Up to PL e of EN ISO 13849-1
PNOZ XV1P



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

Approvals

	PNOZ XV1P
c UL us LISTED	◆
	◆
	◆

Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
  - 1 safety contact (N/O), delay-on de-energisation
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
  - Light barriers
- LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Unit description

The max. category the safety contacts can achieve in accordance with EN 954-1 and EN ISO 13849-1 is stated in the technical details.
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

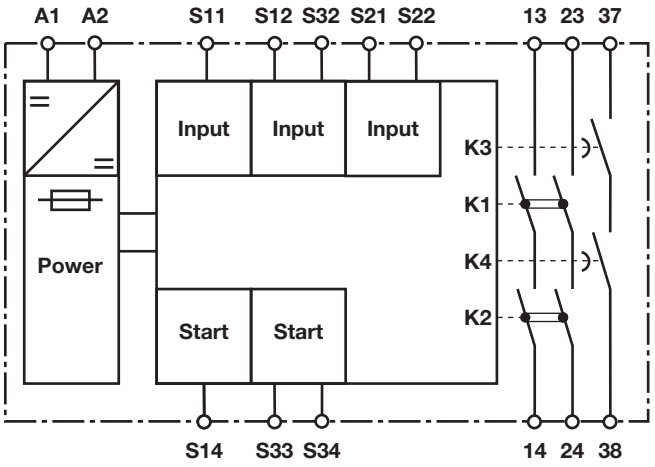
- E-STOP pushbuttons
- Safety gates
- Light beam devices

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



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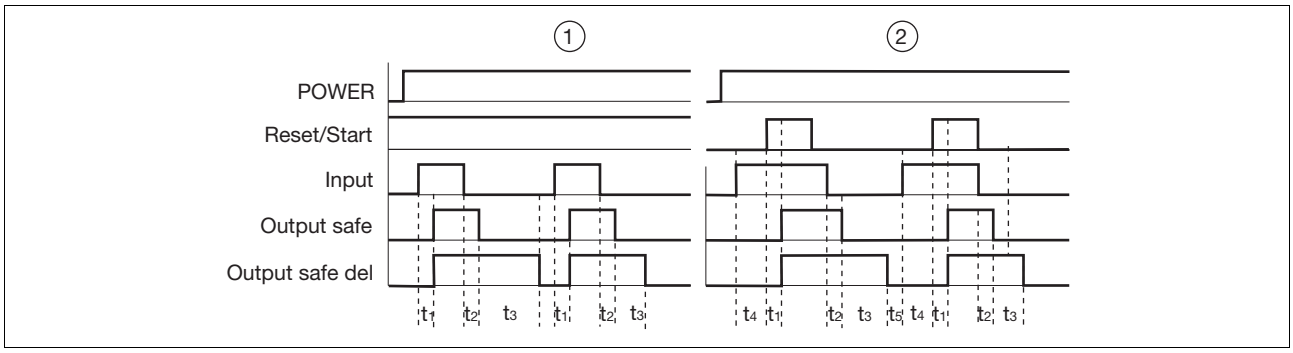
Function description

- 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.
- 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.
- 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 S11-S14, S33-S34
- Input: Input circuits S11-S12, S12-S32, S21-S22
- Output safe: Safety contacts, instantaneous 13-14, 23-24
- Output safe del: Safety contacts, delayed 37-38
- ①: Automatic reset
- ②: Monitored reset
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Delay time
- t_4: Waiting period
- t_5: Recovery time

Wiring

Please note:

- Information given in the “Technical details” must be followed.
- Outputs 37-38 are delay-on de-energisation 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_{max} in the input circuit:

