-STOP pushbuttons
- ▶ Safety gates
- ▶ Safety mats
- ▶ Safe edges

### Block diagram

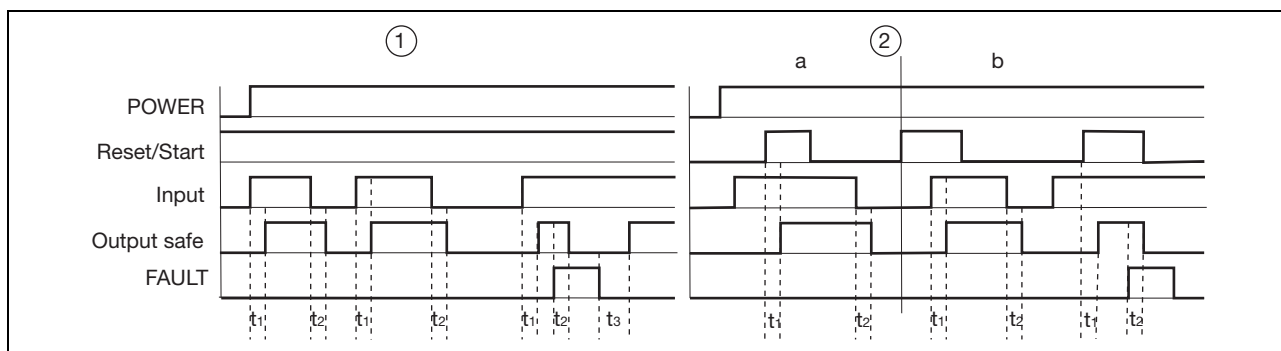


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### Function description

- ▶ 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 and shorts between contacts in the input circuit.
- ▶ When the safety mat is actuated, a short is formed between the inputs and internal fault detection is energised. The safety contacts open and the LED EXT.FAULT is lit. If the safety mat is cleared and supply voltage is maintained, the unit is ready for operation again once the recovery time has elapsed.
- ▶ 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 expander modules or external contactors/relays.

### Timing diagram



### Key

- ▶ Power: Supply voltage
- ▶ Reset/start: Reset circuit S33-S34
- ▶ Input: Input circuits S11-S12, S21-S22, S31-S32
- ▶ Output safe: Safety contacts 13-14, 23-24
- ▶ FAULT: Short between contacts in the input circuit due to actuation of safety mat
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ a: Input circuit closes before reset circuit
- ▶ b: Reset circuit closes before input circuit
- ▶ t<sub>1</sub>: Switch-on delay
- ▶ t<sub>2</sub>: Delay-on de-energisation
- ▶ t<sub>3</sub>: Recovery time after short across contacts

### Wiring

Please note:

- ▶ Information given in the “Technical details” must be followed.
- ▶ Outputs 13-14, 23-24 are safety contacts.
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see technical details).
- ▶ Calculation of the max. cable runs I<sub>max</sub> in the input circuit:

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

R<sub>I<sub>max</sub></sub> = max. overall cable resistance (see technical details)

R<sub>l</sub> /km = cable resistance/km

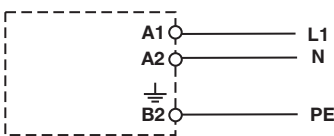
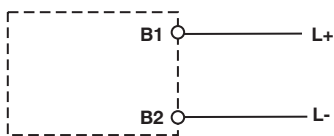
- ▶ Use copper wire that can withstand 60/75 °C.

- ▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

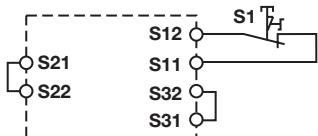
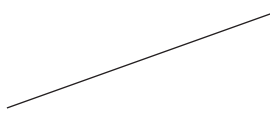
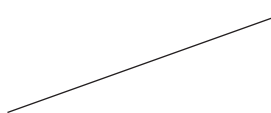
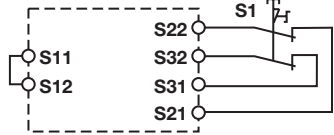
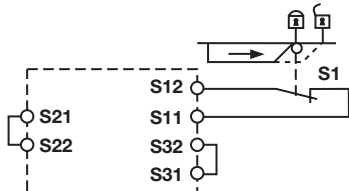
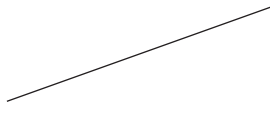
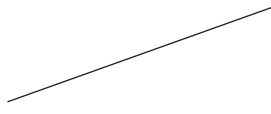
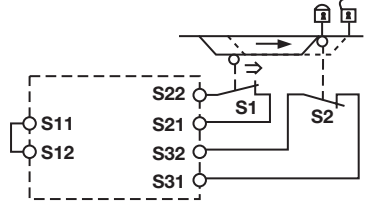
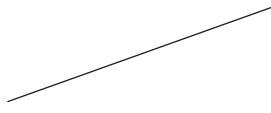
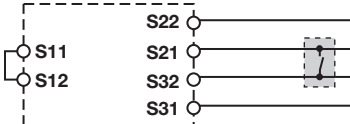
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### Preparing for operation

#### ► Supply voltage

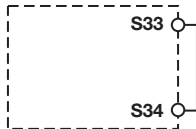
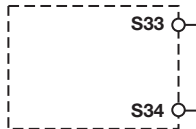
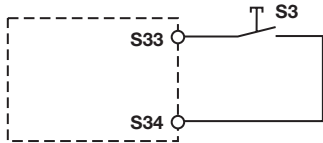
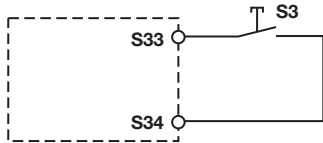
Supply voltage	AC	DC
		

#### ► Input circuit

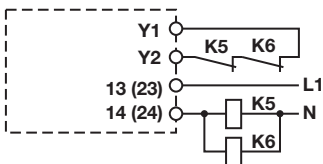
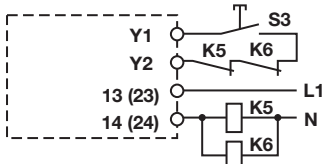
Input circuit	Single-channel	Dual-channel
E-STOP <b>without</b> detection of shorts across contacts		
E-STOP <b>with</b> detection of shorts across contacts		
Safety gate <b>without</b> detection of shorts across contacts		
Safety gate <b>with</b> detection of shorts across contacts		
Safety gate <b>with</b> detection of shorts across contacts		

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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		

### ▶ Feedback loop

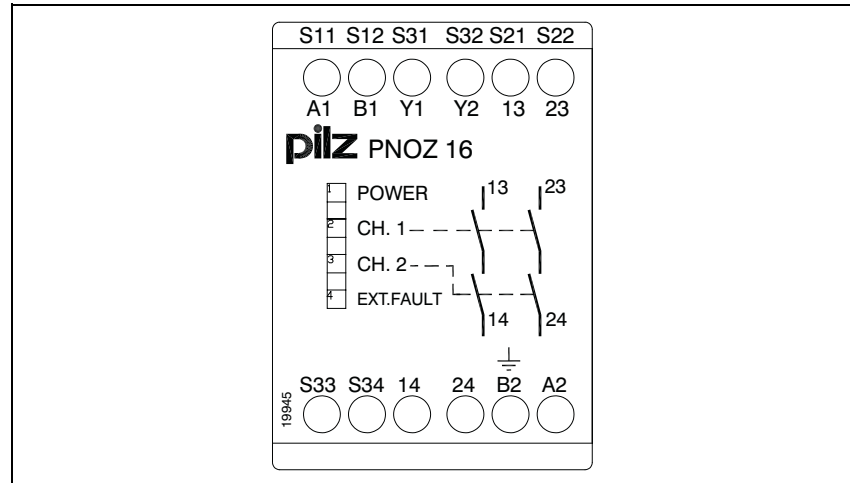
Feedback loop	Automatic reset	Manual reset
Contacts from external contactors		

