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## Category 4, EN 954-1 PNOZ 2VQ



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

### Approvals

PNOZ 2VQ	
	◆
	◆

### Unit features

- ▶ Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 2 safety contacts (N/O), delay-on de-energisation
  - 1 auxiliary contact (N/C), instantaneous
- ▶ Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
- ▶ Delay-on de-energisation can be set separately for both safety contacts with delay-on de-energisation
- ▶ Delay time can be cancelled via reset button
- ▶ LED indicator for:
  - Switch status channel 1/2
  - Supply voltage

### 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

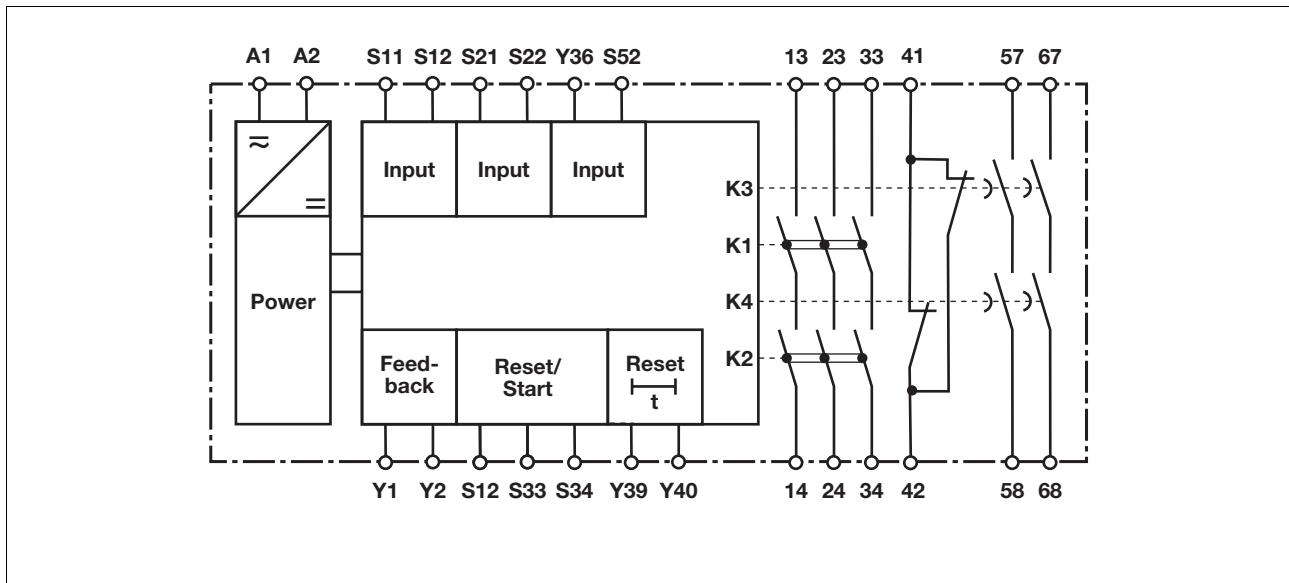
The max. category the safety contacts can achieve in accordance with EN 954-1 is stated in the technical details.

### 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 unit has an electronic fuse.

### Block diagram

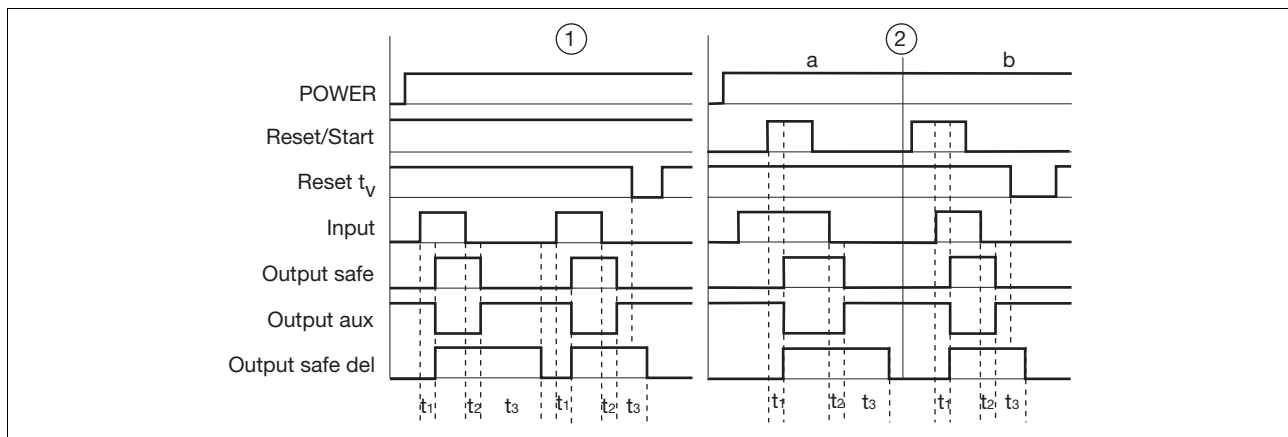


## Category 4, EN 954-1 PNOZ 2VQ

### 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.
- ▶ 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.
- ▶ 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 expansion modules or external contactors/relays.

