Up to PL e of EN ISO 13849-1
PNOZ XV2



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

Approvals

	PNOZ XV2
c UL us LISTED	◆
TÜV SÜD	◆
CCC	◆

Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
  - 2 safety contacts (N/O), delay-on de-energisation
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Reset button
- LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
  - Reset circuit
- Delay-on de-energisation, fixed or adjustable
- Delay time can be cancelled via reset button
- See order reference for unit types

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

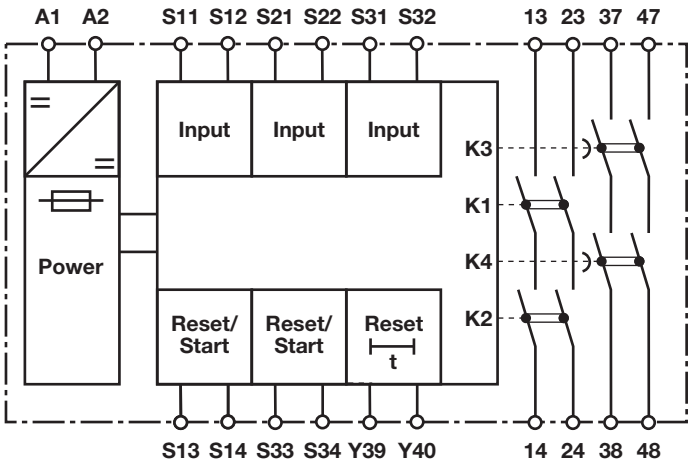
The max. category the safety contacts can achieve in accordance with EN 954-1 and EN ISO 13849-1 is stated in the technical details.

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



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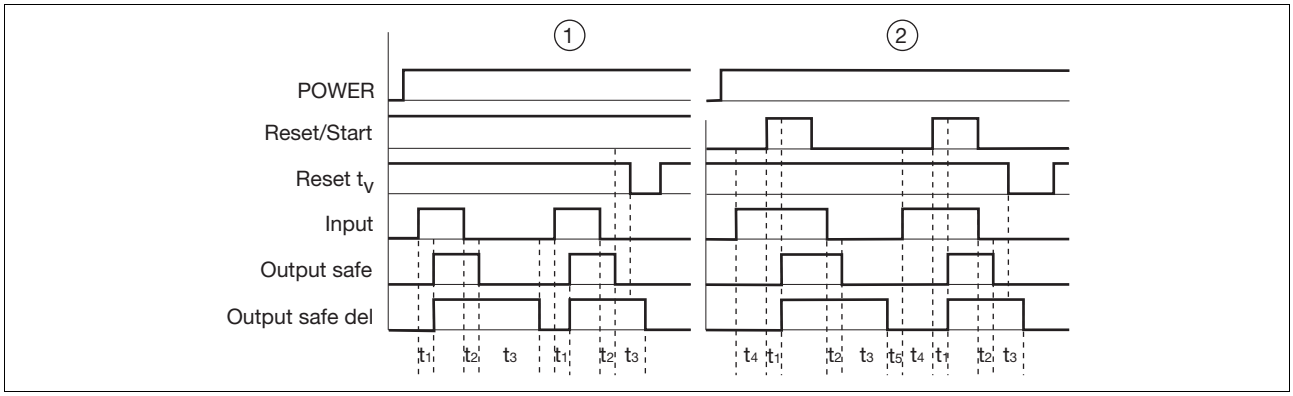
Function description

