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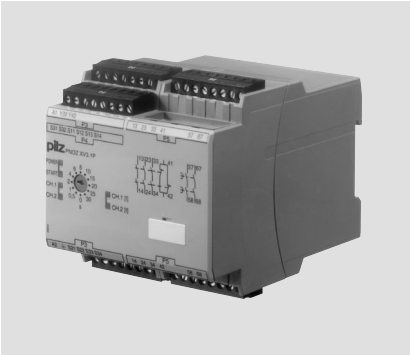


Safety relay for monitoring E-STOP pushbuttons and safety gates.

Approvals

	PNOZ XV3.1P
c UL us LISTED	◆
TÜV SÜD	◆
CCC	◆

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
  - Light barriers
  - Reset button
- Delay-on de-energisation, fixed or adjustable
- Delay time can be cancelled via reset button
- LED indicator for:
  - Switch status channel 1/2
  - Supply voltage
  - Reset circuit
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- 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
- Light beam devices

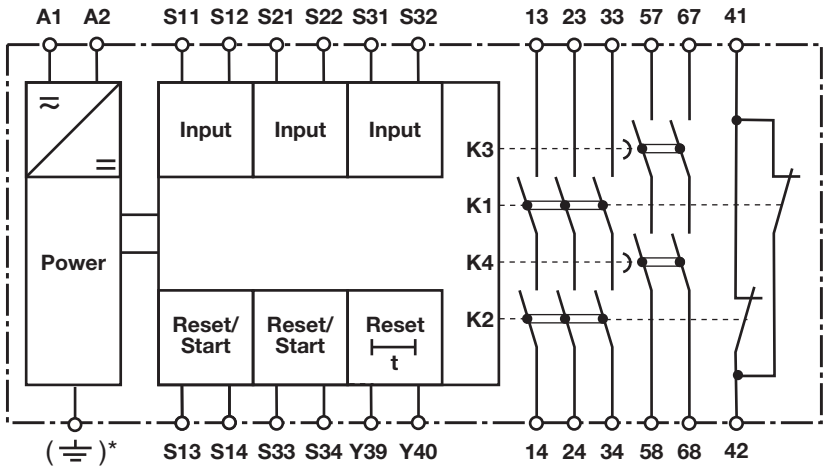
The max. category the safety contacts can achieve in accordance with EN 954-1 and EN ISO 13849-1 is stated in the technical details.

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 tranformer is short circuit-proof. An electronic fuse is used on a DC supply.

Block diagram



*only with 24 – 240 VAC/DC

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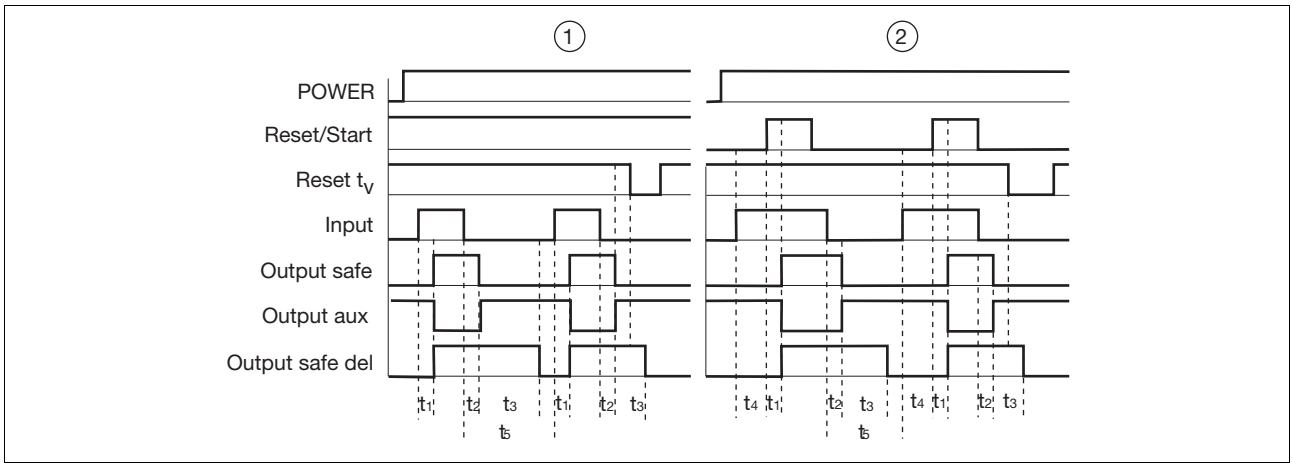
Function description

