Technical Catalogue Relays PNOZ
Version 2016-09

PILZ
THE SPIRIT OF SAFETY

- Configuration guide
- Safety relays PNOZ X
- Safety relays PNOZsigma

Contents

Introduction	
Relays for functional safety	
Selection guide	6
Safety relays PNOZ X	10
Safety relays PNOZsigma	546

Safety relays PNOZ monitor safety functions such as E-STOP, safety gate, light grid, two-hand control and much more.

Safety relays from the product range PNOZ X are proven through their reliability and robustness and have developed a wide application range in the most varied of safety applications. PNOZ is the most widely used safety relay in the world. One PNOZ is used per safety function.

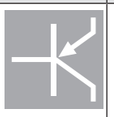
The compact safety relays PNOZsigma combine many years of experience with today's very latest safety technology: with little effort they can achieve maximum safety and cost effectiveness. With particularly narrow housing widths and multifunctionality compressed into each unit, PNOZsigma represents maximum functionality in minimum width. So you can implement safety technology faster, with greater flexibility and therefore more efficiently, while saving space.

This catalogue contains a selection guide as well as a description of the individual products in the product ranges PNOZ X and PNOZsigma. Each unit is described in a detailed data sheet, helping you to select the units and also enabling configuration.

Further information on the products is available in the operating manuals for the respective units. Please read the operating instructions before commissioning.

Contents	Page
Selection guide	6
Safety relays PNOZ X	10
Safety relays PNOZsigma	546

Selection guide
PNOZ X

Type	Application							Performance Level (PL) - EN ISO 13849-1	Safety Integrity Level (SIL) CL – Claim limit in accordance with IEC 62061	Output contacts				Housing width in mm
										Safety-related		Not safety-related		
						n=0								
PNOZ X1P	♦	♦						e	3	3	-	1	-	22.5
PNOZ X2P	♦	♦						e	3	2	-	-	-	22.5
PNOZ X2.1VP	♦	♦						d	3	2	2	-	1	22.5
PNOZ X2.3P	♦	♦						e	3	3	-	-	-	22.5
PNOZ X2.7P	♦	♦	♦					e	3	3	-	1	-	22.5
PNOZ X2.8P	♦	♦	♦					e	3	3	-	1	-	22.5
PNOZ X2.9P	♦	♦	♦					e	3	3	-	1	-	22.5
PNOZ X3P	♦	♦	♦					e	3	3	-	1	1	45.0
PNOZ X3.10P	♦	♦	♦					e	3	3	-	1	1	45.0
PNOZ X7P	♦	♦						e	3	2	-	-	-	22.5
PNOZ X8P	♦	♦	♦					e	3	3	-	2	2	45.0
PNOZ X9P	♦	♦	♦					e	3	7	-	2	2	90.0
PNOZ X10.11P	♦	♦	♦					e	3	6	-	4	-	90.0
PNOZ X11P	♦	♦						e	3	7	-	1	2	90.0
PNOZ XV1P	♦	♦	♦					e (d) *	3	2	1	-	-	22.5
PNOZ XV2P	♦	♦						e (d) *	3	2	2	-	-	45.0
PNOZ XV2.1P	♦	♦						e (d) *	3	2	2	-	-	90.0
PNOZ XV3P	♦	♦	♦					e (d) *	3	3	2	-	-	45.0
PNOZ XV3.1P	♦	♦	♦					e (d) *	3	3	2	1	-	90.0
PZE X4P	Contact expansion							e	3	4	-	-	-	22.5
PZE X4.1P	Contact expansion							e	3	4	-	-	-	22.5
PZE X4VP	Contact expansion							d	2	4	-	-	-	22.5
PZE X4VP4	Contact expansion							d	2	4	-	-	-	45.0
PZE X4VP8	Contact expansion							d	2	4	-	-	-	45.0

Selection guide
PNOZ X

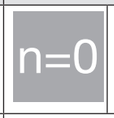
Type	Application							Performance Level (PL) - EN ISO 13849-1	Safety Integrity Level (SIL) CL – Claim limit in accordance with IEC 62061	Output contacts				Housing width in mm
										Safety-related		Not safety-related		
PZE X5P	Contact expansion							e	3	5	-	-	2	45.0
PZE 9P	Contact expansion							e	3	8	-	1	-	90.0
PMUT X1P	♦		♦	♦				e	3	3	-	1	5	90.0
PSWZ X1P						♦		e	3	2	-	1	1	45.0

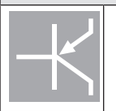
* Value applies for instantaneous (delayed) safety contacts

Selection guide
PNOZsigma

Type	Application						Performance Level (PL) - EN ISO 13849-1	Safety Integrity Level (SIL) CL – Claim limit in accordance with IEC 62061	Output contacts				Universal power supply 48 … 240 VAC/DC	Housing width in mm
									Safety-related		Not safety-related			
PNOZ s1	♦	♦					c	2	2	-	-	1		12.5
PNOZ s2	♦	♦					e	3	3	-	1	1		17.5
PNOZ s3	♦	♦	♦				e	3	2	-	-	1		17.5
PNOZ s4	♦	♦	♦				e	3	3	-	1	1	♦	22.5
PNOZ s4.1	♦	♦	♦				e	3	3	-	1	1	♦	22.5
PNOZ s5	♦	♦	♦		♦		e	3	2	2	-	1	♦	22.5
PNOZ s6				♦		EN 574, Type IIIC	e	3	3	-	1	1	♦	22.5
PNOZ s6.1				♦		EN 574, Type IIIA	c	1	3	-	1	1	♦	22.5
PNOZ s7	Contact expansion						e	3	4	-	1	-		17.5
PNOZ s7.1	Contact expansion						e	3	3	-	-	-		17.5
PNOZ s7.2	Contact expansion						e	3	4	-	1	-		17.5
PNOZ s8	Contact expansion						c	2	2	-	-	1		12.5
PNOZ s9	Contact expansion or safe timer relay				♦		e	3	-	3	1	-		17.5
PNOZ s10	Contact expansion						e	3	4	-	1	-		45.0
PNOZ s11	Contact expansion						e	3	8	-	1	-		45.0
PNOZ s20	Contact expansion						e	3	-	-	-	3		22.5
PNOZ s22	Contact expansion for PNOZ s30 and PNOZ mm0.1p/mm0.2p						e	3	2x3	-	2x1	-		22.5

Selection guide
PNOZsigma

Type	Application	Performance Level (PL) - EN ISO 13849-1	Safety Integrity Level (SIL) CL – Claim limit in accordance with IEC 62061	Output contacts				Universal power supply 24 … 240 VAC/DC	Housing width in mm
				Safety-related		Not safety-related			
									
PNOZ s30	Safe speed and standstill monitor	e	3	2	-	2	4	♦	45.0
	♦ ♦ ♦								

Type	Application	Performance Level (PL) - EN ISO 13849-1	Safety Integrity Level (SIL) CL – Claim limit in accordance with IEC 62061	Semiconductor outputs		Universal power supply 24 … 240 VAC/DC	Housing width in mm
				2-pin	1-pin		
							
PNOZ s50	Safe brake control	e	3	2	3		45.0
	♦						

Safety relays PNOZ X

Safety relays PNOZ X

Contents	Page
PNOZ X1P	12
PNOZ X2P	23
PNOZ X2.1VP	41
PNOZ X2.3P	54
PNOZ X2.7P	66
PNOZ X2.8P	88
PNOZ X2.9P	112
PNOZ X3P	126
PNOZ X3.10P	147
PNOZ X7P	162
PNOZ X8P	179
PNOZ X9P	213
PNOZ X10.11P	237
PNOZ X11P	251
PNOZ XV1P	273
PNOZ XV2P	292
PNOZ XV2.1P	318
PNOZ XV3P	345
PNOZ XV3.1P	372
PZE X4P	409
PZE X4.1P	419
PZE X4VP	435
PZE X4VP4	454
PZE X4VP8	463
PZE X5P	472
PZE 9P	482
PMUT X1P	500
PSWZ X1P	519

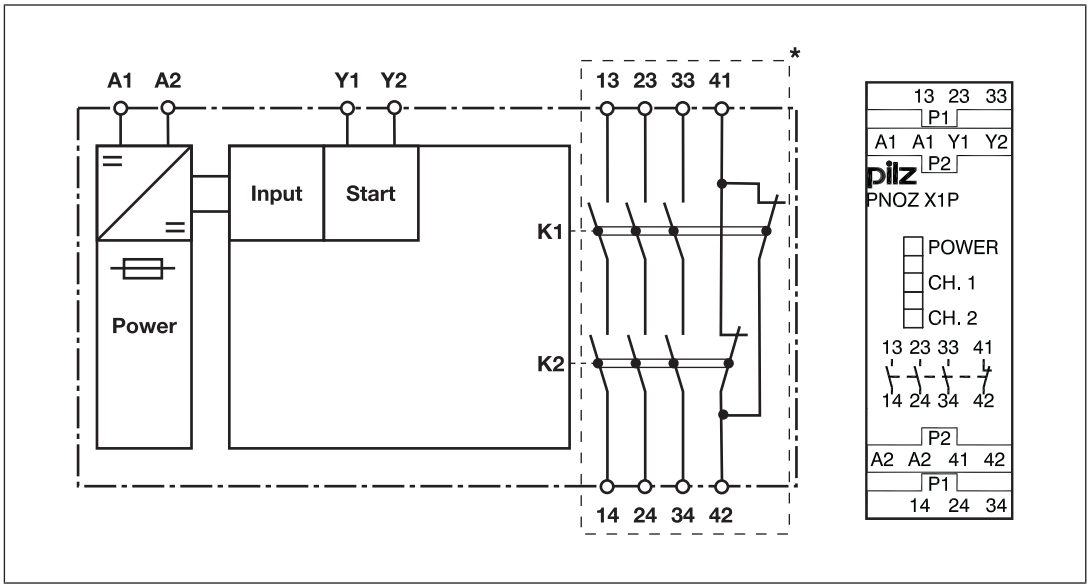
Safety relays PNOZ X
PNOZ X1P

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X1P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X1P provides a safety-oriented interruption of a safety circuit. When the supply voltage is applied via the E-STOP pushbutton, the “POWER” LED is lit. The unit is ready for operation when the start circuit Y1-Y2 is closed.

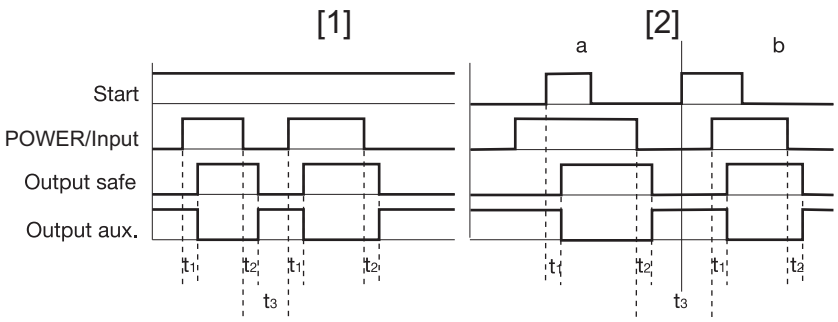
- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - LEDs "CH1" and "CH2" will light.
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "POWER", "CH1" and "CH2" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ X1P

Timing diagram



Legend

- Power/Input: Supply voltage/input circuit
- Start: Start circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- [1]: Automatic start
- [2]: Manual start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X1P

Wiring

Please note:

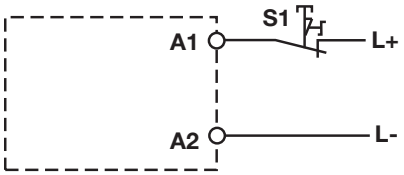
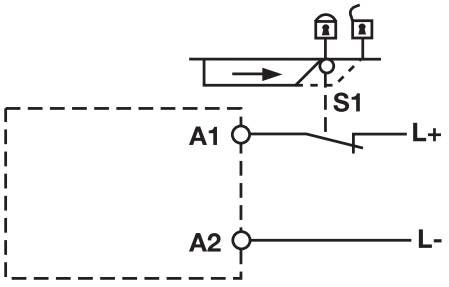
- Information given in the "Technical details [17]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [17]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

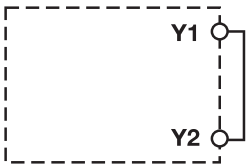
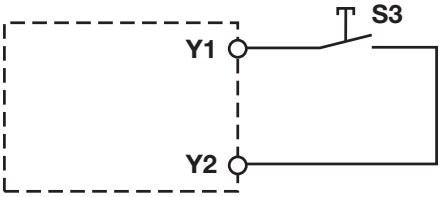
R_{lmax} = max. overall cable resistance (see Technical details [17])
R_l / km = cable resistance/km

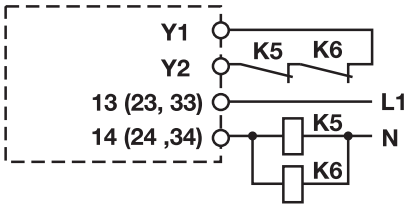
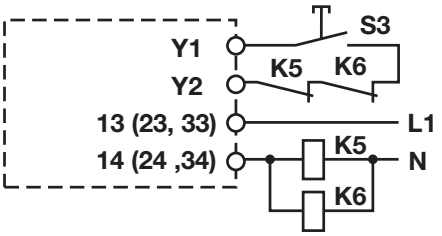
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Preparing for operation

Supply voltage/input circuit	E-STOP	Safety gate
24 VDC		

Safety relays PNOZ X
PNOZ X1P

Start circuit	Automatic start	Manual start
E-STOP/safety gate		

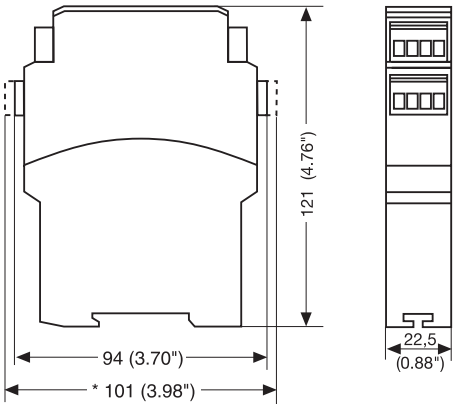
Feedback loop	Automatic start	Manual start
Contacts from external contactors		

Legend

- S1: E-STOP/safety gate switch
- S3: Start button
- : Gate open
- : Gate closed

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X1P

Technical details

General	777100	787100
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777100**	**787100**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**1,5 W**	**1,5 W**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,2 A**	**1,2 A**
Pulse duration, A1	**2,5 ms**	**2,5 ms**
Inputs	**777100**	**787100**
Number	**1**	**1**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**45 mA**	**45 mA**
Start circuit DC	**45 mA**	**45 mA**
Feedback loop DC	**45 mA**	**45 mA**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Relay outputs	**777100**	**787100**
Number of output contacts		
Safety contacts (N/O), instant-aneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PNOZ X1P

Relay outputs	777100	787100
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PNOZ X1P

Relay outputs	777100	787100
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**100 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**100 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777100**	**787100**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Times	**777100**	**787100**
Switch-on delay		
With automatic start typ.	**60 ms**	**60 ms**
With automatic start max.	**120 ms**	**120 ms**
With manual start typ.	**50 ms**	**50 ms**
With manual start max.	**120 ms**	**120 ms**
Delay-on de-energisation		
With E-STOP typ.	**55 ms**	**55 ms**
With E-STOP max.	**90 ms**	**90 ms**
With power failure typ.	**55 ms**	**55 ms**
With power failure max.	**90 ms**	**90 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**150 ms**	**150 ms**
After power failure	**150 ms**	**150 ms**

Safety relays PNOZ X
PNOZ X1P

Times	777100	787100
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777100**	**787100**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777100**	**787100**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZ X
PNOZ X1P

Mechanical data	777100	787100
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**205 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

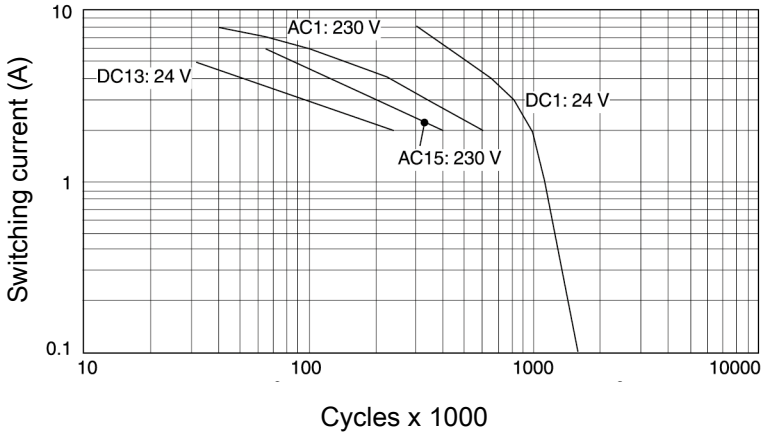
Supplementary data

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.

Safety relays PNOZ X
PNOZ X1P

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: 2 A
- Utilisation category AC15
- Contact service life: 400 000 cycles

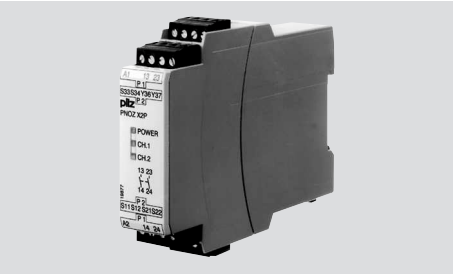
Provided the application to be implemented requires fewer than 400 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X1P C	24 VDC	Spring-loaded terminals	787 100
PNOZ X1P	24 VDC	Screw terminals	777 100

Safety relays PNOZ X
PNOZ X2P



Unit features

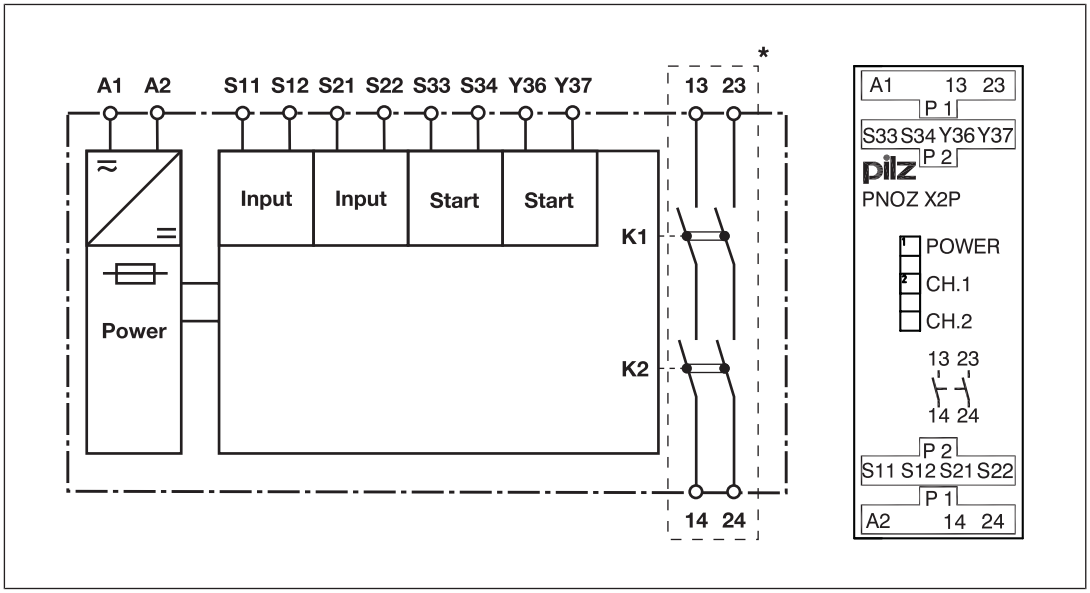
- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X2P

Block diagram/terminal configuration

Type: 24 V AC/DC

- U_B: 24 VAC/DC; Order no. 777303, 787303

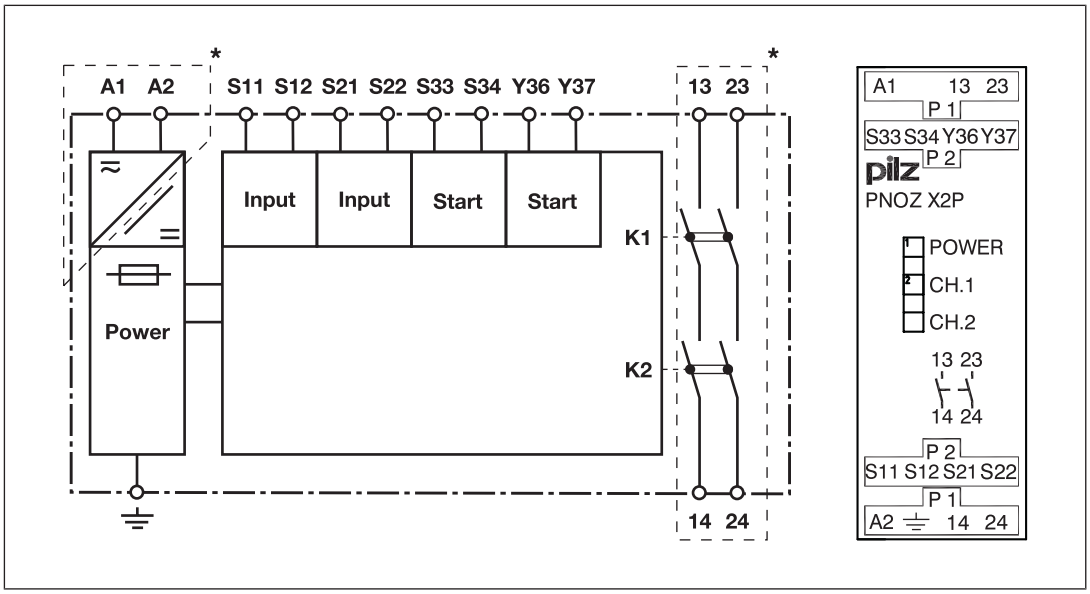


*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X2P

Type: 48-240 V AC/DC

- U_B: 48-240 VAC/DC; Order no. 777307, 787307



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X2P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S33-S34 is closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - Safety contacts 13-14 and 23-24 are closed, the unit is active.
  - The LEDs "CH.1" and "CH.2" are lit.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - Safety contacts 13-14 and 23-24 are redundantly opened.
  - The LEDs "CH.1" and "CH.2" go out.

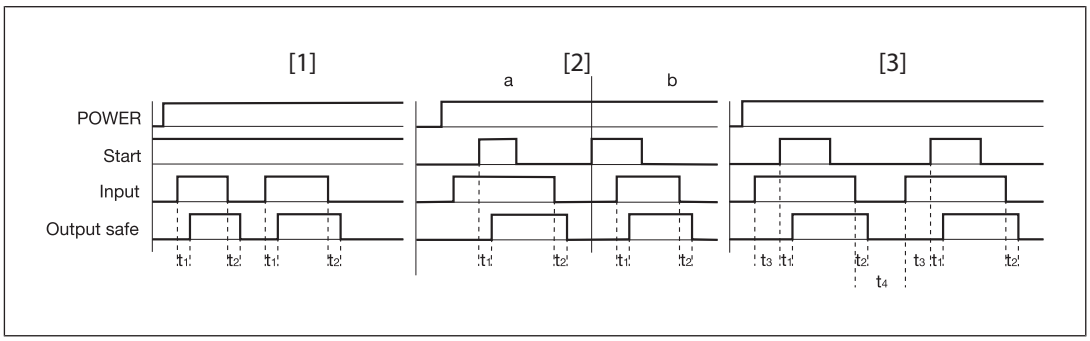
Operating modes

- Single-channel operation (only 24 VAC/DC units): No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X2P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.

Safety relays PNOZ X
PNOZ X2P

- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [30]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X2P

Wiring

Please note:

- Information given in the "Technical details [30]" must be followed.
- The outputs 13-14, 23-24 are safety contacts.
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [30]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [30])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- On 24 VAC/DC units:
  The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

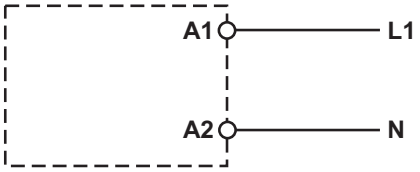
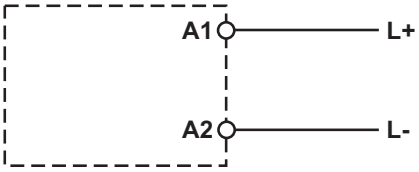
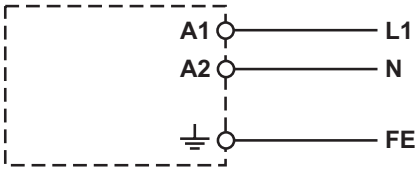
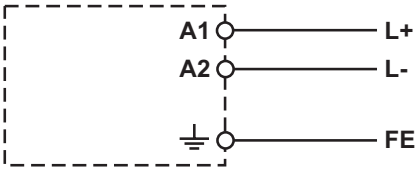
Important for detection of shorts across contacts:

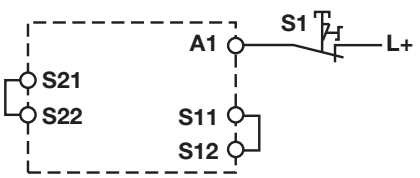
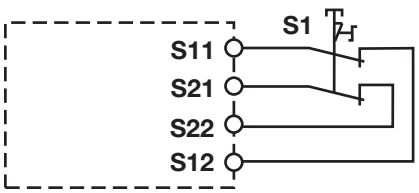
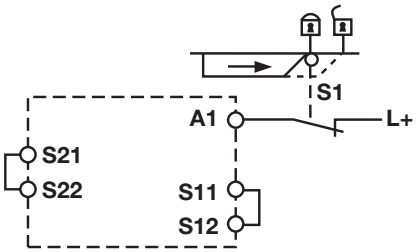
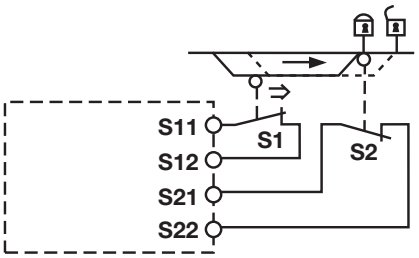
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

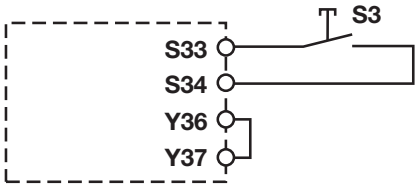
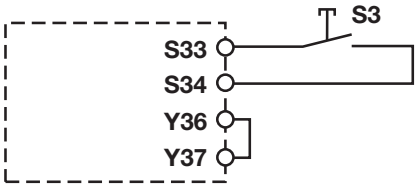
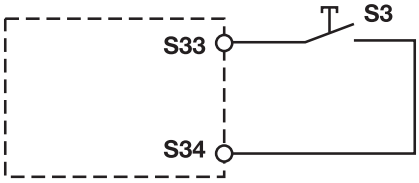
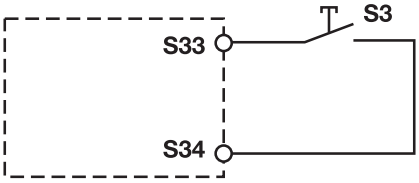
Safety relays PNOZ X
PNOZ X2P

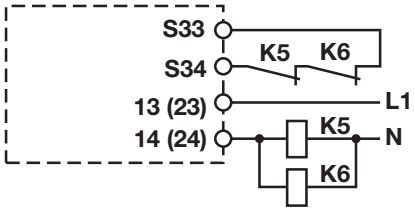
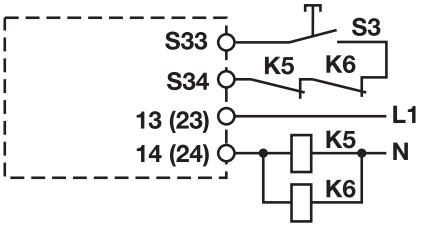
Preparing for operation

Supply voltage	AC	DC
U_B = 24 VAC/DC		
U_B = 48-240 VAC/DC		

Input circuit	Single-channel (only U_B 24 VAC/DC)	Dual-channel (with detection of shorts across contacts)
E-STOP		
Safety gate		

Safety relays PNOZ X
PNOZ X2P

Start circuit	Single-channel (only U_B 24 VAC/ DC)	Dual-channel (with detection of shorts across contacts)
Automatic start		
Manual start		
Monitored start		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

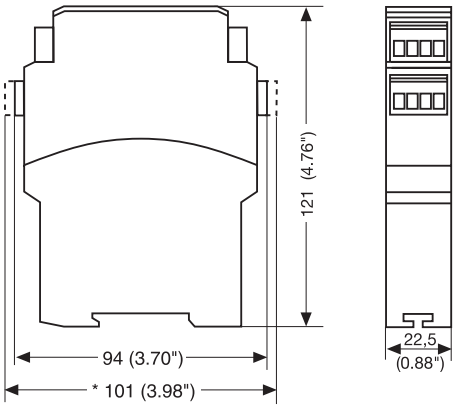
Legend

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

Safety relays PNOZ X
PNOZ X2P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777303 – 777307

See below for more order numbers

General	777303	777307
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777303**	**777307**
Supply voltage		
Voltage	24 V	48 - 240 V
Kind	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	4,5 VA	3,5 VA
Output of external power supply (DC)	2 W	1 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	1,7 A	–
Pulse duration, A1	1,5 ms	–
Inputs	**777303**	**777307**
Number	2	2

Safety relays PNOZ X
PNOZ X2P

Inputs	777303	777307
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**25 mA**	**15 mA**
Start circuit DC	**50 mA**	**25 mA**
Feedback loop DC	**50 mA**	**25 mA**
Min. input resistance at power-on	**21 Ohm**	**19 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**50 Ohm**	–
Single-channel at UB AC	**150 Ohm**	–
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	**100 Ohm**
Relay outputs	**777303**	**777307**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**

Safety relays PNOZ X
PNOZ X2P

Relay outputs	777303	777307
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**6 A**	**6 A**
Pilot Duty	**C300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Times	**777303**	**777307**
Switch-on delay		
With automatic start typ.	**60 ms**	**120 ms**
With automatic start max.	**90 ms**	**150 ms**
With automatic start after power on typ.	**60 ms**	**130 ms**
With automatic start after power on max.	**100 ms**	**160 ms**
With manual start typ.	**40 ms**	**40 ms**
With manual start max.	**90 ms**	**150 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**70 ms**	**40 ms**
With power failure max.	**110 ms**	**70 ms**
With power failure typ. UB 240 V	–	**320 ms**
With power failure max. UB 240 V	–	**500 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**150 ms**	**550 ms**

Safety relays PNOZ X
PNOZ X2P

Times	777303	777307
Waiting period with a monitored start	180 ms	180 ms
Min. start pulse duration with a monitored start	30 ms	30 ms
Supply interruption before de-energisation	20 ms	20 ms
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777303**	**777307**
Climatic suitability	EN 60068-2-78	EN 60068-2-78
Ambient temperature		
Temperature range	-10 - 55 °C	-10 - 55 °C
Storage temperature		
Temperature range	-40 - 85 °C	-40 - 85 °C
Climatic suitability		
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1
Vibration		
In accordance with the standard	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm
Airgap creepage		
In accordance with the standard	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II
Pollution degree	2	2
Rated insulation voltage	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV
Protection type		
Mounting area (e.g. control cabinet)	IP54	IP54
Housing	IP40	IP40
Terminals	IP20	IP20
Mechanical data	**777303**	**777307**
Mounting position	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles
Material		
Bottom	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0
Connection type	Screw terminal	Screw terminal

Safety relays PNOZ X
PNOZ X2P

Mechanical data	777303	777307
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**
Dimensions		
Height	**94 mm**	**94 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**200 g**	**200 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787303 – 787307

General	787303	787307
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787303**	**787307**
Supply voltage		
Voltage	**24 V**	**48 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**4,5 VA**	**3,5 VA**
Output of external power supply (DC)	**2 W**	**1 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	–
Pulse duration, A1	**1,5 ms**	–
Inputs	**787303**	**787307**
Number	**2**	**2**

Safety relays PNOZ X
PNOZ X2P

Inputs	787303	787307
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**25 mA**	**15 mA**
Start circuit DC	**50 mA**	**25 mA**
Feedback loop DC	**50 mA**	**25 mA**
Min. input resistance at power-on	**21 Ohm**	**19 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**50 Ohm**	–
Single-channel at UB AC	**150 Ohm**	–
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	**100 Ohm**
Relay outputs	**787303**	**787307**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**

Safety relays PNOZ X
PNOZ X2P

Relay outputs	787303	787307
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**6 A**	**6 A**
Pilot Duty	**C300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Times	**787303**	**787307**
Switch-on delay		
With automatic start typ.	**60 ms**	**120 ms**
With automatic start max.	**90 ms**	**150 ms**
With automatic start after power on typ.	**60 ms**	**130 ms**
With automatic start after power on max.	**100 ms**	**160 ms**
With manual start typ.	**40 ms**	**40 ms**
With manual start max.	**90 ms**	**150 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**70 ms**	**40 ms**
With power failure max.	**110 ms**	**70 ms**
With power failure typ. UB 240 V	–	**320 ms**
With power failure max. UB 240 V	–	**500 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**150 ms**	**550 ms**

Safety relays PNOZ X
PNOZ X2P

Times	787303	787307
Waiting period with a monitored start	180 ms	180 ms
Min. start pulse duration with a monitored start	30 ms	30 ms
Supply interruption before de-energisation	20 ms	20 ms
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787303**	**787307**
Climatic suitability	EN 60068-2-78	EN 60068-2-78
Ambient temperature		
Temperature range	-10 - 55 °C	-10 - 55 °C
Storage temperature		
Temperature range	-40 - 85 °C	-40 - 85 °C
Climatic suitability		
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1
Vibration		
In accordance with the standard	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm
Airgap creepage		
In accordance with the standard	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II
Pollution degree	2	2
Rated insulation voltage	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV
Protection type		
Mounting area (e.g. control cabinet)	IP54	IP54
Housing	IP40	IP40
Terminals	IP20	IP20
Mechanical data	**787303**	**787307**
Mounting position	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles
Material		
Bottom	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0
Connection type	Spring-loaded terminal	Spring-loaded terminal

Safety relays PNOZ X
PNOZ X2P

Mechanical data	787303	787307
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**200 g**	**200 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

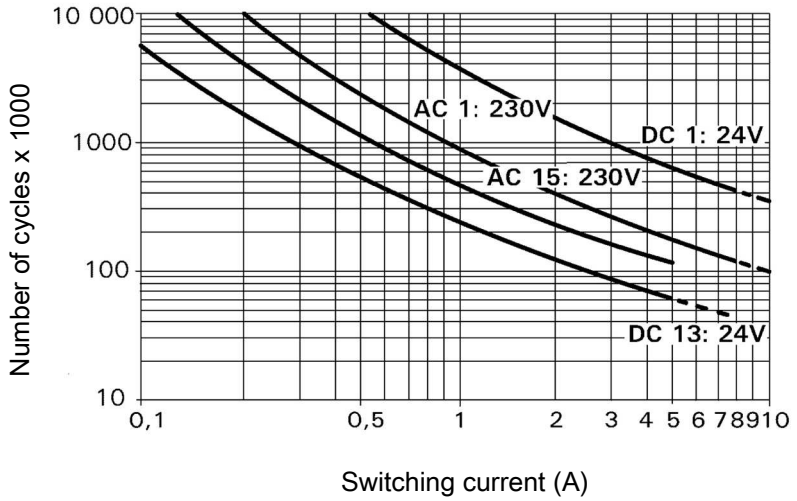
Safety relays PNOZ X
PNOZ X2P

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.