- Single-channel operation: no redundancy in the input circuit, earth faults in the reset 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.
- 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 S13-S14, S33-S34
- Reset t_v: Y39-Y40
- Input: Input circuits S11-S12, S21-S22, S31-S32
- Output safe: Safety contacts, instantaneous 13-14, 23-24
- Output safe del: Safety contacts, delayed 37-38, 47-48
- 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 13-14, 23-24 are instantaneous safety contacts, outputs 37-38, 47-48 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 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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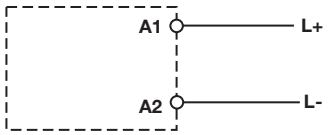
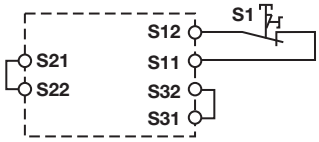
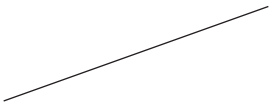
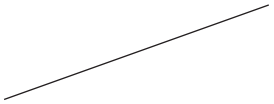
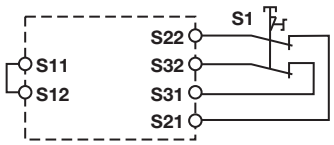
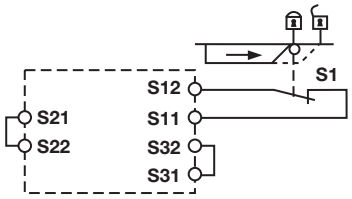
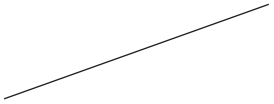
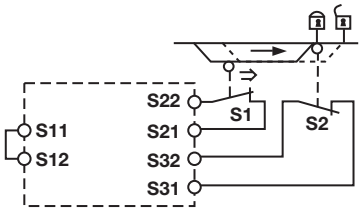
Preparing for operation

- 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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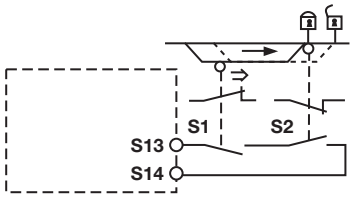
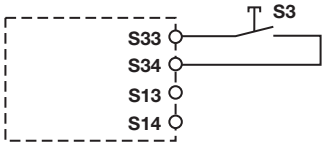
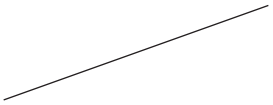
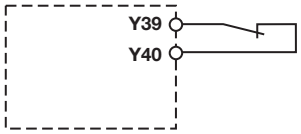
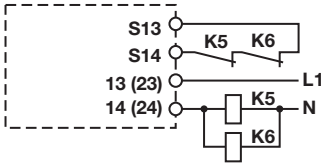
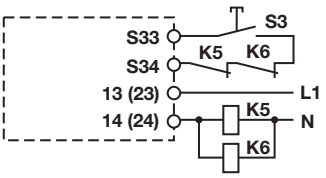
Reset circuit

Reset circuit	E-STOP wiring Safety gate without position monitoring	Safety gate with position monitoring
Automatic reset		
Monitored reset		

Reset delay time

Reset	Without reset	With reset
Link or N/C contact		

Feedback loop

Feedback loop	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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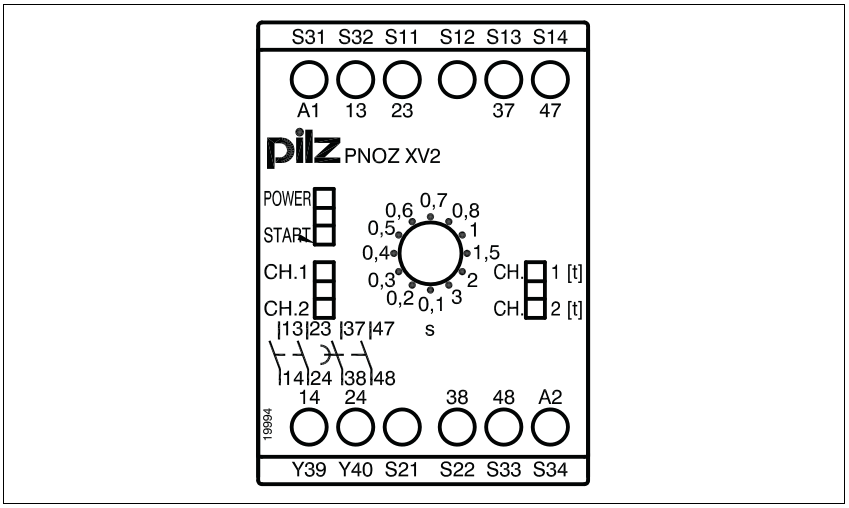
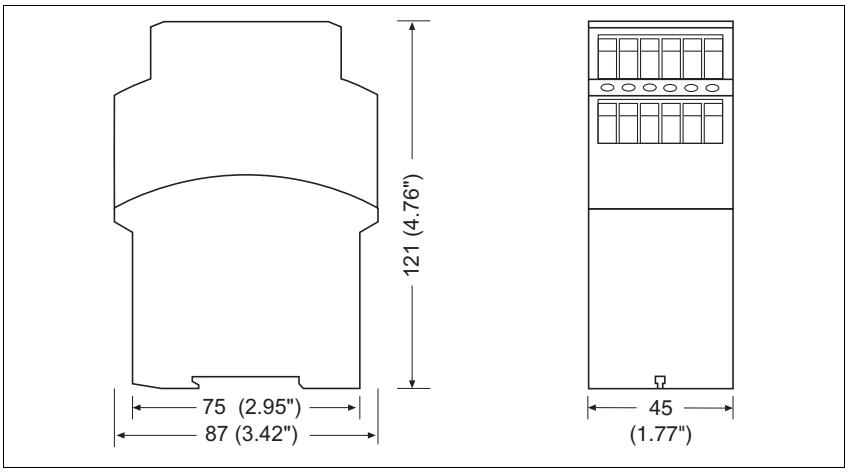
Terminal configuration