### ▶ Key

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

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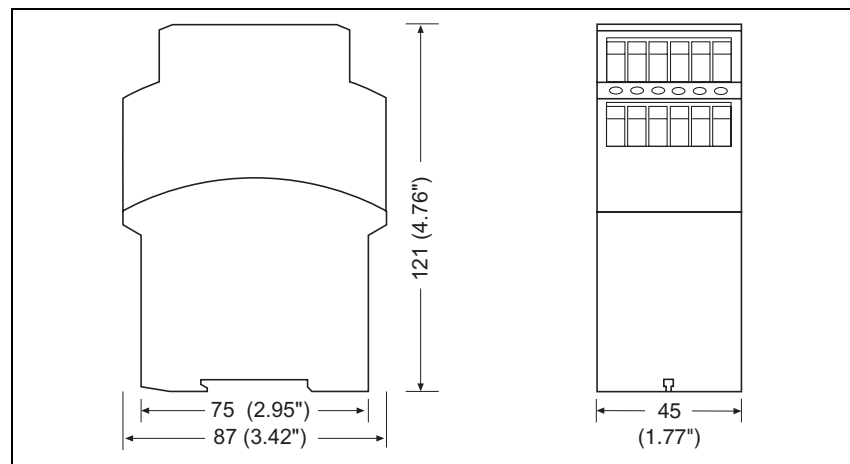
### Terminal configuration



### 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

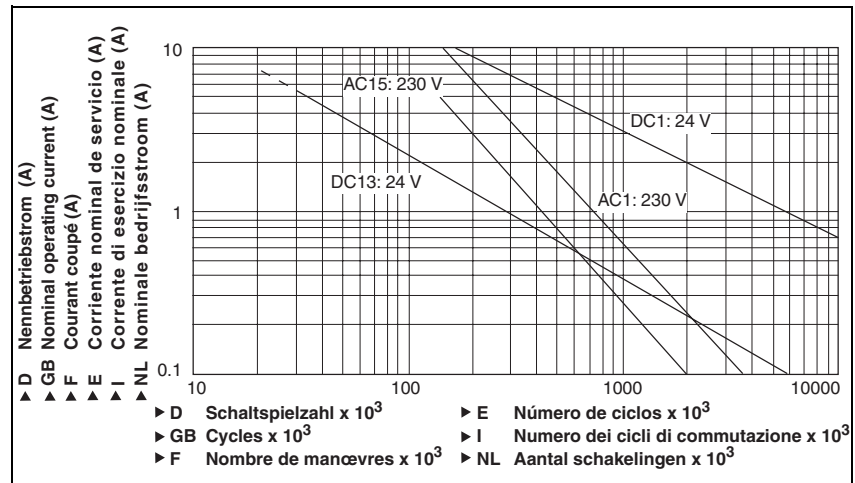


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### Notice

This data sheet is only intended for use during configuration. 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 <sub>B</sub> AC	<b>24 V, 42 V, 48 V, 110 V, 115 V, 120 V, 230 V, 240 V</b>
Supply voltage U <sub>B</sub> DC	<b>24 V</b>
Voltage tolerance	<b>-15 %/+10 %</b>
Power consumption at U <sub>B</sub> AC	<b>3.5 VA</b>
Power consumption at U <sub>B</sub> DC	<b>2.0 W</b>
Frequency range AC	<b>50 - 60 Hz</b>
Residual ripple DC	<b>20 %</b>
Voltage and current at	
input circuit DC: <b>24.0 V</b>	<b>25.0 mA</b>
reset circuit DC: <b>24.0 V</b>	<b>25.0 mA</b>
feedback loop DC: <b>24.0 V</b>	<b>25.0 mA</b>
Output contacts in accordance with <b>EN 954-1</b> Category 4	Safety contacts (N/O): <b>2</b>
Utilisation category in accordance with <b>EN 60947-4-1</b>	
Safety contacts: AC1 at <b>240 V</b>	<b>I<sub>min</sub>: 0.01 A, I<sub>max</sub>: 8.00 A</b> <b>P<sub>max</sub>: 2000 VA</b>
Safety contacts: DC1 at <b>24 V</b>	<b>I<sub>min</sub>: 0.01 A, I<sub>max</sub>: 8.0 A</b> <b>P<sub>max</sub>: 200 W</b>
Utilisation category in accordance with <b>EN 60947-5-1</b>	
Safety contacts: AC15 at <b>230 V</b>	<b>I<sub>max</sub>: 5.0 A</b>
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	<b>I<sub>max</sub>: 6.0 A</b>
Contact material	<b>AgSnO<sub>2</sub> + 0.2 µm Au</b>
External contact fuse protection to <b>EN 60947-5-1</b>	
Blow-out fuse, quick	
Safety contacts:	<b>10 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>6 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>6 A</b>
Safety mat resistance + overall cable resistance	<b>80 Ohm</b>
Max. overall cable resistance R <sub>lmax</sub> input circuits, reset circuits	
single-channel at U <sub>B</sub> DC	<b>40 Ohm</b>
single-channel at U <sub>B</sub> AC	<b>40 Ohm</b>
dual-channel with detect. of shorts across contacts at U <sub>B</sub> DC	<b>80 Ohm</b>
dual-channel with detect. of shorts across contacts at U <sub>B</sub> AC	<b>80 Ohm</b>