Unit types with UB 24 VAC/DC

- U_B: 24 VAC/DC; Order no. 777303, 787303



Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 4 000 000 cycles

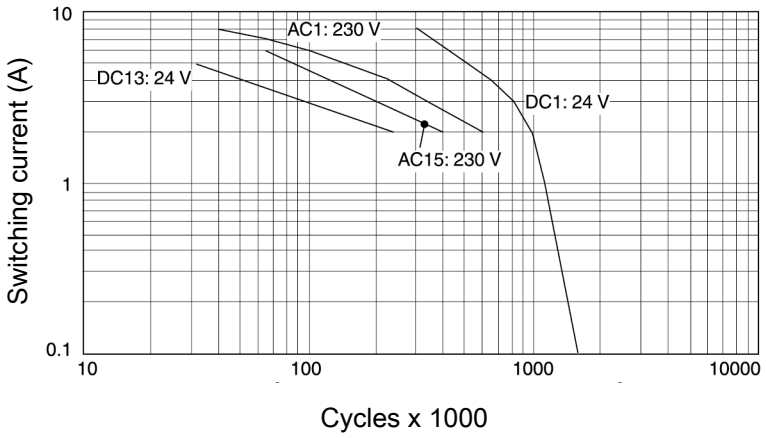
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ X2P

Unit types with UB 48-240 VAC/DC

- U_B: 48-240 VAC/DC; Order no. 777307, 787307



Example

- Inductive load: 2 A
- Utilisation category AC15
- Contact service life: 400 000 cycles

Provided the application to be implemented requires fewer than 400 000 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X2P	24 VAC/DC	Screw terminals	777 303
PNOZ X2P C	24 VAC/DC	Spring-loaded terminals	787 303
PNOZ X2P	48-240 VAC/DC	Screw terminals	777 307
PNOZ X2P C	48-240 VAC/DC	Spring-loaded terminals	787 307

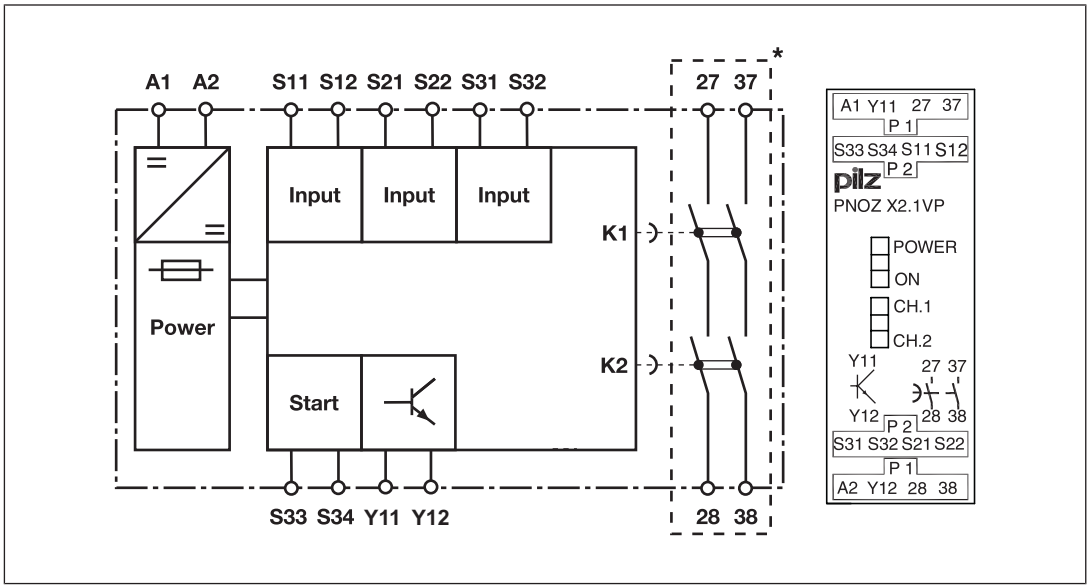
Safety relays PNOZ X
PNOZ X2.1VP

Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), delay-on de-energisation
- 1 semiconductor output for variable frequency inverter
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- LED display for:
  - Supply voltage
  - Switch state of the safety contacts
  - State of semiconductor output
- Semiconductor output signals:
  - Switching status of the input circuit
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X2.1VP

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X2.1VP provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S33-S34 is closed.

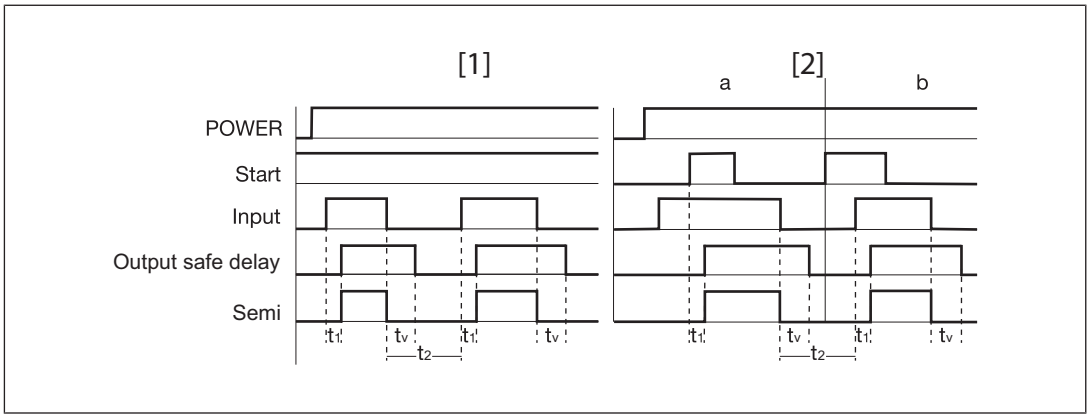
- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The LEDs "CH.1" and "CH.2" are lit.
  - Safety contacts 27-28 and 37-38 are closed. The unit is active.
  - The semiconductor output Y11-Y12 is enabled.
  - The "ON" LED is lit.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The semiconductor output Y11-Y12 is disabled instantaneously.
  - The "ON" LED goes out.
  - Safety contacts 27-28 and 37-38 are opened redundantly after the delay time has elapsed.
  - The LEDs "CH.1" and "CH.2" go out.

Safety relays PNOZ X
PNOZ X2.1VP

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X2.1VP detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe delay: Safety contacts, delayed
- Semi: Semiconductor output
- [1]: Automatic start
- [2]: Manual start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Recovery time
- t_v: Delay time

Safety relays PNOZ X
PNOZ X2.1VP

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [48]" must be followed.
- Outputs 27-28, 37-38 are delay-on de-energisation safety contacts.
- Semiconductor output Y11-Y12 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [48]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [48])
R_l / km = cable resistance/km

- Use copper wire that can withstand 60/75 °C.
- Do not switch low currents using contacts that have been used previously with high currents.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

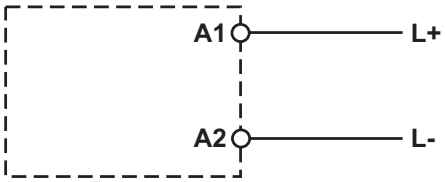
Important for detection of shorts across contacts:

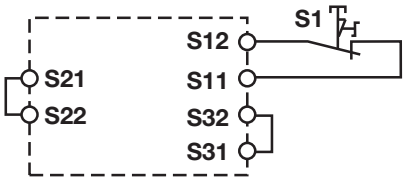
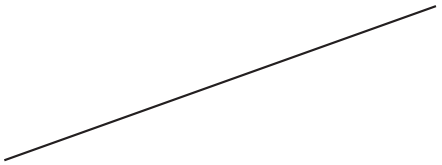
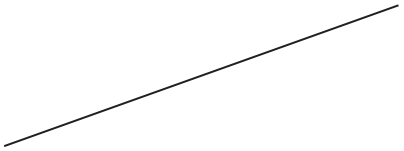
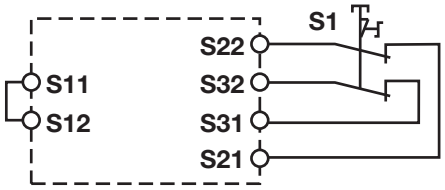
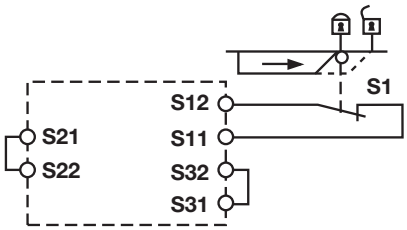
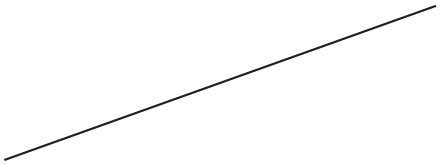
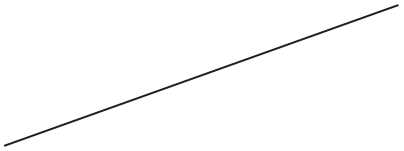
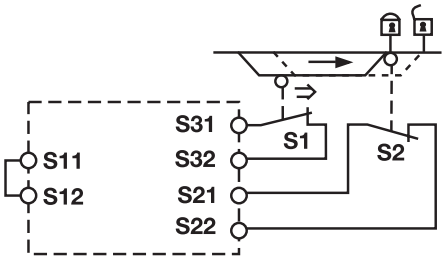
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

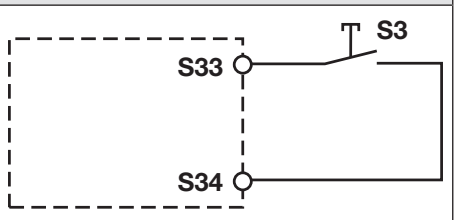
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

Safety relays PNOZ X
PNOZ X2.1VP

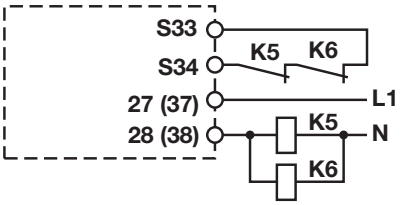
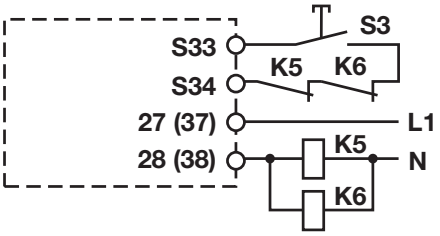
Preparing for operation

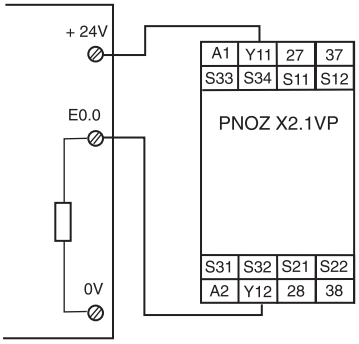
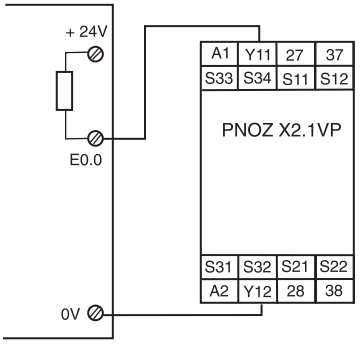
Supply voltage	AC	DC
		

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		

Start circuit	Automatic start	Manual start
		

Safety relays PNOZ X
PNOZ X2.1VP

Feedback loop	Automatic start	Manual start
Contacts from external contactors		

Semiconductor output	Low level at the input of the driven unit	Fault: High level of the driven unit
After opening the input circuit		

Legend

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

Safety relays PNOZ X
PNOZ X2.1VP

Application example

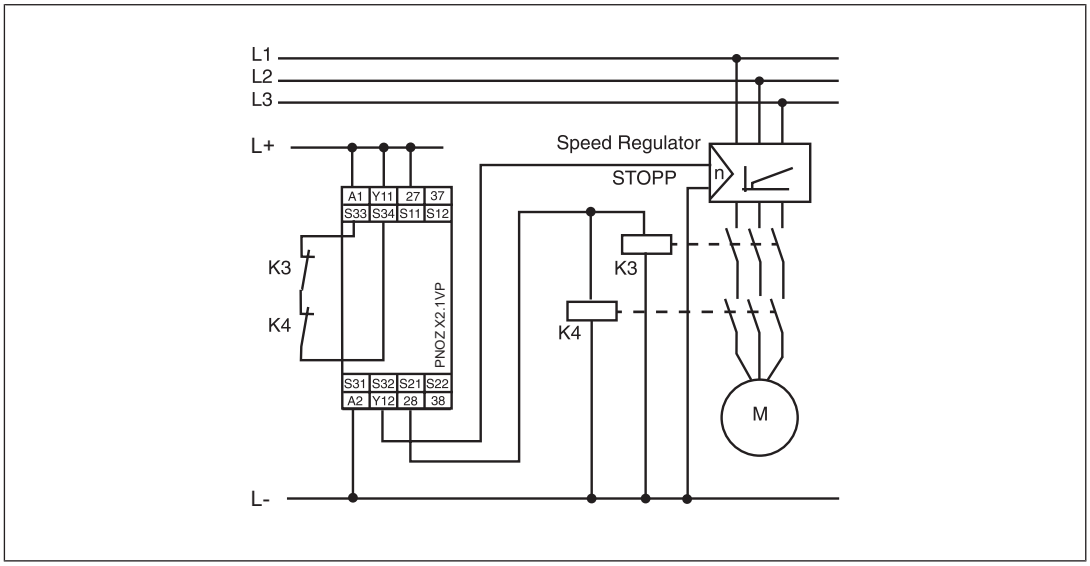
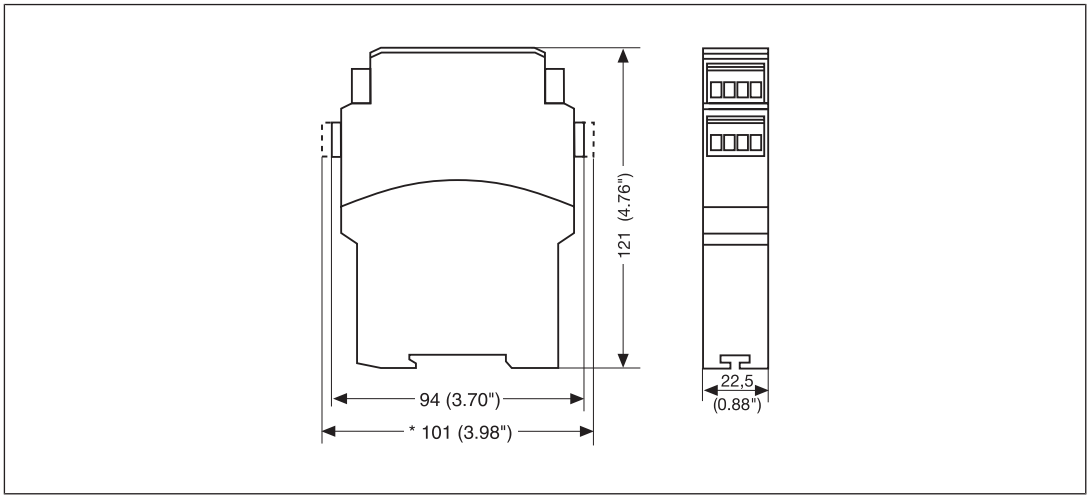


Fig.: Variable frequency inverter with semiconductor output

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X2.1VP

Technical details

General	777600	787600
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777600**	**787600**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	1,5 W	1,5 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	1,7 A	1,7 A
Pulse duration, A1	1,5 ms	1,5 ms
Inputs	**777600**	**787600**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	25 mA	25 mA
Start circuit DC	50 mA	50 mA
Feedback loop DC	50 mA	50 mA
Max. overall cable resistance Rl-max		
Single-channel at UB DC	40 Ohm	40 Ohm
Dual-channel with detection of shorts across contacts at UB DC	20 Ohm	20 Ohm
Semiconductor outputs	**777600**	**787600**
Number	1	1
Voltage	24 V	24 V
Current	100 mA	100 mA
External supply voltage	24 V	24 V
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Relay outputs	**777600**	**787600**
Number of output contacts		
Safety contacts (N/O), delayed	2	2
Max. short circuit current IK	1 kA	1 kA

Safety relays PNOZ X
PNOZ X2.1VP

Relay outputs	777600	787600
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**100 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ X2.1VP

Times	777600	787600
Switch-on delay		
With automatic start typ.	**100 ms**	**100 ms**
With automatic start max.	**210 ms**	**210 ms**
With manual start typ.	**35 ms**	**35 ms**
With manual start max.	**210 ms**	**210 ms**
Delay-on de-energisation		
With power failure typ.	**1100 ms**	**1100 ms**
With power failure max.	**1500 ms**	**1500 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**1550 ms**	**1550 ms**
After power failure	**1550 ms**	**1550 ms**
Delay time tv	**0,75 s**	**0,75 s**
Time accuracy	**-30 %/+100 %**	**-30 %/+100 %**
Supply interruption before de-energisation	**10 ms**	**10 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777600**	**787600**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZ X
PNOZ X2.1VP

Environmental data	777600	787600
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777600**	**787600**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**200 g**	**200 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X2.1VP

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 3**	**2,64E-09**	**SIL 3**	**1,26E-05**	**20**

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

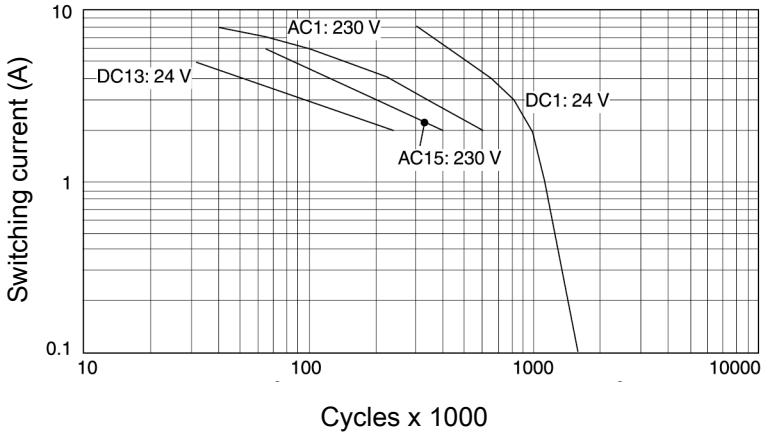
Supplementary data

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.

Safety relays PNOZ X
PNOZ X2.1VP

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: 2 A
- Utilisation category AC15
- Contact service life: 400 000 cycles

Provided the application to be implemented requires fewer than 400 000 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X2.1VP C	24 VDC	Spring-loaded terminals	787 600
PNOZ X2.1VP	24 VDC	Screw terminals	777 600

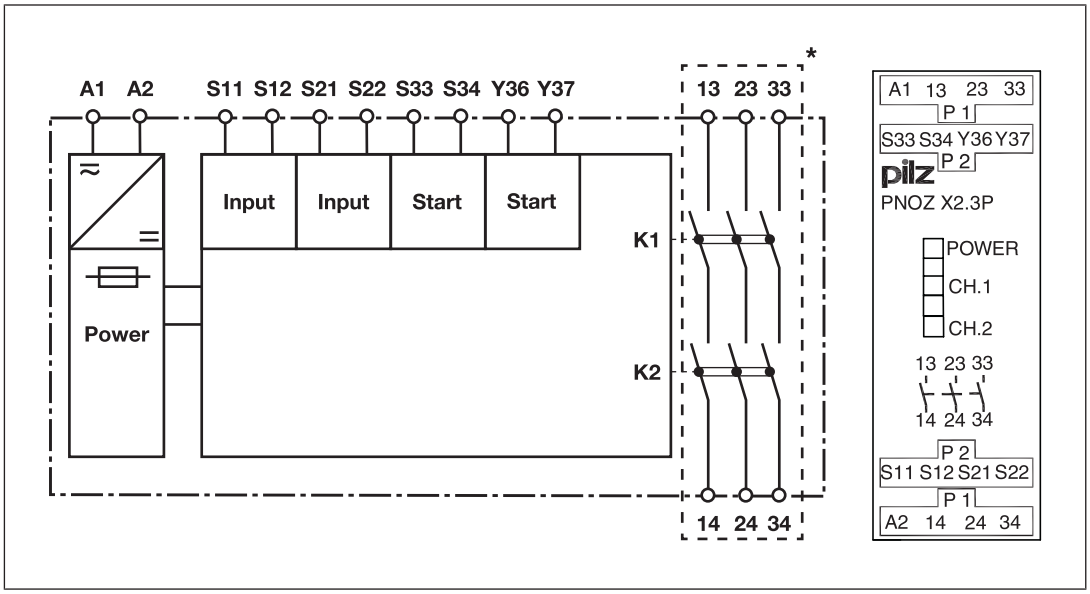
Safety relays PNOZ X
PNOZ X2.3P

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X2.3P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X2.3P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S33-S34 is closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - Safety contacts 13-14, 23-24 and 33-34 are closed, the unit is active.
  - LEDs "CH1" and "CH2" will light.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly.
  - LEDs "CH1" and "CH2" go out.

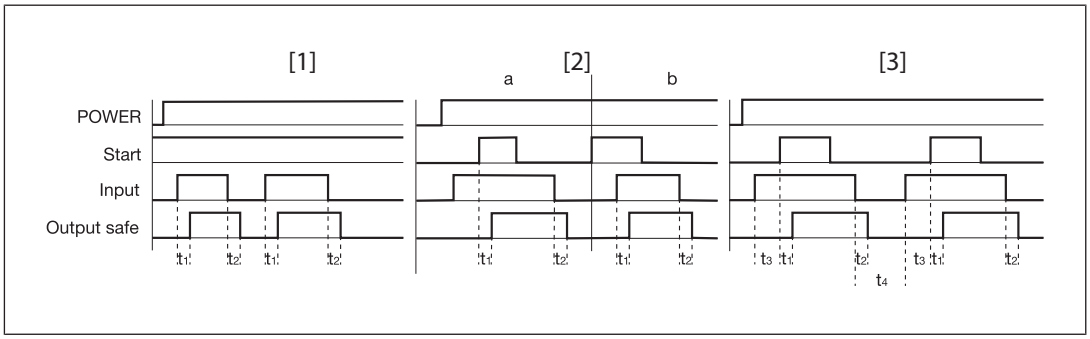
Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X2.3P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.

Safety relays PNOZ X
PNOZ X2.3P

- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [60]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X2.3P

Wiring

Please note:

- Information given in the "Technical details [60]" must be followed.
- The output contacts 13-14, 23-24, 33-34 are safety contacts.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [60]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

  R_{lmax} = max. overall cable resistance (see Technical details [60])
  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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

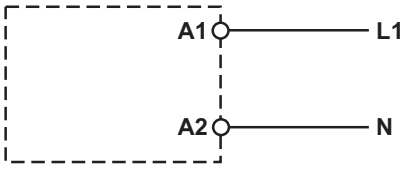
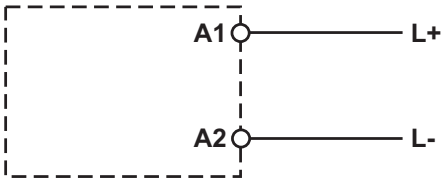
Important for detection of shorts across contacts:

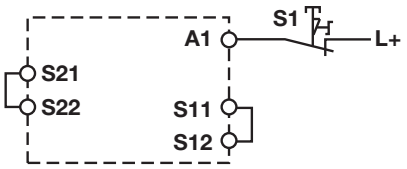
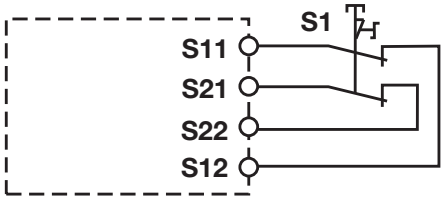
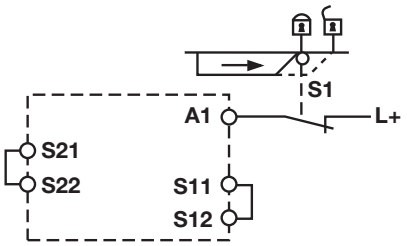
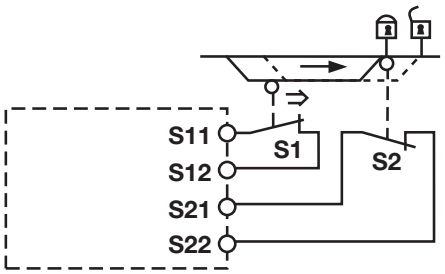
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

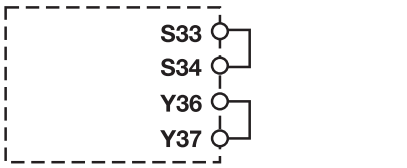
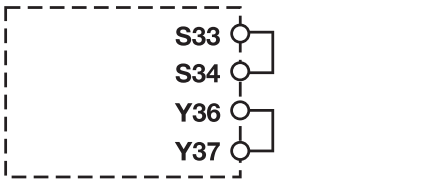
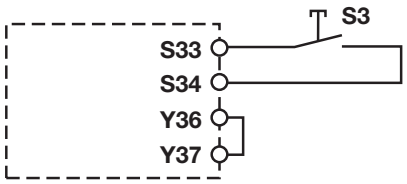
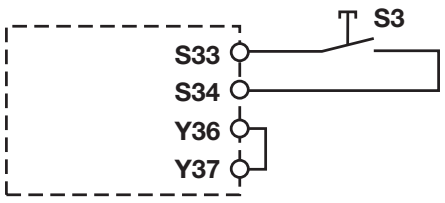
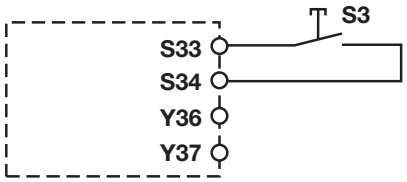
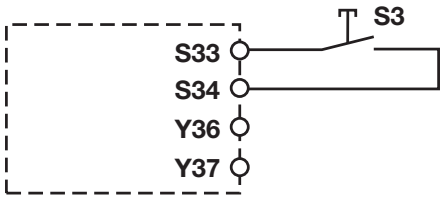
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

Safety relays PNOZ X
PNOZ X2.3P

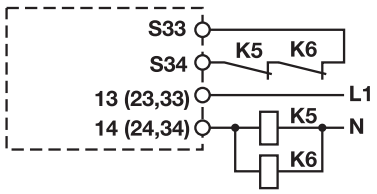
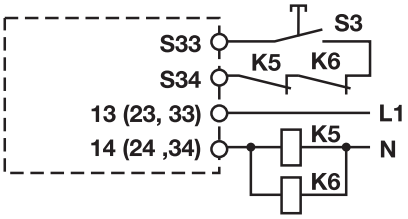
Preparing for operation

Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel (with detection of shorts across contacts)
E-STOP		
Safety gate		

Start circuit	Single-channel	Dual-channel (with detection of shorts across contacts)
Automatic start		
Manual start		
Monitored start		

Safety relays PNOZ X
PNOZ X2.3P

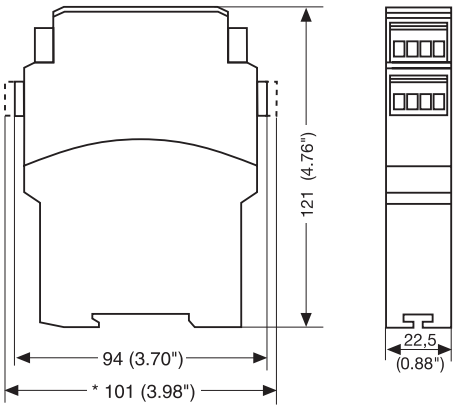
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X2.3P

Technical details

General	777304	787304
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777304**	**787304**
Supply voltage		
Voltage	24 V	24 V
Kind	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	4 VA	4 VA
Output of external power supply (DC)	2 W	2 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	1,7 A	1,7 A
Pulse duration, A1	1,5 ms	1,5 ms
Inputs	**777304**	**787304**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	25 mA	25 mA
Start circuit DC	25 mA	25 mA
Feedback loop DC	25 mA	25 mA
Min. input resistance at power-on	21 Ohm	21 Ohm
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Single-channel at UB AC	30 Ohm	30 Ohm
Dual-channel with detection of shorts across contacts at UB DC	20 Ohm	20 Ohm
Dual-channel with detection of shorts across contacts at UB AC	40 Ohm	40 Ohm
Relay outputs	**777304**	**787304**
Number of output contacts		
Safety contacts (N/O), instant-aneous	3	3

Safety relays PNOZ X
PNOZ X2.3P

Relay outputs	777304	787304
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**100 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ X2.3P

Conventional thermal current while loading several contacts	777304	787304
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**5 A**
Times	**777304**	**787304**
Switch-on delay		
With automatic start typ.	**50 ms**	**50 ms**
With automatic start max.	**90 ms**	**90 ms**
With automatic start after power on typ.	**60 ms**	**60 ms**
With automatic start after power on max.	**100 ms**	**100 ms**
With manual start typ.	**40 ms**	**40 ms**
With manual start max.	**90 ms**	**90 ms**
With monitored start typ.	**40 ms**	**40 ms**
With monitored start max.	**70 ms**	**70 ms**
Delay-on de-energisation		
With E-STOP typ.	**12 ms**	**12 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**60 ms**	**60 ms**
With power failure max.	**100 ms**	**100 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**150 ms**	**150 ms**
Waiting period with a monitored start	**210 ms**	**210 ms**
Min. start pulse duration with a monitored start	**40 ms**	**40 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**

Safety relays PNOZ X
PNOZ X2.3P

Times	777304	787304
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777304**	**787304**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777304**	**787304**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZ X
PNOZ X2.3P

Mechanical data	777304	787304
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**205 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

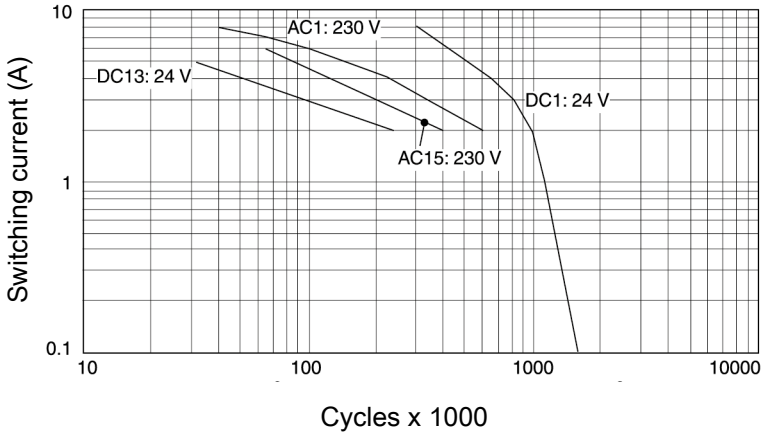
Supplementary data

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.

Safety relays PNOZ X
PNOZ X2.3P

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: 2 A
- Utilisation category AC15
- Contact service life: 400 000 cycles

Provided the application to be implemented requires fewer than 400 000 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X2.3P C	24 VAC/DC	Spring-loaded terminals	787 304
PNOZ X2.3P	24 VAC/DC	Screw terminals	777 304

Safety relays PNOZ X
PNOZ X2.7P

Unit features

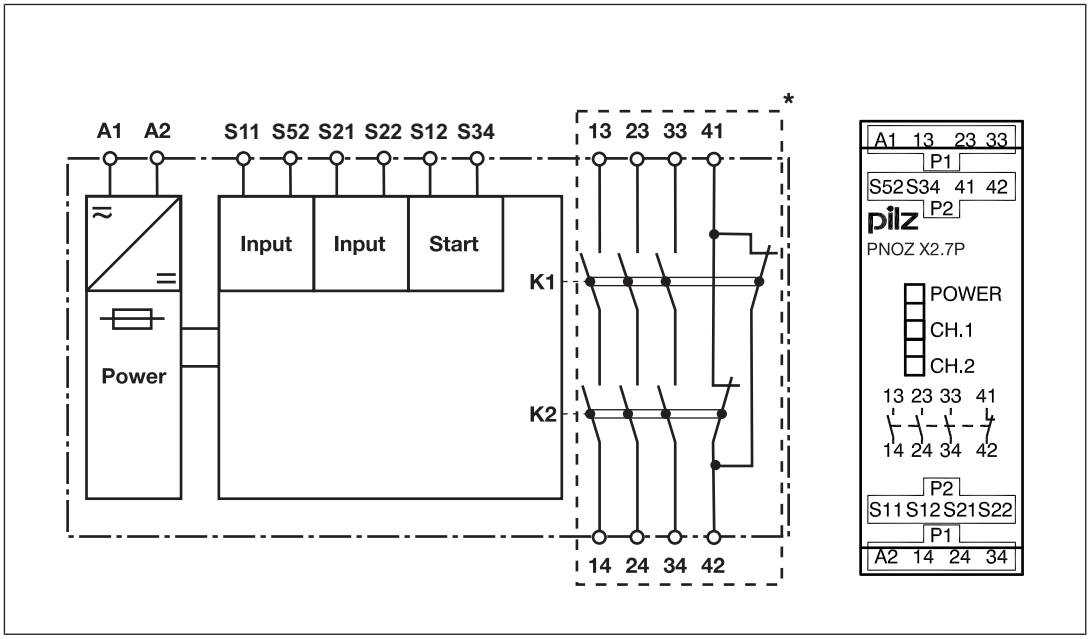
- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start button
  - Light guards and safety switches
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X2.7P

Block diagram/terminal configuration

Type: 24 VAC/DC

- U_B: 24 VAC/DC; Order no. 777305, 787305

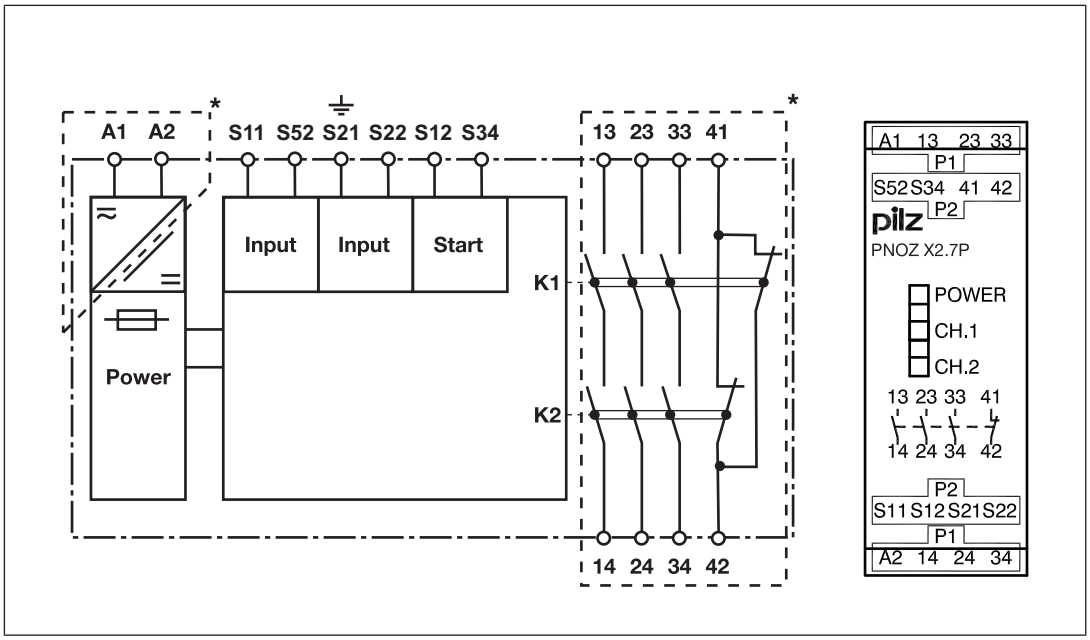


*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X2.7P

Type: 24 - 240 V AC/DC

- U_B: 24 – 240 VAC/DC; Order no. 777306, 787306



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X2.7P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S12-S34 is closed.

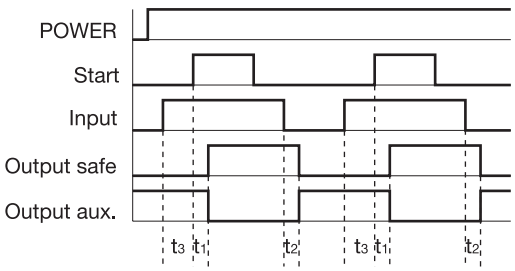
- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - LEDs "CH1" and "CH2" will light.
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH1" and "CH2" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.

Safety relays PNOZ X
PNOZ X2.7P

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ X2.7P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X2.7P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [📖 73]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period

Safety relays PNOZ X
PNOZ X2.7P

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [73]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [73]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [73])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- On 24 VAC/DC units:
  The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Important for detection of shorts across contacts:

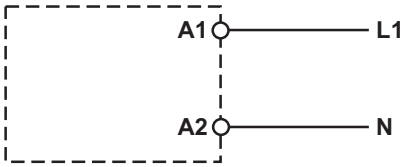
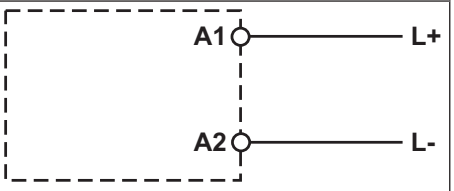
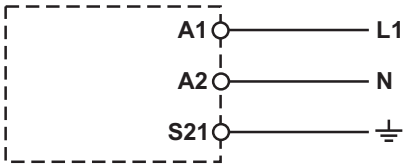
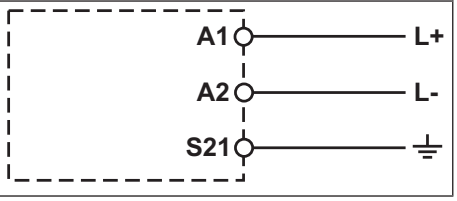
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

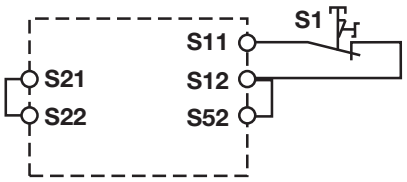
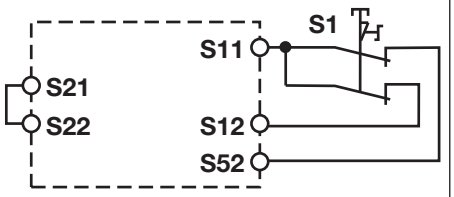
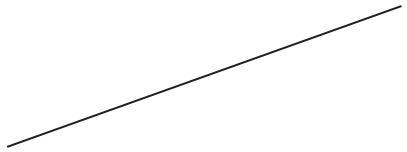
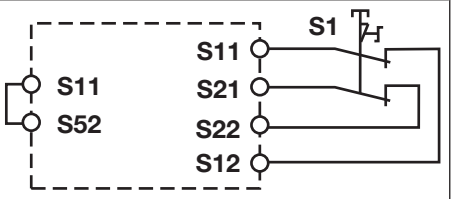
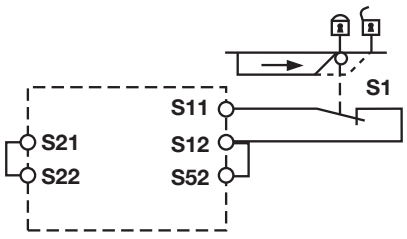
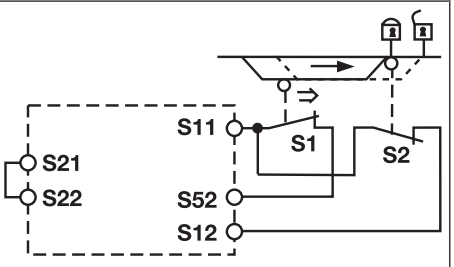
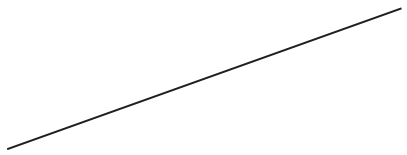
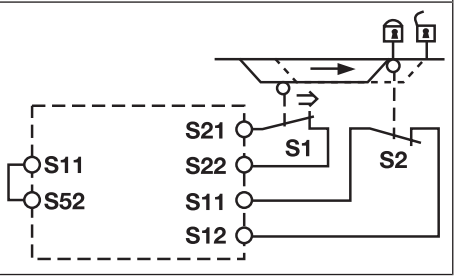
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.