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



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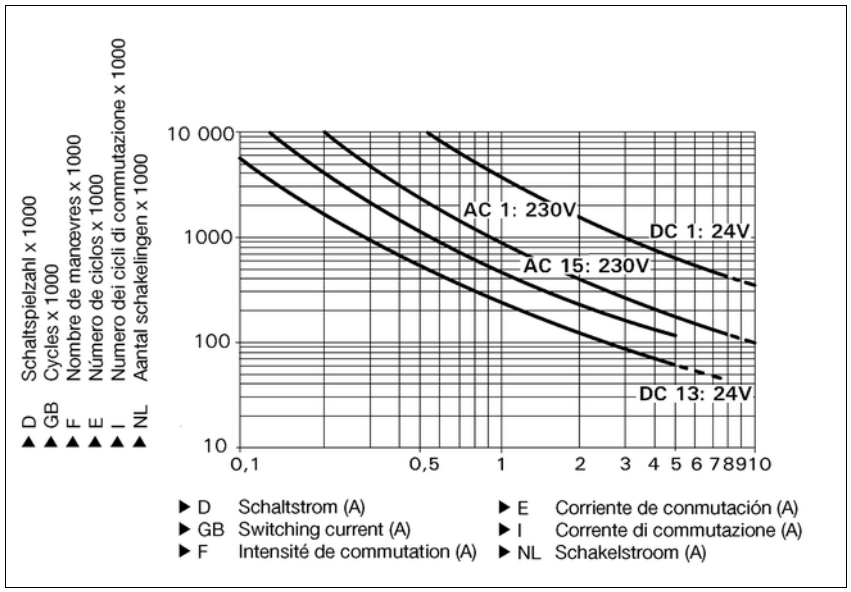
Notice

This data sheet is only intended for use during configuration. Please refer to the operating manual for installation and operation.

Service life graph

The service life graphs indicate the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.



Example
- Inductive load: 0,2 A
- Utilisation category: AC15
- Contact service life: 4,000,000 cycles

Provided the application requires fewer than 4,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

Technical details

Electrical data	
Supply voltage	
Supply voltage U_B DC	**24 V**
Voltage tolerance	**-15 %/+10 %**
Power consumption at U_B DC	**4.5 W**
Residual ripple DC	**160 %**
Voltage and current at	
Input circuit DC: **24.0 V**	**35.0 mA**
Reset circuit DC: **24.0 V**	**40.0 mA**
Feedback loop DC: **24.0 V**	**3.5 mA**
Number of output contacts	
Safety contacts (S) instantaneous:	**2**
Safety contacts (N/O), delayed:	**2**