- 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.
- 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 S13-S14, S33-S34
- Input: Input circuits S11-S12, S21-S22, S31-S32
- Output safe: Safety contacts, instantaneous 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: 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, 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 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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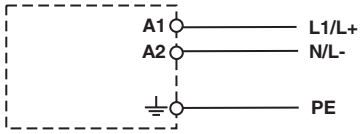
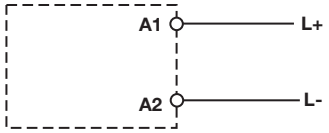
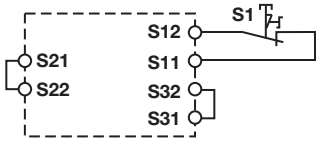
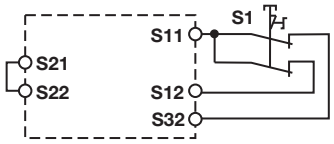
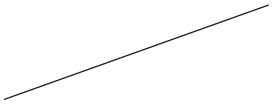
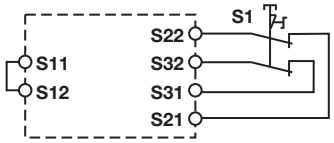
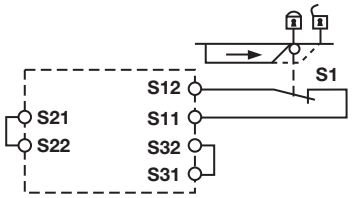
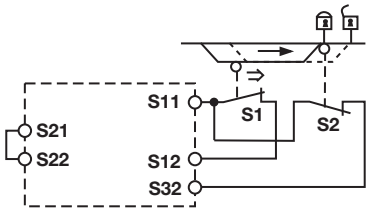
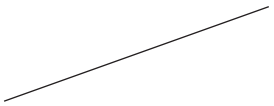
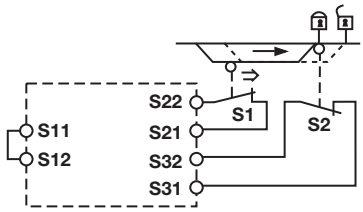
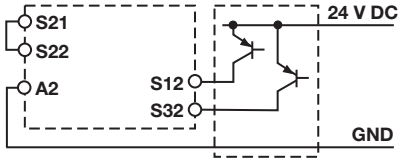
Preparing for operation

- Supply voltage

Supply voltage	24 - 240 VAC/DC	24 VDC
		

- 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 (only when U_B = 24 VDC)		

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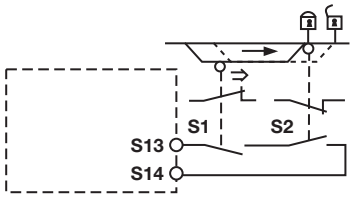
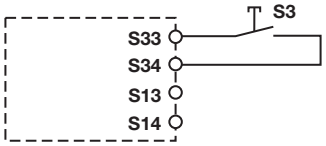
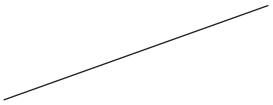
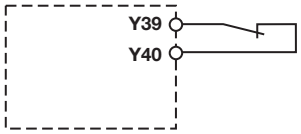
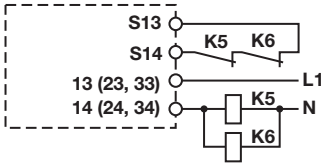
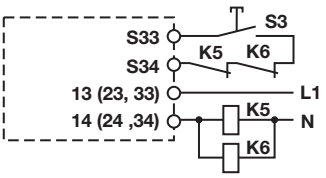
Reset circuit