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

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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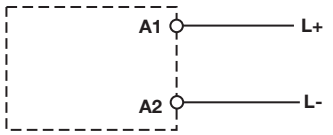
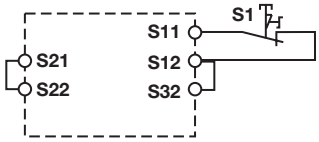
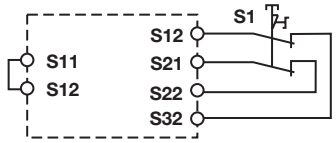
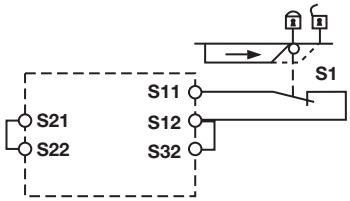
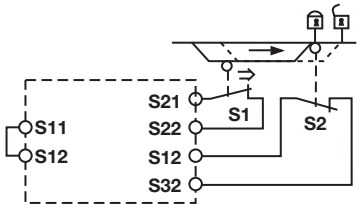
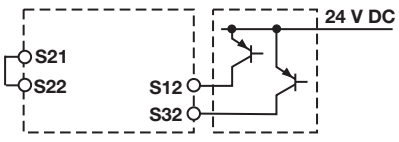
Preparing for operation

- 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		
Light beam device **with** detection of shorts across contacts via ESPE		

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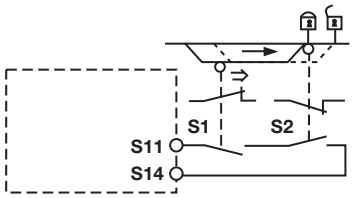
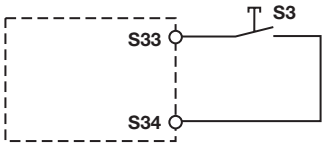
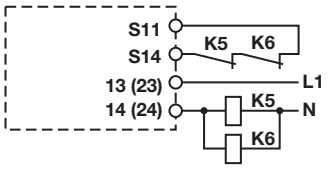
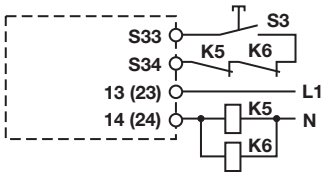
▸ Reset circuit

Reset circuit	E-STOP wiring, safety gate	Safety gate (dual-channel)
Automatic reset		
Monitored reset		

▸ Feedback circuit

Feedback circuit	Automatic reset	Monitored reset
Contacts from external contactors		

▸ Key

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

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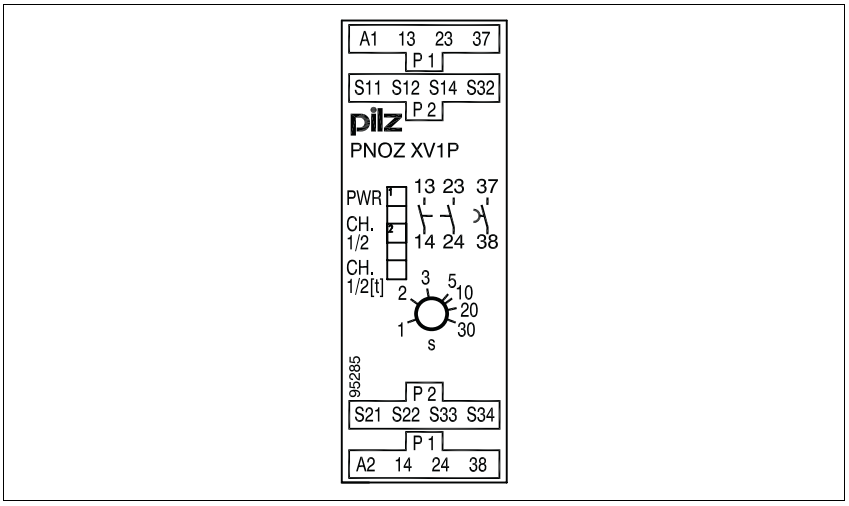
Terminal configuration