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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}: **8.0 A** P_{max}: **2000 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}: **8.0 A** P_{max}: **2000 VA**
Safety contacts, delayed: 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}: **5.0 A**
Safety contacts, delayed: DC13 at **24 V** (6 cycles/min)	I_{max}: **7.0 A**
Contact material	**AgSnO2 + 0.2µ Au**
External contact fuse protection (I_K = 1 kA) to **EN 60947-5-1**	
Blow-out fuse, quick	
Safety contacts:	**10 A**
Safety contacts, delayed:	**10 A**
Blow-out fuse, slow	
Safety contacts:	**6 A**
Safety contacts, delayed:	**6 A**
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	**6 A**
Safety contacts, delayed:	**6 A**
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	**100 Ohm**
dual-channel with detect. of shorts across contacts at U_B DC	**10 Ohm**
Min. input resistance when switching on	**143 Ohm**
Safety-related characteristic data	
PL in accordance with **EN ISO 13849-1: 2006**	
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 [year] in accordance with **EN ISO 13849-1: 2006**	**20**

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Times	
Switch-on delay	
with automatic reset typ.	**350 ms**
with automatic reset max.	**650 ms**
with automatic reset after power on typ.	**385 ms**
with automatic reset after power on max.	**700 ms**
on monitored reset with rising edge typ.	**35 ms**
on monitored reset with rising edge max.	**70 ms**
Delay-on de-energisation	
with E-STOP typ.	**15 ms**
with E-STOP max.	**30 ms**
with power failure typ.	**85 ms**
with power failure max.	**200 ms**
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms +tv**
after power failure	**250 ms**
Delay time t_V: selectable	**0,00 s**; **0,50 s**; **1,00 s**; **2,00 s**; **4,00 s**; **6,00 s**; **8,00 s**; **10,00 s**; **15,00 s**; **20,00 s**; **25,00 s**; **30,00 s** No. 774500 **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** No. 774502 **0,00 s**; **5,00 s**; **10,00 s**; **20,00 s**; **40,00 s**; **60,00 s**; **80,00 s**; **100,00 s**; **150,00 s**; **200,00 s**; **250,00 s**; **300,00 s** No. 774508
Delay time t_V: fixed	**0.50 s** No. 774504 **10.00 s** No. 774506 **3.00 s** No. 774505
Repetition accuracy	**2 %**
Time accuracy	**-15% / +15% +50 ms**
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**
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 / II**
Rated insulation voltage	**250 V**
Rated impulse withstand voltage	**4.00 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 mm² , 24 - 10 AWG**
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.20 - 2.50 mm² , 24 - 14 AWG**
without crimp connectors or with TWIN crimp connectors	**0.20 - 2.50 mm² , 24 - 14 AWG**

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Mechanical data	
Torque setting with screw terminals	**0.60 Nm**
Dimensions	
Height	**87.0 mm**
Width	**45.0 mm**
Depth	**121.0 mm**
Weight	**335 g** No. 774504, 774505, 774506 **350 g** No. 774500, 774502, 774508

No. stands for order number.

It is essential to consider the relay's service life graphs. The relay outputs' safety-related characteristic data is only valid if the values in the service life graphs are met.

The PFH value depends on the switching frequency and the load on the relay output.
If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

All the units used within a safety function must be considered when calculating the safety characteristic data.

INFORMATION
A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

The standards current on **2010-07** apply.

Conventional thermal current while loading several contacts

Number of contacts	I_{th} per contact at U_B DC
1	**8.00 A**
2	**6.80 A**
3	**5.50 A**
4	**4.80 A**

Order reference

Type	Features			Terminals	Order no.
PNOZ XV2		24 VDC	0.5 s fixed	Screw terminals	774 504
PNOZ XV2		24 VDC	3.0 s fixed	Screw terminals	774 505
PNOZ XV2		24 VDC	10.0 s fixed	Screw terminals	774 506
PNOZ XV2		24 VDC	3 s selectable	Screw terminals	774 502
PNOZ XV2		24 VDC	30 s selectable	Screw terminals	774 500
PNOZ XV2		24 VDC	300 s selectable	Screw terminals	774 508