

Category 4, EN 954-1 PNOZ 2VQ



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

Approvals

	PNOZ 2VQ
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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

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

Safety features

The relay conforms to the following safety criteria:

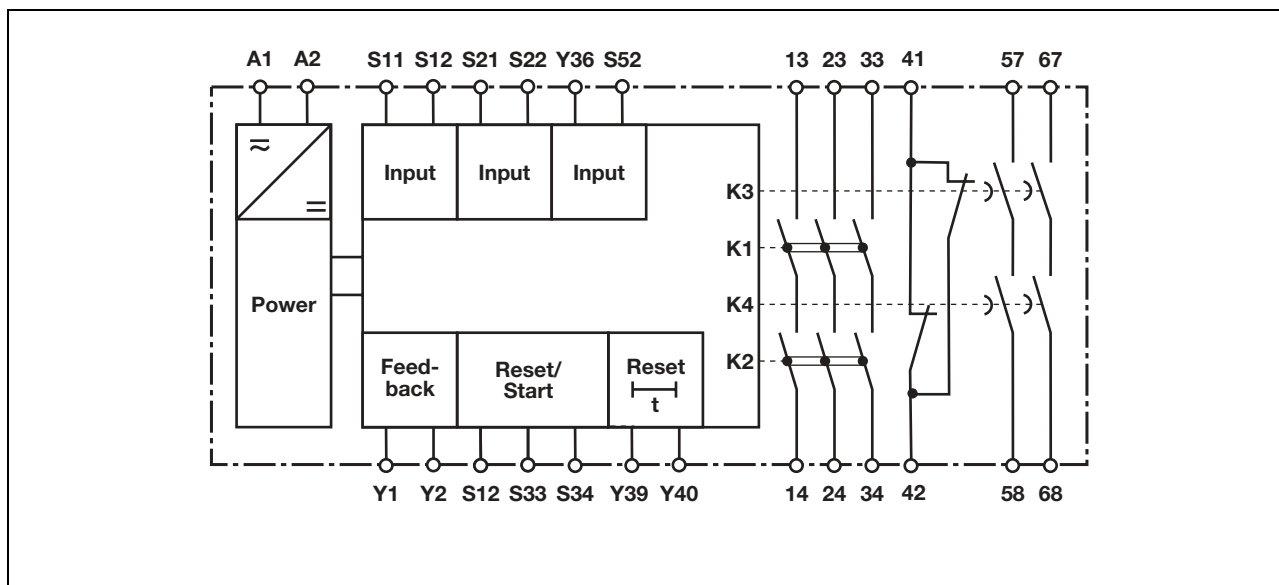
- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.
- ▶ The correct opening and closing of the safety function relays is tested automatically in each on-off cycle.
- ▶ The unit has an electronic fuse.

Unit description

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

- ▶ E-STOP pushbuttons
- ▶ Safety gates

Block diagram

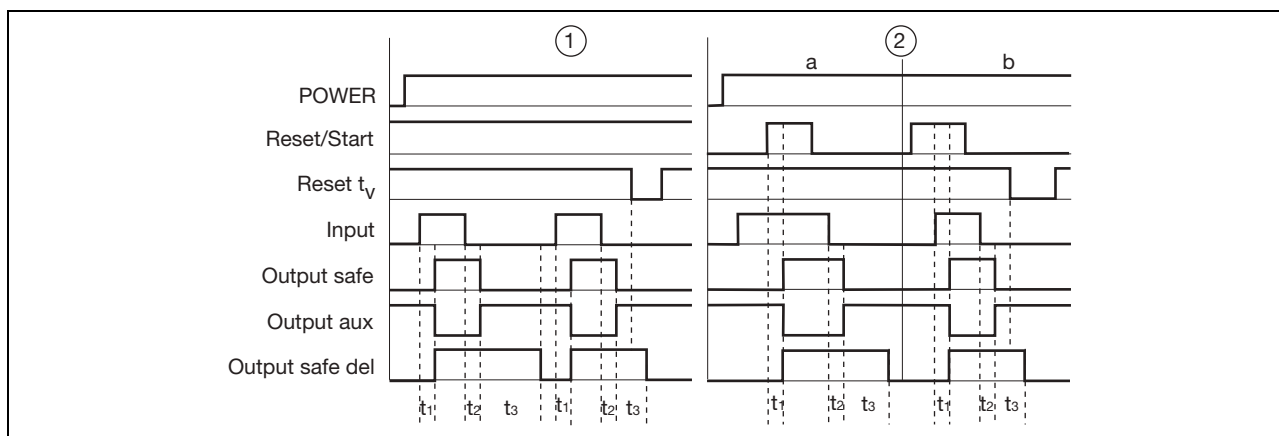


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Function description

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

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


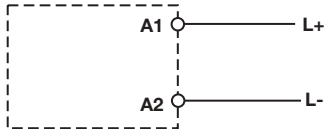
R_{lmax} = max. overall cable resistance (see technical details)
 R_l / km = cable resistance/km