Safety relays PNOZ X
PNOZ X2.7P

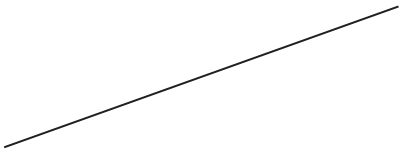
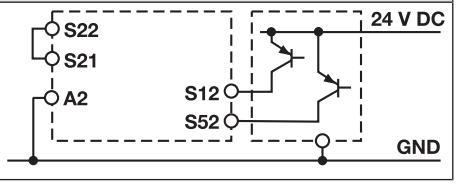
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

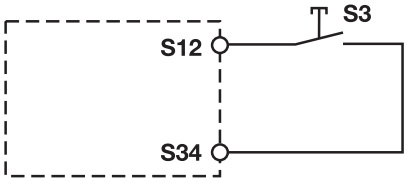
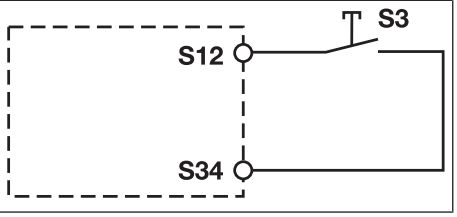
Preparing for operation

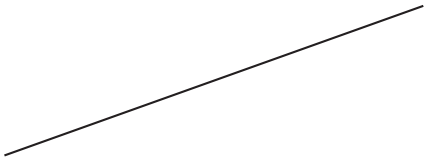
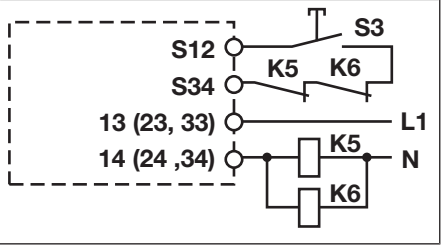
Supply voltage	AC	DC
U_B = 24 VAC/DC; Order no. 777305, 787305		
U_B = 24 - 240 VAC/DC; Order no. 777306, 787306		

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		

Safety relays PNOZ X
PNOZ X2.7P

Input circuit	Single-channel	Dual-channel
Light guards or safety switch, detection of shorts across contacts via ESPE (only when U_B = 24 VDC); Order no. 777305, 787305)		

Start circuit	Single-channel	Dual-channel
Monitored start		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

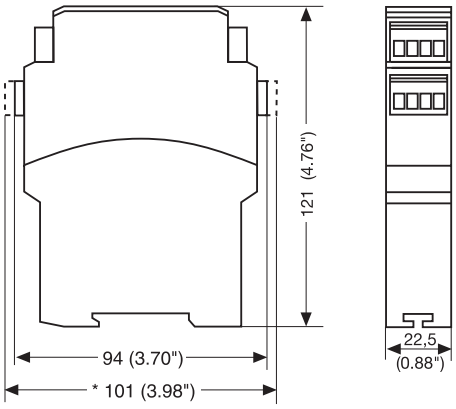
Legend

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

Safety relays PNOZ X
PNOZ X2.7P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777305 – 777306

See below for more order numbers

General	777305	777306
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777305**	**777306**
Supply voltage		
Voltage	**24 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5,5 VA**	**4,5 VA**
Output of external power supply (DC)	**2,5 W**	**2 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	–
Pulse duration, A1	**3,3 ms**	–
Inputs	**777305**	**777306**
Number	**2**	**2**

Safety relays PNOZ X
PNOZ X2.7P

Inputs	777305	777306
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**30 mA**	**25 mA**
Start circuit DC	**40 mA**	**50 mA**
Feedback loop DC	**40 mA**	**50 mA**
Min. input resistance at power-on	**71 Ohm**	**141 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**45 Ohm**
Single-channel at UB AC	**100 Ohm**	**45 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**50 Ohm**	**80 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**100 Ohm**	**80 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**15 Ohm**	**15 Ohm**
Relay outputs	**777305**	**777306**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**

Safety relays PNOZ X
PNOZ X2.7P

Relay outputs	777305	777306
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. P.**	**24 V DC G. P.**
With current	**6 A**	**6 A**
Pilot Duty	**R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**

Safety relays PNOZ X
PNOZ X2.7P

Relay outputs	777305	777306
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777305**	**777306**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**6 A**
Conv. therm. current with 3 contacts	**3,5 A**	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**4,5 A**
Times	**777305**	**777306**
Switch-on delay		
With monitored start typ.	**30 ms**	**30 ms**
With monitored start max.	**50 ms**	**40 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**10 ms**
With E-STOP max.	**30 ms**	**20 ms**
With power failure typ.	**60 ms**	–
With power failure max.	**100 ms**	–
With power failure typ. UB 240 V	–	**1100 ms**
With power failure max. UB 240 V	–	**1500 ms**
With power failure typ. UB 24 V	–	**180 ms**
With power failure max. UB 24 V	–	**230 ms**

Safety relays PNOZ X
PNOZ X2.7P

Times	777305	777306
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**200 ms**	**1500 ms**
Waiting period with a monitored start	**250 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777305**	**777306**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-35 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777305**	**777306**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZ X
PNOZ X2.7P

Mechanical data	777305	777306
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**
Dimensions		
Height	**94 mm**	**94 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**190 g**	**210 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787305 – 787306

General	787305	787306
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787305**	**787306**
Supply voltage		
Voltage	**24 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5,5 VA**	**4,5 VA**
Output of external power supply (DC)	**2,5 W**	**2 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**

Safety relays PNOZ X
PNOZ X2.7P

Electrical data	787305	787306
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	–
Pulse duration, A1	**3,3 ms**	–
Inputs	**787305**	**787306**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**30 mA**	**25 mA**
Start circuit DC	**40 mA**	**50 mA**
Feedback loop DC	**40 mA**	**50 mA**
Min. input resistance at power-on	**71 Ohm**	**141 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**45 Ohm**
Single-channel at UB AC	**100 Ohm**	**45 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**50 Ohm**	**80 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**100 Ohm**	**80 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**15 Ohm**	**15 Ohm**
Relay outputs	**787305**	**787306**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PNOZ X2.7P

Relay outputs	787305	787306
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. P.**	**24 V DC G. P.**
With current	**6 A**	**6 A**
Pilot Duty	**R300**	**B300, R300**

Safety relays PNOZ X
PNOZ X2.7P

Relay outputs	787305	787306
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787305**	**787306**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**6 A**
Conv. therm. current with 3 contacts	**3,5 A**	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**4,5 A**
Times	**787305**	**787306**
Switch-on delay		
With monitored start typ.	**30 ms**	**30 ms**
With monitored start max.	**50 ms**	**40 ms**

Safety relays PNOZ X
PNOZ X2.7P

Times	787305	787306
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**10 ms**
With E-STOP max.	**30 ms**	**20 ms**
With power failure typ.	**60 ms**	–
With power failure max.	**100 ms**	–
With power failure typ. UB 240 V	–	**1100 ms**
With power failure max. UB 240 V	–	**1500 ms**
With power failure typ. UB 24 V	–	**180 ms**
With power failure max. UB 24 V	–	**230 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**200 ms**	**1500 ms**
Waiting period with a monitored start	**250 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787305**	**787306**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-35 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZ X
PNOZ X2.7P

Environmental data	787305	787306
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787305**	**787306**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**190 g**	**210 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Safety relays PNOZ X
PNOZ X2.7P

Supplementary data

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.

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.

Unit types with UB 24 VAC/DC

- U_B: 24 VAC/DC; Order no. 777305, 787305

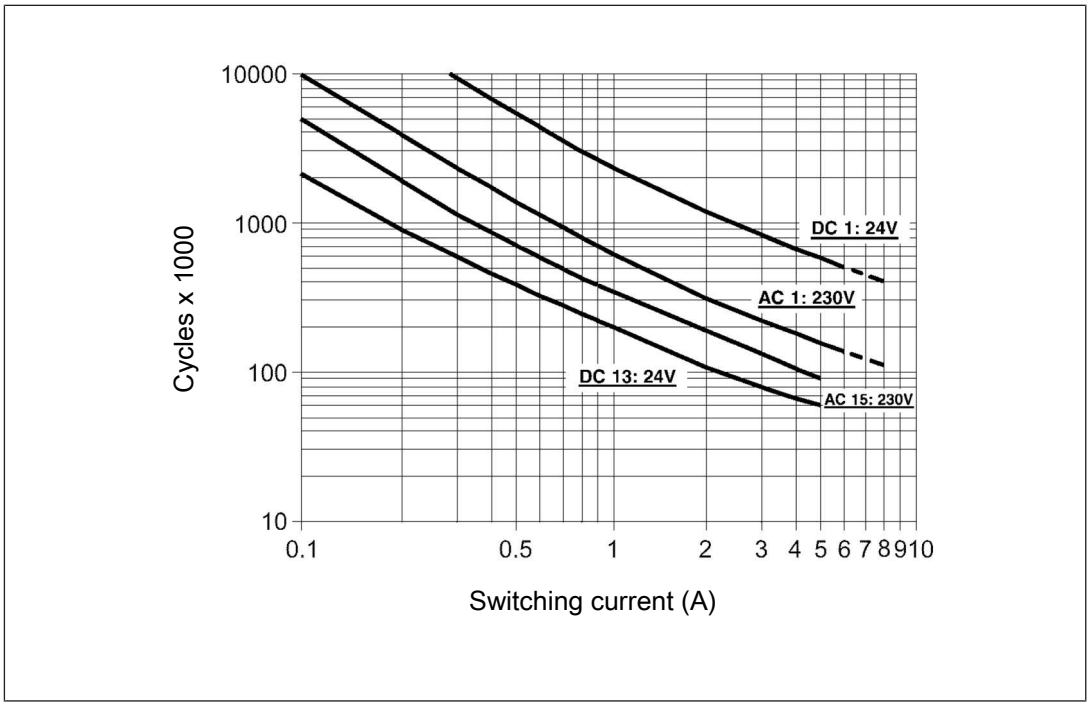


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZ X
PNOZ X2.7P

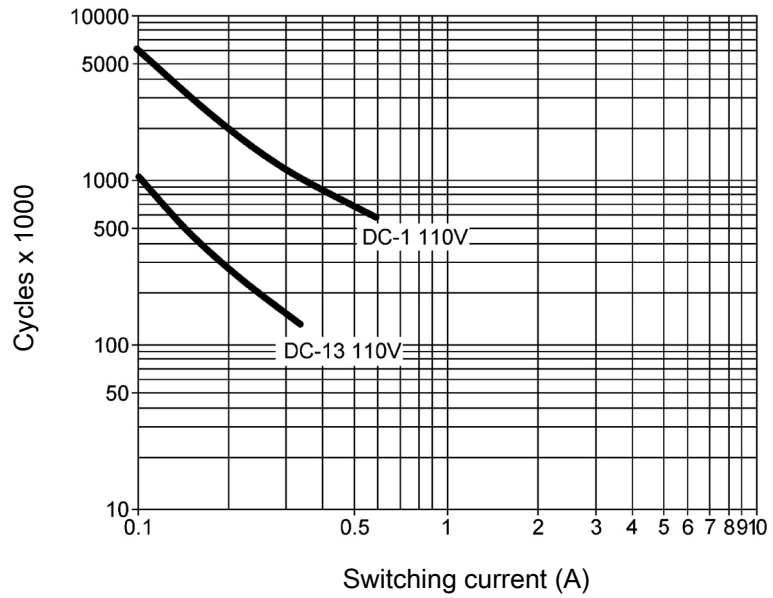


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 73]) 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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ X2.7P

Unit types with UB 24-240 VAC/DC

- U_B: 24 – 240 VAC/DC; Order no. 777306, 787306

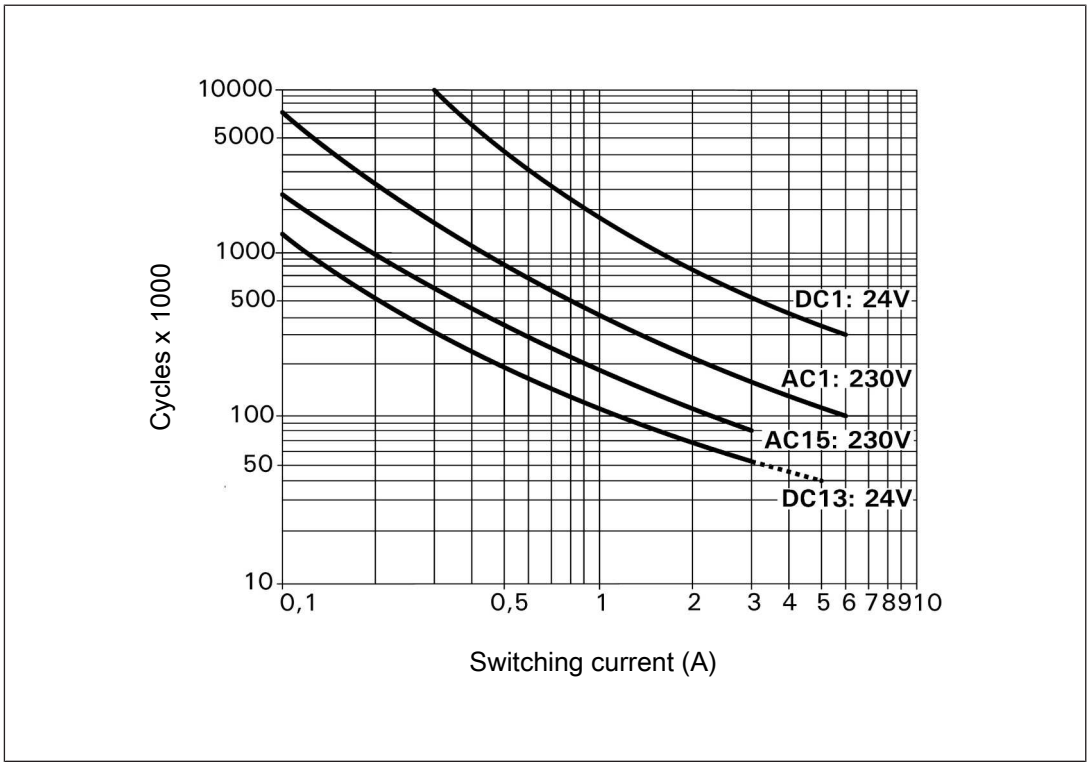


Fig.: Service life graphs at 24 V DC and 230 V AC

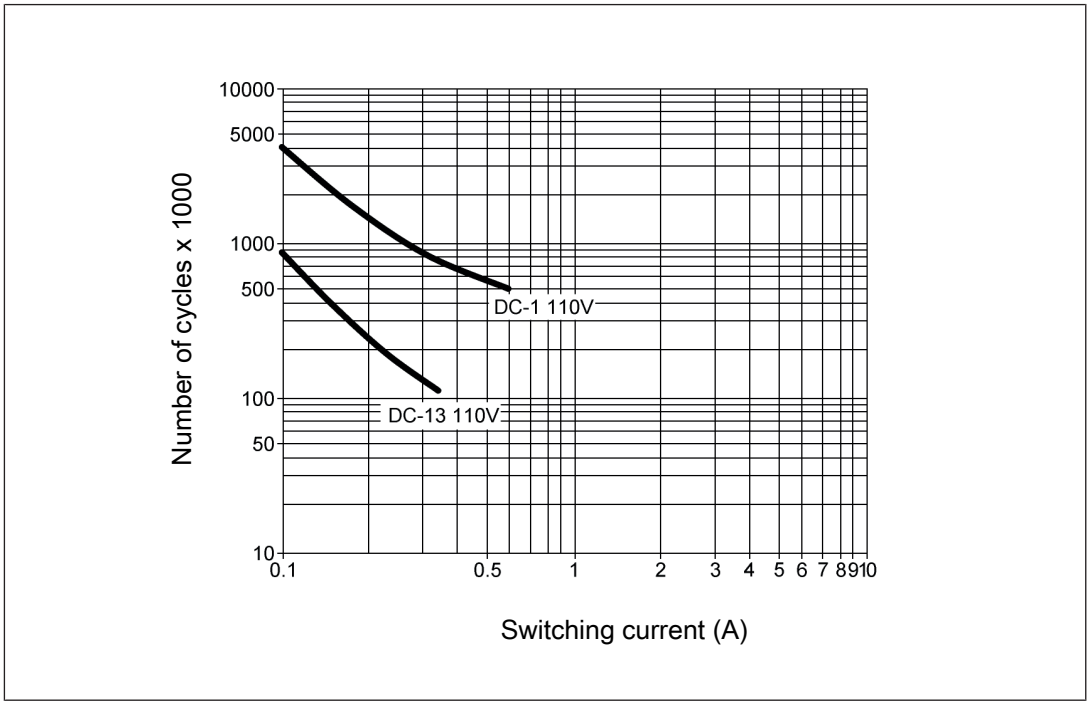


Fig.: Service life graphs at 110 V DC

Safety relays PNOZ X
PNOZ X2.7P

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 73]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order no.
PNOZ X2.7P C	24 VAC/DC	Spring-loaded terminals	787 305
PNOZ X2.7P	24 VAC/DC	Screw terminals	777 305
PNOZ X2.7P C	24 - 240 V AC/DC	Spring-loaded terminals	787 306
PNOZ X2.7P	24 - 240 V AC/DC	Screw terminals	777 306

Safety relays PNOZ X
PNOZ X2.8P

Unit features

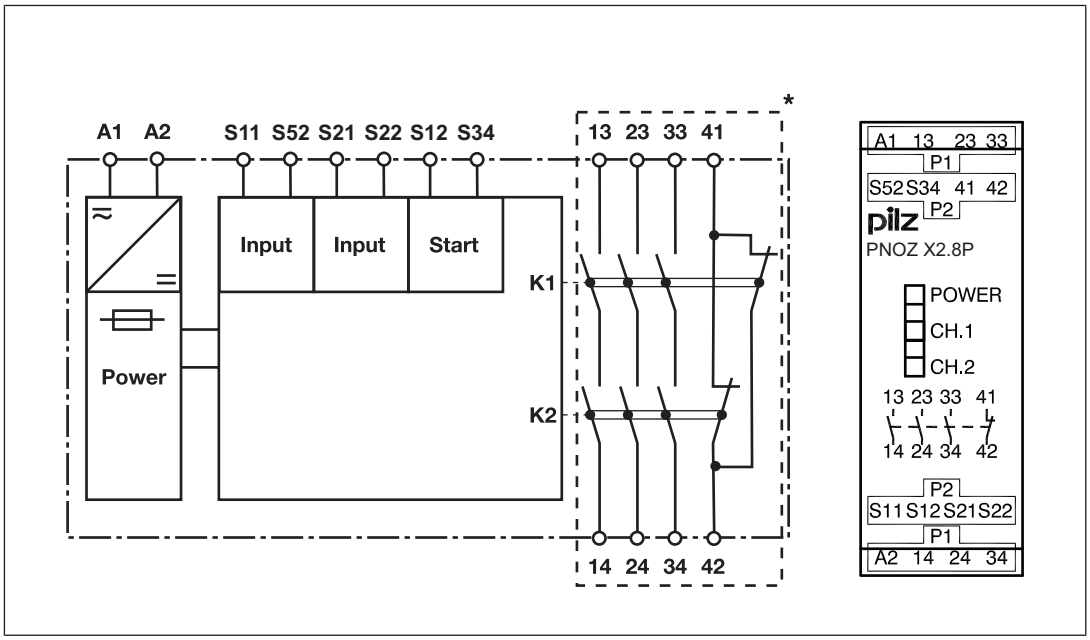
- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start button
  - Light guards and safety switches
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X2.8P

Block diagram/terminal configuration

Type: 24 VAC/DC

- U_B: 24 VAC/DC; Order no. 777301, 787301

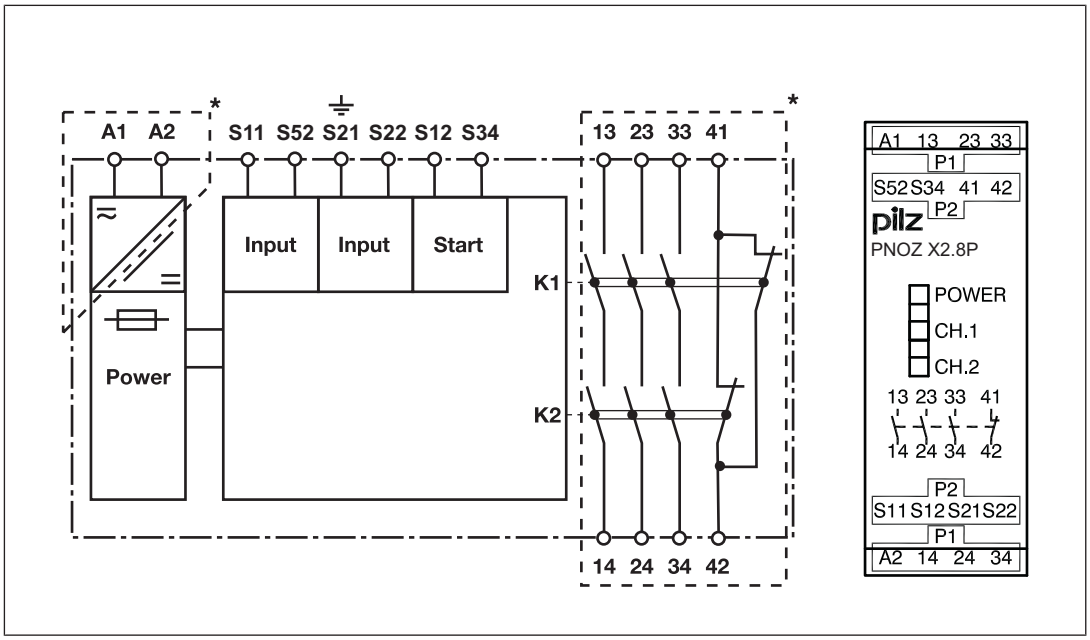


*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X2.8P

Type: 24 - 240 V AC/DC

- U_B: 24 – 240 VAC/DC; Order no. 777302, 787302



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PPNOZ X2.8P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S12-S34 is closed.

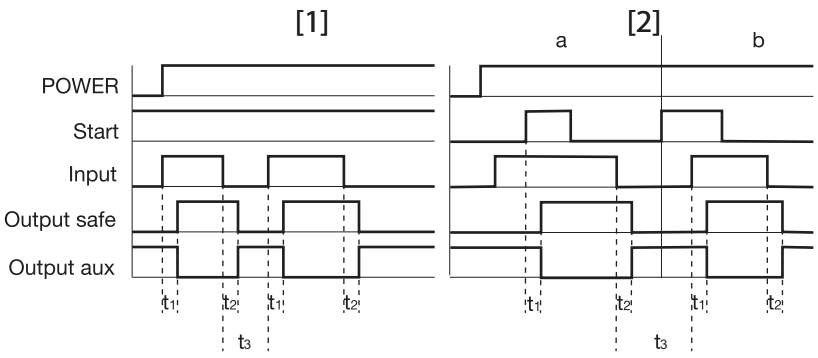
- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - LEDs "CH1" and "CH2" will light.
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH1" and "CH2" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.

Safety relays PNOZ X
PNOZ X2.8P

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ X2.8P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X2.8P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- [1]: Automatic start
- [2]: Manual start
- a: Input circuit closes before start circuit

- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [96]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [96]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [96])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- On 24 VAC/DC units:
  The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

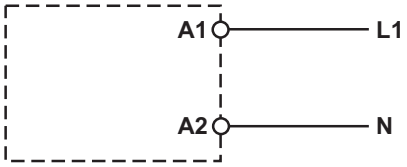
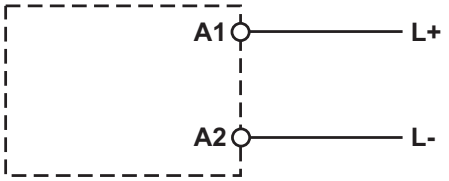
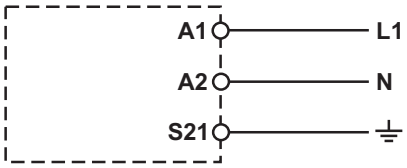
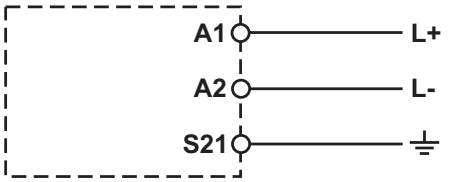
Safety relays PNOZ X
PNOZ X2.8P

Important for detection of shorts across contacts:

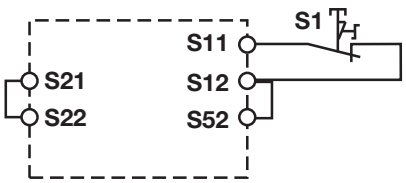
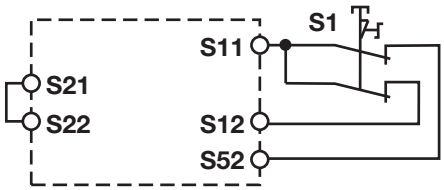
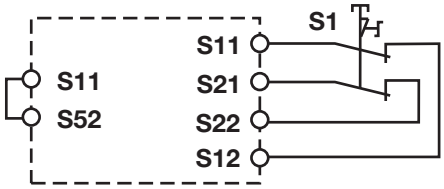
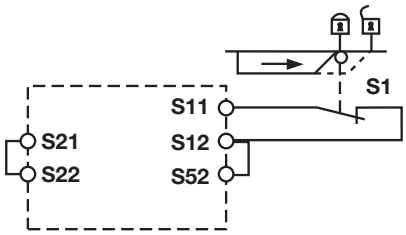
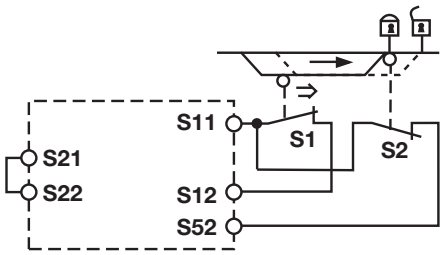
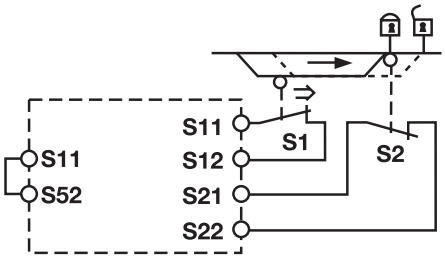
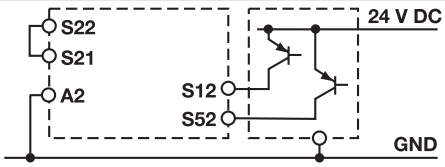
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

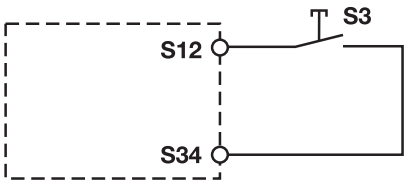
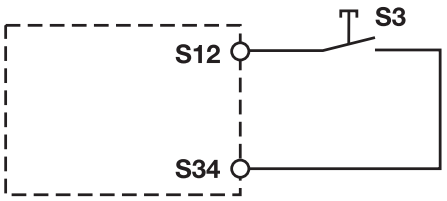
Preparing for operation

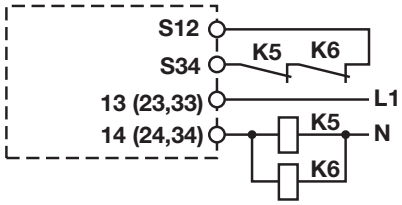
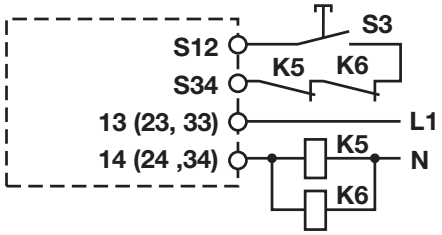
Supply voltage	AC	DC
U_B = 24 VAC/DC; Order no. 777301, 787301		
U_B = 24 - 240 VAC/DC; Order no. 777302, 787302		

Safety relays PNOZ X
PNOZ X2.8P

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 guards or safety switch, detection of shorts across contacts via ESPE (only when U_B = 24 VDC); Order no. 777301, 787301)		

Safety relays PNOZ X
PNOZ X2.8P

Start circuit	E-STOP wiring, safety gate (single-channel)	E-STOP wiring, safety gate (dual-channel)
Automatic start		
Manual start		

Feedback loop	Automatic start	Manual start
Contacts from external contactors		

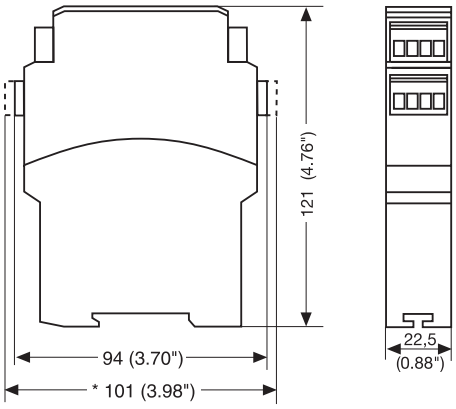
Legend

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

Safety relays PNOZ X
PNOZ X2.8P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777301 – 777302

See below for more order numbers

General	**777301**	**777302**
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**777301**	**777302**
Supply voltage		
Voltage	**24 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5,5 VA**	**4,5 VA**
Output of external power supply (DC)	**2,5 W**	**2 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	–
Pulse duration, A1	**3,3 ms**	–
Inputs	**777301**	**777302**
Number	**2**	**2**

Safety relays PNOZ X
PNOZ X2.8P

Inputs	777301	777302
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**30 mA**	**25 mA**
Start circuit DC	**40 mA**	**50 mA**
Feedback loop DC	**40 mA**	**50 mA**
Min. input resistance at power-on	**88 Ohm**	**209 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**45 Ohm**
Single-channel at UB AC	**100 Ohm**	**45 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**50 Ohm**	**80 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**100 Ohm**	**80 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**15 Ohm**	**15 Ohm**
Relay outputs	**777301**	**777302**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**

Safety relays PNOZ X
PNOZ X2.8P

Relay outputs	777301	777302
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. P.**	**24 V DC G. P.**
With current	**6 A**	**6 A**
Pilot Duty	**R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**

Safety relays PNOZ X
PNOZ X2.8P

Relay outputs	777301	777302
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777301**	**777302**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**6 A**
Conv. therm. current with 3 contacts	**3,5 A**	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**4,5 A**
Times	**777301**	**777302**
Switch-on delay		
With automatic start typ.	**250 ms**	**340 ms**
With automatic start max.	**450 ms**	**400 ms**
With automatic start after power on typ.	**250 ms**	**600 ms**
With automatic start after power on max.	**450 ms**	**800 ms**
With manual start typ.	**125 ms**	**180 ms**
With manual start max.	**450 ms**	**400 ms**

Safety relays PNOZ X
PNOZ X2.8P

Times	777301	777302
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**10 ms**
With E-STOP max.	**30 ms**	**20 ms**
With power failure typ.	**60 ms**	–
With power failure max.	**100 ms**	–
With power failure typ. UB 240 V	–	**1100 ms**
With power failure max. UB 240 V	–	**1500 ms**
With power failure typ. UB 24 V	–	**180 ms**
With power failure max. UB 24 V	–	**230 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**200 ms**	**1500 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777301**	**777302**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-35 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZ X
PNOZ X2.8P

Environmental data	777301	777302
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777301**	**777302**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**
Dimensions		
Height	**94 mm**	**94 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**190 g**	**210 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X2.8P

Order no. 787301 – 787302

General	787301	787302
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**787301**	**787302**
Supply voltage		
Voltage	**24 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5,5 VA**	**4,5 VA**
Output of external power supply (DC)	**2,5 W**	**2 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	–
Pulse duration, A1	**3,3 ms**	–
Inputs	**787301**	**787302**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**30 mA**	**25 mA**
Start circuit DC	**40 mA**	**50 mA**
Feedback loop DC	**40 mA**	**50 mA**
Min. input resistance at power-on	**88 Ohm**	**209 Ohm**

Safety relays PNOZ X
PNOZ X2.8P

Inputs	787301	787302
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**45 Ohm**
Single-channel at UB AC	**100 Ohm**	**45 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**50 Ohm**	**80 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**100 Ohm**	**80 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**15 Ohm**	**15 Ohm**
Relay outputs	**787301**	**787302**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**

Safety relays PNOZ X
PNOZ X2.8P

Relay outputs	787301	787302
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. P.**	**24 V DC G. P.**
With current	**6 A**	**6 A**
Pilot Duty	**R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZ X
PNOZ X2.8P

Conventional thermal current while loading several contacts	787301	787302
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**6 A**
Conv. therm. current with 3 contacts	**3,5 A**	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**4,5 A**
Times	**787301**	**787302**
Switch-on delay		
With automatic start typ.	**250 ms**	**340 ms**
With automatic start max.	**450 ms**	**400 ms**
With automatic start after power on typ.	**250 ms**	**600 ms**
With automatic start after power on max.	**450 ms**	**800 ms**
With manual start typ.	**125 ms**	**180 ms**
With manual start max.	**450 ms**	**400 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**10 ms**
With E-STOP max.	**30 ms**	**20 ms**
With power failure typ.	**60 ms**	–
With power failure max.	**100 ms**	–
With power failure typ. UB 240 V	–	**1100 ms**
With power failure max. UB 240 V	–	**1500 ms**
With power failure typ. UB 24 V	–	**180 ms**
With power failure max. UB 24 V	–	**230 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**200 ms**	**1500 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞

Safety relays PNOZ X
PNOZ X2.8P

Environmental data	787301	787302
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-35 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787301**	**787302**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Cage clamp terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**

Safety relays PNOZ X
PNOZ X2.8P

Mechanical data	787301	787302
Dimensions		
Height	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**190 g**	**210 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZ X
PNOZ X2.8P

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.