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<b>Times</b>	
Switch-on delay	
with automatic reset typ.	<b>230 ms</b>
with automatic reset max.	<b>350 ms</b>
with automatic reset after power on typ.	<b>310 ms</b>
with automatic reset after power on max.	<b>450 ms</b>
with manual reset typ.	<b>230 ms</b>
with manual reset max.	<b>350 ms</b>
Delay-on de-energisation	
with E-STOP typ.	<b>18 ms</b>
with E-STOP max.	<b>30 ms</b>
with power failure typ.	<b>50 ms</b>
with power failure max.	<b>80 ms</b>
Recovery time at max. switching frequency 1/s	
after E-STOP	<b>50 ms</b>
after power failure	<b>100 ms</b>
Recovery time after short across contacts	
at U <sub>B</sub> DC - Tol.	<b>650 ms</b>
at U <sub>B</sub> DC nom.	<b>400 ms</b>
at U <sub>B</sub> DC + Tol.	<b>320 ms</b>
at U <sub>B</sub> AC - Tol.	<b>400 ms</b>
at U <sub>B</sub> AC nom.	<b>300 ms</b>
at U <sub>B</sub> AC + Tol.	<b>280 ms</b>
Simultaneity, channel 1 and 2	∞
Supply interruption before de-energisation	<b>20 ms</b>
<b>Environmental data</b>	
EMC	<b>EN 60947-5-1, EN 61000-6-2</b>
Vibration in accordance with <b>EN 60068-2-6</b>	
Frequency	<b>10 - 55 Hz</b>
Amplitude	<b>0.35 mm</b>
Climatic suitability	<b>EN 60068-2-78</b>
Airgap creepage	<b>VDE 0110-1</b>
Ambient temperature	<b>-10 - 55 °C</b>
Storage temperature	<b>-40 - 85 °C</b>
Protection type	
Mounting (e.g. control cabinet)	<b>IP54</b>
Housing	<b>IP40</b>
Terminals	<b>IP20</b>
<b>Mechanical data</b>	
Housing material	
Housing	<b>PPO UL 94 V0</b>
Front	<b>ABS UL 94 V0</b>
Max. cross section of external conductors with screw terminals	
1 core flexible	<b>0.20 - 4.00 mm<sup>2</sup>, 24 - 10 AWG</b>
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	<b>0.20 - 2.50 mm<sup>2</sup>, 24 - 14 AWG</b>
without crimp connectors or with TWIN crimp connectors	<b>0.20 - 2.50 mm<sup>2</sup>, 24 - 14 AWG</b>
Torque setting with screw terminals	<b>0.60 Nm</b>
Dimensions	
Height	<b>87.0 mm</b>
Width	<b>45.0 mm</b>
Depth	<b>121.0 mm</b>
Weight	<b>350 g</b>

The standards current on **02/03** apply.

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### Order reference

Type	Features	Terminals	Order no.
PNOZ 16	24 VAC/DC	Screw terminals	774 060
PNOZ 16	42 VAC                      24 VDC	Screw terminals	774 061
PNOZ 16	48 VAC                      24 VDC	Screw terminals	774 062
PNOZ 16	110 VAC                     24 VDC	Screw terminals	774 063
PNOZ 16	115 VAC                     24 VDC	Screw terminals	774 064
PNOZ 16	120 VAC                     24 VDC	Screw terminals	774 065
PNOZ 16	230 VAC                     24 VDC	Screw terminals	774 066
PNOZ 16	240 VAC                     24 VDC	Screw terminals	774 067