

## Category 4, EN 954-1 PNOZ Ex



Safety relay for monitoring E-STOP pushbuttons and safety gates in potentially explosive atmospheres

### Approvals

	PNOZ Ex
	◆
	◆
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### Unit features

- ▶ Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 instantaneous auxiliary contact (N/O) in the intrinsically safe area
  - 1 instantaneous auxiliary contact (N/O) for fusing in the intrinsically safe area
  - 1 instantaneous auxiliary contact (N/C) in the non-intrinsically safe area
- ▶ Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
- ▶ LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
- ▶ Ex area II (1)GD [EEx ia] IIB/IIC
- ▶ See order reference for unit types

The safety relay provides an intrinsically safe output circuit and volt-free contacts for potentially explosive areas (standards used: EN 50014 +A1-A2 and EN 50020).

The unit is suitable for non-contact barriers (e.g. light curtains) because a dynamic start is possible.

### Safety features

The relay meets the following safety requirements:

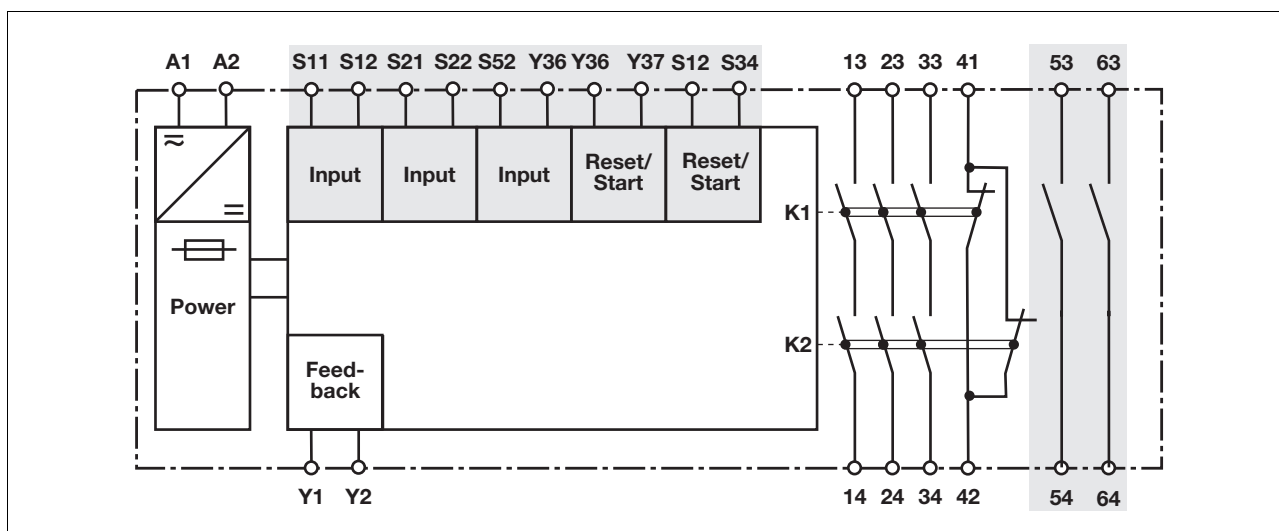
- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ The correct opening and closing of the safety function relays is tested automatically in each on-off cycle.

### 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

### Block diagram



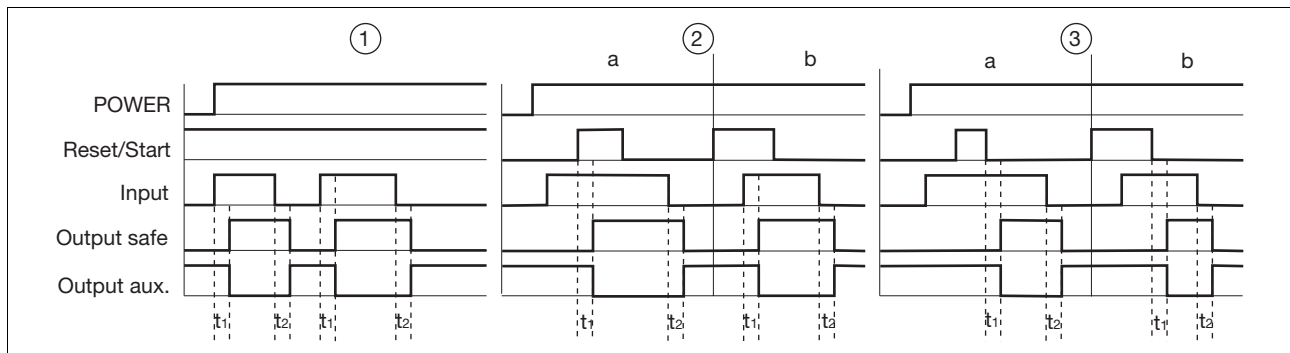
Grey area = intrinsically safe area

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### Function description

- ▶ 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.
- ▶ 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 S12-S34, Y36-Y37, Y1-Y2
- ▶ Input: Input circuits S11-S12, S21-S21, S52, Y36
- ▶ Output safe: Safety contacts 13-14, 23-24, 33-34
- ▶ Output aux: Auxiliary contacts 41-42, 53-54, 63-64
- ▶ ①: Automatic reset
- ▶ ②: Manual reset
- ▶ ③: Monitored 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