Unit types with UB 24 VAC/DC

- U_B: 24 VAC/DC; Order no. 777301, 787301

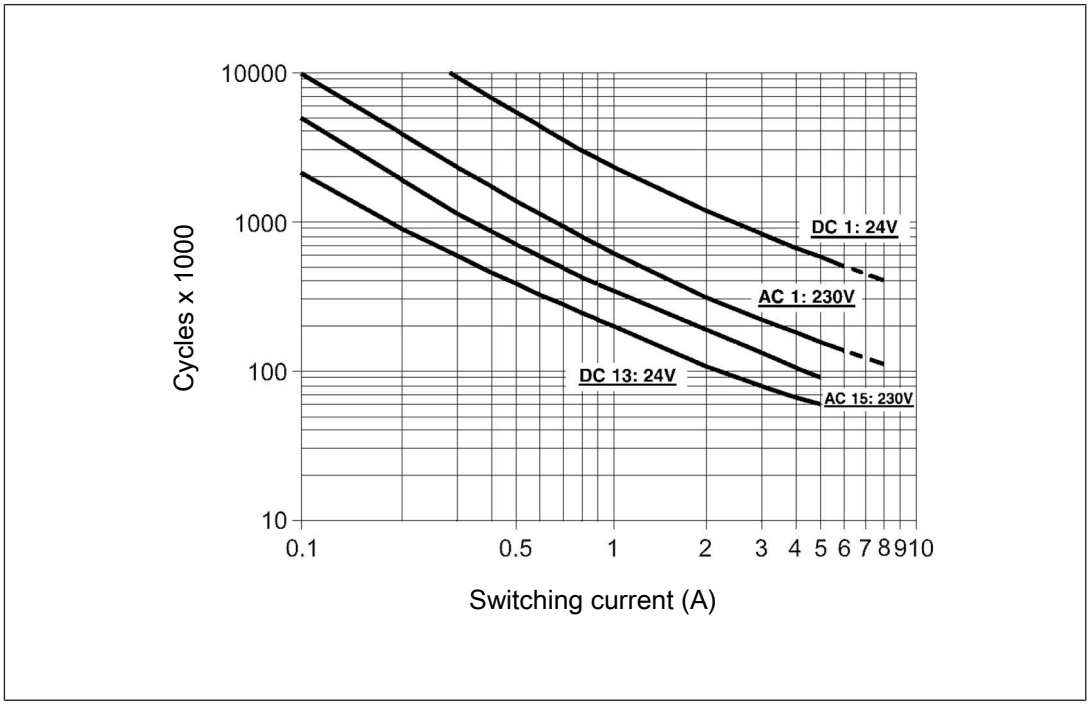


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZ X
PNOZ X2.8P

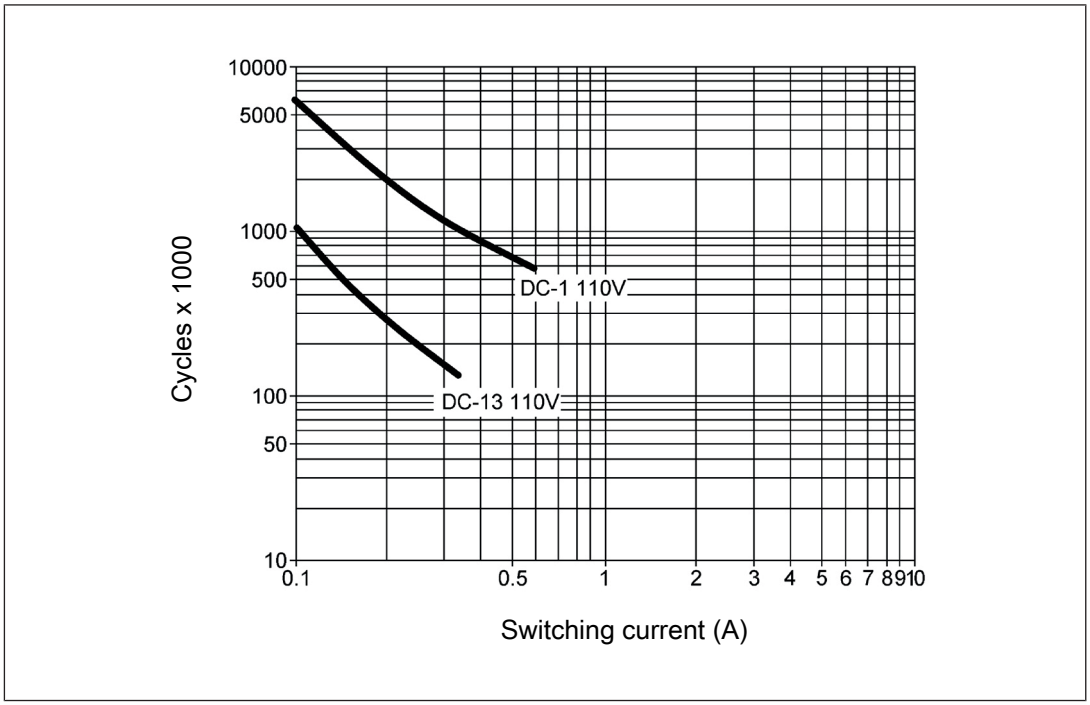


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 96]) 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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ X2.8P

Unit types with UB 24-240 VAC/DC

- U_B: 24 – 240 VAC/DC; Order no. 777302, 787302

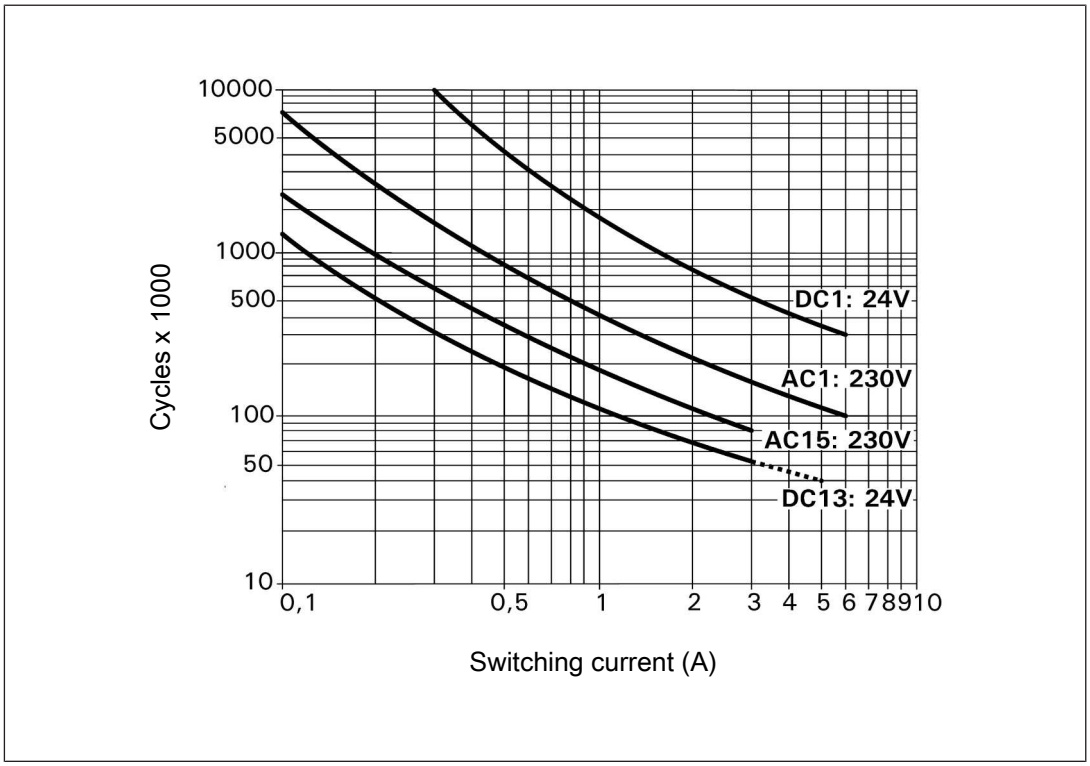


Fig.: Service life graphs at 24 V DC and 230 V AC

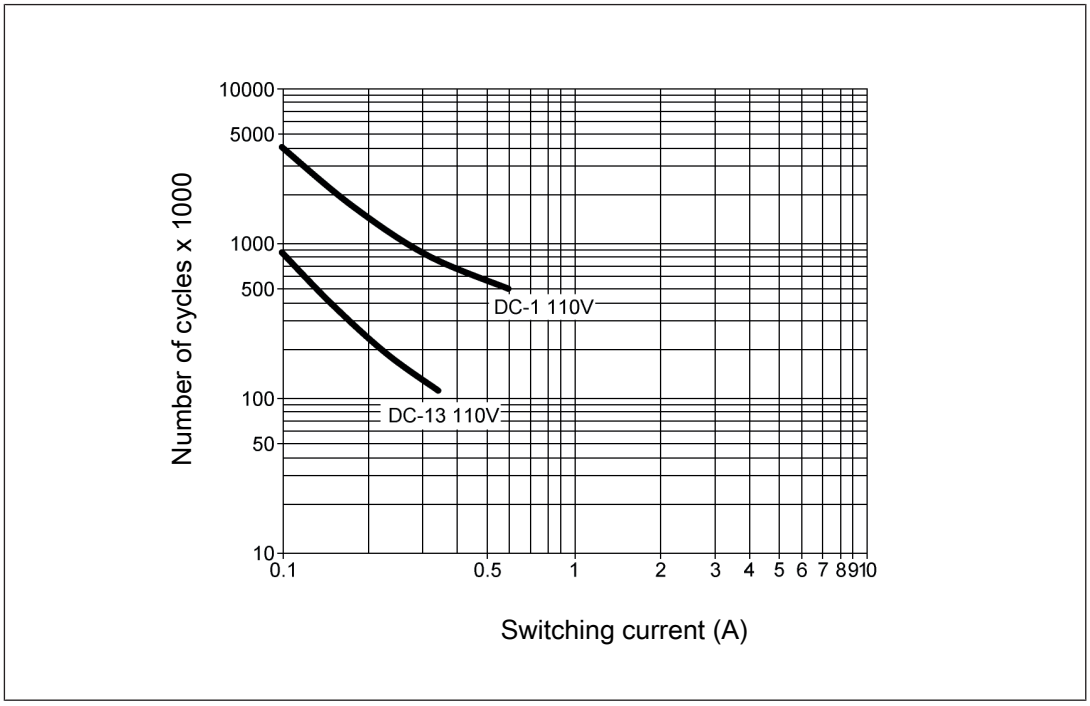


Fig.: Service life graphs at 110 V DC

Safety relays PNOZ X
PNOZ X2.8P

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

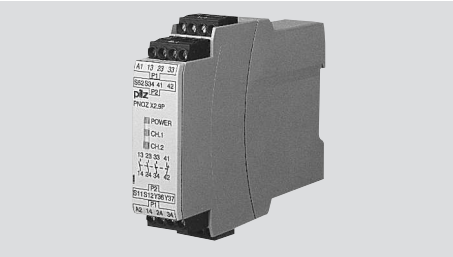
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [96]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order no.
PNOZ X2.8P	24 VAC/DC	Screw terminals	777 301
PNOZ X2.8P C	24 VAC/DC	Spring-loaded terminals	787 301
PNOZ X2.8P	24 - 240 V AC/DC	Screw terminals	777 302
PNOZ X2.8P C	24 - 240 V AC/DC	Spring-loaded terminals	787 302

Safety relays PNOZ X
PNOZ X2.9P

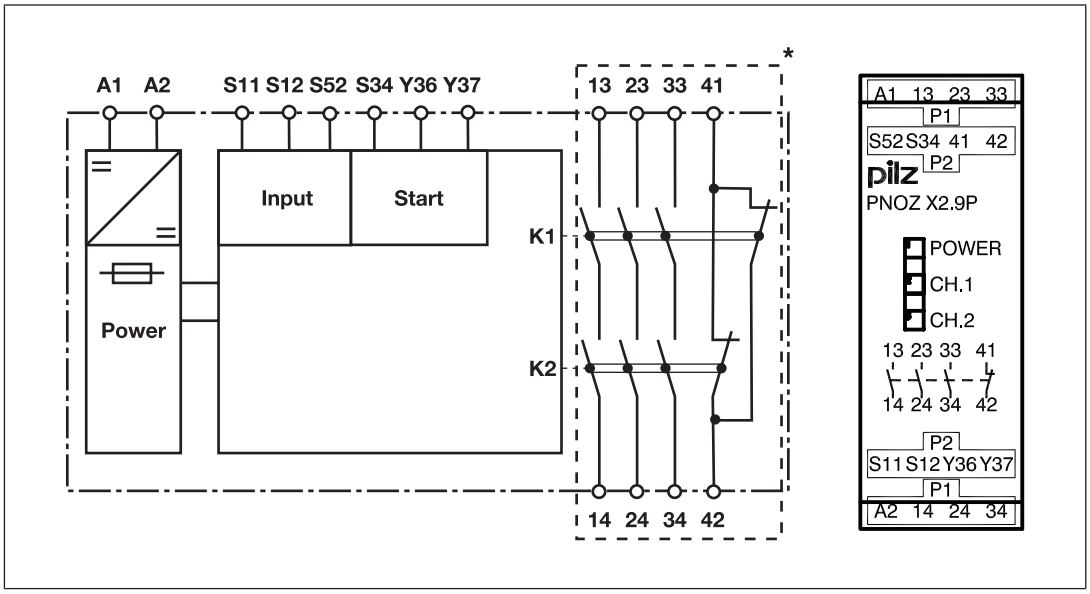


Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start button
  - Light guards and safety switches
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X2.9P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X2.9P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S12-S34 is closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The LEDs "CH.1" and "CH.2" are lit.
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.

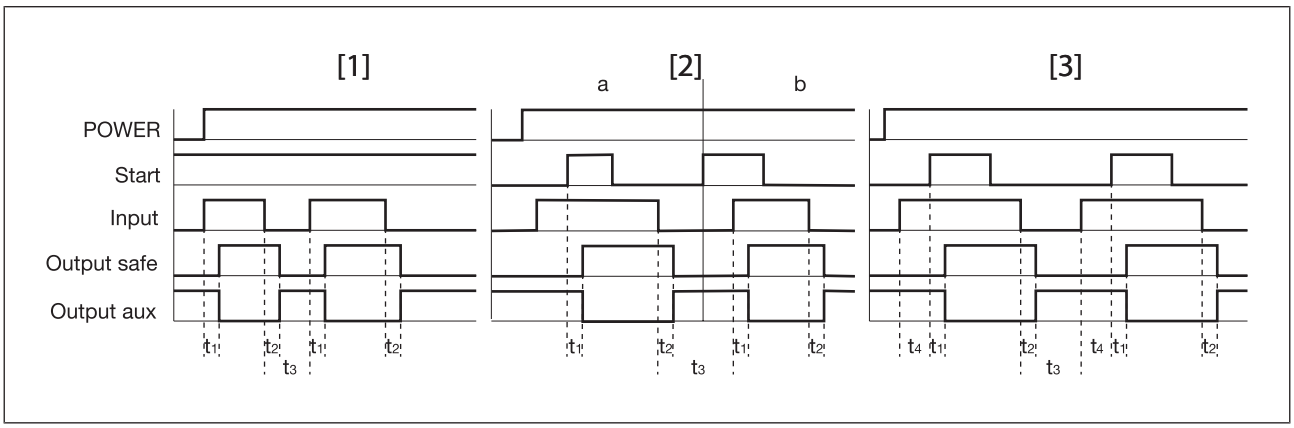
Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ X2.9P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.

Safety relays PNOZ X
PNOZ X2.9P

- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [118]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time
- t_4: Waiting period with a monitored start

Safety relays PNOZ X
PNOZ X2.9P

Installation

- The unit 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).

Wiring

Please note:

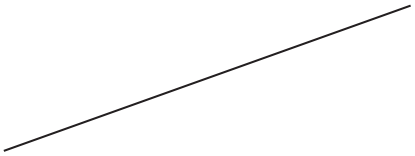
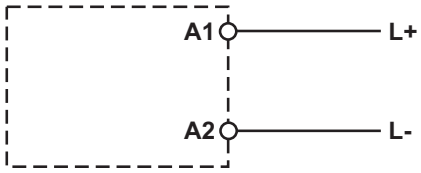
- Information given in the "Technical details [118]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [118]).
- Calculation of the max. cable length l_{max} in the input circuit:

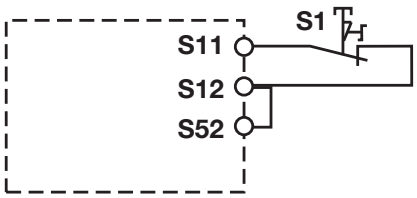
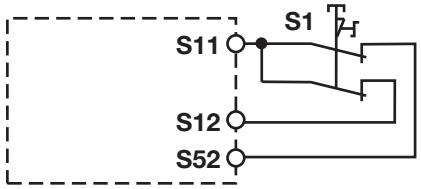
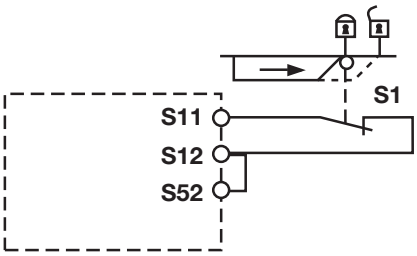
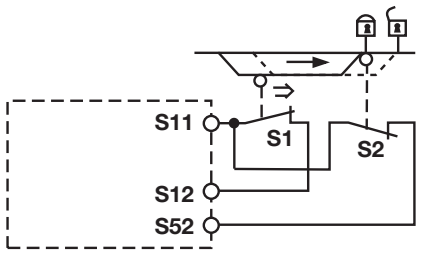
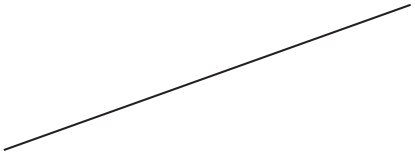
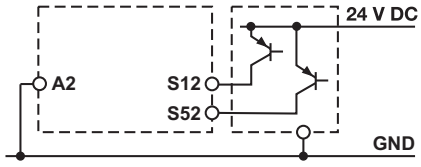
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

  R_{lmax} = max. overall cable resistance (see Technical details [118])
  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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

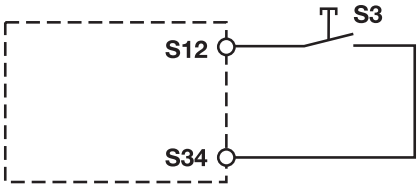
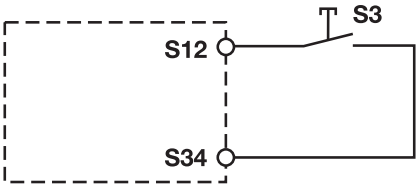
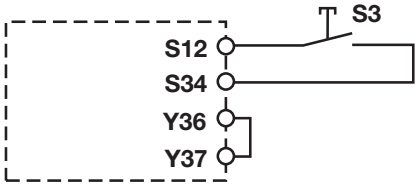
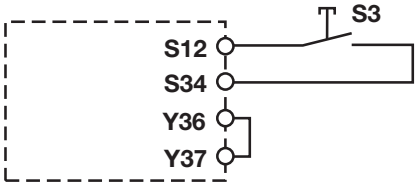
Safety relays PNOZ X
PNOZ X2.9P

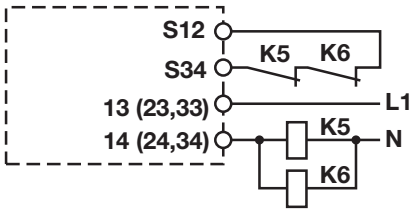
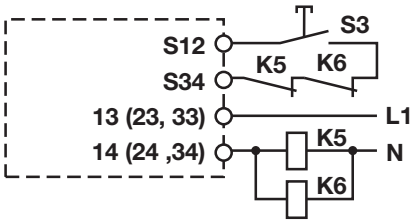
Preparing for operation

Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Light guard or safety switch, detection of shorts across contacts via ESPE		

Safety relays PNOZ X
PNOZ X2.9P

Start circuit	E-STOP wiring (single-channel) safety gate (single-channel)	E-STOP wiring (dual-channel), safety gate (dual-channel)
Automatic start		
Manual start		
Monitored start		

Feedback loop	Automatic start	Manual start/monitored start
Contacts from external contactors		

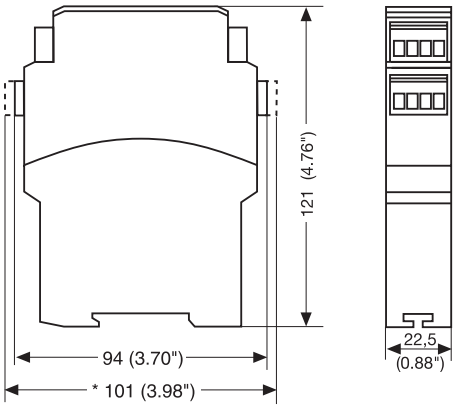
Legend

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

Safety relays PNOZ X
PNOZ X2.9P

Dimensions in mm

* with spring-loaded terminals



Technical details

General	777300	787300
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777300**	**787300**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**2 W**	**2 W**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	**1,7 A**
Pulse duration, A1	**3,3 ms**	**3,3 ms**
Inputs	**777300**	**787300**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**

Safety relays PNOZ X
PNOZ X2.9P

Inputs	777300	787300
Current at		
Input circuit DC	**30 mA**	**30 mA**
Start circuit DC	**60 mA**	**60 mA**
Feedback loop DC	**60 mA**	**60 mA**
Min. input resistance at power-on	**205 Ohm**	**205 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**50 Ohm**	**50 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**80 Ohm**	**80 Ohm**
Relay outputs	**777300**	**787300**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**

Safety relays PNOZ X
PNOZ X2.9P

Relay outputs	777300	787300
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ X2.9P

Conventional thermal current while loading several contacts	777300	787300
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Times	**777300**	**787300**
Switch-on delay		
With automatic start typ.	**200 ms**	**200 ms**
With automatic start max.	**400 ms**	**400 ms**
With automatic start after power on typ.	**200 ms**	**200 ms**
With automatic start after power on max.	**400 ms**	**400 ms**
With manual start typ.	**100 ms**	**100 ms**
With manual start max.	**400 ms**	**400 ms**
With monitored start typ.	**30 ms**	**30 ms**
With monitored start max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ.	**70 ms**	**70 ms**
With power failure max.	**120 ms**	**120 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**150 ms**	**150 ms**
Waiting period with a monitored start	**200 ms**	**200 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777300**	**787300**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**

Safety relays PNOZ X
PNOZ X2.9P

Environmental data	777300	787300
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777300**	**787300**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**

Safety relays PNOZ X
PNOZ X2.9P

Mechanical data	777300	787300
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**180 g**	**180 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

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.

Safety relays PNOZ X
PNOZ X2.9P

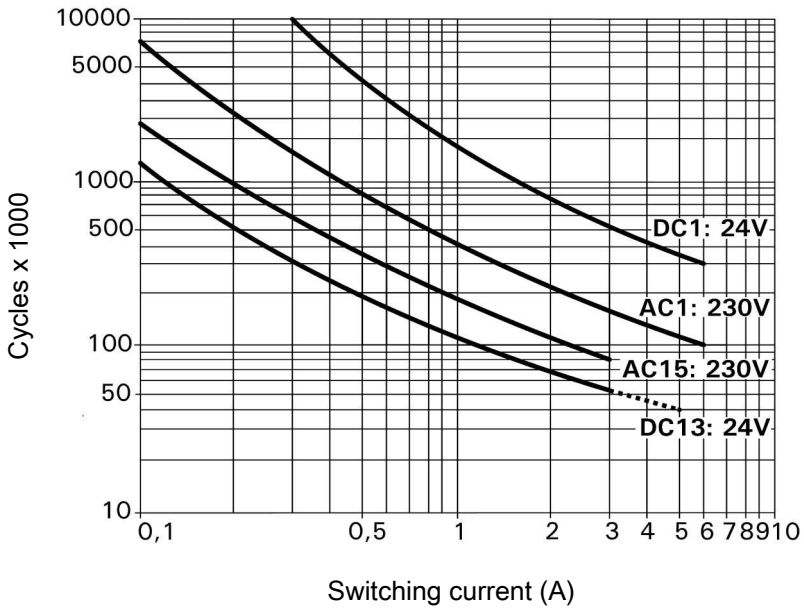


Fig.: Service life graphs at 24 VDC and 230 VAC

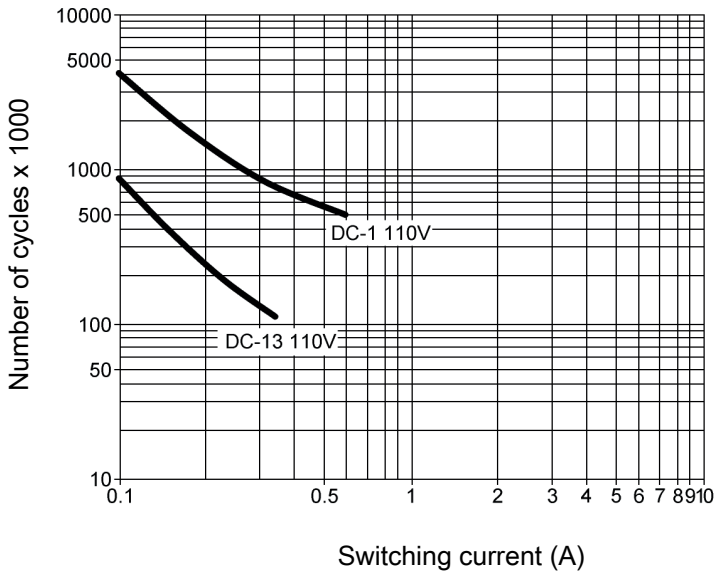


Fig.: Service life graphs at 110 VDC

Safety relays PNOZ X
PNOZ X2.9P

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

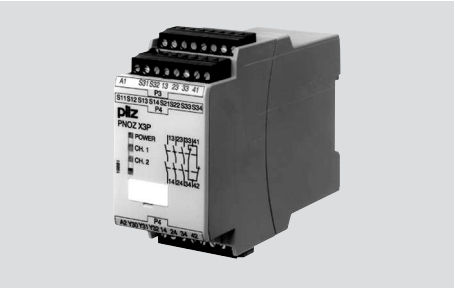
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 118]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order no.
PNOZ X2.9P	24 VDC	Screw terminals	777 300
PNOZ X2.9P C	24 VDC	Spring-loaded terminals	787 300

Safety relays PNOZ X
PNOZ X3P



Unit features

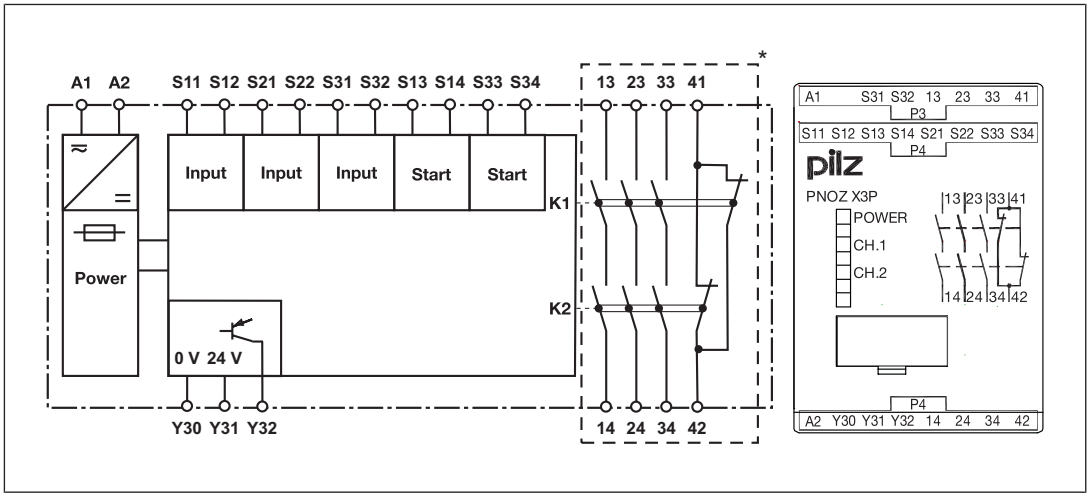
- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start button
  - Light guards and safety switches
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Semiconductor output signals:
  - Switch state of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X3P

Block diagram/terminal configuration

Type: 24 VAC/DC

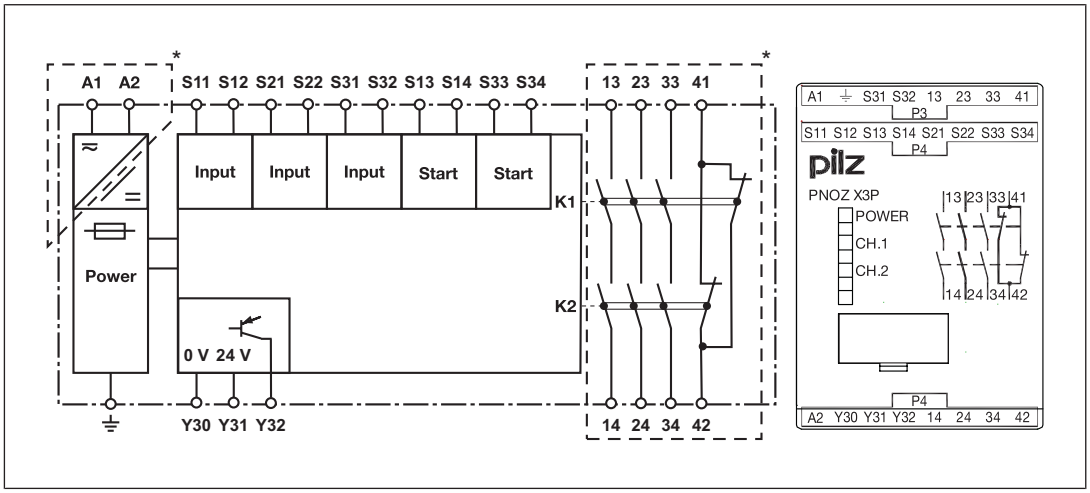
- U_B: 24 VAC/DC; Order no. 777310, 787310



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Type: 24-240 VAC/DC

- U_B: 24-240 VAC/DC; Order no. 777313, 787313



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X3P

Function Description

The safety relay PNOZ X3P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S13-S14 is closed.

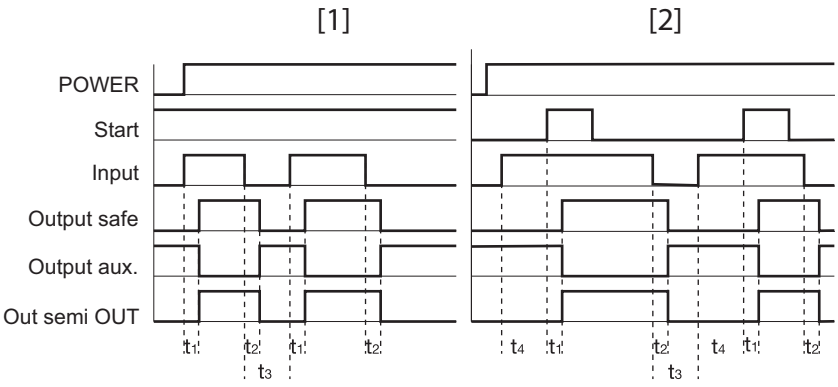
- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
  - The LEDs "CH.1" and "CH.2" are lit.
  - A high signal is present at the semiconductor output switch state Y32.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.
  - The LEDs "CH.1" and "CH.2" go out.
  - A low signal is present at the semiconductor output switch state Y32.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X3P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [📖 133]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ X3P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Out semi OUT: Semiconductor output switch state
- [1]: Automatic start
- [2]: Monitored start
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time
- t_4: Waiting period with a monitored start

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X3P

Wiring

Please note:

- Information given in the "Technical details [📖 133]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- Do not connect undesignated terminals.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit)
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 133]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 133])
R_l / km = cable resistance/km

- Use copper wire that can withstand 60/75 °C.
- Do not switch low currents using contacts that have been used previously with high currents.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- On 24 VAC/DC units:
  The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

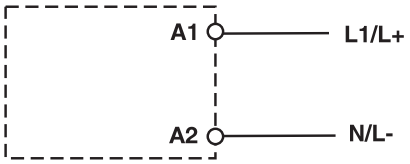
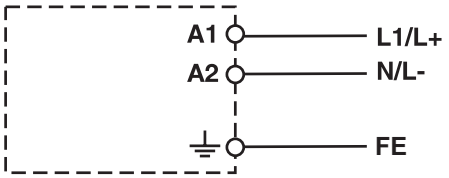
Important for detection of shorts across contacts:

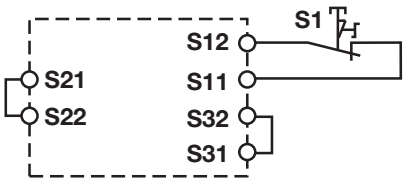
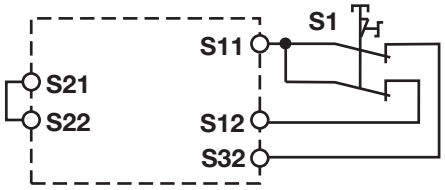
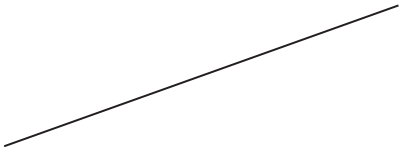
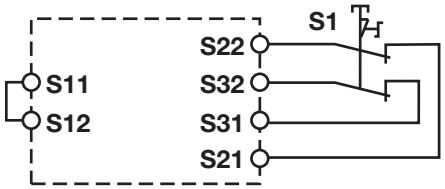
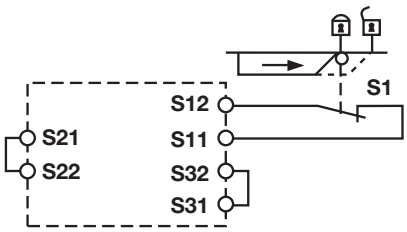
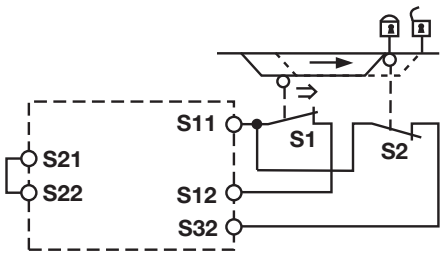
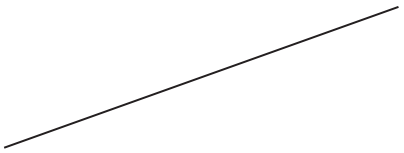
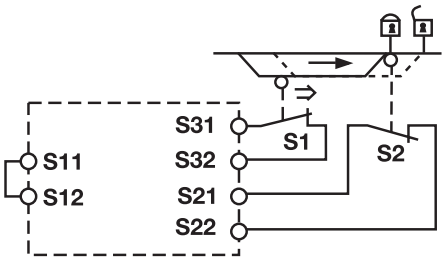
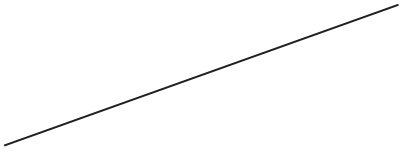
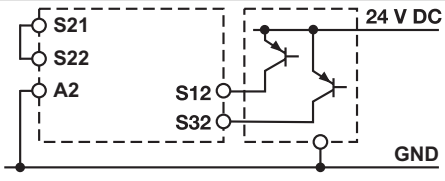
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

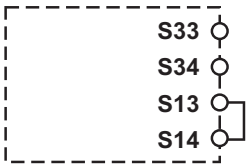
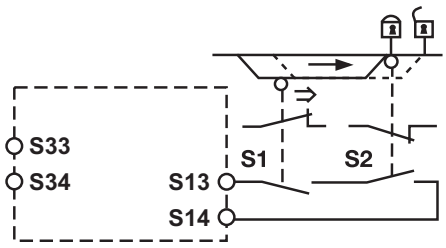
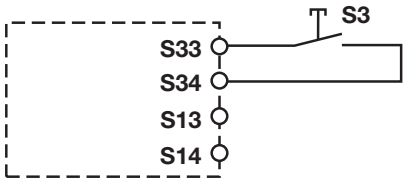
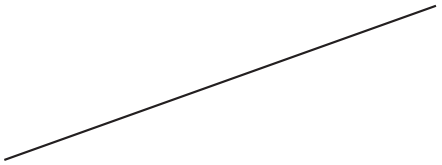
Safety relays PNOZ X
PNOZ X3P

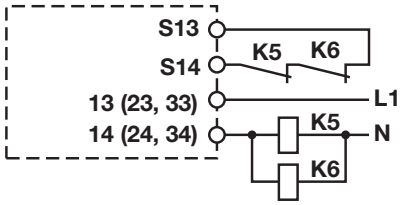
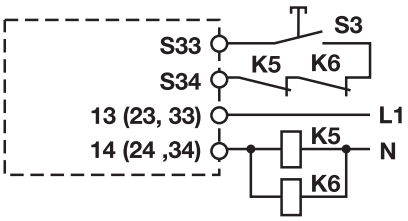
Preparing for operation

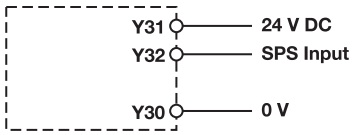
Supply voltage	24 VAC/DC	24 - 240 V AC/DC
		

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 guard or safety switch, detection of shorts across contacts via ESPE (only for units with U_B = 24 VDC)		

Safety relays PNOZ X
PNOZ X3P

Start circuit	E-STOP wiring Safety gate without start-up test	Safety gate with start-up test
Automatic start		
Monitored start		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

Semiconductor output


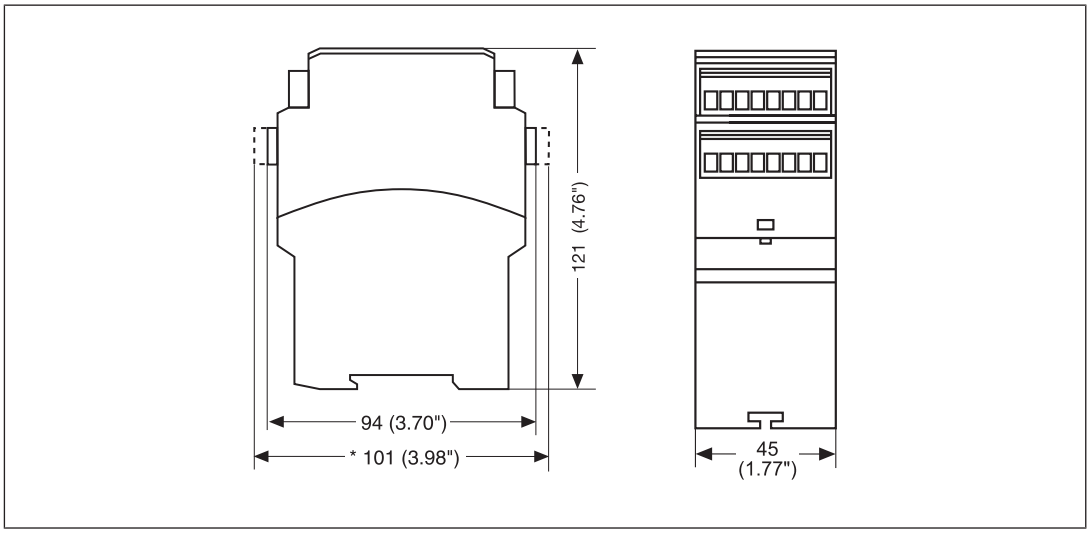
Legend

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

Safety relays PNOZ X
PNOZ X3P

Dimensions in mm

* With spring-loaded terminals



Technical details

Order no. 777310 – 777313

See below for more order numbers

General	777310	777313
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**777310**	**777313**
Supply voltage		
Voltage	24 V	24 - 240 V
Kind	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	5 VA	5 VA
Output of external power supply (DC)	2,5 W	2,5 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	1,7 A	–
Pulse duration, A1	1,5 ms	–
Inputs	**777310**	**777313**
Number	2	2