### Timing diagram



### Key

- ▶ Power: Supply voltage
- ▶ Reset/start: Reset circuit S12, S33, S34
- ▶ Reset  $t_v$ : Y39-Y40
- ▶ Input: Input circuits S11-S12, S21-S22, Y36-S52
- ▶ Output safe: Safety contacts 13-14, 23-24, 33-34
- ▶ Output safe del: Safety contacts, delayed 57-58, 67-68
- ▶ Output aux: Auxiliary contacts 41-42
- ▶ ①: Automatic reset
- ▶ ②: Manual 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 inst. contacts
- ▶  $t_3$ : Delay time

### Wiring

Please note:

- ▶ Information given in the “Technical details” must be followed.
- ▶ Outputs 13-14, 23-24, 33-34 are instantaneous safety contacts, outputs 57-58, 67-68 are delay-on de-energisation safety contacts, output 41-42 is an instantaneous 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.

## Category 4, EN 954-1 PNOZ 2VQ

### 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	/	

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### ▶ Reset circuit

Reset circuit	E-STOP/safety gate wiring (single-channel and dual-channel without shorts across contacts)	E-STOP/safety gate wiring (dual-channel with shorts across contacts)
Automatic reset		
Manual reset		

### ▶ Reset delay time

Reset	Without reset	With reset
Link or N/C contact		

### ▶ Feedback loop

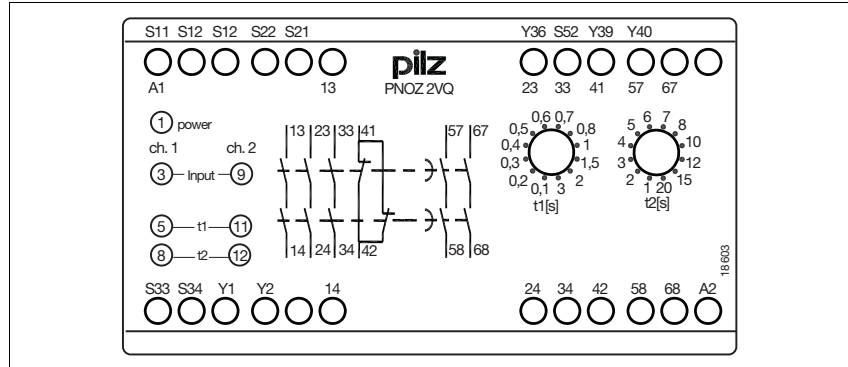
Feedback loop	
Contacts from external contactors	