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

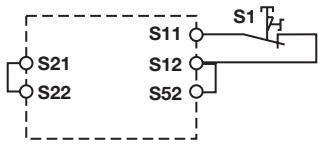
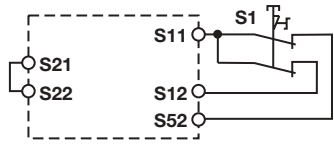

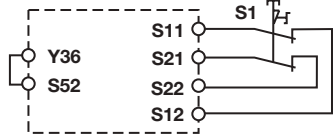
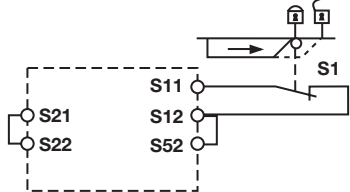
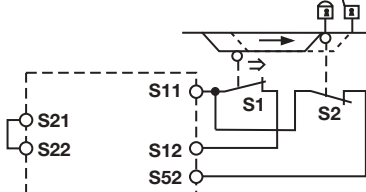

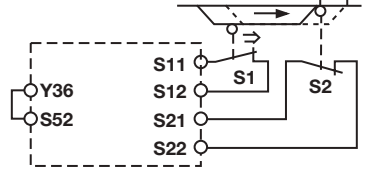
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Preparing for operation

► Supply voltage

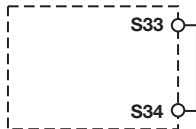
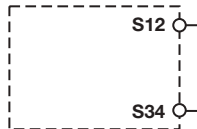
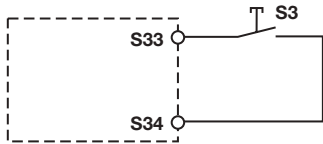
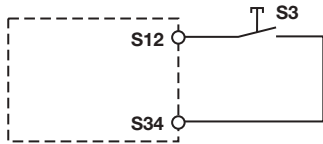
Supply voltage	AC	DC
		

► Input circuit

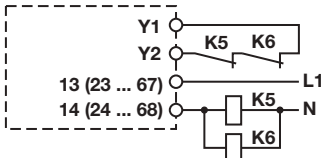
Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Safety gate without detection of shorts across contacts		
Safety gate with detection of shorts across contacts		

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▶ Reset circuit

Reset circuit	E-STOP/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		

▶ Feedback loop

Feedback loop	
Contacts from external contactors	

▶ Key

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

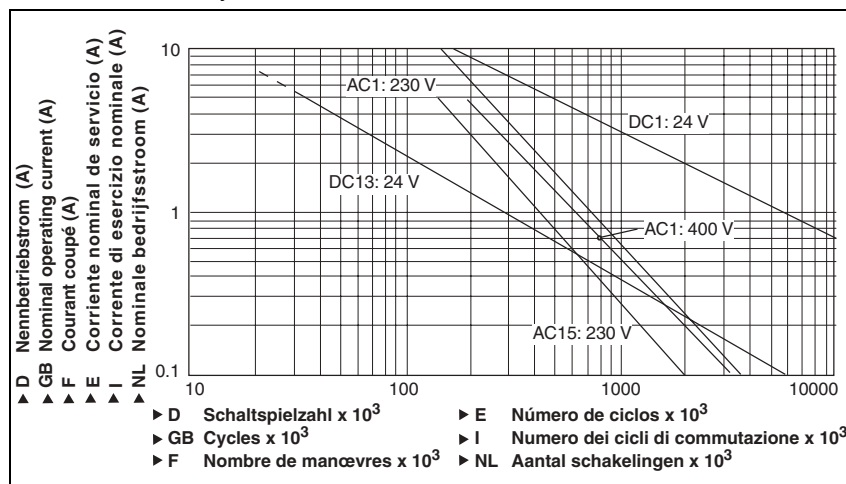
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Notice

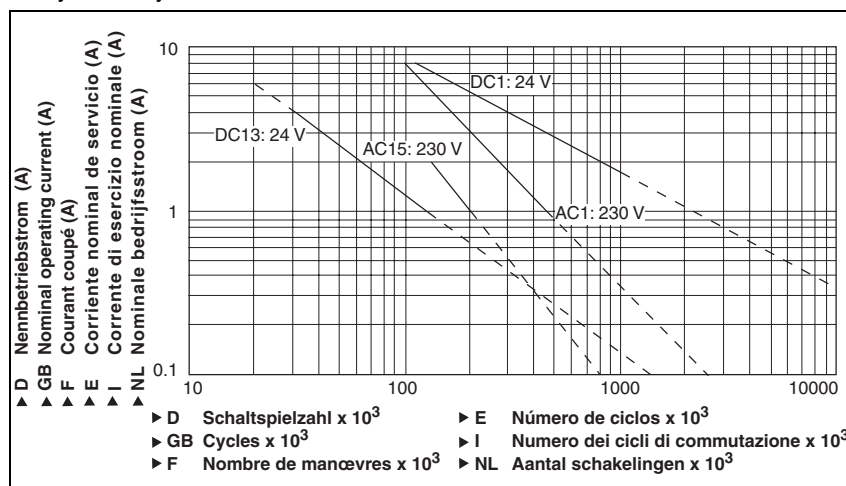
This data sheet is only intended for use during configuration. For installation and operation, please refer to the operating instructions supplied with the unit.