Safety relays PNOZ X
PNOZ X3P

Inputs	777310	777313
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**40 mA**	**35 mA**
Start circuit DC	**70 mA**	**50 mA**
Feedback loop DC	**20 mA**	**20 mA**
Min. input resistance at power-on	**90 Ohm**	**90 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**150 Ohm**	**200 Ohm**
Single-channel at UB AC	**180 Ohm**	**200 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**300 Ohm**	**400 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**360 Ohm**	**400 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	**30 Ohm**
Semiconductor outputs	**777310**	**777313**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777310**	**777313**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PNOZ X3P

Relay outputs	777310	777313
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**6 A**	**6 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**6 A**	**6 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PNOZ X3P

Relay outputs	777310	777313
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777310**	**777313**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**7 A**
Conv. therm. current with 3 contacts	**7 A**	**6 A**

Safety relays PNOZ X
PNOZ X3P

Times	777310	777313
Switch-on delay		
With automatic start typ.	**250 ms**	**330 ms**
With automatic start max.	**500 ms**	**450 ms**
With automatic start after power on typ.	**280 ms**	**750 ms**
With automatic start after power on max.	**550 ms**	**1.000 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**25 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**50 ms**	–
With power failure max.	**70 ms**	–
With power failure typ. UB 240 V	–	**1500 ms**
With power failure max. UB 240 V	–	**2200 ms**
With power failure typ. UB 24 V	–	**150 ms**
With power failure max. UB 24 V	–	**180 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**100 ms**	**200 ms**
After power failure on wide-range power supply	–	**2250 ms**
Waiting period with a monitored start	**300 ms**	**200 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777310**	**777313**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-20 - 55 °C**	**-20 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1**

Safety relays PNOZ X
PNOZ X3P

Environmental data	777310	777313
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777310**	**777313**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**
Dimensions		
Height	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**270 g**	**310 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X3P

Order no. 787310 – 787313

General	787310	787313
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**787310**	**787313**
Supply voltage		
Voltage	**24 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5 VA**	**5 VA**
Output of external power supply (DC)	**2,5 W**	**2,5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	–
Pulse duration, A1	**1,5 ms**	–
Inputs	**787310**	**787313**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**40 mA**	**35 mA**
Start circuit DC	**70 mA**	**50 mA**
Feedback loop DC	**20 mA**	**20 mA**
Min. input resistance at power-on	**90 Ohm**	**90 Ohm**

Safety relays PNOZ X
PNOZ X3P

Inputs	787310	787313
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**150 Ohm**	**200 Ohm**
Single-channel at UB AC	**180 Ohm**	**200 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**300 Ohm**	**400 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**360 Ohm**	**400 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	**30 Ohm**
Semiconductor outputs	**787310**	**787313**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**787310**	**787313**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X3P

Relay outputs	787310	787313
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**6 A**	**6 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**6 A**	**6 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X3P

Relay outputs	787310	787313
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787310**	**787313**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**7 A**
Conv. therm. current with 3 contacts	**7 A**	**6 A**
Times	**787310**	**787313**
Switch-on delay		
With automatic start typ.	**250 ms**	**330 ms**
With automatic start max.	**500 ms**	**450 ms**
With automatic start after power on typ.	**280 ms**	**750 ms**
With automatic start after power on max.	**550 ms**	**1.000 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**50 ms**	**50 ms**

Safety relays PNOZ X
PNOZ X3P

Times	787310	787313
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**25 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**50 ms**	–
With power failure max.	**70 ms**	–
With power failure typ. UB 240 V	–	**1500 ms**
With power failure max. UB 240 V	–	**2200 ms**
With power failure typ. UB 24 V	–	**150 ms**
With power failure max. UB 24 V	–	**180 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**100 ms**	**200 ms**
After power failure on wide-range power supply	–	**2250 ms**
Waiting period with a monitored start	**300 ms**	**200 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787310**	**787313**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-20 - 55 °C**	**-20 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**

Safety relays PNOZ X
PNOZ X3P

Environmental data	787310	787313
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787310**	**787313**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**270 g**	**310 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

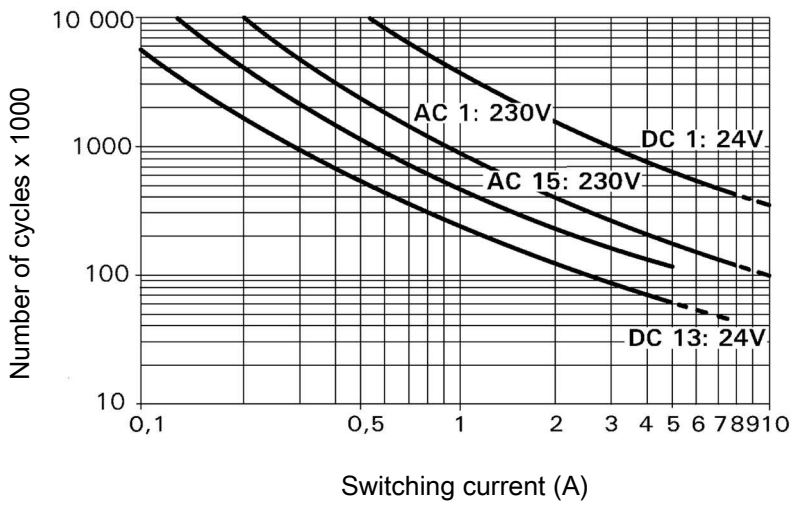
Safety relays PNOZ X
PNOZ X3P

Supplementary data

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.

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 to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

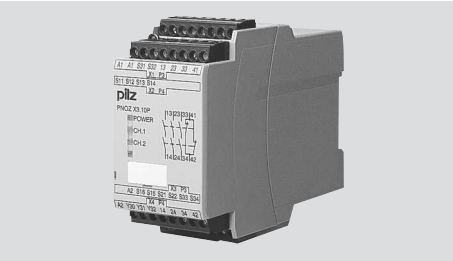
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ X3P

Order reference

Product type	Features	Connection type	Order no.
PNOZ X3P	24 VAC/DC	Screw terminals	777 310
PNOZ X3P C	24 VAC/DC	Spring-loaded terminals	787 310
PNOZ X3P	24 - 240 V AC/DC	Screw terminals	777 313
PNOZ X3P C	24 - 240 V AC/DC	Spring-loaded terminals	787 313

Safety relays PNOZ X
PNOZ X3.10P

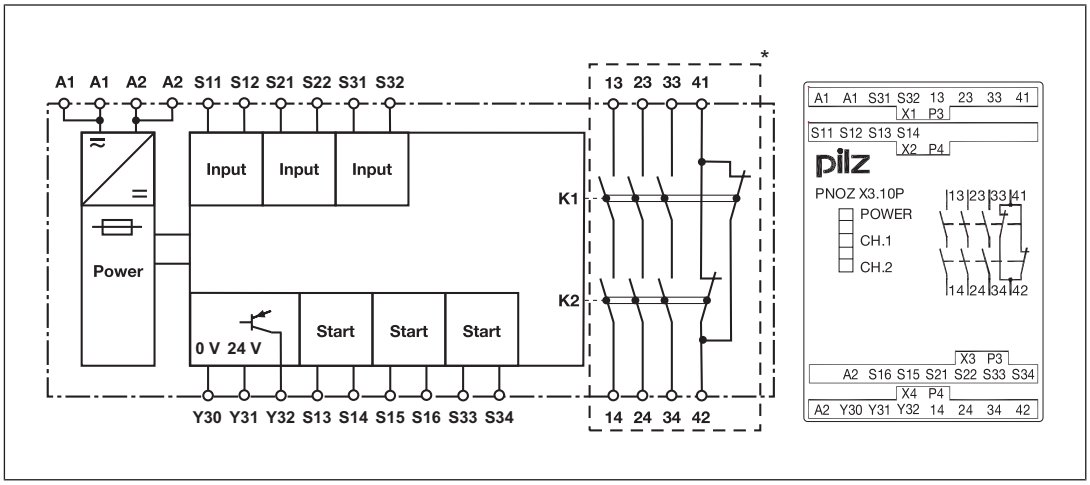


Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start button
  - Light guards and safety switches
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Semiconductor output signals:
  - Switch state of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X3.10P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X3.10P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the start circuit S13-S14 is closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contact 41-42 is open. The unit is active.
  - The LEDs "CH.1" and "CH.2" are lit.
  - A high signal is present at the semiconductor output switch state Y32.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.
  - The LEDs "CH.1" and "CH.2" go out.
  - A low signal is present at the semiconductor output switch state Y32.

Operating modes

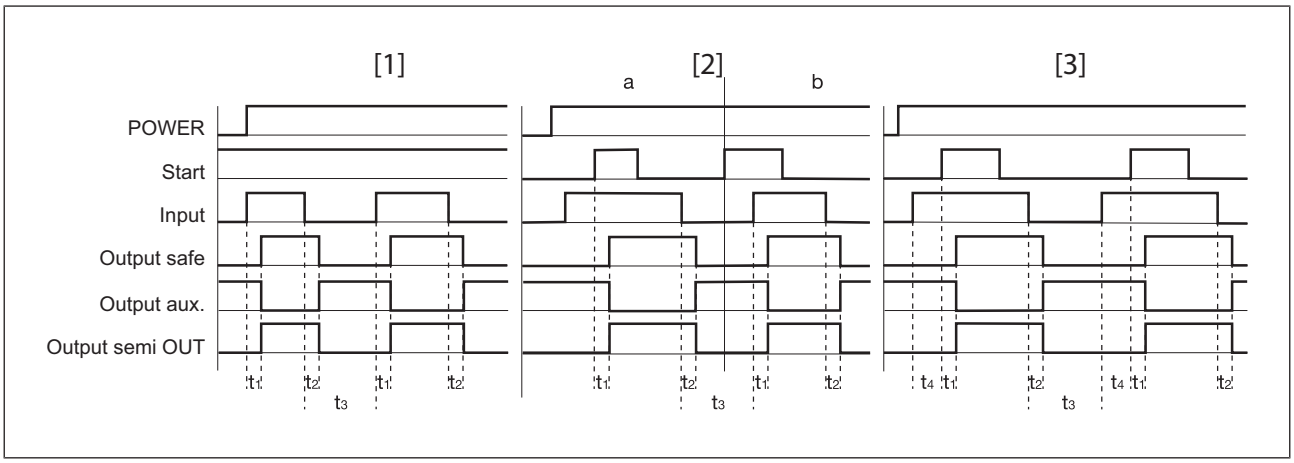
- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X3.10P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,

Safety relays PNOZ X
PNOZ X3.10P

– shorts across contacts in the input circuit.

- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [📖 154]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Out semi OUT: Semiconductor output switch state
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time
- t_4: Waiting period with a monitored start

Safety relays PNOZ X
PNOZ X3.10P

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [154]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- Do not connect undesignated terminals.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit) and link between S15-S16 (safety gate with start-up test)
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [154]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [154])
R_l / km = cable resistance/km

- Use copper wire that can withstand 60/75 °C.
- Do not switch low currents using contacts that have been used previously with high currents.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Important for detection of shorts across contacts:

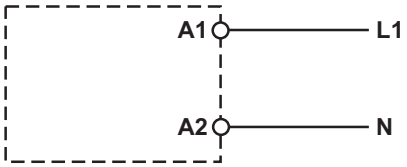
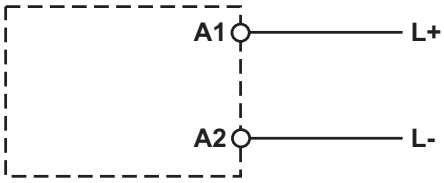
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

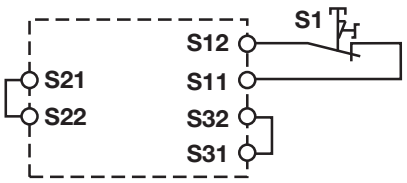
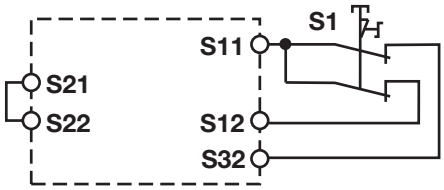
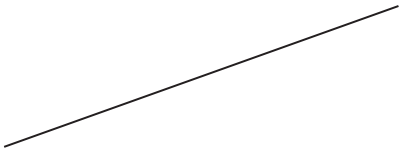
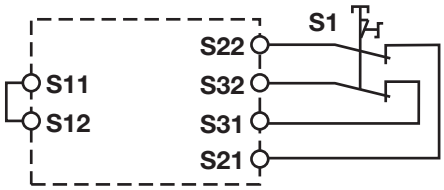
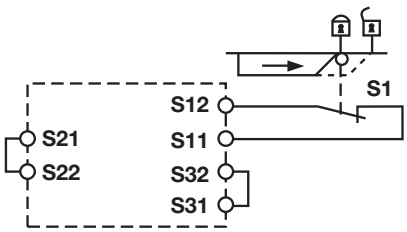
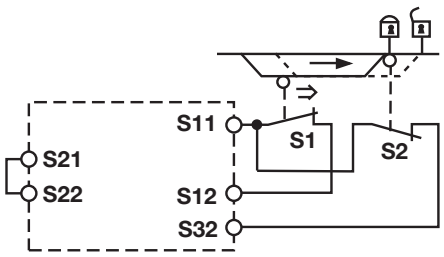
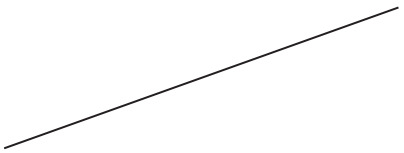
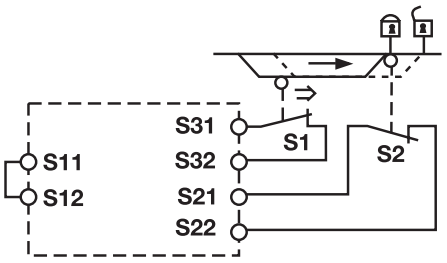
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.

Safety relays PNOZ X
PNOZ X3.10P

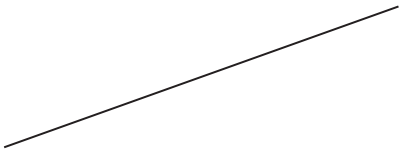
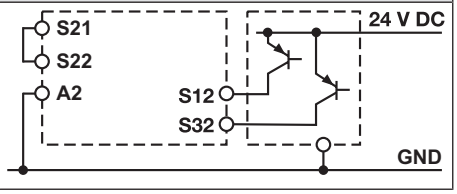
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

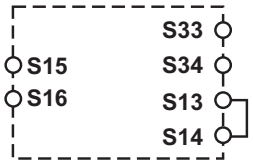
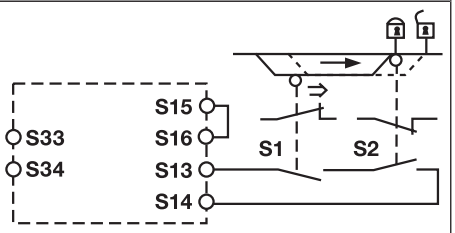
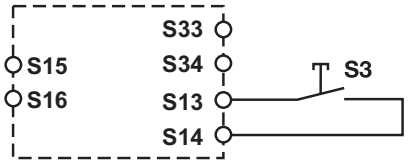
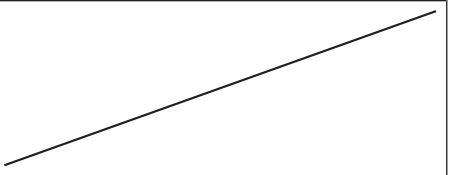
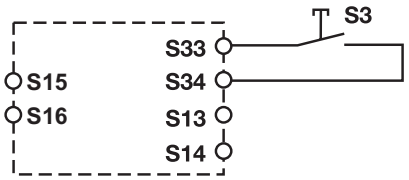
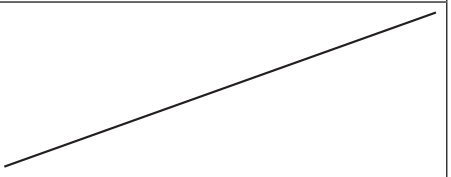
Preparing for operation

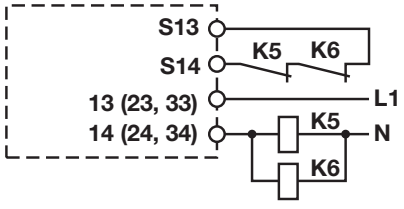
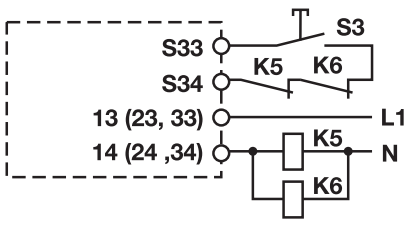
Supply voltage	AC	DC
		

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		

Safety relays PNOZ X
PNOZ X3.10P

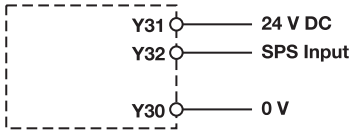
Input circuit	Single-channel	Dual-channel
Light guard or safety switch, detection of shorts across contacts via ESPE		

Start circuit	E-STOP wiring Safety gate without start-up test	Safety gate (dual-channel) with start-up test
Automatic start		
Manual start		
Monitored start		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

Safety relays PNOZ X
PNOZ X3.10P

Semiconductor output

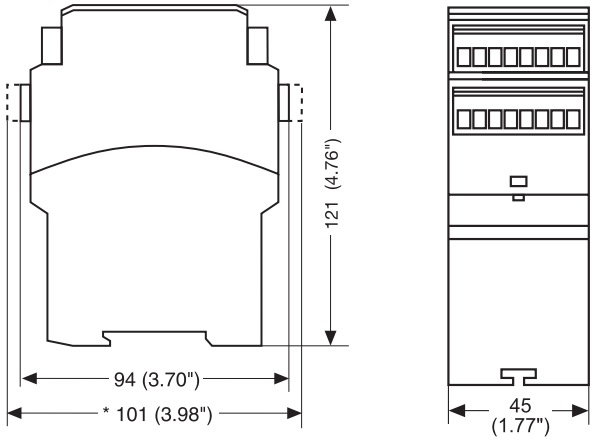


Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X3.10P

Technical details

General	777314	787314
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777314**	**787314**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5 VA**	**5 VA**
Output of external power supply (DC)	**2,5 W**	**2,5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	**1,7 A**
Pulse duration, A1	**7 ms**	**7 ms**
Inputs	**777314**	**787314**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**40 mA**	**40 mA**
Start circuit DC	**70 mA**	**70 mA**
Feedback loop DC	**20 mA**	**20 mA**
Min. input resistance at power-on	**90 Ohm**	**90 Ohm**

Safety relays PNOZ X
PNOZ X3.10P

Inputs	777314	787314
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**150 Ohm**	**150 Ohm**
Single-channel at UB AC	**180 Ohm**	**180 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**300 Ohm**	**300 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**360 Ohm**	**360 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	**30 Ohm**
Semiconductor outputs	**777314**	**787314**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777314**	**787314**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X3.10P

Relay outputs	777314	787314
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**6 A**	**6 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**6 A**	**6 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X3.10P

Relay outputs	777314	787314
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777314**	**787314**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**7 A**	**7 A**
Times	**777314**	**787314**
Switch-on delay		
With automatic start typ.	**250 ms**	**250 ms**
With automatic start max.	**500 ms**	**500 ms**
With automatic start after power on typ.	**280 ms**	**280 ms**
With automatic start after power on max.	**550 ms**	**550 ms**
With manual start typ.	**200 ms**	**200 ms**
With manual start max.	**500 ms**	**500 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**50 ms**	**50 ms**

Safety relays PNOZ X
PNOZ X3.10P

Times	777314	787314
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**180 ms**	**180 ms**
With power failure max.	**260 ms**	**260 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**350 ms**	**350 ms**
Waiting period with a monitored start	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**150 ms**	**150 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777314**	**787314**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-20 - 55 °C**	**-20 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**

Safety relays PNOZ X
PNOZ X3.10P

Mechanical data	777314	787314
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**290 g**	**290 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X3.10P

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

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

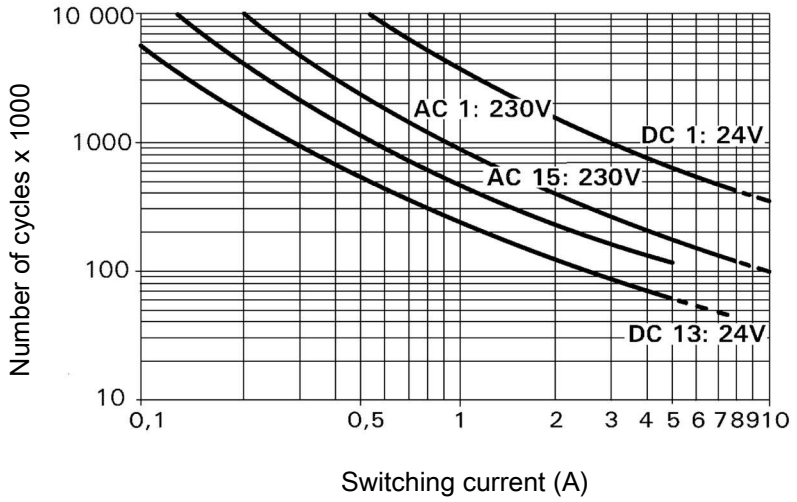
Supplementary data

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.

Safety relays PNOZ X
PNOZ X3.10P

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

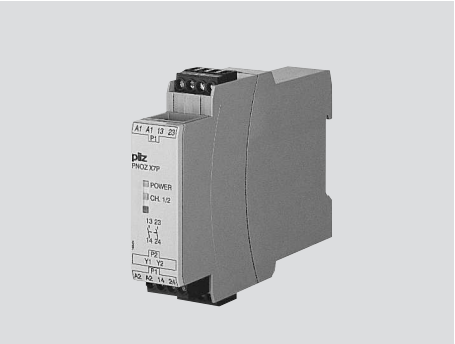
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X3.10P C	24 VAC/DC	Spring-loaded terminals	787 314
PNOZ X3.10P	24 VAC/DC	Screw terminals	777 314

Safety relays PNOZ X
PNOZ X7P



Unit features

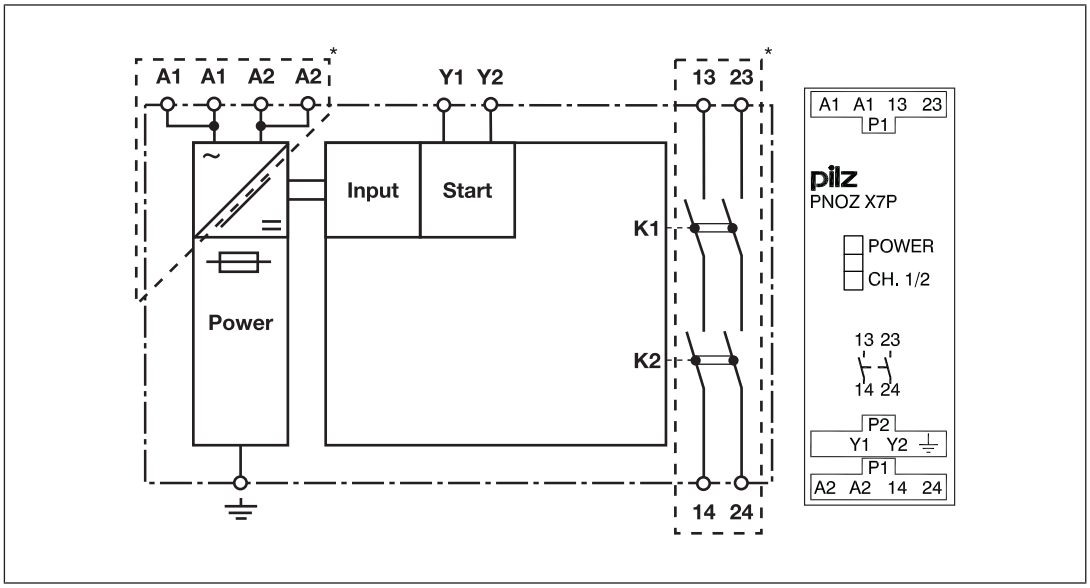
- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals
- See order reference for unit types

Safety relays PNOZ X
PNOZ X7P

Block diagram/terminal configuration

Types: AC

- U_B: 110 - 120 VAC; Order no. 777053, 787053
- U_B: 230 - 240 VAC; Order no. 777056, 787056

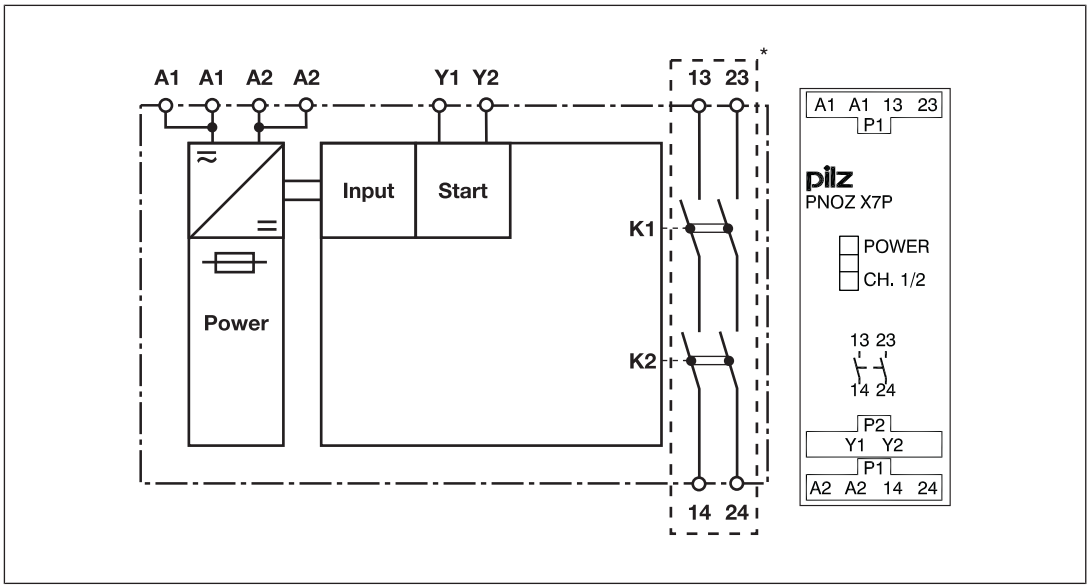


*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X7P

Types: AC/DC

- U_B: 24 VAC/DC; Order no. 777059, 787059



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X7P provides a safety-oriented interruption of a safety circuit. When the supply voltage is applied via the E-STOP pushbutton, the “POWER” LED is lit. The unit is ready for operation when the start circuit and feedback loop Y1-Y2 is closed.

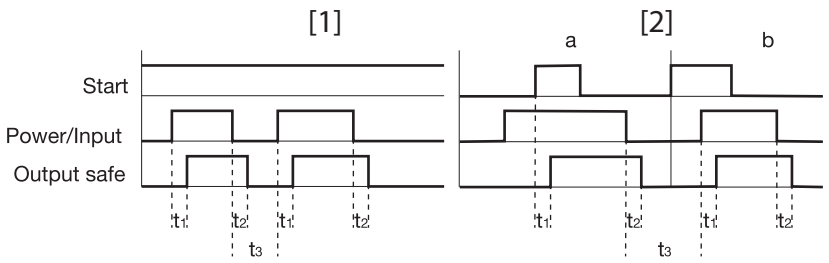
- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The LED "CH. 1/2" lights.
  - Safety contacts 13-14 and 23-24 are closed. The unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LED "CH. 1/2" goes out.
  - Safety contacts 13-14 and 23-24 are redundantly opened.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ X7P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- [1]: Automatic start
- [2]: Manual start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X7P

Wiring

Please note:

- Information given in the "Technical details [168]" must be followed.
- Calculating the max. cable length I_{max} in the input circuit on PNOZ X7P 24 VAC/DC:

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

R_{lmax} = max. overall cable resistance (see Technical details [168])
R_l / km = cable resistance/km

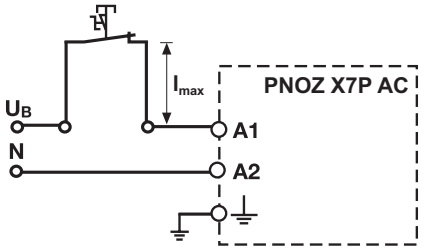
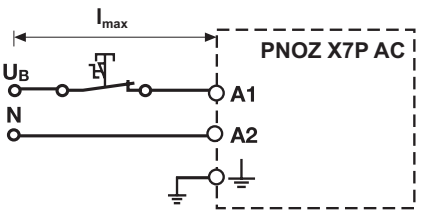
- Calculating the max. cable length I_{max} in the input circuit on PNOZ X7P AC units:

$$I_{max} = \frac{C_{lmax}}{C_l / km}$$

C_{lmax} = max. overall line capacitance (see Technical details [168])
C_l / km = line capacitance/km

Stub circuit: The max. permitted cable length I_{max} depends on the max. overall line capacitance C_{lmax} (see Technical details [168]).

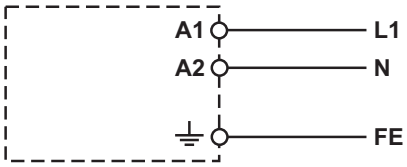
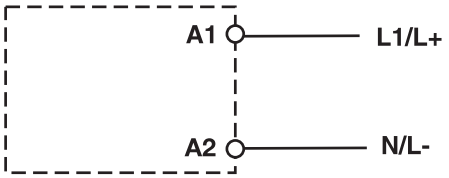
Alternative: Loop circuit: Capacitance is negligible; 1 phase: Max. cable length I_{max}: 1 km

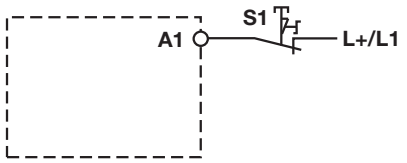
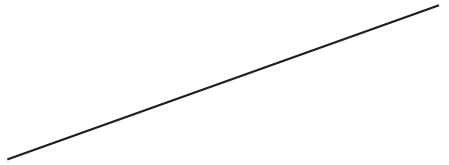
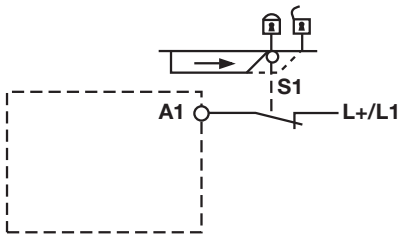
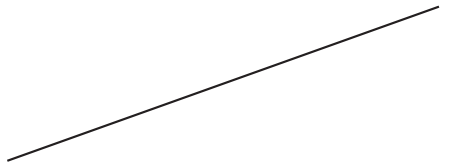
	Stub circuit	Loop circuit
Cable length		

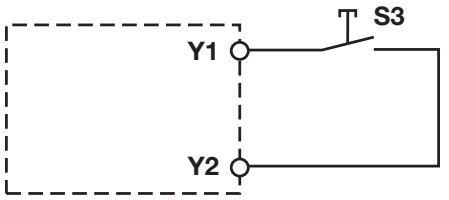
- The outputs 13-14, 23-24 are safety contacts.
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [168]).
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- On AC units: Connect operational earth terminal to functional earth.
- On 24 VAC/DC units:
  The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

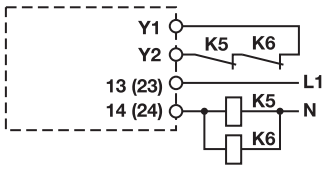
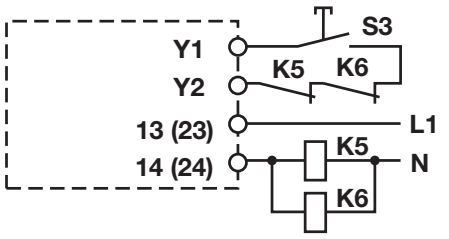
Safety relays PNOZ X
PNOZ X7P

Preparing for operation

Supply voltage	AC	24 VAC/DC
		

Input circuit	Single-channel	Dual-channel
E-STOP		
Safety gate		

Start circuit	Automatic start	Manual start
		

Feedback loop	Automatic start	Manual start
Contacts from external contactors		

Legend

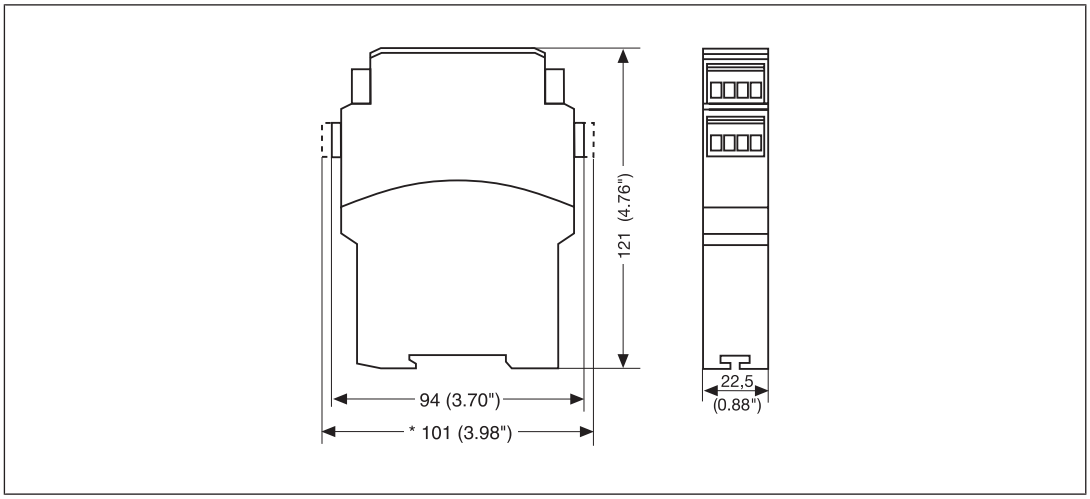
- S1: E-STOP/safety gate switch
- S3: Start button
- : Gate open

Safety relays PNOZ X
PNOZ X7P

- : Gate closed

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777053 – 777059

See below for more order numbers

General	777053	777056	777059
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777053**	**777056**	**777059**
Supply voltage			
Voltage	110 - 120 V	230 - 240 V	24 V
Kind	AC	AC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	2 VA	2 VA	3 VA
Output of external power supply (DC)	–	–	1,5 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	–	–	160 %
Duty cycle	100 %	100 %	100 %
Max. inrush current impulse			
Current pulse, A1	–	–	1,7 A
Pulse duration, A1	–	–	8 ms

Safety relays PNOZ X
PNOZ X7P

Inputs	777053	777056	777059
Number	1	1	1
Voltage at			
Input circuit DC	110 - 120 V	230 - 240 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	17 mA	8 mA	50 mA
Start circuit DC	40 mA	40 mA	210 mA
Feedback loop DC	40 mA	40 mA	210 mA
Max. overall cable resistance RImax			
Single-channel at UB DC	–	–	15 Ohm
Single-channel at UB AC	–	–	15 Ohm
Max. overall line capacitance CImax	37 nF	7 nF	–
Relay outputs	**777053**	**777056**	**777059**
Number of output contacts			
Safety contacts (N/O), instantaneous	2	2	2
Max. short circuit current IK	1 kA	1 kA	1 kA
Utilisation category			
In accordance with the standard	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts			
AC1 at	240 V	240 V	240 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	4 A	4 A	6 A
Max. power	1000 VA	1000 VA	1500 VA
DC1 at	24 V	24 V	24 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	4 A	4 A	6 A
Max. power	100 W	100 W	150 W
Utilisation category			
In accordance with the standard	EN 60947-5-1	EN 60947-5-1	EN 60947-5-1

Safety relays PNOZ X
PNOZ X7P

Relay outputs	777053	777056	777059
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**4 A**	**4 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**6 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**4 A**	**4 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**4 A**	**4 A**	**6 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**4 A**	**4 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**4 A**	**4 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
Conventional thermal current	–	–	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777053**	**777056**	**777059**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**4 A**	**4 A**	–
Conv. therm. current with 2 contacts	**3 A**	**3 A**	–

Safety relays PNOZ X
PNOZ X7P

Times	777053	777056	777059
Switch-on delay			
With automatic start typ.	**230 ms**	**230 ms**	**50 ms**
With automatic start max.	**700 ms**	**700 ms**	**150 ms**
With automatic start after power on typ.	**230 ms**	**230 ms**	**50 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**150 ms**
With manual start typ.	**140 ms**	**140 ms**	**35 ms**
With manual start max.	**700 ms**	**700 ms**	**150 ms**
Delay-on de-energisation			
With E-STOP typ.	**70 ms**	**70 ms**	**45 ms**
With E-STOP max.	**100 ms**	**100 ms**	**70 ms**
With power failure typ.	**70 ms**	**70 ms**	**45 ms**
With power failure max.	**100 ms**	**100 ms**	**70 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**120 ms**	**120 ms**	**50 ms**
After power failure	**120 ms**	**120 ms**	**150 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Environmental data	**777053**	**777056**	**777059**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**

Safety relays PNOZ X
PNOZ X7P

Environmental data	777053	777056	777059
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777053**	**777056**	**777059**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**230 g**	**230 g**	**190 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X7P

Order no. 787053 – 787059

General	787053	787056	787059
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787053**	**787056**	**787059**
Supply voltage			
Voltage	**110 - 120 V**	**230 - 240 V**	**24 V**
Kind	**AC**	**AC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**2 VA**	**2 VA**	**3 VA**
Output of external power supply (DC)	–	–	**1,5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	–	–	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	–	–	**1,7 A**
Pulse duration, A1	–	–	**8 ms**
Inputs	**787053**	**787056**	**787059**
Number	**1**	**1**	**1**
Voltage at			
Input circuit DC	**110 - 120 V**	**230 - 240 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**17 mA**	**8 mA**	**50 mA**
Start circuit DC	**40 mA**	**40 mA**	**210 mA**
Feedback loop DC	**40 mA**	**40 mA**	**210 mA**
Max. overall cable resistance RImax			
Single-channel at UB DC	–	–	**15 Ohm**
Single-channel at UB AC	–	–	**15 Ohm**
Max. overall line capacitance CImax	**37 nF**	**7 nF**	–

Safety relays PNOZ X
PNOZ X7P

Relay outputs	787053	787056	787059
Number of output contacts			
Safety contacts (N/O), instantaneous	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**4 A**	**4 A**	**6 A**
Max. power	**1000 VA**	**1000 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**4 A**	**4 A**	**6 A**
Max. power	**100 W**	**100 W**	**150 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**4 A**	**4 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**6 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**4 A**	**4 A**	**6 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**4 A**	**4 A**	**6 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**

Safety relays PNOZ X
PNOZ X7P

Relay outputs	787053	787056	787059
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**4 A**	**4 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**4 A**	**4 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
Conventional thermal current	–	–	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787053**	**787056**	**787059**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**4 A**	**4 A**	–
Conv. therm. current with 2 contacts	**3 A**	**3 A**	–
Times	**787053**	**787056**	**787059**
Switch-on delay			
With automatic start typ.	**230 ms**	**230 ms**	**50 ms**
With automatic start max.	**700 ms**	**700 ms**	**150 ms**
With automatic start after power on typ.	**230 ms**	**230 ms**	**50 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**150 ms**
With manual start typ.	**140 ms**	**140 ms**	**35 ms**
With manual start max.	**700 ms**	**700 ms**	**150 ms**
Delay-on de-energisation			
With E-STOP typ.	**70 ms**	**70 ms**	**45 ms**
With E-STOP max.	**100 ms**	**100 ms**	**70 ms**
With power failure typ.	**70 ms**	**70 ms**	**45 ms**
With power failure max.	**100 ms**	**100 ms**	**70 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**120 ms**	**120 ms**	**50 ms**
After power failure	**120 ms**	**120 ms**	**150 ms**

Safety relays PNOZ X
PNOZ X7P

Times	787053	787056	787059
Supply interruption before de-energisation	20 ms	20 ms	20 ms
Environmental data	**787053**	**787056**	**787059**
Climatic suitability	EN 60068-2-78	EN 60068-2-78	EN 60068-2-78
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**787053**	**787056**	**787059**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Spring-loaded terminal	Spring-loaded terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in	plug-in

Safety relays PNOZ X
PNOZ X7P

Mechanical data	787053	787056	787059
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**	**8 mm**
Dimensions			
Height	**101 mm**	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**225 g**	**225 g**	**190 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

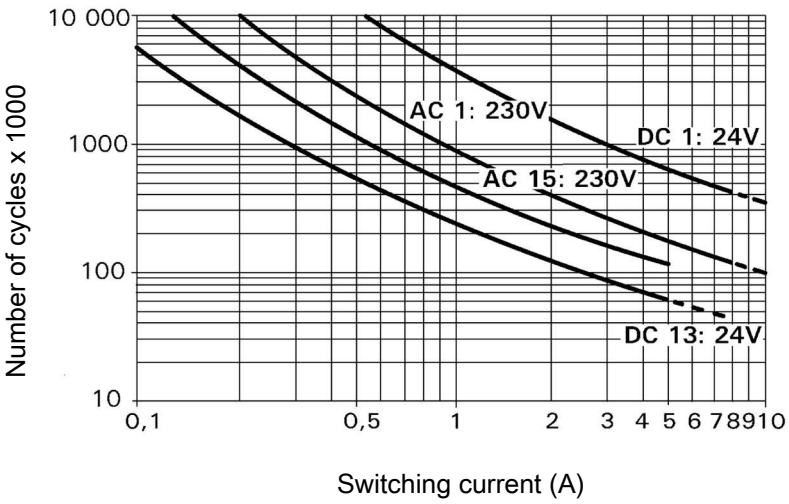
Supplementary data

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.