### Wiring

#### Please note:

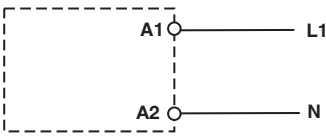
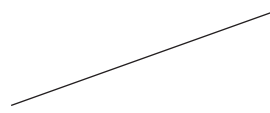
- ▶ Information given in the “Technical details” must be followed.
- ▶ Outputs 13-14, 23-24, 33-34 are safety contacts, outputs 41-42, 53-54, 63-64 are auxiliary contacts (e.g. for display).
- ▶ To prevent contact welding, a fuse should be connected before the output contacts (see technical details).
- ▶ Calculation of the max. cabling runs  $I_{max}$  in the input circuit:
 
$$I_{max} = \frac{R_{I_{max}}}{R_l / km}$$

$R_{I_{max}}$  = 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.


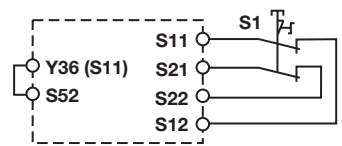
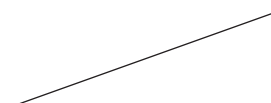
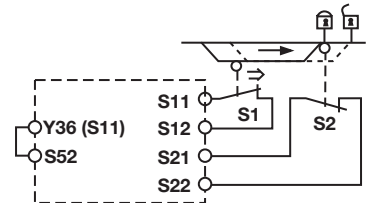
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### Preparing for operation



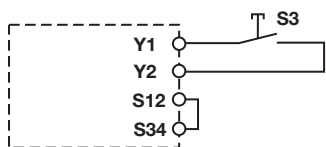
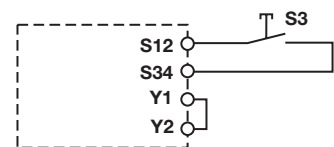
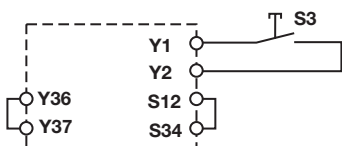
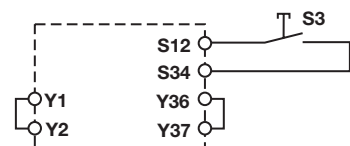
#### ► Supply voltage

Supply voltage	AC	DC
		

#### ► Input circuit

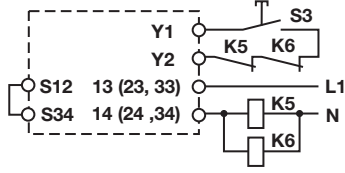
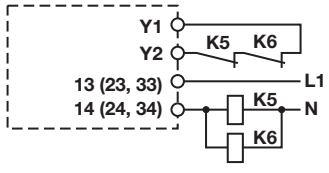
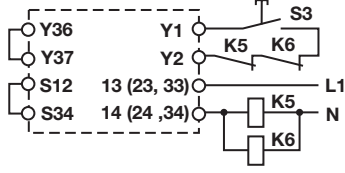
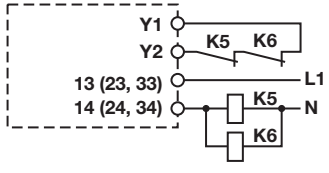
Input circuit	Single-channel	Dual-channel
E-STOP <b>with</b> detection of shorts across contacts		
Safety gate <b>with</b> detection of shorts across contacts		

#### ► Reset circuit




Reset circuit	Reset from the non-intrinsically safe area	Reset from the intrinsically safe area
Automatic reset		
Manual reset		
Monitored reset		