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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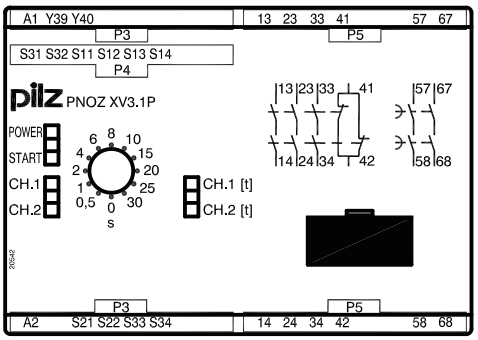
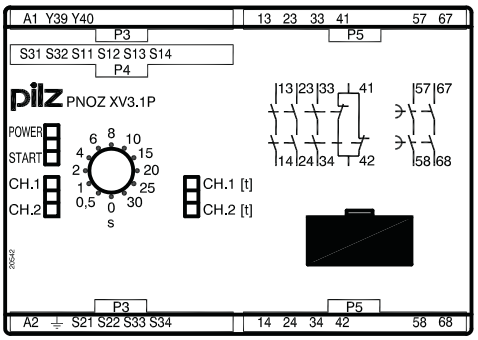
Terminal configuration

U_B 24 VDC



U_B 24 - 240 VAC/DC

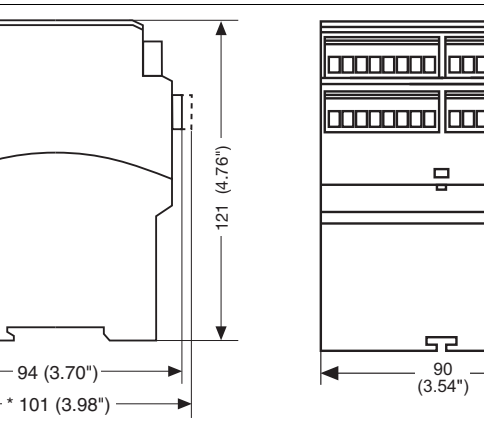


Installation

- 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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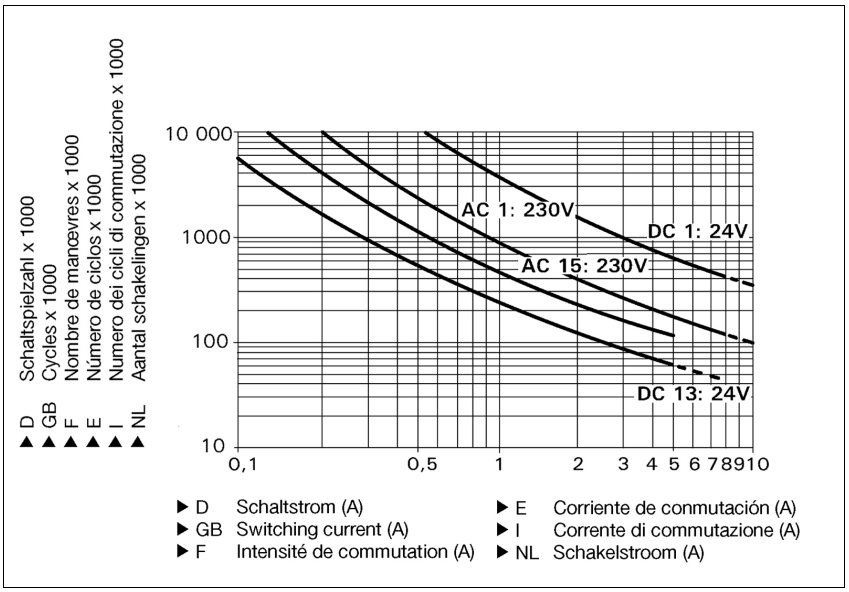
Notice