### ▶ Key

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

## Category 4, EN 954-1 PNOZ 2VQ

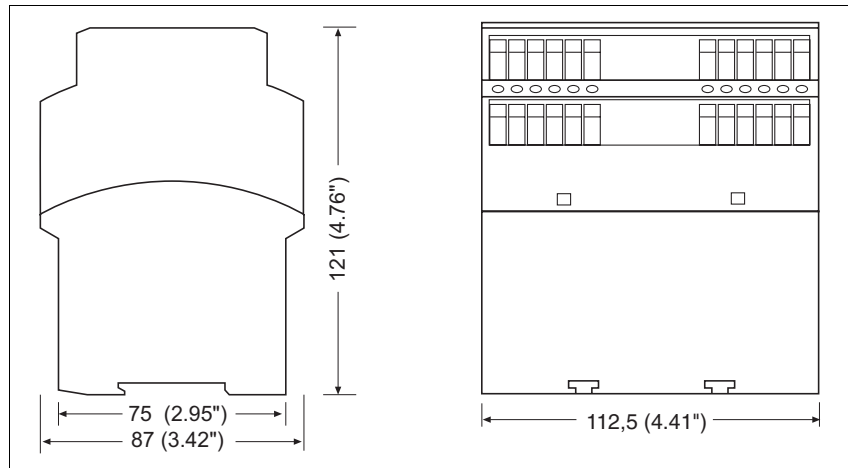
### Terminal configuration



### 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



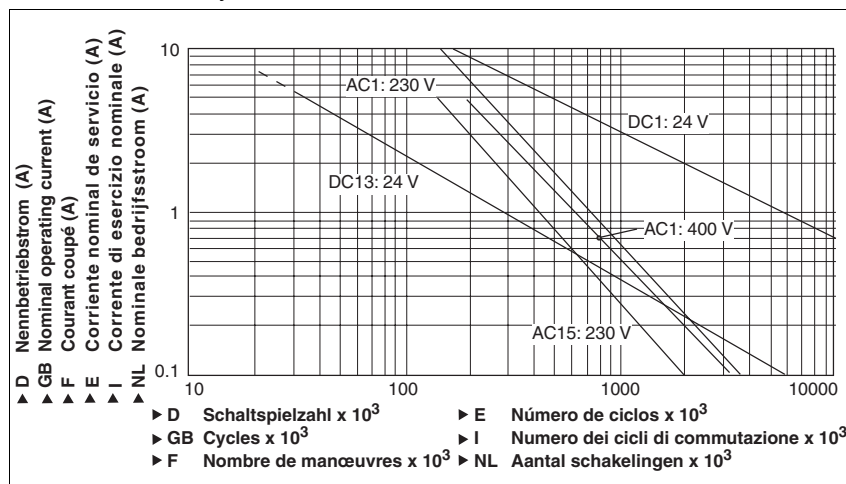
## Category 4, EN 954-1 PNOZ 2VQ

### Notice

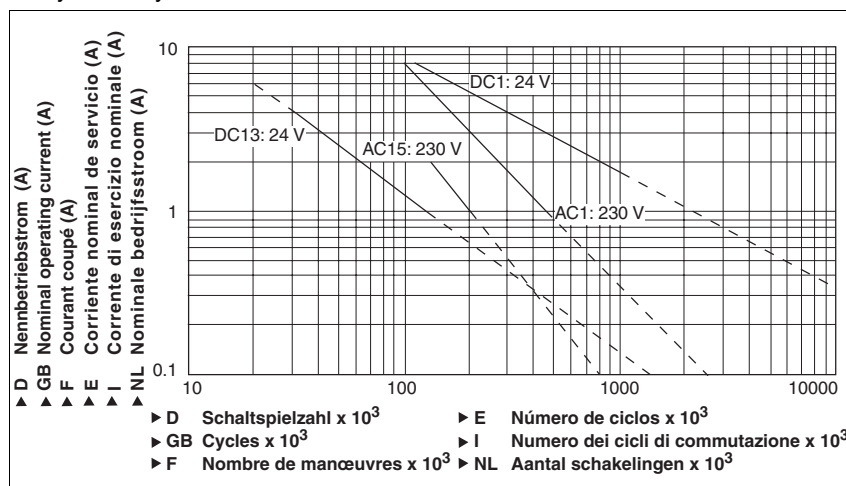
This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

### Service life graph

Instantaneous safety contacts:



Delayed safety contacts:



### Technical details

#### Electrical data

Supply voltage	
Supply voltage U <sub>B</sub> DC	<b>24 V</b>
Voltage tolerance	<b>-15 %/+10 %</b>
Power consumption at U <sub>B</sub> DC	<b>6.5 W</b>
Residual ripple DC	<b>160 %</b>
Voltage and current at	
Input circuit DC: <b>24.0 V</b>	<b>35.0 mA</b>
Reset circuit DC: <b>24.0 V</b>	<b>100.0 mA</b>
Feedback loop DC: <b>24.0 V</b>	<b>100.0 mA</b>
Number of output contacts	
Safety contacts (S) instantaneous:	<b>3</b>
Safety contacts (N/O), delayed:	<b>2</b>
Auxiliary contacts (N/C):	<b>1</b>