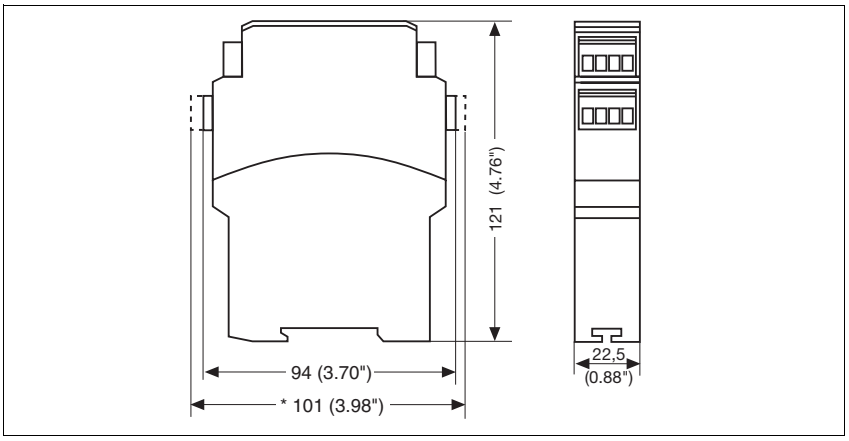


Installation

- 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

* with spring-loaded terminals



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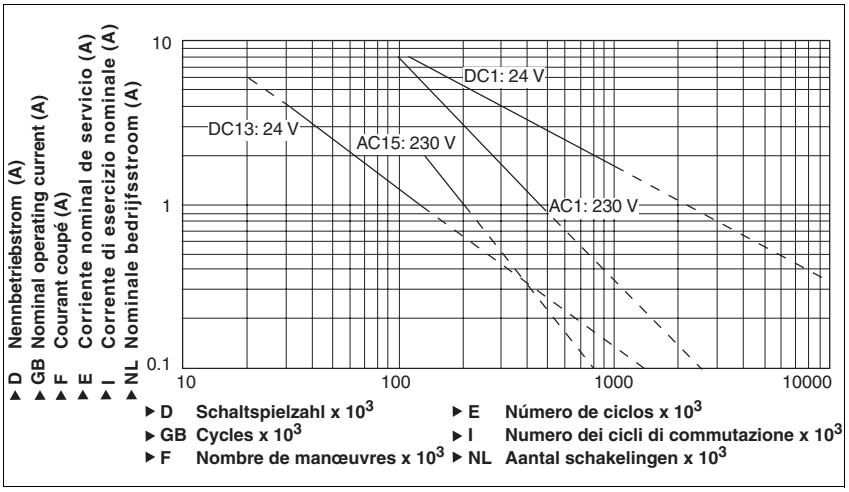
Notice

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_B DC	**24 V**
Voltage tolerance	**-15 %/+10 %**
Power consumption at U_B DC	**3.5 W**
Residual ripple DC	**20 %**
Voltage and current at	
Input circuit DC: **24.0 V**	**35.0 mA**
Reset circuit DC: **24.0 V**	**35.0 mA**
Feedback loop DC: **24.0 V**	**3.5 mA**
Number of output contacts	
Safety contacts (S) instantaneous:	**2**
Safety contacts (N/O), delayed:	**1**
Utilisation category in accordance with **EN 60947-4-1**	
Safety contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **5.0 A** P_{max}: **1250 VA**
Safety contacts: DC1 at **24 V**	I_{min}: **0.01 A** , I_{max}: **5.0 A** P_{max}: **125 W**
Safety contacts, delayed: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **5.0 A** P_{max}: **1250 VA**
Safety contacts, delayed: DC1 at **24 V**	I_{min}: **0.01 A** , I_{max}: **5.0 A** P_{max}: **125 W**
Utilisation category in accordance with **EN 60947-5-1**	
Safety contacts: AC15 at **230 V**	I_{max}: **1.5 A**
Safety contacts: DC13 at **24 V** (6 cycles/min)	I_{max}: **2.0 A**
Safety contacts, delayed: AC15 at **230 V**	I_{max}: **2.0 A**
Safety contacts, delayed: DC13 at **24 V** (6 cycles/min)	I_{max}: **4.0 A**
Contact material	**AgSnO2 + 0.2 µm Au**