This data sheet is only intended for use during configuration. 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**
Supply voltage U_B AC/DC	**24 - 240 V**
Voltage tolerance	**-15 %/+10 %**
Power consumption at U_B AC	**8.5 VA** No. 777530, 777532, 777538, 787530, 787532, 787538
Power consumption at U_B DC	**4.5 W** No. 777520, 777522, 777525, 787520, 787522 **5.0 W** No. 777530, 777532, 777538, 787530, 787532, 787538
Frequency range AC	**50 - 60 Hz**
Residual ripple DC	**160 %**
Voltage and current at	
Input circuit DC: **24.0 V**	**40.0 mA** No. 777530, 777532, 777538, 787530, 787532, 787538 **50.0 mA** No. 777520, 777522, 777525, 787520, 787522
Reset circuit DC: **24.0 V**	**40.0 mA**
Feedback loop DC: **24.0 V**	**3.1 mA**

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Electrical data	
Number of output contacts	
Safety contacts (S) instantaneous:	**3**
Safety contacts (N/O), delayed:	**2**
Auxiliary contacts (N/C):	**1**
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**
Auxiliary contacts: AC1 at **240 V**	I_{min}: **0.01 A** , I_{max}: **8.0 A** P_{max}: **2000 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}: **5.0 A**
Safety contacts, delayed: DC13 at **24 V** (6 cycles/min)	I_{max}: **7.0 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 (I_K = 1 kA) to **EN 60947-5-1**	
Blow-out fuse, quick	
Safety contacts:	**10 A**
Safety contacts, delayed:	**10 A**
Auxiliary contacts:	**10 A**
Blow-out fuse, slow	
Safety contacts:	**6 A**
Safety contacts, delayed:	**6 A**
Auxiliary contacts:	**6 A**
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	**6 A**
Safety contacts, delayed:	**6 A**
Auxiliary contacts:	**6 A**
Max. overall cable resistance R_{lmax} input circuits, reset circuits	
single-channel at U_B DC	**100 Ohm** No. 777520, 777522, 777525, 787520, 787522 **150 Ohm** No. 777530, 777532, 777538, 787530, 787532, 787538
single-channel at U_B AC	**150 Ohm** No. 777530, 777532, 777538, 787530, 787532, 787538
dual-channel without detect. of shorts across contacts at U_B DC	**120 Ohm** No. 777520, 777522, 777525, 787520, 787522 **200 Ohm** No. 777530, 777532, 777538, 787530, 787532, 787538
dual-channel without detect. of shorts across contacts at U_B AC	**200 Ohm** No. 777530, 777532, 777538, 787530, 787532, 787538
dual-channel with detect. of shorts across contacts at U_B DC	**10 Ohm** No. 777520, 777522, 777525, 787520, 787522 **20 Ohm** No. 777530, 777532, 777538, 787530, 787532, 787538
dual-channel with detect. of shorts across contacts at U_B AC	**20 Ohm** No. 777530, 777532, 777538, 787530, 787532, 787538
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**)

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Safety-related characteristic data	
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**
Times	
Switch-on delay	
with automatic reset typ.	**400 ms**
with automatic reset max.	**550 ms** No. 777530, 777532, 777538, 787530, 787532, 787538 **850 ms** No. 777520, 777522, 777525, 787520, 787522
with automatic reset after power on typ.	**400 ms** No. 777520, 777522, 777525, 787520, 787522 **750 ms** No. 777530, 777532, 777538, 787530, 787532, 787538
with automatic reset after power on max.	**1,050 ms** No. 777530, 777532, 777538, 787530, 787532, 787538 **870 ms** No. 777520, 777522, 777525, 787520, 787522
on monitored reset with rising edge typ.	**35 ms** No. 777530, 777532, 777538, 787530, 787532, 787538 **40 ms** No. 777520, 777522, 777525, 787520, 787522
on monitored reset with rising edge max.	**60 ms** No. 777530, 777532, 777538, 787530, 787532, 787538 **70 ms** No. 777520, 777522, 777525, 787520, 787522
Delay-on de-energisation	
with E-STOP typ.	**15 ms**
with E-STOP max.	**30 ms**
with power failure typ.	**110 ms** No. 777520, 777522, 777525, 787520, 787522
with power failure max.	**150 ms** No. 777520, 777522, 777525, 787520, 787522
with power failure typ. U_B AC/DC: **24 V** No. 777530, 777532, 777538, 787530, 787532, 787538	**120 ms** No. 777530, 777532, 777538, 787530, 787532, 787538
with power failure max. U_B AC/DC: **24 V** No. 777530, 777532, 777538, 787530, 787532, 787538	**170 ms** No. 777530, 777532, 777538, 787530, 787532, 787538
with power failure typ. U_B AC : **240 V**	**900 ms** No. 777530, 777532, 777538, 787530, 787532, 787538
with power failure max. U_B AC : **240 V**	**1400 ms** No. 777530, 777532, 777538, 787530, 787532, 787538
Recovery time at max. switching frequency 1/s	
after E-STOP	**50 ms +tv**
after power failure	**200 ms** No. 777520, 777522, 777525, 787520, 787522
after power failure on universal power supply	**1450 ms** No. 777530, 777532, 777538, 787530, 787532, 787538