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<b>Electrical data</b>	
<b>Category of output contacts in accordance with EN 954-1, EN ISO 13849-1</b>	
Safety contacts (S) instantaneous:	<b>4</b>
Delay time <30 s	<b>3</b>
<b>Utilisation category in accordance with EN 60947-4-1</b>	
Safety contacts: AC1 at <b>240 V</b>	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 2000 VA$
Safety contacts: AC1 at <b>400 V</b>	$I_{min}: 0.01 A, I_{max}: 5.00 A$ $P_{max}: 2000 VA$
Safety contacts: DC1 at <b>24 V</b>	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 200 W$
Safety contacts, delayed: AC1 at <b>240 V</b>	$I_{min}: 0.01 A, I_{max}: 4.0 A$ $P_{max}: 1000 VA$
Safety contacts, delayed: DC1 at <b>24 V</b>	$I_{min}: 0.01 A, I_{max}: 4.0 A$ $P_{max}: 100 W$
Auxiliary contacts: AC1 at <b>240 V</b>	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 2000 VA$
Auxiliary contacts: DC1 at <b>24 V</b>	$I_{min}: 0.01 A, I_{max}: 8.0 A$ $P_{max}: 200 W$
<b>Utilisation category in accordance with EN 60947-5-1</b>	
Safety contacts: AC15 at <b>230 V</b>	$I_{max}: 5.0 A$
Safety contacts: DC13 at <b>24 V</b> (6 cycles/min)	$I_{max}: 7.0 A$
Safety contacts, delayed: AC15 at <b>230 V</b>	$I_{max}: 4.0 A$
Safety contacts, delayed: DC13 at <b>24 V</b> (6 cycles/min)	$I_{max}: 4.0 A$
Auxiliary contacts: AC15 at <b>230 V</b>	$I_{max}: 5.0 A$
Safety contacts, delayed: DC13 at <b>24 V</b> (6 cycles/min)	$I_{max}: 7.0 A$
Contact material	<b>AgSnO<sub>2</sub> + 0.2 µm Au</b>
<b>External contact fuse protection (<math>I_k = 1 kA</math>) to EN 60947-5-1</b>	
Blow-out fuse, quick	
Safety contacts:	<b>10 A</b>
Safety contacts, delayed:	<b>6 A</b>
Auxiliary contacts:	<b>10 A</b>
Blow-out fuse, slow	
Safety contacts:	<b>6 A</b>
Safety contacts, delayed:	<b>4 A</b>
Auxiliary contacts:	<b>6 A</b>
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	<b>6 A</b>
Safety contacts, delayed:	<b>4 A</b>
Auxiliary contacts:	<b>6 A</b>
<b>Max. overall cable resistance <math>R_{lmax}</math></b>	
input circuits, reset circuits	
single-channel at $U_B$ DC	<b>60 Ohm</b>
dual-channel without detect. of shorts across contacts at $U_B$ DC	<b>120 Ohm</b>
dual-channel with detect. of shorts across contacts at $U_B$ DC	<b>5 Ohm</b>
<b>Times</b>	
Switch-on delay	
with automatic reset typ.	<b>200 ms</b>
with automatic reset max.	<b>300 ms</b>
with automatic reset after power on typ.	<b>200 ms</b>
with automatic reset after power on max.	<b>300 ms</b>
with manual reset typ.	<b>200 ms</b>
with manual reset max.	<b>300 ms</b>



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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.	30 ms
with power failure max.	40 ms
Recovery time at max. switching frequency 1/s	
after E-STOP	50 ms +tv
after power failure	100 ms
Delay time $t_V$ : selectable	0,10 s; 0,20 s; 0,30 s; 0,40 s; 0,50 s; 0,60 s; 0,70 s; 0,80 s; 1,00 s; 1,50 s; 2,00 s; 3,00 s Order no.: 774013 1,00 s, 2,00 s, 3,00 s, 4,00 s, 5,00 s, 6,00 s, 7,00 s, 8,00 s, 10,00 s, 12,00 s, 15,00 s, 20,00 s
Repetition accuracy	2 %
Time accuracy	-15 %/+15 % +50 ms
Simultaneity, channel 1 and 2	150 ms
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
Rated insulation voltage	400 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
Cross section of external conductors with screw terminals	
1 core flexible	0.20 - 4.00 mm <sup>2</sup> , 24 - 10 AWG
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.20 - 2.50 mm <sup>2</sup> , 24 - 14 AWG
without crimp connectors or with TWIN crimp connectors	0.20 - 2.50 mm <sup>2</sup> , 24 - 14 AWG
Torque setting with screw terminals	0.60 Nm
Dimensions	
Height	87.0 mm
Width	112.5 mm
Depth	121.0 mm
Weight	600 g

The standards current on **2008-07** apply.

## Category 4, EN 954-1 PNOZ 2VQ

### Conventional thermal current

$I_{th}$ (A) at $U_B$ DC	
1 contact	<b>8.00 A</b>
2 contacts	<b>6.80 A</b>
3 contacts	<b>5.50 A</b>
4 contacts	<b>5.00 A</b>
5 contacts	<b>4.50 A</b>

### Order reference

Type	Features	Terminals	Order no.
PNOZ 2VQ	24 VDC	Screw terminals	774 013



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