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.

Safety relays PNOZ X
PNOZ X7P



Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 4 000 000 cycles

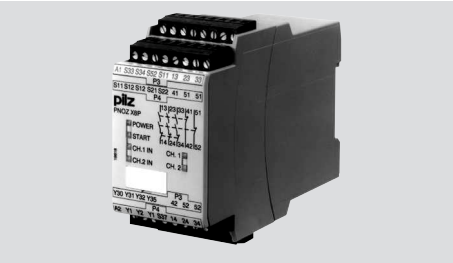
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X7P C	24 VAC/DC	Spring-loaded terminals	787 059
PNOZ X7P	24 VAC/DC	Screw terminals	777 059
PNOZ X7P C	110 - 120 VAC	Spring-loaded terminals	787 053
PNOZ X7P	110 - 120 VAC	Screw terminals	777 053
PNOZ X7P C	230 - 240 VAC	Spring-loaded terminals	787 056
PNOZ X7P	230 - 240 VAC	Screw terminals	777 056

Safety relays PNOZ X
PNOZ X8P



Unit features

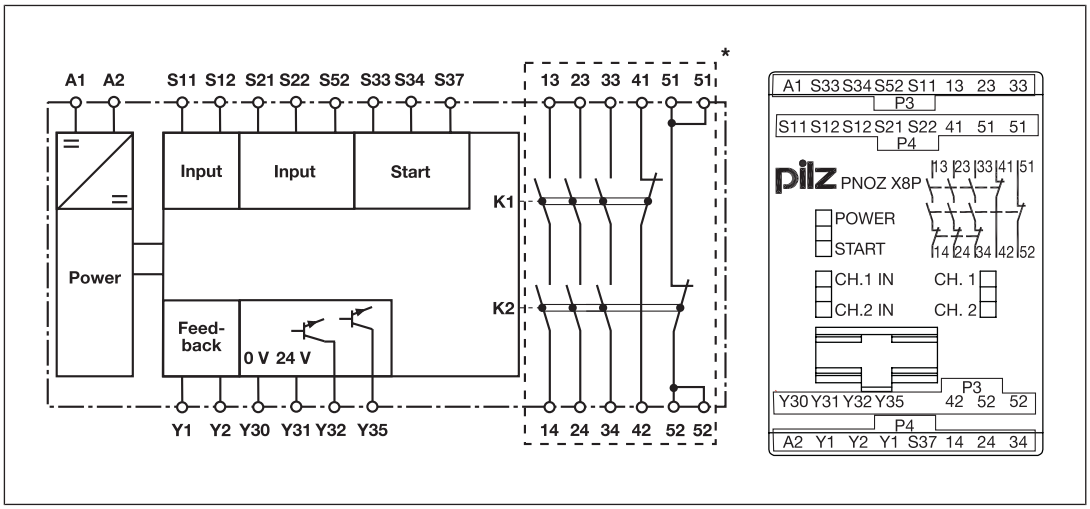
- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 2 auxiliary contacts (N/C), instantaneous
- 2 semiconductor outputs
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start button
  - Light guards and safety switches
- LED indicator for:
  - Supply voltage
  - Input state
  - Switch state of the safety contacts
  - Start circuit
- Semiconductor outputs signal:
  - Supply voltage is present
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X8P

Block diagram/terminal configuration

Types: DC

- U_B: 24 VDC; Order no. 777760, 787760

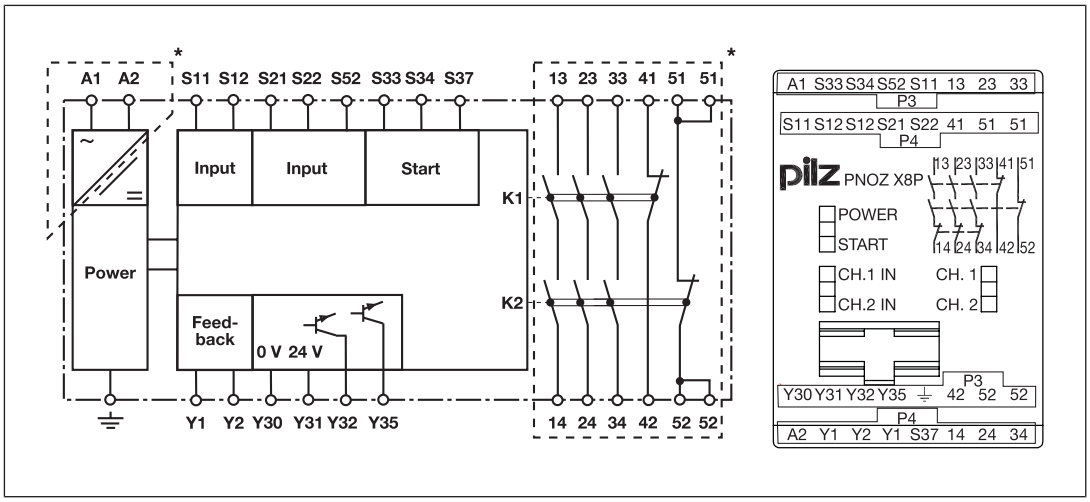


*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X8P

Types: AC

- U_B: 24 VAC; Order no. 777770, 787770
- U_B: 110 VAC; Order no. 777764, 787764
- U_B: 115 VAC; Order no. 777765
- U_B: 120 VAC; Order no. 777766, 787766
- U_B: 230 VAC; Order no. 777768, 787768



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X8P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the feedback loop Y1-Y2 and the start circuit S33-S34 are closed. The "START" LED is lit.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - LEDs "CH1 IN" and "CH2 IN" will light.
  - The "START" LED goes out.
  - Safety contacts 13-14, 23-24 and 33-34 are closed, auxiliary contacts 41-42 and 51-52 are opened. The unit is active.
  - LEDs "CH1" and "CH2" will light.
  - A high signal is present at the semiconductor output switch state Y32.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - LEDs "CH1 IN" and "CH2 IN" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contacts 41-42 and 51-52 are closed.
  - The LEDs "CH1" and "CH2" go out.
  - A low signal is present at the semiconductor output switch state Y32.

Safety relays PNOZ X
PNOZ X8P

Semiconductor output supply voltage Y35

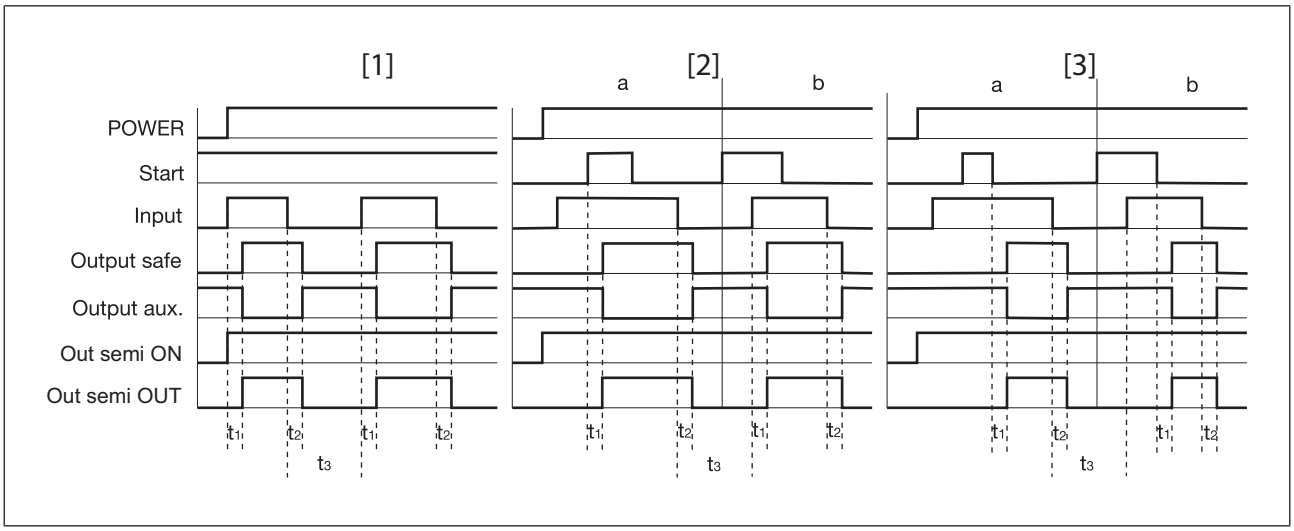
- A high signal is present at semi-conductor output Y35 if the supply voltage is present and the internal fuse has not blown.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X8P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ X8P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ X8P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contacts
- Out semi ON: Semiconductor output supply voltage
- Out semi OUT: Semiconductor output switch state
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X8P

Wiring

Please note:

- Information given in the "Technical details [📖 188]" must be followed.
- Delivery status of units with screw terminals: Link between Y1-Y2 (feedback loop)
- Outputs 13-14, 23-24, 33-34 are safety contacts, outputs 41-42, 51-52 are auxiliary contacts (e.g. for display).
- Do **not** use auxiliary contacts 41-42, 51-52 for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 188]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 188])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

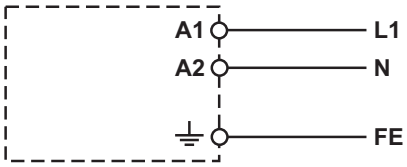
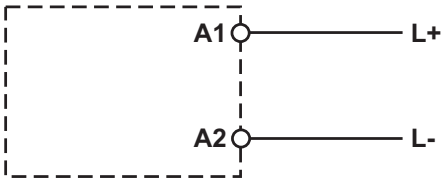
Important for detection of shorts across contacts:

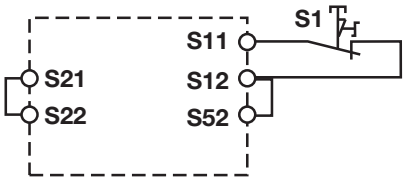
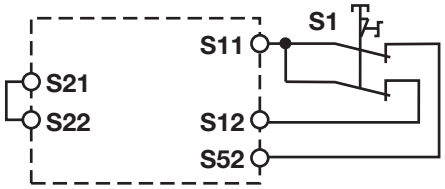
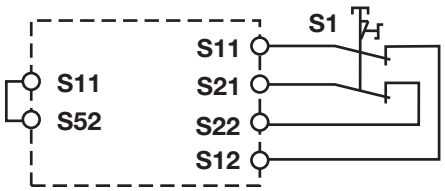
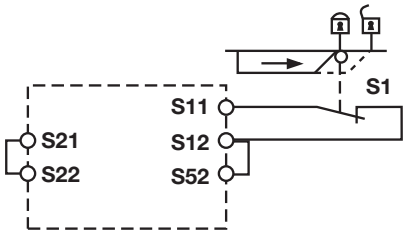
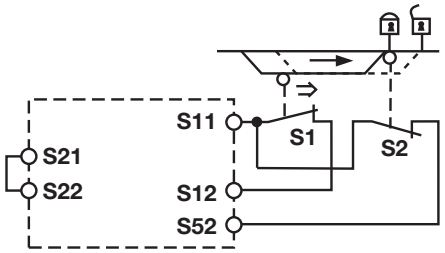
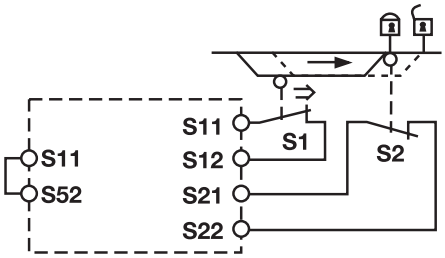
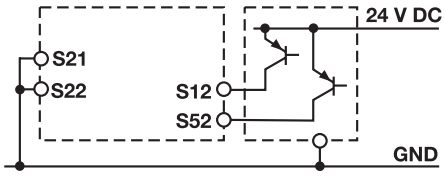
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

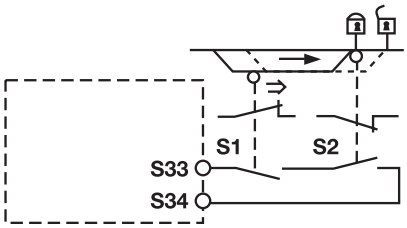
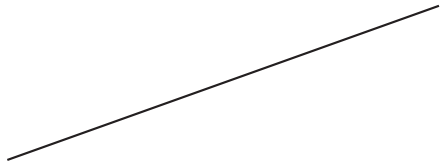
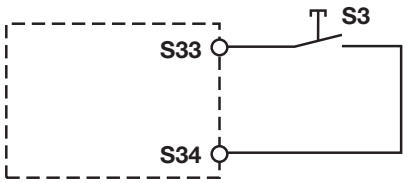
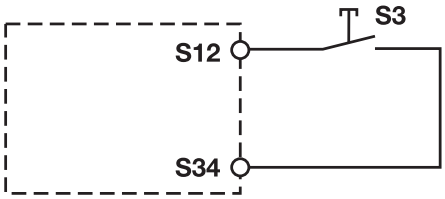
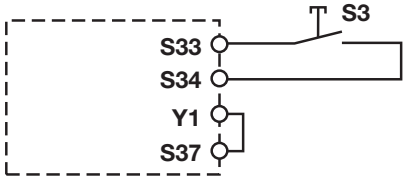
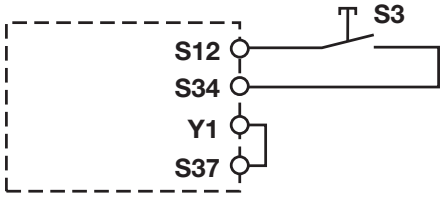
Safety relays PNOZ X
PNOZ X8P

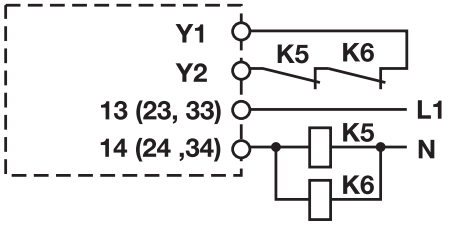
Preparing for operation

Supply voltage	AC	DC
		

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		 Simultaneity S1 and S2: 150 ms
Safety gate **with** detection of shorts across contacts		
Light guard or safety switch, detection of shorts across contacts via ESPE		

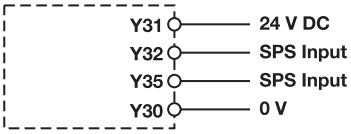
Safety relays PNOZ X
PNOZ X8P

Start circuit	E-STOP/safety gate wiring (single-channel, dual-channel without detection of shorts across contacts)	E-STOP/safety gate wiring (dual-channel with detection of shorts across contacts)
Automatic start		
Automatic start with start-up test		
Manual start		
Monitored start		

Feedback loop	without feedback loop monitoring	with feedback loop monitoring
Link or contacts from external contactors		

Safety relays PNOZ X
PNOZ X8P

Semiconductor output

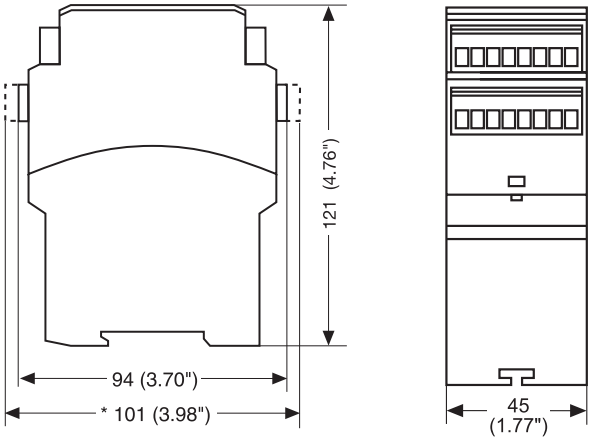


Legend

- S1: E-STOP pushbuttons
- S3: Start button
- : Switch operated
- : Gate open
- : Gate closed

Dimensions in mm

* With spring-loaded terminals



Safety relays PNOZ X
PNOZ X8P

Technical details Order no. 777760-777765

General	777760	777764	777765
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777760**	**777764**	**777765**
Supply voltage			
Voltage	**24 V**	**110 V**	**115 V**
Kind	**DC**	**AC**	**AC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	**6,5 VA**	**6,5 VA**
Output of external power supply (DC)	**2,5 W**	–	–
Frequency range AC	–	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	–	–
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**10 A**	–	–
Pulse duration, A1	**0,5 ms**	–	–
Inputs	**777760**	**777764**	**777765**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**45 mA**	**40 mA**	**40 mA**
Start circuit DC	**50 mA**	**60 mA**	**60 mA**
Feedback loop DC	**50 mA**	**60 mA**	**60 mA**
Min. input resistance at power-on	**89 Ohm**	**89 Ohm**	**89 Ohm**

Safety relays PNOZ X
PNOZ X8P

Inputs	777760	777764	777765
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**100 Ohm**	–	–
Single-channel at UB AC	–	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**200 Ohm**	–	–
Dual-channel without detection of shorts across contacts at UB AC	–	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**16 Ohm**	–	–
Dual-channel with detection of shorts across contacts at UB AC	–	**28 Ohm**	**28 Ohm**
Semiconductor outputs	**777760**	**777764**	**777765**
Number	**2**	**2**	**2**
Voltage	**24 V**	**24 V**	**24 V**
Current	**50 mA**	**50 mA**	**50 mA**
External supply voltage	**24 V**	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777760**	**777764**	**777765**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Auxiliary contacts (N/C)	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	777760	777764	777765
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	777760	777764	777765
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777760**	**777764**	**777765**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	–	**8 A**	**8 A**
Conv. therm. current with 2 contacts	–	**7,3 A**	**7,3 A**
Conv. therm. current with 3 contacts	–	**6 A**	**6 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	–	–
Conv. therm. current with 2 contacts	**8 A**	–	–
Conv. therm. current with 3 contacts	**7 A**	–	–

Safety relays PNOZ X
PNOZ X8P

Times	777760	777764	777765
Switch-on delay			
With automatic start typ.	**160 ms**	**175 ms**	**175 ms**
With automatic start max.	**200 ms**	**220 ms**	**220 ms**
With automatic start after power on typ.	**185 ms**	**200 ms**	**200 ms**
With automatic start after power on max.	**220 ms**	**250 ms**	**250 ms**
With manual start typ.	**190 ms**	**190 ms**	**190 ms**
With manual start max.	**250 ms**	**250 ms**	**250 ms**
With monitored start typ.	**130 ms**	**130 ms**	**130 ms**
With monitored start max.	**180 ms**	**180 ms**	**180 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**100 ms**	**160 ms**	**160 ms**
With power failure max.	**200 ms**	**220 ms**	**220 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms**	**50 ms**	**50 ms**
After power failure	**180 ms**	**250 ms**	**250 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**35 ms**	**35 ms**	**35 ms**
Environmental data	**777760**	**777764**	**777765**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**

Safety relays PNOZ X
PNOZ X8P

Environmental data	777760	777764	777765
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777760**	**777764**	**777765**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**

Safety relays PNOZ X
PNOZ X8P

Mechanical data	777760	777764	777765
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**315 g**	**415 g**	**415 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Technical details Order no. 777766-777770

General	777766	777768	777770
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777766**	**777768**	**777770**
Supply voltage			
Voltage	**120 V**	**230 V**	**24 V**
Kind	**AC**	**AC**	**AC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**6,5 VA**	**6,5 VA**	**6,5 VA**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**	**50 - 60 Hz**
Duty cycle	**100 %**	**100 %**	**100 %**
Inputs	**777766**	**777768**	**777770**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**40 mA**	**40 mA**	**40 mA**
Start circuit DC	**60 mA**	**60 mA**	**60 mA**
Feedback loop DC	**60 mA**	**60 mA**	**60 mA**
Min. input resistance at power-on	**89 Ohm**	**89 Ohm**	**89 Ohm**

Safety relays PNOZ X
PNOZ X8P

Inputs	777766	777768	777770
Max. overall cable resistance Rlmax			
Single-channel at UB AC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**200 Ohm**	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**28 Ohm**	**28 Ohm**	**28 Ohm**
Semiconductor outputs	**777766**	**777768**	**777770**
Number	**2**	**2**	**2**
Voltage	**24 V**	**24 V**	**24 V**
Current	**50 mA**	**50 mA**	**50 mA**
External supply voltage	**24 V**	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777766**	**777768**	**777770**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Auxiliary contacts (N/C)	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	777766	777768	777770
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	777766	777768	777770
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777766**	**777768**	**777770**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,3 A**	**7,3 A**	**7,3 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**	**6 A**
Times	**777766**	**777768**	**777770**
Switch-on delay			
With automatic start typ.	**175 ms**	**175 ms**	**175 ms**
With automatic start max.	**220 ms**	**220 ms**	**220 ms**
With automatic start after power on typ.	**200 ms**	**200 ms**	**200 ms**
With automatic start after power on max.	**250 ms**	**250 ms**	**250 ms**
With manual start typ.	**190 ms**	**190 ms**	**190 ms**
With manual start max.	**250 ms**	**250 ms**	**250 ms**
With monitored start typ.	**130 ms**	**130 ms**	**130 ms**
With monitored start max.	**180 ms**	**180 ms**	**180 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**160 ms**	**160 ms**	**160 ms**
With power failure max.	**220 ms**	**220 ms**	**220 ms**

Safety relays PNOZ X
PNOZ X8P

Times	777766	777768	777770
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms**	**50 ms**	**50 ms**
After power failure	**250 ms**	**250 ms**	**250 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**35 ms**	**35 ms**	**35 ms**
Environmental data	**777766**	**777768**	**777770**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777766**	**777768**	**777770**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZ X
PNOZ X8P

Mechanical data	777766	777768	777770
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**415 g**	**415 g**	**415 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X8P

Technical details Order no. 787760-787766

General	787760	787764	787766
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**787760**	**787764**	**787766**
Supply voltage			
Voltage	**24 V**	**110 V**	**120 V**
Kind	**DC**	**AC**	**AC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	**6,5 VA**	**6,5 VA**
Output of external power supply (DC)	**2,5 W**	–	–
Frequency range AC	–	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	–	–
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**10 A**	–	–
Pulse duration, A1	**0,5 ms**	–	–
Inputs	**787760**	**787764**	**787766**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**45 mA**	**40 mA**	**40 mA**
Start circuit DC	**50 mA**	**60 mA**	**60 mA**
Feedback loop DC	**50 mA**	**60 mA**	**60 mA**
Min. input resistance at power-on	**89 Ohm**	**89 Ohm**	**89 Ohm**

Safety relays PNOZ X
PNOZ X8P

Inputs	787760	787764	787766
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**100 Ohm**	–	–
Single-channel at UB AC	–	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**200 Ohm**	–	–
Dual-channel without detection of shorts across contacts at UB AC	–	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**16 Ohm**	–	–
Dual-channel with detection of shorts across contacts at UB AC	–	**28 Ohm**	**28 Ohm**
Semiconductor outputs	**787760**	**787764**	**787766**
Number	**2**	**2**	**2**
Voltage	**24 V**	**24 V**	**24 V**
Current	**50 mA**	**50 mA**	**50 mA**
External supply voltage	**24 V**	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**787760**	**787764**	**787766**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Auxiliary contacts (N/C)	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	787760	787764	787766
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	787760	787764	787766
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787760**	**787764**	**787766**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	–	**8 A**	**8 A**
Conv. therm. current with 2 contacts	–	**7,3 A**	**7,3 A**
Conv. therm. current with 3 contacts	–	**6 A**	**6 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	–	–
Conv. therm. current with 2 contacts	**8 A**	–	–
Conv. therm. current with 3 contacts	**7 A**	–	–

Safety relays PNOZ X
PNOZ X8P

Times	787760	787764	787766
Switch-on delay			
With automatic start typ.	**160 ms**	**175 ms**	**175 ms**
With automatic start max.	**200 ms**	**220 ms**	**220 ms**
With automatic start after power on typ.	**185 ms**	**200 ms**	**200 ms**
With automatic start after power on max.	**220 ms**	**250 ms**	**250 ms**
With manual start typ.	**190 ms**	**190 ms**	**190 ms**
With manual start max.	**250 ms**	**250 ms**	**250 ms**
With monitored start typ.	**130 ms**	**130 ms**	**130 ms**
With monitored start max.	**180 ms**	**180 ms**	**180 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**100 ms**	**160 ms**	**160 ms**
With power failure max.	**200 ms**	**220 ms**	**220 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms**	**50 ms**	**50 ms**
After power failure	**180 ms**	**250 ms**	**250 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**35 ms**	**35 ms**	**35 ms**
Environmental data	**787760**	**787764**	**787766**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**

Safety relays PNOZ X
PNOZ X8P

Environmental data	787760	787764	787766
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**787760**	**787764**	**787766**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Cage clamp terminal**	**Cage clamp terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**	**8 mm**
Dimensions			
Height	**101 mm**	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**315 g**	**415 g**	**415 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X8P

Technical details Order no. 787768-787770

General	787768	787770
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**787768**	**787770**
Supply voltage		
Voltage	230 V	24 V
Kind	AC	AC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	6,5 VA	6,5 VA
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Duty cycle	100 %	100 %
Inputs	**787768**	**787770**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	40 mA	40 mA
Start circuit DC	60 mA	60 mA
Feedback loop DC	60 mA	60 mA
Min. input resistance at power-on	89 Ohm	89 Ohm
Max. overall cable resistance Rl-max		
Single-channel at UB AC	100 Ohm	100 Ohm
Dual-channel without detection of shorts across contacts at UB AC	200 Ohm	200 Ohm
Dual-channel with detection of shorts across contacts at UB AC	28 Ohm	28 Ohm
Semiconductor outputs	**787768**	**787770**
Number	2	2
Voltage	24 V	24 V
Current	50 mA	50 mA
External supply voltage	24 V	24 V
Voltage tolerance	-20 %/+20 %	-20 %/+20 %

Safety relays PNOZ X
PNOZ X8P

Relay outputs	787768	787770
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**

Safety relays PNOZ X
PNOZ X8P

Relay outputs	787768	787770
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787768**	**787770**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,3 A**	**7,3 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X8P

Times	787768	787770
Switch-on delay		
With automatic start typ.	**175 ms**	**175 ms**
With automatic start max.	**220 ms**	**220 ms**
With automatic start after power on typ.	**200 ms**	**200 ms**
With automatic start after power on max.	**250 ms**	**250 ms**
With manual start typ.	**190 ms**	**190 ms**
With manual start max.	**250 ms**	**250 ms**
With monitored start typ.	**130 ms**	**130 ms**
With monitored start max.	**180 ms**	**180 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**160 ms**	**160 ms**
With power failure max.	**220 ms**	**220 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**250 ms**	**250 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**35 ms**	**35 ms**
Environmental data	**787768**	**787770**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**

Safety relays PNOZ X
PNOZ X8P

Environmental data	787768	787770
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787768**	**787770**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Cage clamp terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**415 g**	**415 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X8P

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

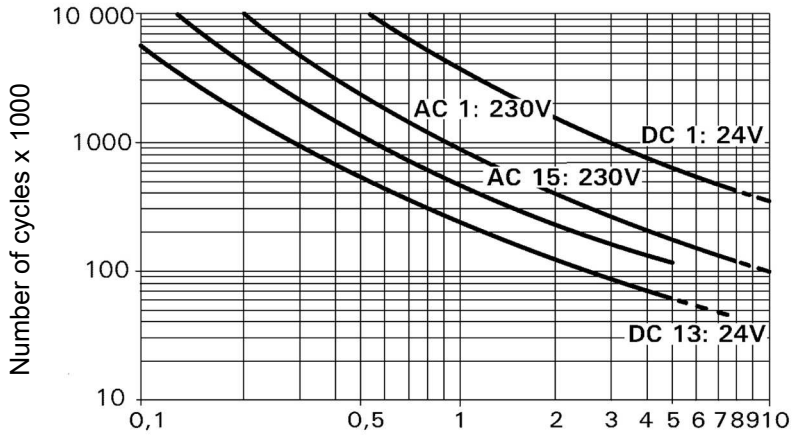
All the units used within a safety function must be considered when calculating the safety characteristic data.

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.

Supplementary data

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.



Safety relays PNOZ X
PNOZ X8P

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 4 000 000 cycles

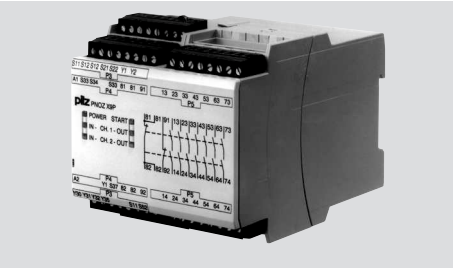
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X8P	24 VAC	Screw terminals	777 770
PNOZ X8P C	24 VAC	Spring-loaded terminals	787 770
PNOZ X8P	110 V AC	Screw terminals	777 764
PNOZ X8P C	110 V AC	Spring-loaded terminals	787 764
PNOZ X8P	115 V AC	Screw terminals	777 765
PNOZ X8P	120 V AC	Screw terminals	777 766
PNOZ X8P C	120 V AC	Spring-loaded terminals	787 766
PNOZ X8P	230 V AC	Screw terminals	777 768
PNOZ X8P C	230 V AC	Spring-loaded terminals	787 768
PNOZ X8P	24 VDC	Screw terminals	777 760
PNOZ X8P C	24 VDC	Spring-loaded terminals	787 760

Safety relays PNOZ X
PNOZ X9P



Unit features

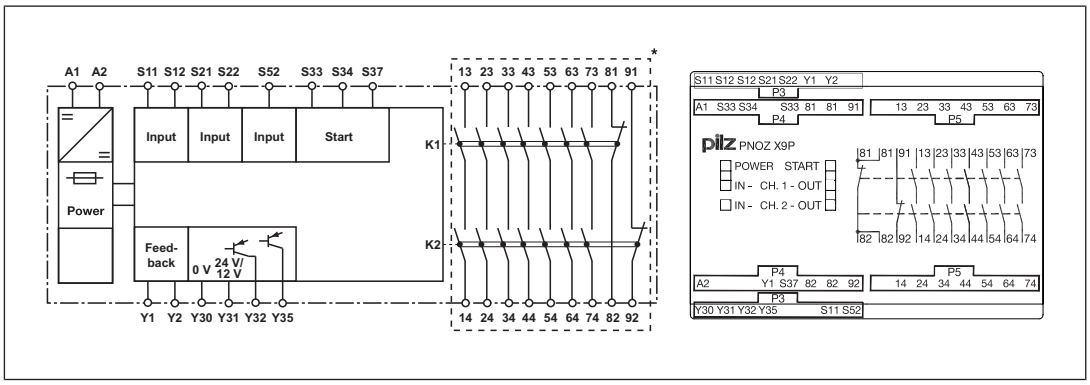
- Positive-guided relay outputs:
  - 7 safety contacts (N/O), instantaneous
  - 2 auxiliary contacts (N/C), instantaneous
- 2 semiconductor outputs
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- LED indicator for:
  - Supply voltage
  - Input state
  - Switch state of the safety contacts
  - Start circuit
- Semiconductor outputs signal:
  - Supply voltage is present
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X9P

Block diagram/terminal configuration

Types: DC

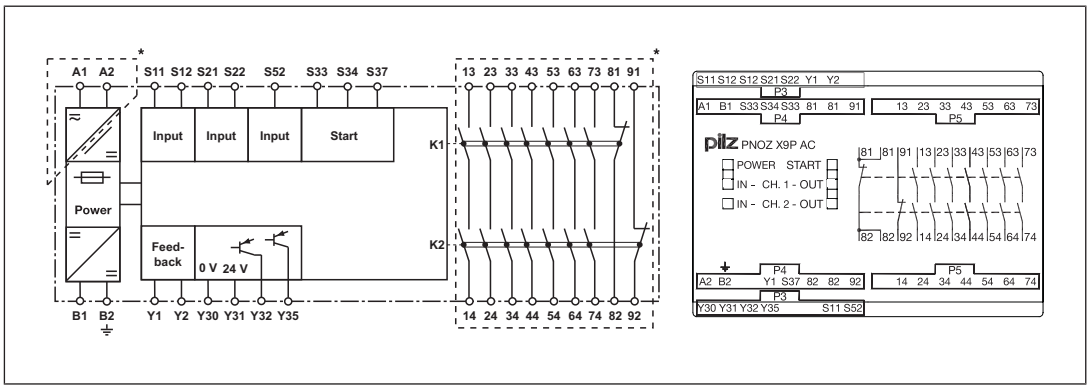
- U_B: 12 VDC; Order no. 777607
- U_B: 24 VDC; Order no. 777609, 787609



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Type: AC/DC

- U_B: 24-240 V AC/DC, 24 V DC; Order no. 777606, 787606



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ X9P

Function Description

The safety relay PNOZ X9P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the feedback loop Y1-Y2 and the start circuit S33-S34 are closed. The "START" LED is lit.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The LEDs "CH.1 IN" and "CH.2 IN" are lit.
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54, 63-64 and 73-74 are closed, the auxiliary contacts 81-82 and 91-92 are opened. The unit is active.
  - A high signal is present at the semiconductor output switch state Y32.
  - The LEDs "CH.1 OUT" and "CH.2 OUT" are lit. The "START" LED goes out.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1 IN" and "CH.2 IN" go out.
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54, 63-64 and 73-74 are opened redundantly, the auxiliary contacts 81-82 and 91-92 are closed.
  - A low signal is present at the semiconductor output switch state Y32.
  - The LEDs "CH.1 OUT" and "CH.2 OUT" go out.
- A high signal is present at semi-conductor output Y35 if the supply voltage is present and the internal fuse has not blown.