Service life graph

Instantaneous safety contacts:



Delayed safety contacts:



Technical details

Electrical data

Supply voltage	
Supply voltage U _B DC	24 V
Voltage tolerance	-15 %/+10 %
Power consumption at U _B DC	6.5 W
Residual ripple DC	160 %
Voltage and current at input circuit DC: 24.0 V	35.0 mA
reset circuit DC: 24.0 V	100.0 mA
feedback loop DC: 24.0 V	100.0 mA
Output contacts in accordance with EN 954-1 Category 4	Safety contacts (N/O): 3
Output contacts in accordance with EN 954-1 Category 3	Safety contacts (N/O), delayed: 2
	Delay time <30 s
	Auxiliary contacts (N/C): 1

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Electrical data

Utilisation category in accordance with **EN 60947-4-1**

Safety contacts: AC1 at 240 V	I_{\min} : 0.01 A , I_{\max} : 8.00 A P_{\max} : 2,000 VA
Safety contacts: AC1 at 400 V	I_{\min} : 0.01 A , I_{\max} : 5.00 A P_{\max} : 2,000 VA
Safety contacts: DC1 at 24 V	I_{\min} : 0.01 A , I_{\max} : 8.0 A P_{\max} : 200 W
Safety contacts, delayed: AC1 at 240 V	I_{\min} : 0.01 A , I_{\max} : 4.0 A P_{\max} : 1,000 VA
Safety contacts, delayed: DC1 at 24 V	I_{\min} : 0.01 A , I_{\max} : 4.0 A P_{\max} : 100 W
Auxiliary contacts: AC1 at 240 V	I_{\min} : 0.01 A , I_{\max} : 8.0 A P_{\max} : 2,000 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} : 7.0 A
Safety contacts, delayed: AC15 at 230 V	I_{\max} : 4.0 A
Safety contacts, delayed: DC13 at 24 V (6 cycles/min)	I_{\max} : 4.0 A
Auxiliary contacts: AC15 at 230 V	I_{\max} : 5.0 A
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	I_{\max} : 7.0 A

Contact material **AgSnO₂ + 0.2 µm Au**

External contact fuse protection to **EN 60947-5-1**

Blow-out fuse, quick	
Safety contacts:	10 A
Safety contacts, delayed:	6 A
Auxiliary contacts:	10 A
Blow-out fuse, slow	
Safety contacts:	6 A
Safety contacts, delayed:	4 A
Auxiliary contacts:	6 A
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	6 A
Safety contacts, delayed:	4 A
Auxiliary contacts:	6 A

Max. overall cable resistance R_{lmax} input circuits, reset circuits single-channel at U_B DC	60 Ohm
dual-channel without detect. of shorts across contacts at U_B DC	120 Ohm
dual-channel with detect. of shorts across contacts at U_B DC	5 Ohm

Times

Switch-on delay	
with automatic reset typ.	200 ms
with automatic reset max.	300 ms
with automatic reset after power on typ.	200 ms
with automatic reset after power on max.	300 ms
with manual reset typ.	200 ms
with manual reset max.	300 ms
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

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Times	
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
Delay time t_{V2} : selectable	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 in accordance with EN 60068-2-6	
Frequency	10 - 55 Hz
Amplitude	0.35 mm
Climatic suitability	EN 60068-2-78
Airgap creepage	VDE 0110-1
Ambient temperature	-10 - 55 °C
Storage temperature	-40 - 85 °C
Protection type	
Mounting (e.g. control cabinet)	IP54
Housing	IP40
Terminals	IP20
Mechanical data	
Housing material	
Housing	PPO UL 94 V0
Front	ABS UL 94 V0
Max. cross section of external conductors with screw terminals	
1 core flexible	0.20 - 4.00 mm ² , 24 - 10 AWG
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.20 - 2.50 mm ² , 24 - 14 AWG
without crimp connectors or with TWIN crimp connectors	0.20 - 2.50 mm ² , 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 **06/02** apply.

Max. continuous current	
Number of contacts	I_{max} (A) at U_B DC
1	8.00 A
2	6.80 A
3	5.50 A
4	5.00 A
5	4.50 A

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