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Electrical data	
External contact fuse protection (I_K = 1 kA) to **EN 60947-5-1**	
Blow-out fuse, quick	
Safety contacts:	**6 A**
Safety contacts, delayed:	**6 A**
Blow-out fuse, slow	
Safety contacts:	**4 A**
Safety contacts, delayed:	**4 A**
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	**4 A**
Safety contacts, delayed:	**4 A**
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	**100 Ohm**
dual-channel without detect. of shorts across contacts at U_B DC	**150 Ohm**
dual-channel with detect. of shorts across contacts at U_B DC	**15 Ohm**
Safety-related characteristic data	
PL in accordance with **EN ISO 13849-1**	
Safety contacts, instantaneous	**PL e** (**Cat. 4**)
Safety contacts, delayed <30 s	**PL d** (**Cat. 3**)
Safety contacts, delayed ≥30 s	**PL c** (**Cat. 1**)
Category in accordance with **EN 954-1**	
Safety contacts, instantaneous	**Cat. 4**
Safety contacts, delayed <30 s	**Cat. 3**
Safety contacts, delayed ≥30 s	**Cat. 1**
SIL CL in accordance with **EN IEC 62061**	
Safety contacts, instantaneous	**SIL CL 3**
Safety contacts, delayed <30 s	**SIL CL 3**
Safety contacts, delayed ≥30 s	**SIL CL 1**
PFH in accordance with **EN IEC 62061**	
Safety contacts, instantaneous	**2.31E-09**
Safety contacts, delayed <30 s	**2.64E-09**
Safety contacts, delayed ≥30 s	**2.87E-09**
SIL in accordance with **IEC 61511**	
Safety contacts, instantaneous	**SIL 3**
Safety contacts, delayed <30 s	**SIL 3**
Safety contacts, delayed ≥30 s	**SIL 2**
PFD in accordance with **IEC 61511**	
Safety contacts, instantaneous	**2.03E-06**
Safety contacts, delayed <30 s	**1.26E-05**
Safety contacts, delayed ≥30 s	**4.64E-05**
t_M in years	**20**
Times	
Switch-on delay	
with automatic reset typ.	**300 ms**
with automatic reset max.	**550 ms**
with automatic reset after power on typ.	**350 ms**
with automatic reset after power on max.	**750 ms**
on monitored reset with rising edge typ.	**30 ms**
on monitored reset with rising edge max.	**60 ms**
Delay-on de-energisation	
with E-STOP typ.	**15 ms**
with E-STOP max.	**30 ms**
with power failure typ.	**100 ms**
with power failure max.	**150 ms**

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Times	
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms +tv**
after power failure	**300 ms**
Repetition accuracy	**2 %**
Time accuracy	**-20 %/+20 %**
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 60947-5-1**, **EN 61000-6-2**, **EN 61000-6-3**
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**
Overvoltage category	**III**
Rated insulation voltage	**250 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	**0.25 - 2.50 mm² , 24 - 12 AWG** Order no.: 777601, 777602
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** Order no.: 777601, 777602
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 777601, 777602
Torque setting with screw terminals	**0.50 Nm** Order no.: 777601, 777602
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** Order no.: 787601, 787602
Spring-loaded terminals: Terminal points per connection	**2** Order no.: 787601, 787602
Stripping length	**8 mm** Order no.: 787601, 787602
Dimensions	
Height	**101.0 mm** Order no.: 787601, 787602 **94.0 mm** Order no.: 777601, 777602
Width	**22.5 mm**
Depth	**121.0 mm**
Weight	**225 g** Order no.: 787601, 787602 **230 g** Order no.: 777601, 777602

The standards current on **2003-09** apply.

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Conventional thermal current

I_{th} (A) at U_B DC	
1 contact	**5.00 A**
2 contacts	**3.70 A**
3 contacts	**3.00 A**

Order reference

Type	Features			Terminals	Order no.
PNOZ XV1P		24 VDC	3 s selectable	Screw terminals	777 601
PNOZ XV1P C		24 VDC	3 s selectable	Spring-loaded terminals	787 601
PNOZ XV1P		24 VDC	30 s selectable	Screw terminals	777 602
PNOZ XV1P C		24 VDC	30 s selectable	Spring-loaded terminals	787 602