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### Feedback loop

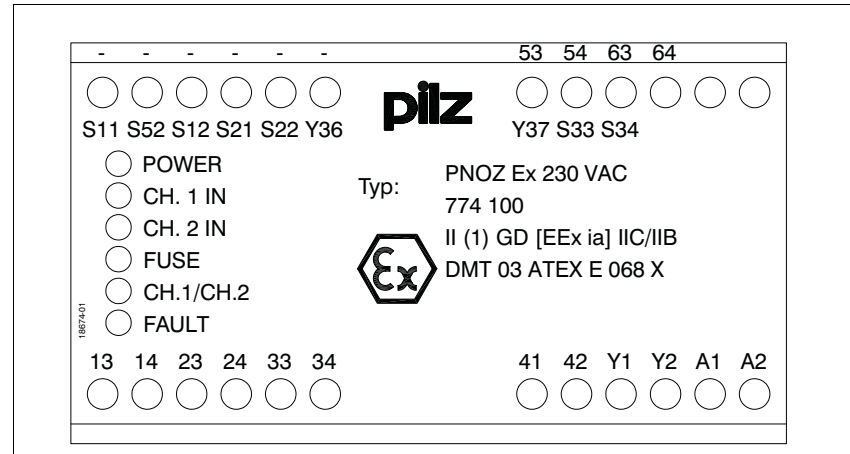
Feedback loop	Reset from the non-intrinsically safe area	Reset from the intrinsically safe area
Contacts from external contactors (manual reset)		
Contacts from external contactors (monitored reset)		

### Key

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

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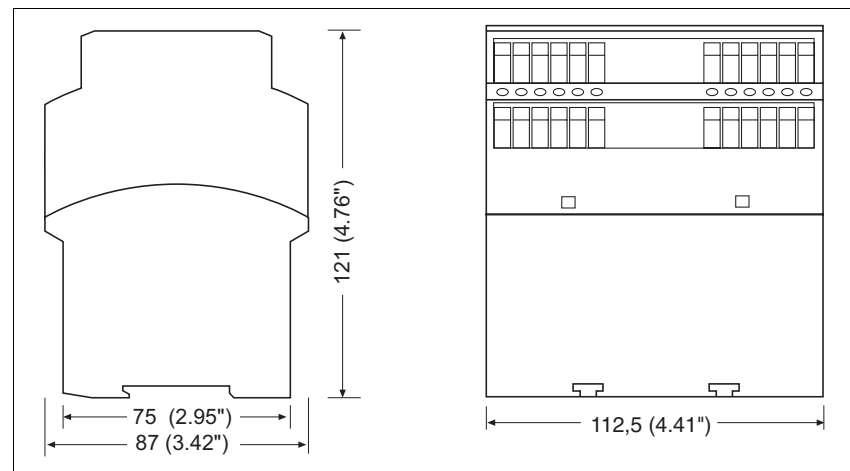
### Terminal configuration



### 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).
- ▶ Always install the unit outside the potentially explosive area. Only the intrinsically safe output circuit (terminals S11, S12, S21, S22, S34, S52, Y36, Y37 and GND) and the volt-free contacts (terminals 53, 54 and 63, 64) may be brought into the potentially explosive area.
- ▶ Air gaps between uninsulated parts of intrinsically safe circuits and earthed metal parts must be a minimum of 3 mm; air gaps between uninsulated parts of intrinsically safe circuits and uninsulated parts of non-intrinsically safe circuits must at least conform with the values required in Table 4, Amendment 4 of EN 50020