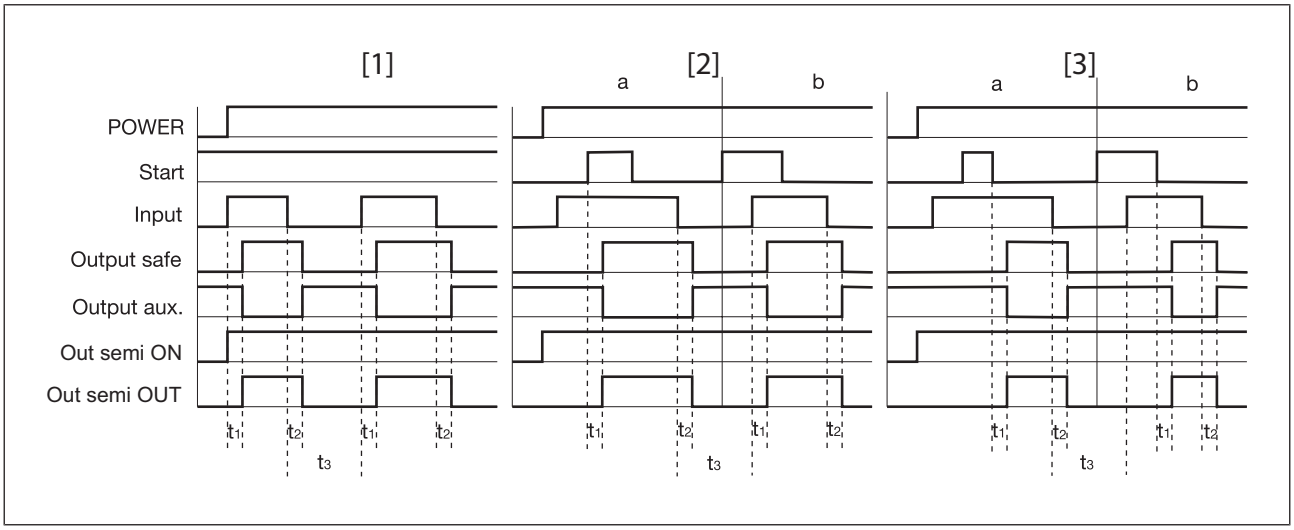
Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ X9P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X9P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.

Safety relays PNOZ X
PNOZ X9P

- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contacts
- Out semi ON: Semiconductor output supply voltage
- Out semi OUT: Semiconductor output switch state
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Safety relays PNOZ X
PNOZ X9P

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [222]" must be followed.
- Delivery status of units with screw terminals: Link between Y1-Y2 (feedback loop)
- Outputs 13-14, 23-24, 33-34, 43-44, 53-54, 63-64, 73-74 are safety contacts, the outputs 81-82, 91-92 are auxiliary contacts (e.g. for display).
- Do **not** use auxiliary contacts 81-82, 91-92 and semiconductor outputs Y32, Y35 for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [222]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [222])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- 777607, 777609, 787609 units or 777606, 787606 units, when the supply voltage is connected via B1 and B2:
  The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

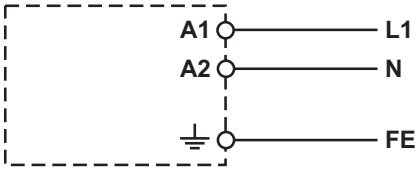
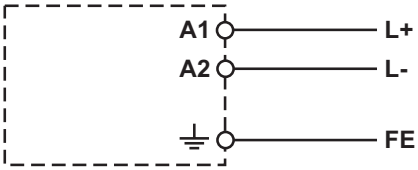
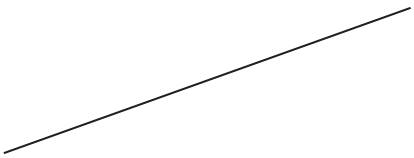
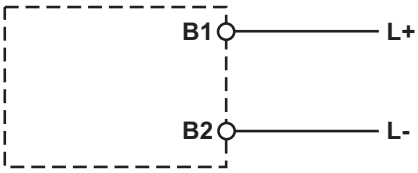
Safety relays PNOZ X
PNOZ X9P

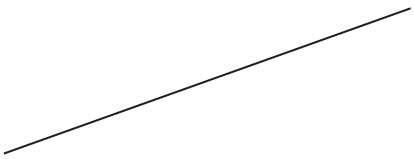
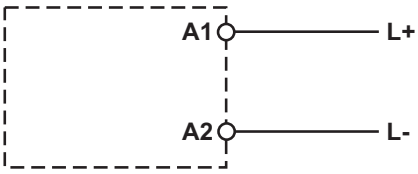
Important for detection of shorts across contacts:

As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

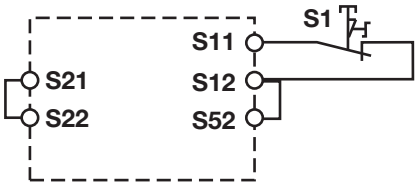
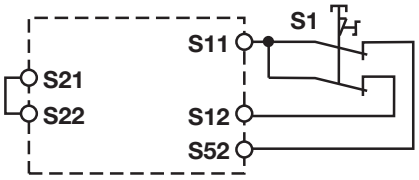
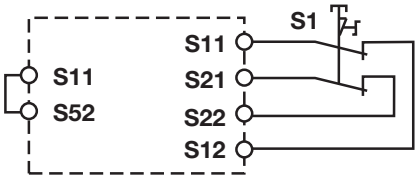
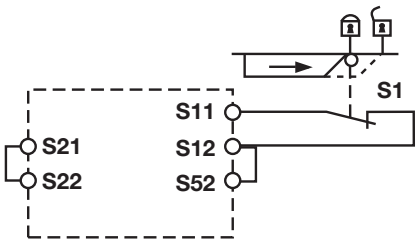
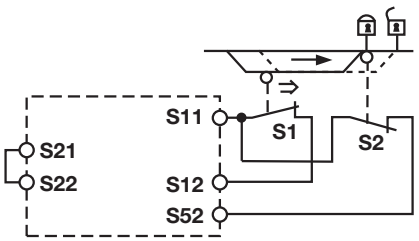
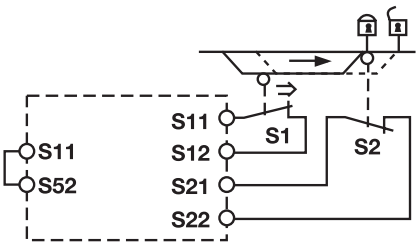
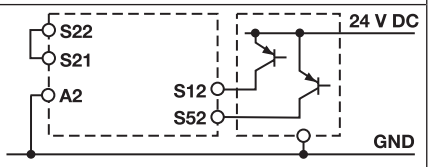
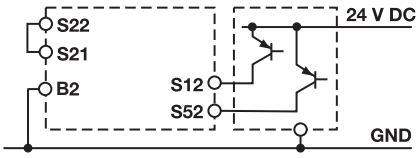
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

Preparing for operation

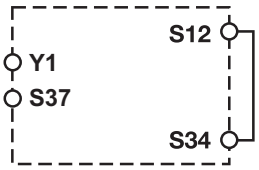
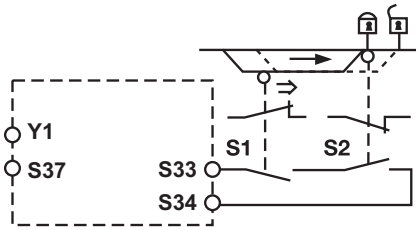
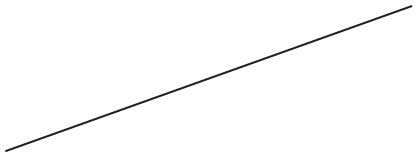
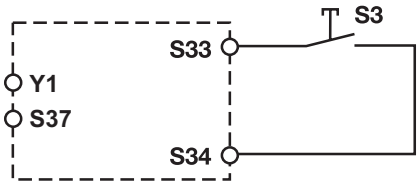
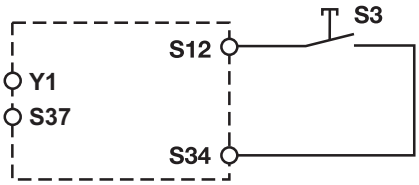
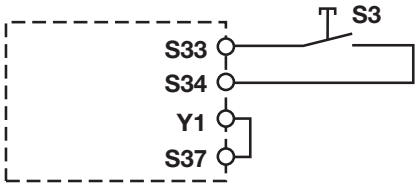
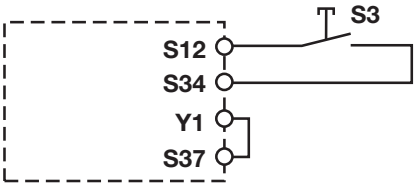
Supply voltage	AC	DC
▸ Order no. 777606, 787606 U_B: 24-240 V AC/DC via **A1** and **A2**		
▸ Order no. 777606, 787606 U_B: 24 V DC via **B1** and **B2**		

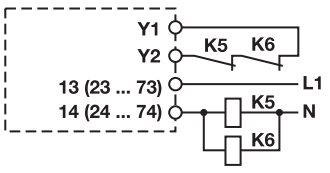
Supply voltage	AC	DC
▸ Order no. 777607 U_B: 12 V DC ▸ Order no. 777609, 787609 U_B: 24 VDC		

Safety relays PNOZ X
PNOZ X9P

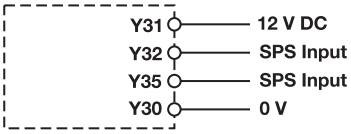
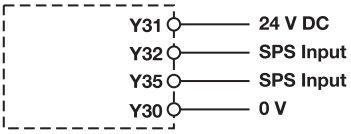
Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
E-STOP **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Safety gate **with** detection of shorts across contacts		
Light guard or safety switch, detection of shorts across contacts via ESPE ▸ Order no. 777609, 787609 U_B: 24 VDC		
Light guard or safety switch, detection of shorts across contacts via ESPE ▸ Order no. 777606, 787606 U_B: 24 V DC via **B1** and **B2**		

Safety relays PNOZ X
PNOZ X9P

Start circuit	Single-channel, dual-channel without detection of shorts across contacts	Dual-channel with detection of shorts across contacts
Automatic start		
Automatic start with start-up test (safety gate, dual-channel)	 Simultaneity S1 and S2: 150 ms, U_B: 12 V DC: 50 ms	
Manual start		
Monitored start		

Feedback loop	without feedback loop monitoring	with feedback loop monitoring
Link or contacts from external contactors		

Safety relays PNOZ X
PNOZ X9P

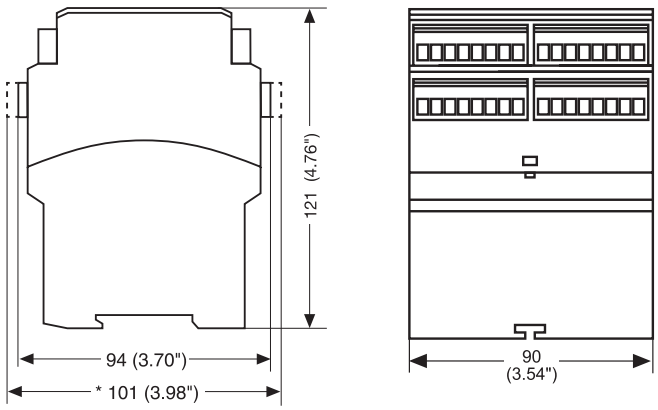
Semiconductor output	U_B: 12 V DC	U_B: 24 V DC; 24-240 V AC/DC
Y31, Y30: External supply voltage		

Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X9P

Technical details

Order no. 777606 – 787606

See below for more order numbers

General	777606	787606
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777606**	**787606**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**8,5 VA**	**8,5 VA**
Output of external power supply (DC)	**5,5 W**	**5,5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**5,5 W**	**5,5 W**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Inputs	**777606**	**787606**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**50 mA**	**50 mA**
Start circuit DC	**100 mA**	**100 mA**
Feedback loop DC	**100 mA**	**100 mA**
Min. input resistance at power-on	**89 Ohm**	**89 Ohm**

Safety relays PNOZ X
PNOZ X9P

Inputs	777606	787606
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**45 Ohm**	**45 Ohm**
Single-channel at UB AC	**45 Ohm**	**45 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**90 Ohm**	**90 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**90 Ohm**	**90 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**15 Ohm**	**15 Ohm**
Semiconductor outputs	**777606**	**787606**
Number	**2**	**2**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777606**	**787606**
Number of output contacts		
Safety contacts (N/O), instantaneous	**7**	**7**
Auxiliary contacts (N/C)	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X9P

Relay outputs	777606	787606
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X9P

Relay outputs	777606	787606
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777606**	**787606**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7 A**	**7 A**
Conv. therm. current with 5 contacts	**6 A**	**6 A**
Conv. therm. current with 6 contacts	**5,5 A**	**5,5 A**
Conv. therm. current with 7 contacts	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7 A**	**7 A**
Conv. therm. current with 5 contacts	**6 A**	**6 A**
Conv. therm. current with 6 contacts	**5,5 A**	**5,5 A**
Conv. therm. current with 7 contacts	**5 A**	**5 A**

Safety relays PNOZ X
PNOZ X9P

Times	777606	787606
Switch-on delay		
With automatic start typ.	**200 ms**	**200 ms**
With automatic start max.	**250 ms**	**250 ms**
With automatic start after power on typ.	**500 ms**	**500 ms**
With automatic start after power on max.	**650 ms**	**650 ms**
With manual start typ.	**200 ms**	**200 ms**
With manual start max.	**250 ms**	**250 ms**
With monitored start typ.	**150 ms**	**150 ms**
With monitored start max.	**220 ms**	**220 ms**
Delay-on de-energisation		
With E-STOP typ.	**20 ms**	**20 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure at B1 typ.	**170 ms**	**170 ms**
With power failure at B1 max.	**250 ms**	**250 ms**
With 240 V power failure at A1 typ.	**430 ms**	**430 ms**
With 240 V power failure at A1 max.	**550 ms**	**550 ms**
With 24 V power failure at A1 typ.	**230 ms**	**230 ms**
With 24 V power failure at A1 max.	**300 ms**	**300 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure at A1	**600 ms**	**600 ms**
After power failure at B1	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**50 ms**	**50 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777606**	**787606**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**

Safety relays PNOZ X
PNOZ X9P

Environmental data	777606	787606
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777606**	**787606**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**

Safety relays PNOZ X
PNOZ X9P

Mechanical data	777606	787606
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**600 g**	**600 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 777607 -787609

General	777607	777609	787609
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777607**	**777609**	**787609**
Supply voltage			
Voltage	**12 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-20 %/+20 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**7 W**	**5,5 W**	**5,5 W**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**5,5 A**	**10 A**	**10 A**
Pulse duration, A1	**1 ms**	**1 ms**	**1 ms**
Inputs	**777607**	**777609**	**787609**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**12 V**	**24 V**	**24 V**
Start circuit DC	**12 V**	**24 V**	**24 V**
Feedback loop DC	**12 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**130 mA**	**50 mA**	**50 mA**
Start circuit DC	**200 mA**	**100 mA**	**100 mA**
Feedback loop DC	**200 mA**	**100 mA**	**100 mA**
Min. input resistance at power-on	**9 Ohm**	**89 Ohm**	**89 Ohm**

Safety relays PNOZ X
PNOZ X9P

Inputs	777607	777609	787609
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**8 Ohm**	**45 Ohm**	**45 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**15 Ohm**	**90 Ohm**	**90 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**8 Ohm**	**15 Ohm**	**15 Ohm**
Semiconductor outputs	**777607**	**777609**	**787609**
Number	**2**	**2**	**2**
Voltage	**12 V**	**24 V**	**24 V**
Current	**20 mA**	**20 mA**	**20 mA**
External supply voltage	**12 V**	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777607**	**777609**	**787609**
Number of output contacts			
Safety contacts (N/O), instantaneous	**7**	**7**	**7**
Auxiliary contacts (N/C)	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X9P

Relay outputs	777607	777609	787609
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X9P

Relay outputs	777607	777609	787609
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777607**	**777609**	**787609**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7 A**	**7 A**	**7 A**
Conv. therm. current with 5 contacts	**6 A**	**6 A**	**6 A**
Conv. therm. current with 6 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 7 contacts	**5 A**	**5 A**	**5 A**
Times	**777607**	**777609**	**787609**
Switch-on delay			
With automatic start typ.	**130 ms**	**200 ms**	**200 ms**
With automatic start max.	**200 ms**	**250 ms**	**250 ms**
With automatic start after power on typ.	**150 ms**	**220 ms**	**220 ms**
With automatic start after power on max.	**220 ms**	**300 ms**	**300 ms**
With manual start typ.	**150 ms**	**200 ms**	**200 ms**
With manual start max.	**200 ms**	**250 ms**	**250 ms**
With monitored start typ.	**100 ms**	**150 ms**	**150 ms**
With monitored start max.	**150 ms**	**220 ms**	**220 ms**

Safety relays PNOZ X
PNOZ X9P

Times	777607	777609	787609
Delay-on de-energisation			
With E-STOP typ.	**20 ms**	**20 ms**	**20 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**60 ms**	**170 ms**	**170 ms**
With power failure max.	**80 ms**	**250 ms**	**250 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms**	**50 ms**	**50 ms**
After power failure	**100 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**50 ms**	**50 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Environmental data	**777607**	**777609**	**787609**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**

Safety relays PNOZ X
PNOZ X9P

Mechanical data	777607	777609	787609
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	–	**2**
Stripping length with spring-loaded terminals	–	–	**8 mm**
Dimensions			
Height	**94 mm**	**94 mm**	**101 mm**
Width	**90 mm**	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**570 g**	**570 g**	**570 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X9P

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

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

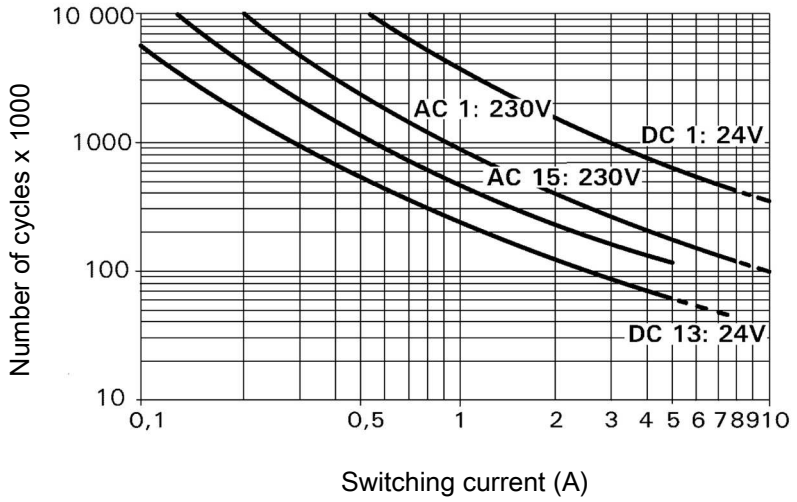
Supplementary data

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.

Safety relays PNOZ X
PNOZ X9P

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 to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

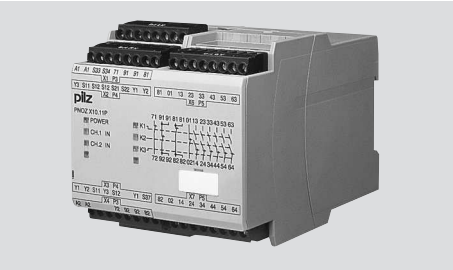
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ X9P

Order reference

Product type	Features	Connection type	Order no.
PNOZ X9P	24-240 V AC/DC, 24 V DC	Screw terminals	777 606
PNOZ X9P C	24-240 V AC/DC, 24 V DC	Spring-loaded terminals	787 606
PNOZ X9P	12 V DC	Screw terminals	777 607
PNOZ X9P	24 VDC	Screw terminals	777 609
PNOZ X9P C	24 VDC	Spring-loaded terminals	787 609

Safety relays PNOZ X
PNOZ X10.11P

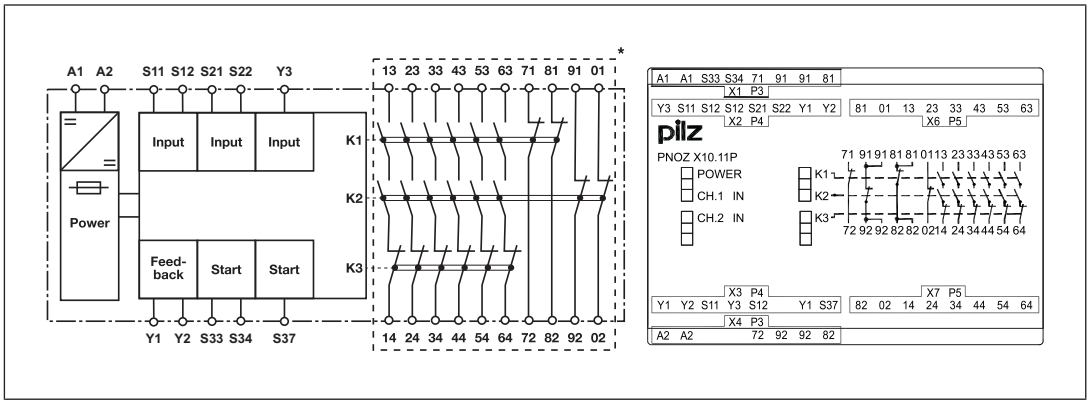


Unit features

- Positive-guided relay outputs:
  - 6 safety contacts (N/O), instantaneous
  - 4 auxiliary contacts (N/C), instantaneous
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- LED display for:
  - Supply voltage
  - Input state channel 1/2
  - Switch status channel 1/2
  - Switch status start relay
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X10.11P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X10.11P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the feedback loop Y1-Y2 and the start circuit S12-S34 are closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - LEDs "CH.1 IN", "CH.2 IN" and "K3" go out.
  - LEDs "K1" and "K2" light as soon as relays K1 and K2 are in operating position.
  - LED "K3" goes out as soon as relay K3 is in rest position.
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54 and 63-64 are closed, auxiliary contacts 71-72, 81-82, 91-92 and 01-02 are opened. The unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1 IN" and "CH.2 IN" go out.
  - LEDs "K1" and "K2" go out as soon as relays K1 and K2 are in rest position.
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54 and 63-64 are opened redundantly, auxiliary contacts 71-72, 81-82, 91-92 and 01-02 are closed.

Operating modes

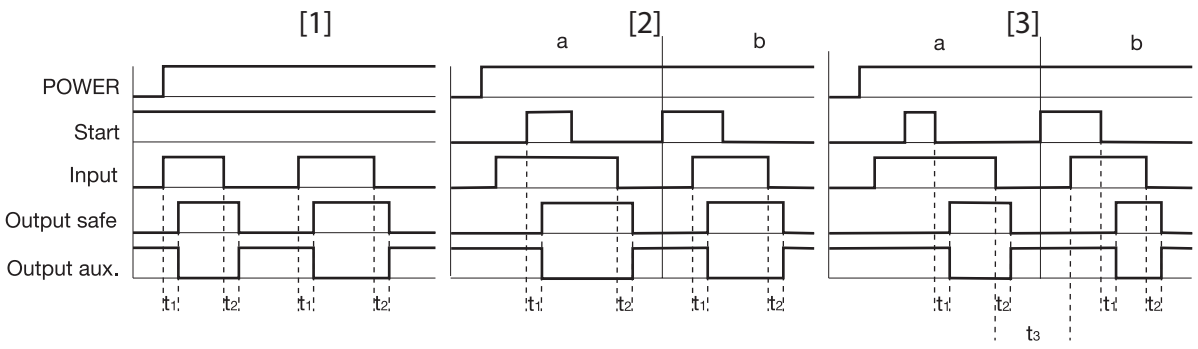
- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X10.11P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.

Safety relays PNOZ X
PNOZ X10.11P

- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ X10.11P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.

  The LED "K3" lights when the start circuit is closed and goes out when the start circuit is opened.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contacts
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit

- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [📖 244]" must be followed.
- Outputs 13-14, 23-24, 33-34, 43-44, 53-54, 63-64 are safety contacts; outputs 71-72, 81-82, 91-92, 01-02 are auxiliary contacts (e.g. for display).
- Do **not** use auxiliary contacts 71-72, 81-82, 91-92, 01-02 for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 244]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 244])
R_l / km = cable resistance/km

- Use copper wire that can withstand 60/75 °C.
- Do not switch low currents using contacts that have been used previously with high currents.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

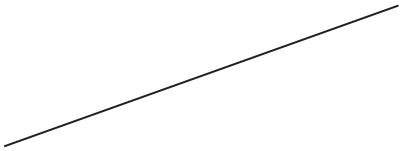
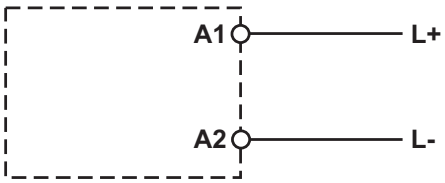
Safety relays PNOZ X
PNOZ X10.11P

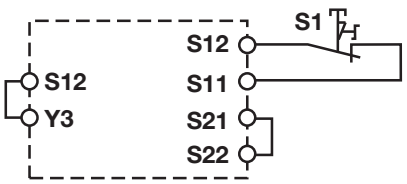
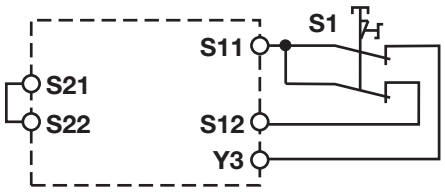
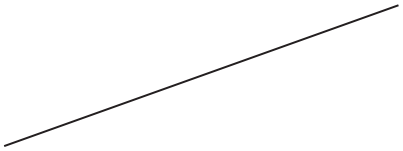
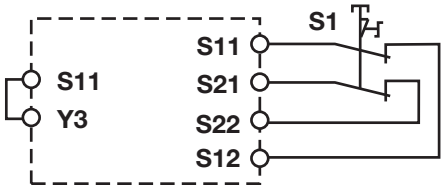
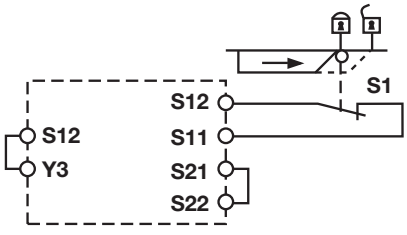
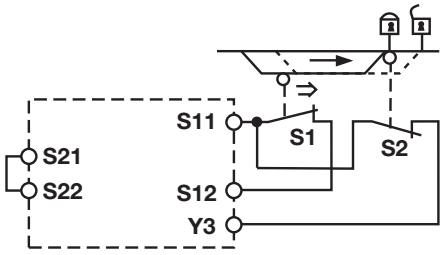
Important for detection of shorts across contacts:

As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

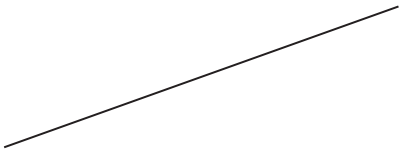
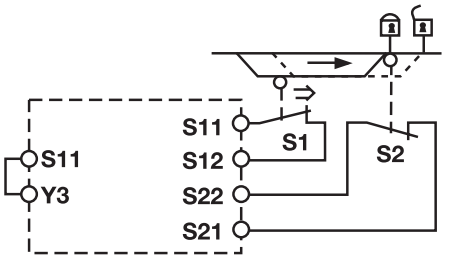
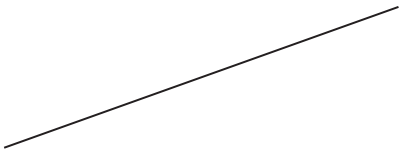
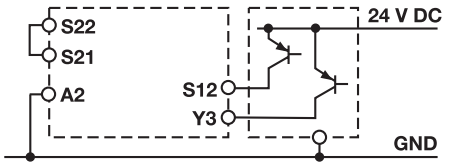
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

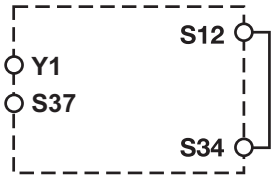
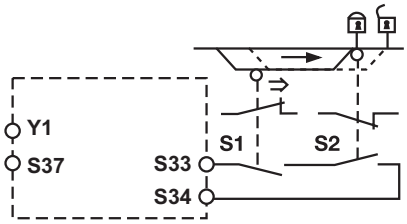
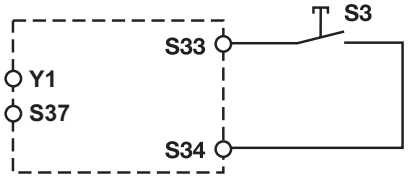
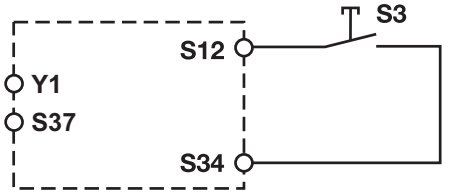
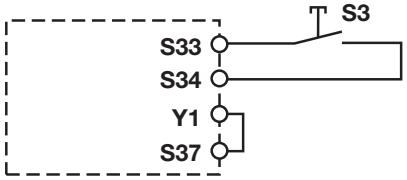
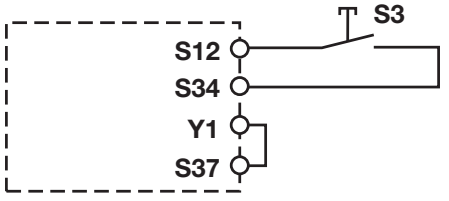
Preparing for operation

Supply voltage	AC	DC
		

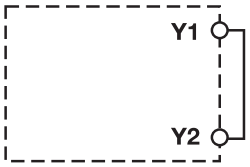
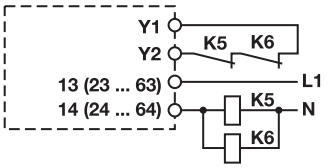
Input circuit	Single-channel	Dual-channel
E-STOP **without** detection of shorts across contacts		
E-STOP **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		

Safety relays PNOZ X
PNOZ X10.11P

Input circuit	Single-channel	Dual-channel
Safety gate **with** detection of shorts across contacts		
Light guards or safety switch, detection of shorts across contacts via ESPE (only when U_B = 24 VDC)		

Start circuit	Single-channel, dual-channel without detection of shorts across contacts	Dual-channel with detection of shorts across contacts
Automatic start		
Automatic start with start-up test	 Simultaneity S1 and S2: 150 ms	
Manual start		
Monitored start		

Safety relays PNOZ X
PNOZ X10.11P

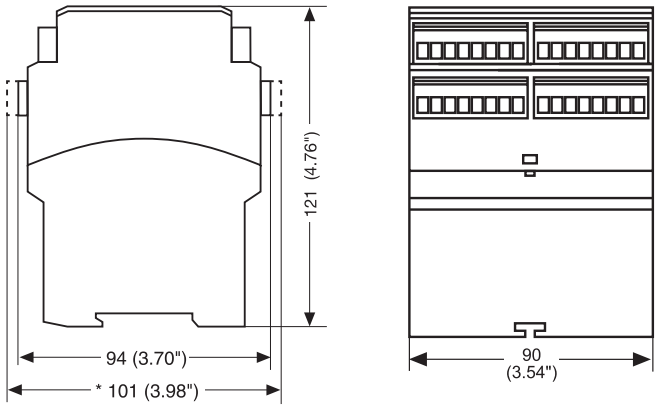
Feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Link or contacts from external contactors		

Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X10.11P

Technical details

General	777750	787750
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777750**	**787750**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	5,5 W	5,5 W
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
Inputs	**777750**	**787750**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	50 mA	50 mA
Start circuit DC	100 mA	100 mA
Feedback loop DC	100 mA	100 mA
Min. input resistance at power-on	89 Ohm	89 Ohm
Max. overall cable resistance Rl-max		
Single-channel at UB DC	45 Ohm	45 Ohm
Dual-channel without detection of shorts across contacts at UB DC	90 Ohm	90 Ohm
Dual-channel with detection of shorts across contacts at UB DC	15 Ohm	15 Ohm
Relay outputs	**777750**	**787750**
Number of output contacts		
Safety contacts (N/O), instantaneous	6	6
Auxiliary contacts (N/C)	4	4
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZ X
PNOZ X10.11P

Relay outputs	777750	787750
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PNOZ X10.11P

Relay outputs	777750	787750
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777750**	**787750**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7 A**	**7 A**
Conv. therm. current with 5 contacts	**6 A**	**6 A**
Conv. therm. current with 6 contacts	**5,5 A**	**5,5 A**

Safety relays PNOZ X
PNOZ X10.11P

Times	777750	787750
Switch-on delay		
With automatic start typ.	**200 ms**	**200 ms**
With automatic start max.	**250 ms**	**250 ms**
With automatic start after power on typ.	**220 ms**	**220 ms**
With automatic start after power on max.	**300 ms**	**300 ms**
With manual start typ.	**200 ms**	**200 ms**
With manual start max.	**250 ms**	**250 ms**
With monitored start typ.	**220 ms**	**220 ms**
With monitored start max.	**260 ms**	**260 ms**
Delay-on de-energisation		
With E-STOP typ.	**20 ms**	**20 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**360 ms**	**360 ms**
With power failure max.	**480 ms**	**480 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**500 ms**	**500 ms**
Min. start pulse duration with a monitored start	**50 ms**	**50 ms**
Supply interruption before de-energisation	**150 ms**	**150 ms**
Environmental data	**777750**	**787750**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**

Safety relays PNOZ X
PNOZ X10.11P

Environmental data	777750	787750
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777750**	**787750**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**580 g**	**580 g**

Safety relays PNOZ X
PNOZ X10.11P

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

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

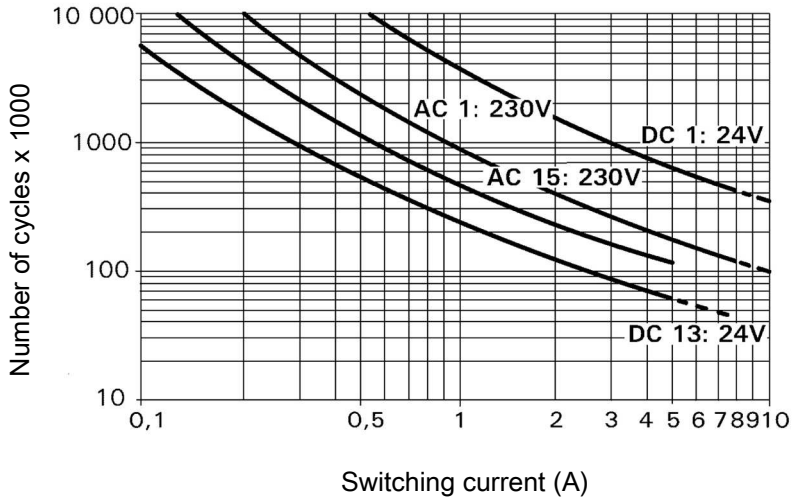
Supplementary data

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.