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Times	
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. 777520 **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. 777522 **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. 777530 **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. 777532 **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. 777538 **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. 787520 **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. 787522 **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. 787530 **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. 787532 **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. 787538
Delay time t_V: fixed	**3.00 s** No. 777525
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**, **EN 61000-6-4**
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	**0.25 - 2.50 mm² , 24 - 12 AWG** No. 777520, 777522, 777525, 777530, 777532, 777538
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	**0.25 - 1.00 mm² , 24 - 16 AWG** No. 777520, 777522, 777525, 777530, 777532, 777538
without crimp connectors or with TWIN crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** No. 777520, 777522, 777525, 777530, 777532, 777538
Torque setting with screw terminals	**0.50 Nm** No. 777520, 777522, 777525, 777530, 777532, 777538

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Mechanical data	
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	**0.20 - 1.50 mm² , 24 - 16 AWG** No. 787520, 787522, 787530, 787532, 787538
Spring-loaded terminals: Terminal points per connection	**2** No. 787520, 787522, 787530, 787532, 787538
Stripping length	**8 mm** No. 787520, 787522, 787530, 787532, 787538
Dimensions	
Height	**101.0 mm** No. 787520, 787522, 787530, 787532, 787538 **94.0 mm** No. 777520, 777522, 777525, 777530, 777532, 777538
Width	**90.0 mm**
Depth	**121.0 mm**
Weight	**510 g** No. 777520, 777522, 777525, 787520, 787522 **540 g** No. 777530, 777532, 777538, 787530, 787532, 787538

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 **2008-07** apply.

Conventional thermal current while loading several contacts

Number of contacts	I_{th} per contact at U_B DC	I_{th} at U_B AC
1	**8.00 A**	**8.00 A** No. 777530, 777532, 777538, 787530, 787532, 787538
2	**7.80 A**	**7.80 A** No. 777530, 777532, 777538, 787530, 787532, 787538
3	**6.50 A**	**6.50 A** No. 777530, 777532, 777538, 787530, 787532, 787538
4	**5.50 A**	**5.50 A** No. 777530, 777532, 777538, 787530, 787532, 787538
5	**5.00 A**	**5.00 A** No. 777530, 777532, 777538, 787530, 787532, 787538

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Order reference

Type	Features			Terminals	Order no.
PNOZ XV3.1P C		24 VDC	30 s selectable	Spring-loaded terminals	787 520
PNOZ XV3.1P		24 VDC	30 s selectable	Screw terminals	777 520
PNOZ XV3.1P C		24 VDC	3 s selectable	Spring-loaded terminals	787 522
PNOZ XV3.1P		24 VDC	3 s selectable	Screw terminals	777 522
PNOZ XV3.1P		24 VDC	3 s fixed	Screw terminals	777 525
PNOZ XV3.1P C	24 - 240 VAC/DC		30 s selectable	Spring-loaded terminals	787 530
PNOZ XV3.1P	24 - 240 VAC/DC		30 s selectable	Screw terminals	777 530
PNOZ XV3.1P C	24 - 240 VAC/DC		3 s selectable	Spring-loaded terminals	787 532
PNOZ XV3.1P	24 - 240 VAC/DC		3 s selectable	Screw terminals	777 532
PNOZ XV3.1P C	24 - 240 VAC/DC		300 s selectable	Spring-loaded terminals	787 538
PNOZ XV3.1P	24 - 240 VAC/DC		300 s selectable	Screw terminals	777 538