### Dimensions

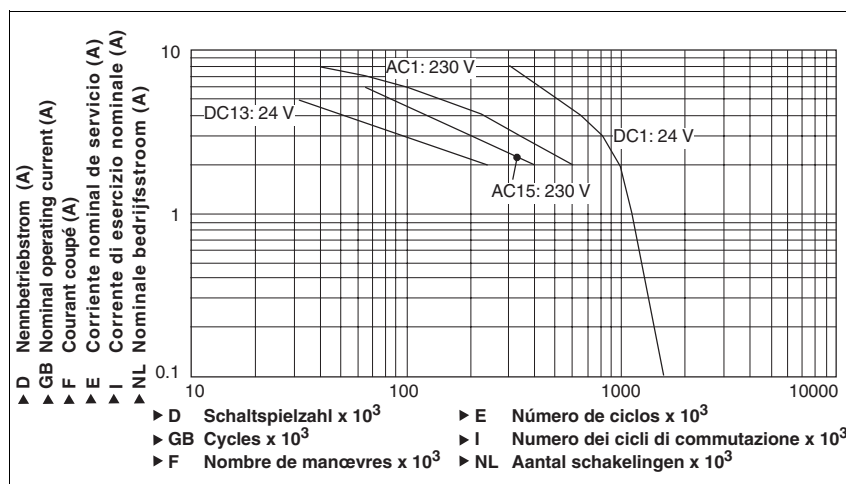


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### Notice

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>115 V, 120 V, 230 V</b>
Voltage tolerance	<b>-15 %/+10 %</b>
Power consumption at U <sub>B</sub> AC	<b>8.0 VA</b>
Frequency range AC	<b>50 - 60 Hz</b>
Voltage and current at	
Input circuit DC: <b>6.0 V</b>	<b>25.0 mA</b>
Reset circuit DC: <b>6.0 V</b>	<b>15.0 mA</b>
Feedback loop DC: <b>24.0 V</b>	<b>20.0 mA</b>
Number of output contacts	
Safety contacts (S) instantaneous:	<b>3</b>
Auxiliary contacts (N/C):	<b>3</b>
Category of output contacts in accordance with <b>EN 954-1</b>	
Safety contacts (S) instantaneous:	<b>4</b>
Utilisation category in accordance with <b>EN 60947-4-1</b>	
Safety contacts: AC1 at <b>240 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>4.00 A</b> P <sub>max</sub> : <b>1000 VA</b>
Safety contacts: DC1 at <b>24 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>2.0 A</b> P <sub>max</sub> : <b>48 W</b>
Auxiliary contacts (intrinsically safe): DC1 at <b>30 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>0.5 A</b> P <sub>max</sub> : <b>10 W</b>
Auxiliary contacts: AC1 at <b>240 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>4.0 A</b> P <sub>max</sub> : <b>1000 VA</b>
Auxiliary contacts: DC1 at <b>24 V</b>	I <sub>min</sub> : <b>0.01 A</b> , I <sub>max</sub> : <b>2.0 A</b> P <sub>max</sub> : <b>48 W</b>
Utilisation category in accordance with <b>EN 60947-5-1</b>	
Safety contacts: AC15 at <b>230 V</b>	I <sub>max</sub> : <b>4.0 A</b>
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	I <sub>max</sub> : <b>2.0 A</b>
Auxiliary contacts: AC15 at <b>230 V</b>	I <sub>max</sub> : <b>4.0 A</b>
Auxiliary contacts: DC13 at <b>24 V</b> (6 cycles/min)	I <sub>max</sub> : <b>2.0 A</b>
Contact material	<b>AgSnO2 + 0.2 µm Au</b>

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<b>Electrical data</b>	
External contact fuse protection ( $I_K = 1 \text{ kA}$ ) to <b>EN 60947-5-1</b>	
Blow-out fuse, quick	
Safety contacts:	<b>4 A</b>
Auxiliary contacts:	<b>4 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>4 A</b>
Auxiliary contacts:	<b>4 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>4 A</b>
Auxiliary contacts:	<b>4 A</b>
Max. overall cable resistance $R_{lmax}$ input circuits, reset circuits	
single-channel at $U_B$ AC	<b>40 Ohm</b>
dual-channel without detect. of shorts across contacts at $U_B$ AC	<b>80 Ohm</b>
dual-channel with detect. of shorts across contacts at $U_B$ AC	<b>15 Ohm</b>
Max. line capacitance	
EX IIB	<b>2 <math>\mu\text{F}</math></b>
EX IIC	<b>1 <math>\mu\text{F}</math></b>
Max. line inductance	
EX IIB	<b>200 <math>\mu\text{H}</math></b>
EX IIC	<b>100 <math>\mu\text{H}</math></b>
<b>Times</b>	
Switch-on delay	
with automatic reset typ.	<b>150 ms</b>
with automatic reset max.	<b>200 ms</b>
with automatic reset after power on typ.	<b>165 ms</b>
with automatic reset after power on max.	<b>210 ms</b>
with manual reset typ.	<b>145 ms</b>
with manual reset max.	<b>200 ms</b>
on monitored reset with rising edge typ.	<b>115 ms</b>
on monitored reset with rising edge max.	<b>150 ms</b>
Delay-on de-energisation	
with E-STOP typ.	<b>10 ms</b>
with E-STOP max.	<b>30 ms</b>
with power failure typ.	<b>110 ms</b>
with power failure max.	<b>150 ms</b>
Recovery time at max. switching frequency 1/s	
after E-STOP	<b>50 ms</b>
after power failure	<b>200 ms</b>
Min. start pulse duration with a monitored reset	<b>30 ms</b>
Simultaneity, channel 1 and 2	<b>150 ms</b>
Supply interruption before de-energisation	<b>35 ms</b>
<b>Environmental data</b>	
EMC	<b>EN 60947-5-1, EN 61000-6-2</b>
Vibration to <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>-20 - 55 °C</b>
Storage temperature	<b>-40 - 85 °C</b>
Protection type	
Mounting (e.g. cabinet)	<b>IP54</b>
Housing	<b>IP40</b>
Terminals	<b>IP20</b>

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### Mechanical data

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>112.5 mm</b>
Depth	<b>121.0 mm</b>
Weight	<b>720 g</b>

The standards current on **05/04** apply.

### Order reference

Type	Features	Terminals	Order no.
PNOZ Ex	230 VAC	Screw terminals	774 100
PNOZ Ex	115 VAC	Screw terminals	774 104
PNOZ Ex	120 VAC	Screw terminals	774 105