Safety relays PNOZ X
PNOZ X10.11P

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

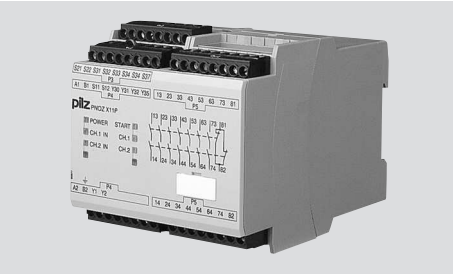
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X10.11P C	24 VDC	Spring-loaded terminals	787 750
PNOZ X10.11P	24 VDC	Screw terminals	777 750

Safety relays PNOZ X
PNOZ X11P

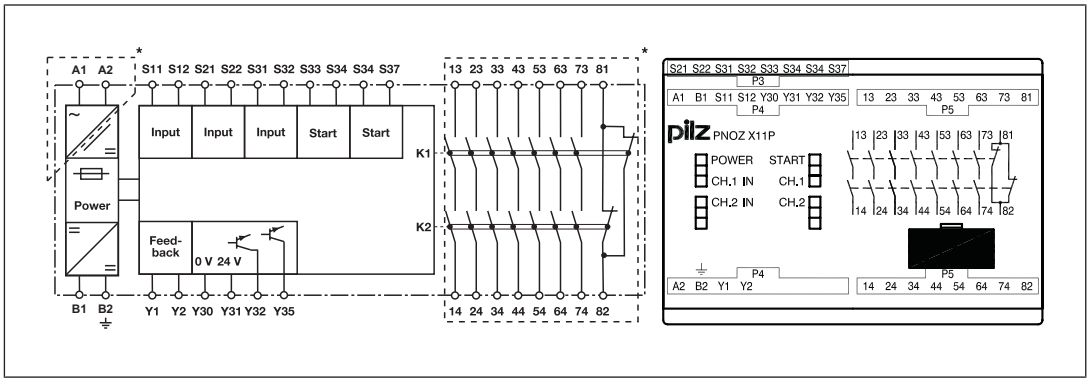


Unit features

- Positive-guided relay outputs:
  - 7 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 2 semiconductor outputs
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- LED indicator for:
  - Supply voltage
  - Input state
  - Switch state of the safety contacts
  - Start circuit
- Semiconductor outputs signal:
  - Supply voltage is present
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ X11P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ X11P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the feedback loop Y1-Y2 and the start circuit S33-S34 are closed. The "START" LED is lit.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The LEDs "CH.1 IN" and "CH.2 IN" are lit.
  - The "START" LED goes out.
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54, 63-64 and 73-74 are closed, auxiliary contact 81-82 is opened. The unit is active.
  - The LEDs "CH.1" and "CH.2" are lit.
  - A high signal is present at the semiconductor output switch state Y32.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1 IN" and "CH.2 IN" go out.
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54, 63-64 and 73-74 are opened redundantly, auxiliary contact 81-82 is closed.
  - The LEDs "CH.1" and "CH.2" go out.
  - A low signal is present at the semiconductor output switch state Y32.

Semiconductor output supply voltage Y35

- A high signal is present at semi-conductor output Y35 if the supply voltage is present and the internal fuse has not blown.

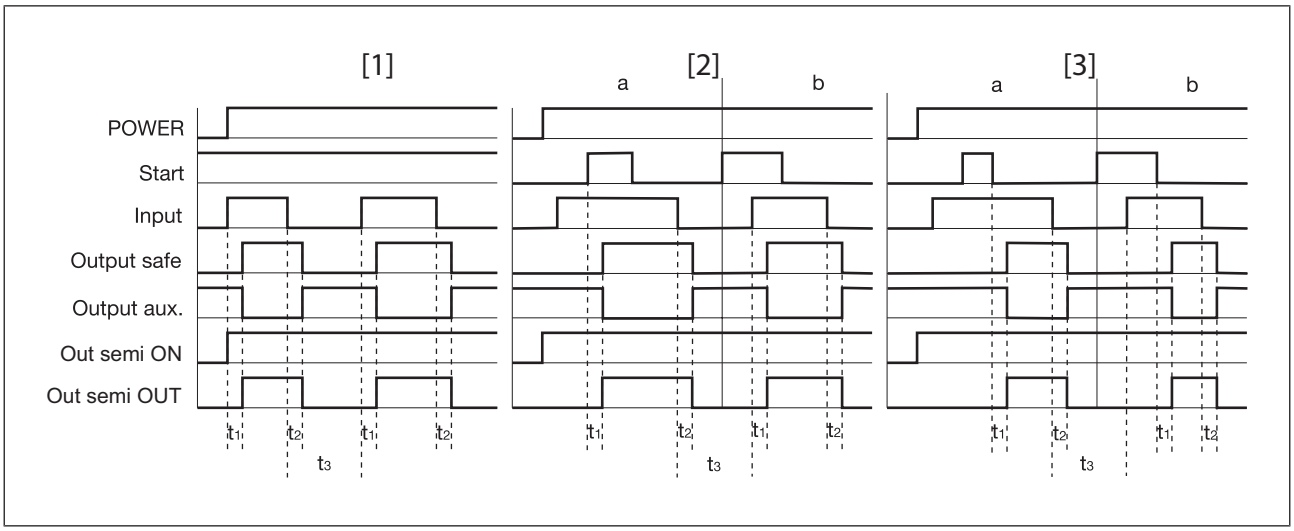
Safety relays PNOZ X
PNOZ X11P

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, PNOZ X11P detects
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Monitored start: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ X11P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Out semi ON: Semiconductor output supply voltage
- Out semi OUT: Semiconductor output switch state
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ X11P

Wiring

Please note:

- Information given in the "Technical details [📖 259]" must be followed.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit) and link between Y1-Y2 (feedback loop)
- Outputs 13-14, 23-24, 33-34, 43-44, 53-54, 63-64, 73-74 are safety contacts; output 81-82 is an auxiliary contact (e.g. for display).
- Auxiliary contact 81-82 should **not** be used for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 259]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 259])
R_l / km = cable resistance/km

- Use copper wiring with a temperature stability of 75 °C.
- Do not switch low currents using contacts that have been used previously with high currents.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- With a 24 VDC supply voltage via terminals B1, B2, the power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

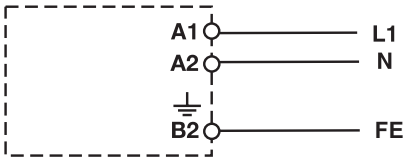
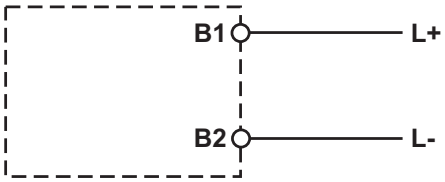
Important for detection of shorts across contacts:

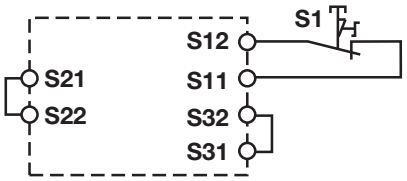
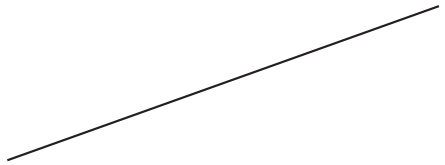
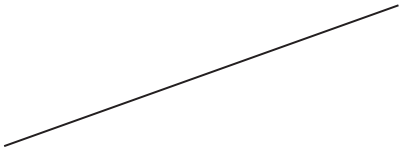
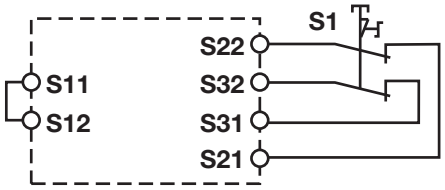
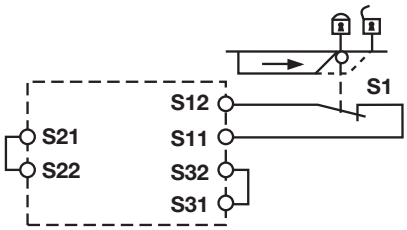
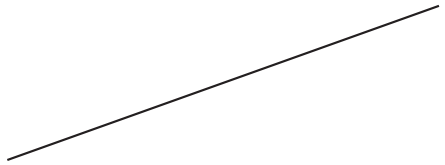
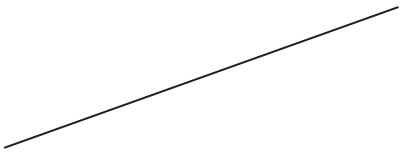
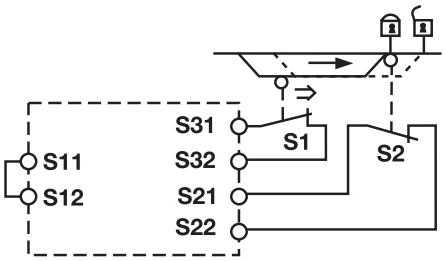
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

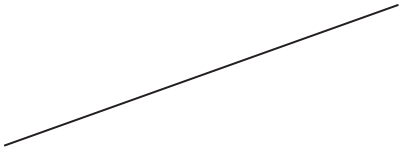
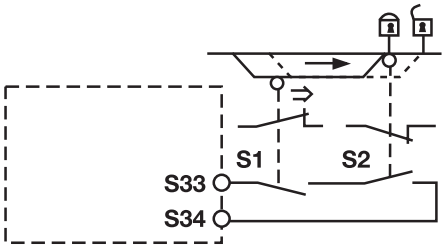
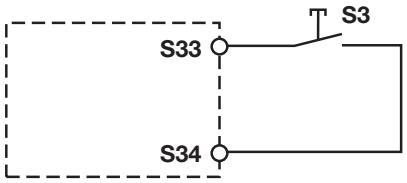
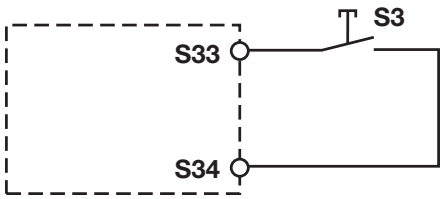
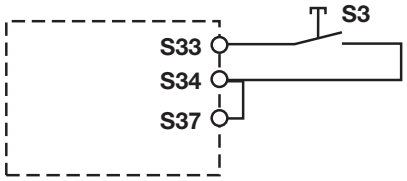
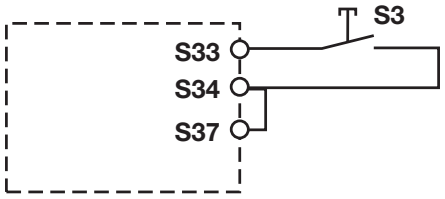
Safety relays PNOZ X
PNOZ X11P

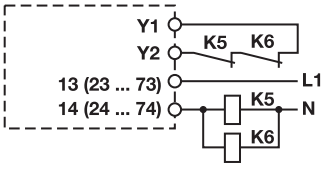
Preparing for operation

Supply voltage	AC	DC
		

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		

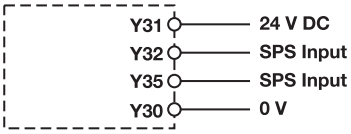
Safety relays PNOZ X
PNOZ X11P

Start circuit	E-STOP wiring (single-channel, dual-channel) Safety gate (single-channel)	Safety gate (dual-channel)
Automatic start		
Automatic start with start-up test		 Simultaneity S1 and S2: 120 ms
Manual start		
Monitored start		

Feedback loop	without feedback loop monitoring	with feedback loop monitoring
Link or contacts from external contactors		

Safety relays PNOZ X
PNOZ X11P

Semiconductor output

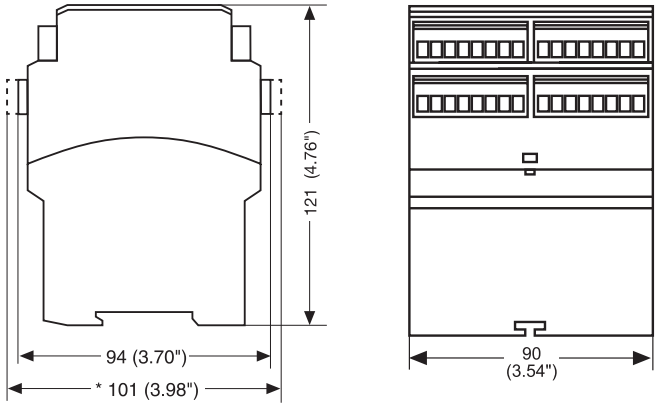


Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ X11P

Technical details

Order no. 777080 – 777086

See below for more order numbers

General	777080	777083	777086
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777080**	**777083**	**777086**
Supply voltage			
Voltage	24 V	110 - 120 V	230 - 240 V
Kind	AC	AC	AC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	9 VA	9 VA	9 VA
Frequency range AC	50 - 60 Hz	50 - 60 Hz	50 - 60 Hz
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	3,5 W	3,5 W	3,5 W
Residual ripple DC	160 %	160 %	160 %
Duty cycle	100 %	100 %	100 %
Inputs	**777080**	**777083**	**777086**
Number	2	2	2
Voltage at			
Input circuit DC	24 V	24 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	50 mA	50 mA	50 mA
Start circuit DC	70 mA	70 mA	70 mA
Feedback loop DC	70 mA	70 mA	70 mA
Min. input resistance at power-on	43 Ohm	43 Ohm	43 Ohm

Safety relays PNOZ X
PNOZ X11P

Inputs	777080	777083	777086
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**50 Ohm**	**50 Ohm**	**50 Ohm**
Single-channel at UB AC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**	**20 Ohm**
Semiconductor outputs	**777080**	**777083**	**777086**
Number	**2**	**2**	**2**
Voltage	**24 V**	**24 V**	**24 V**
Current	**20 mA**	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777080**	**777083**	**777086**
Number of output contacts			
Safety contacts (N/O), instantaneous	**7**	**7**	**7**
Auxiliary contacts (N/C)	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X11P

Relay outputs	777080	777083	777086
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X11P

Relay outputs	777080	777083	777086
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777080**	**777083**	**777086**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**6,8 A**	**6,8 A**	**6,8 A**
Conv. therm. current with 4 contacts	**5,9 A**	**5,9 A**	**5,9 A**
Conv. therm. current with 5 contacts	**5,3 A**	**5,3 A**	**5,3 A**
Conv. therm. current with 6 contacts	**4,8 A**	**4,8 A**	**4,8 A**
Conv. therm. current with 7 contacts	**4,5 A**	**4,5 A**	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7,2 A**	**7,2 A**	**7,2 A**
Conv. therm. current with 5 contacts	**6,5 A**	**6,5 A**	**6,5 A**
Conv. therm. current with 6 contacts	**5,9 A**	**5,9 A**	**5,9 A**
Conv. therm. current with 7 contacts	**5,5 A**	**5,5 A**	**5,5 A**

Safety relays PNOZ X
PNOZ X11P

Times	777080	777083	777086
Switch-on delay			
With automatic start typ.	**450 ms**	**450 ms**	**450 ms**
With automatic start max.	**680 ms**	**680 ms**	**680 ms**
With automatic start after power on typ.	**450 ms**	**450 ms**	**450 ms**
With automatic start after power on max.	**630 ms**	**630 ms**	**630 ms**
With manual start typ.	**450 ms**	**450 ms**	**450 ms**
With manual start max.	**680 ms**	**680 ms**	**680 ms**
With monitored start typ.	**390 ms**	**390 ms**	**390 ms**
With monitored start max.	**550 ms**	**550 ms**	**550 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**40 ms**	**40 ms**	**40 ms**
With power failure max.	**60 ms**	**60 ms**	**60 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms**	**50 ms**	**50 ms**
After power failure	**100 ms**	**100 ms**	**100 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777080**	**777083**	**777086**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**

Safety relays PNOZ X
PNOZ X11P

Environmental data	777080	777083	777086
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777080**	**777083**	**777086**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**

Safety relays PNOZ X
PNOZ X11P

Mechanical data	777080	777083	777086
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**90 mm**	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**640 g**	**640 g**	**640 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787080 – 787086

General	787080	787083	787086
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787080**	**787083**	**787086**
Supply voltage			
Voltage	**24 V**	**110 - 120 V**	**230 - 240 V**
Kind	**AC**	**AC**	**AC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**9 VA**	**9 VA**	**9 VA**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**	**50 - 60 Hz**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**3,5 W**	**3,5 W**	**3,5 W**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Inputs	**787080**	**787083**	**787086**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**50 mA**	**50 mA**	**50 mA**
Start circuit DC	**70 mA**	**70 mA**	**70 mA**
Feedback loop DC	**70 mA**	**70 mA**	**70 mA**
Min. input resistance at power-on	**43 Ohm**	**43 Ohm**	**43 Ohm**

Safety relays PNOZ X
PNOZ X11P

Inputs	787080	787083	787086
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**50 Ohm**	**50 Ohm**	**50 Ohm**
Single-channel at UB AC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**	**15 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**	**20 Ohm**
Semiconductor outputs	**787080**	**787083**	**787086**
Number	**2**	**2**	**2**
Voltage	**24 V**	**24 V**	**24 V**
Current	**20 mA**	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**787080**	**787083**	**787086**
Number of output contacts			
Safety contacts (N/O), instantaneous	**7**	**7**	**7**
Auxiliary contacts (N/C)	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ X11P

Relay outputs	787080	787083	787086
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ X11P

Relay outputs	787080	787083	787086
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787080**	**787083**	**787086**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**6,8 A**	**6,8 A**	**6,8 A**
Conv. therm. current with 4 contacts	**5,9 A**	**5,9 A**	**5,9 A**
Conv. therm. current with 5 contacts	**5,3 A**	**5,3 A**	**5,3 A**
Conv. therm. current with 6 contacts	**4,8 A**	**4,8 A**	**4,8 A**
Conv. therm. current with 7 contacts	**4,5 A**	**4,5 A**	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7,2 A**	**7,2 A**	**7,2 A**
Conv. therm. current with 5 contacts	**6,5 A**	**6,5 A**	**6,5 A**
Conv. therm. current with 6 contacts	**5,9 A**	**5,9 A**	**5,9 A**
Conv. therm. current with 7 contacts	**5,5 A**	**5,5 A**	**5,5 A**

Safety relays PNOZ X
PNOZ X11P

Times	787080	787083	787086
Switch-on delay			
With automatic start typ.	**450 ms**	**450 ms**	**450 ms**
With automatic start max.	**680 ms**	**680 ms**	**680 ms**
With automatic start after power on typ.	**450 ms**	**450 ms**	**450 ms**
With automatic start after power on max.	**630 ms**	**630 ms**	**630 ms**
With manual start typ.	**450 ms**	**450 ms**	**450 ms**
With manual start max.	**680 ms**	**680 ms**	**680 ms**
With monitored start typ.	**390 ms**	**390 ms**	**390 ms**
With monitored start max.	**550 ms**	**550 ms**	**550 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**40 ms**	**40 ms**	**40 ms**
With power failure max.	**60 ms**	**60 ms**	**60 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms**	**50 ms**	**50 ms**
After power failure	**100 ms**	**100 ms**	**100 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**787080**	**787083**	**787086**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**

Safety relays PNOZ X
PNOZ X11P

Environmental data	787080	787083	787086
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**787080**	**787083**	**787086**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Cage clamp terminal**	**Cage clamp terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**	**8 mm**
Dimensions			
Height	**101 mm**	**101 mm**	**101 mm**
Width	**90 mm**	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**640 g**	**640 g**	**640 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ X11P

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

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

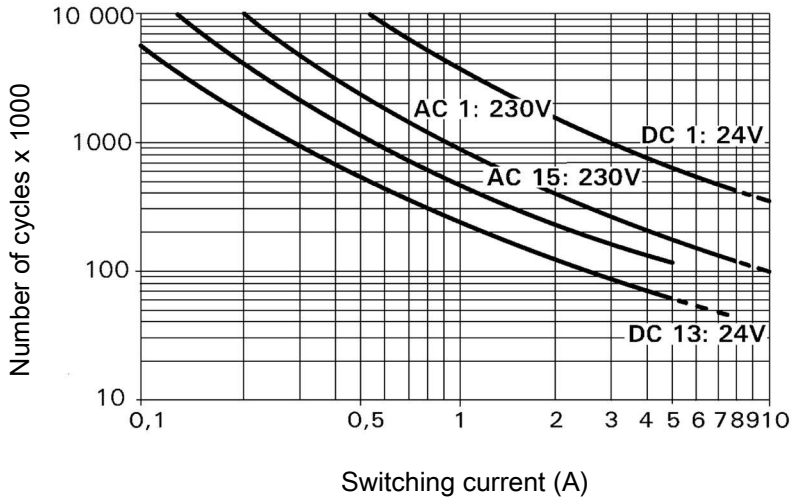
Supplementary data

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.

Safety relays PNOZ X
PNOZ X11P

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

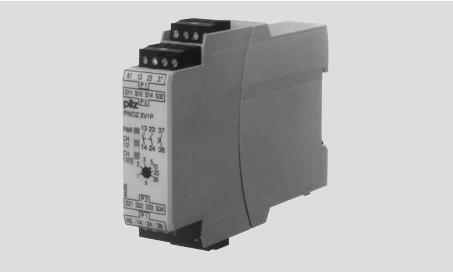
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ X11P	24 VAC; 24 VDC	Screw terminals	777 080
PNOZ X11P C	24 VAC; 24 VDC	Spring-loaded terminals	787 080
PNOZ X11P	110 - 120 VAC; 24 VDC	Screw terminals	777 083
PNOZ X11P C	110 - 120 VAC; 24 VDC	Spring-loaded terminals	787 083
PNOZ X11P	230 - 240 VAC; 24 VDC	Screw terminals	777 086
PNOZ X11P C	230 - 240 VAC; 24 VDC	Spring-loaded terminals	787 086

Safety relays PNOZ X
PNOZ XV1P

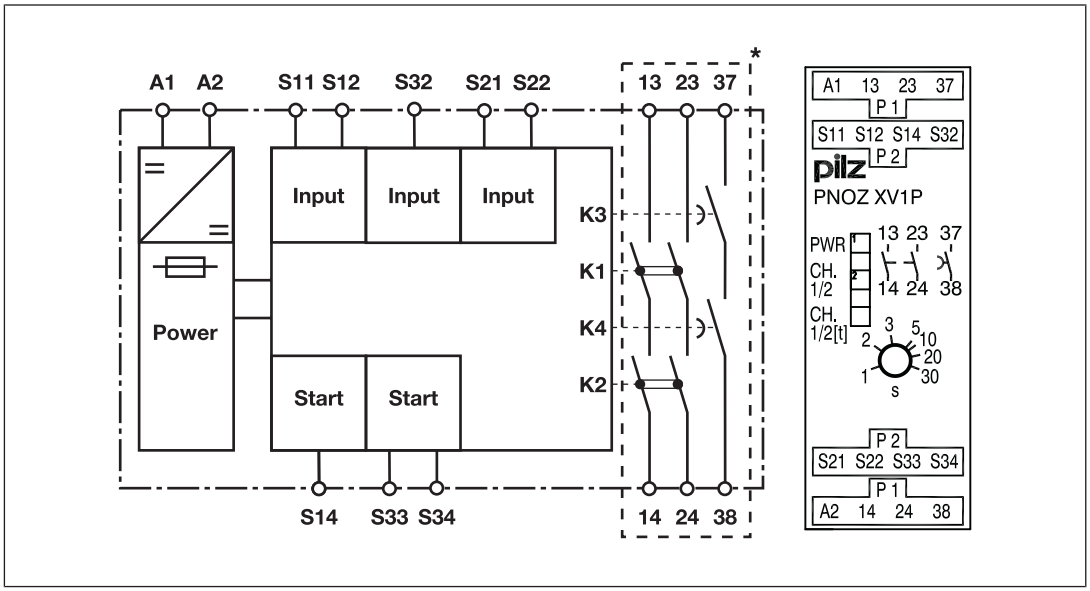


Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
  - 1 safety contact (N/O), delay-on de-energisation
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- Selectable delay time
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ XV1P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ XV1P provides a safety-oriented interruption of a safety circuit. When the supply voltage is applied via the E-STOP pushbutton, the “PWR” LED is lit. The unit is ready for operation when the start circuit S11-S14 is closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The LEDs "CH.1/2" and "CH.1/2[t]" are lit.
  - Safety contacts 13-14, 23-24 and 37-38 are closed, the unit is active.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - Safety contacts 13-14 and 23-24 are redundantly opened.
  - The LED "CH.1/2" goes out.
  - Once the set delay time has elapsed, safety contact 37-38 is opened redundantly.
  - The LED "CH.1/2[t]" goes out.

Before the unit can be restarted, the delay time must have elapsed and the unit must again be ready for operation.

Set delay time:

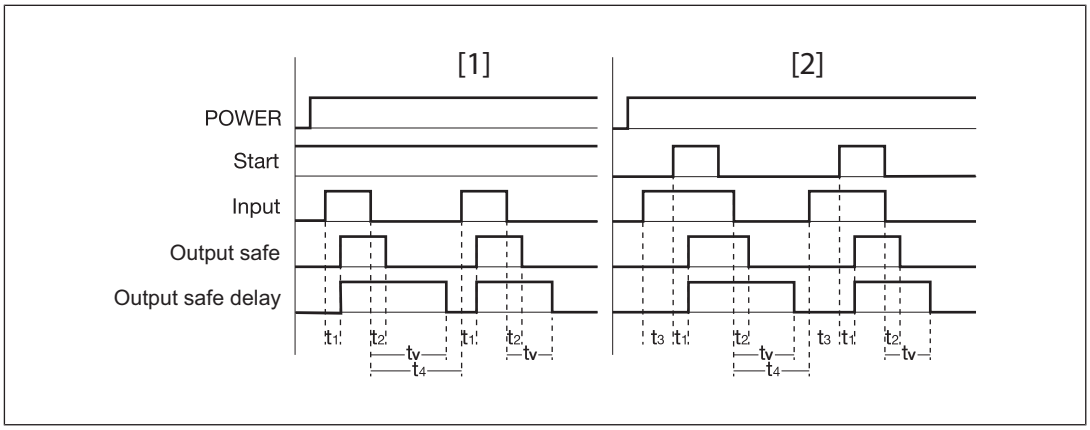
The delay time for safety contact 37-38 can be set on the front of the unit using a screwdriver.

Safety relays PNOZ X
PNOZ XV1P

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ XV1P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ XV1P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - Shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [279]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuit
- Output safe: Safety contacts, instantaneous
- Output safe delay: Delayed safety contact
- [1]: Automatic start
- [2]: Monitored start
- t_1: Switch-on delay

- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time
- t_v: Delay time

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [279]" must be followed.
- Outputs 13-14, 23-24 are instantaneous safety contacts, output 37-38 is a delay-on de-energisation safety contact.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [279]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [279])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Important for detection of shorts across contacts:

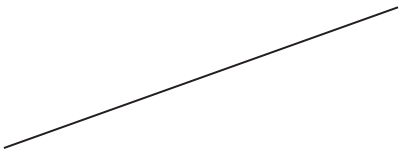
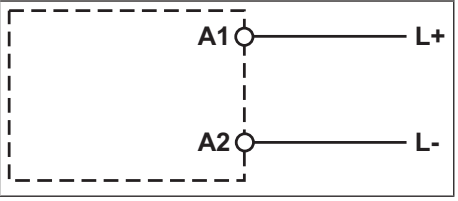
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

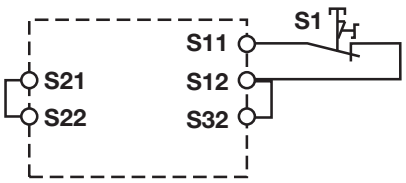
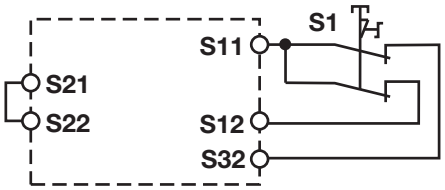
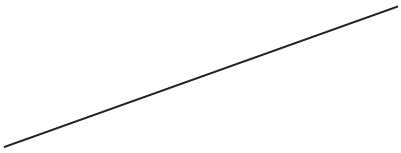
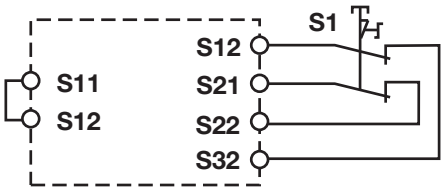
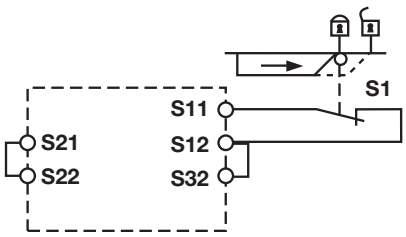
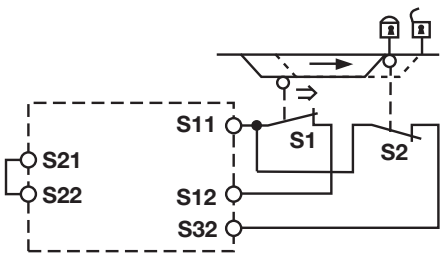
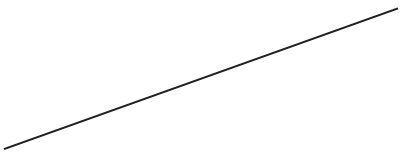
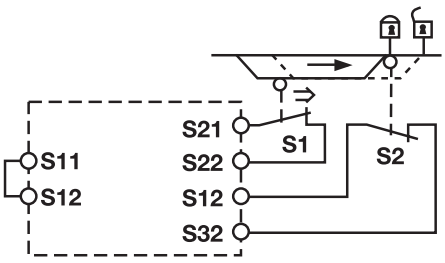
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.

Safety relays PNOZ X
PNOZ XV1P

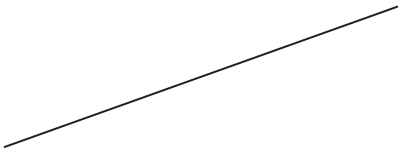
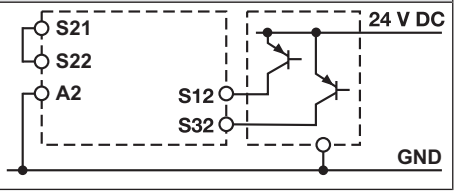
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

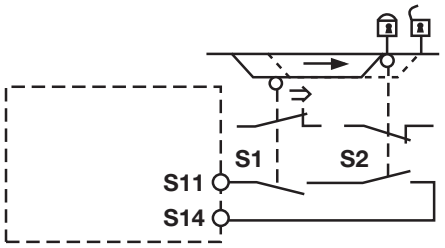
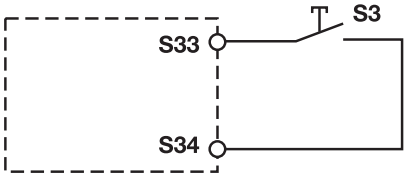
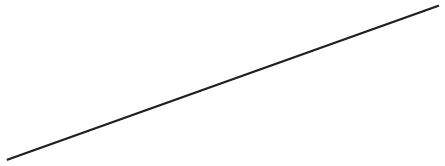
Preparing for operation

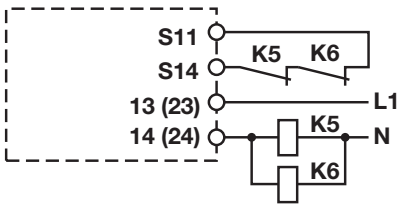
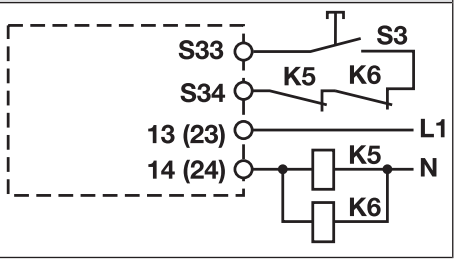
Supply voltage	AC	DC
		

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		

Safety relays PNOZ X
PNOZ XV1P

Input circuit	Single-channel	Dual-channel
Light guard or safety switch, detection of shorts across contacts via ESPE		

Start circuit	E-STOP wiring, safety gate without start-up test	Safety gate with start-up test
Automatic start		 Simultaneity S1 and S2: max. 1 s
Monitored start		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

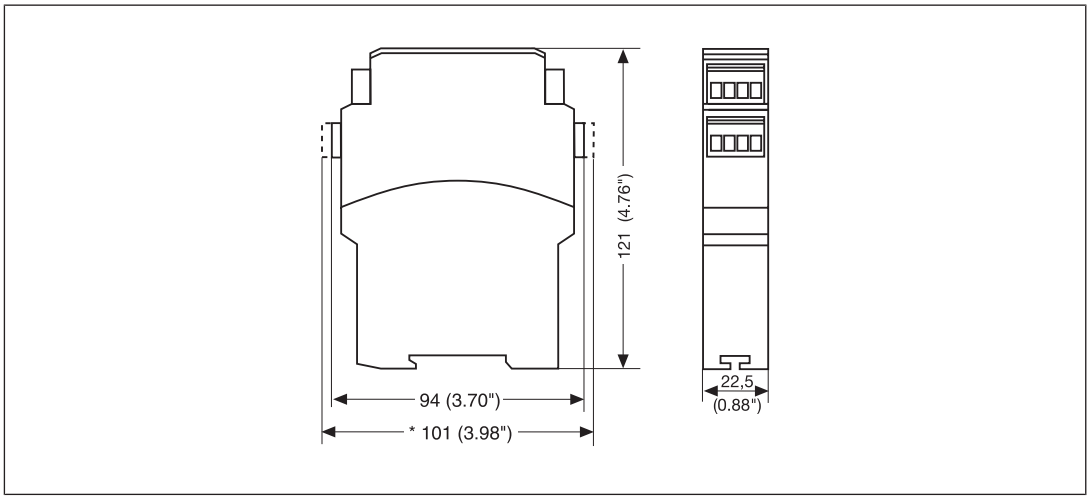
Legend

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

Safety relays PNOZ X
PNOZ XV1P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777601 – 777602

See below for more order numbers

General	777601	777602
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777601**	**777602**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**5 A**	**5 A**
Pulse duration, A1	**1 ms**	**1 ms**
Inputs	**777601**	**777602**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**

Safety relays PNOZ X
PNOZ XV1P

Inputs	777601	777602
Current at		
Input circuit DC	**35 mA**	**35 mA**
Start circuit DC	**35 mA**	**35 mA**
Feedback loop DC	**3,5 mA**	**3,5 mA**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**150 Ohm**	**150 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Relay outputs	**777601**	**777602**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Safety contacts (N/O), delayed	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**1250 VA**	**1250 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**125 W**	**125 W**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**1250 VA**	**1250 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**125 W**	**125 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**

Safety relays PNOZ X
PNOZ XV1P

Relay outputs	777601	777602
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**1,5 A**	**1,5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ XV1P

Conventional thermal current while loading several contacts	777601	777602
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**5 A**	**5 A**
Conv. therm. current with 2 contacts	**3,7 A**	**3,7 A**
Conv. therm. current with 3 contacts	**3 A**	**3 A**
Times	**777601**	**777602**
Switch-on delay		
With automatic start typ.	**300 ms**	**300 ms**
With automatic start max.	**550 ms**	**550 ms**
With automatic start after power on typ.	**350 ms**	**350 ms**
With automatic start after power on max.	**750 ms**	**750 ms**
With monitored start typ.	**30 ms**	**30 ms**
With monitored start max.	**60 ms**	**60 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**100 ms**	**100 ms**
With power failure max.	**150 ms**	**150 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms +tv**	**50 ms +tv**
After power failure	**300 ms**	**300 ms**
Delay time tv	**0,1 - 3 s**	**1 - 30 s**
Time accuracy	**-20 %/+20 %**	**-20 %/+20 %**
Repetition accuracy	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777601**	**777602**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**

Safety relays PNOZ X
PNOZ XV1P

Environmental data	777601	777602
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777601**	**777602**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**

Safety relays PNOZ X
PNOZ XV1P

Mechanical data	777601	777602
Dimensions		
Height	**94 mm**	**94 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**230 g**	**230 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787601 – 787602

General	787601	787602
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787601**	**787602**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**5 A**	**5 A**
Pulse duration, A1	**1 ms**	**1 ms**
Inputs	**787601**	**787602**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**35 mA**	**35 mA**
Start circuit DC	**35 mA**	**35 mA**
Feedback loop DC	**3,5 mA**	**3,5 mA**

Safety relays PNOZ X
PNOZ XV1P

Inputs	787601	787602
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**150 Ohm**	**150 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Relay outputs	**787601**	**787602**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Safety contacts (N/O), delayed	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**1250 VA**	**1250 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**125 W**	**125 W**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**1250 VA**	**1250 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**125 W**	**125 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**

Safety relays PNOZ X
PNOZ XV1P

Relay outputs	787601	787602
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**1,5 A**	**1,5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ XV1P

Conventional thermal current while loading several contacts	787601	787602
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**5 A**	**5 A**
Conv. therm. current with 2 contacts	**3,7 A**	**3,7 A**
Conv. therm. current with 3 contacts	**3 A**	**3 A**
Times	**787601**	**787602**
Switch-on delay		
With automatic start typ.	**300 ms**	**300 ms**
With automatic start max.	**550 ms**	**550 ms**
With automatic start after power on typ.	**350 ms**	**350 ms**
With automatic start after power on max.	**750 ms**	**750 ms**
With monitored start typ.	**30 ms**	**30 ms**
With monitored start max.	**60 ms**	**60 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**100 ms**	**100 ms**
With power failure max.	**150 ms**	**150 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms +tv**	**50 ms +tv**
After power failure	**300 ms**	**300 ms**
Delay time tv	**0,1 - 3 s**	**1 - 30 s**
Time accuracy	**-20 %/+20 %**	**-20 %/+20 %**
Repetition accuracy	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787601**	**787602**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**

Safety relays PNOZ X
PNOZ XV1P

Environmental data	787601	787602
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787601**	**787602**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Cage clamp terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**

Safety relays PNOZ X
PNOZ XV1P

Mechanical data	787601	787602
Weight	**230 g**	**230 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 3**	**2,64E-09**	**SIL 3**	**1,26E-05**	**20**
Safety contacts, delayed ≥30 s	**PL c**	**Cat. 1**	**SIL CL 1**	**2,87E-09**	**SIL 2**	**4,64E-05**	**20**

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

Supplementary data

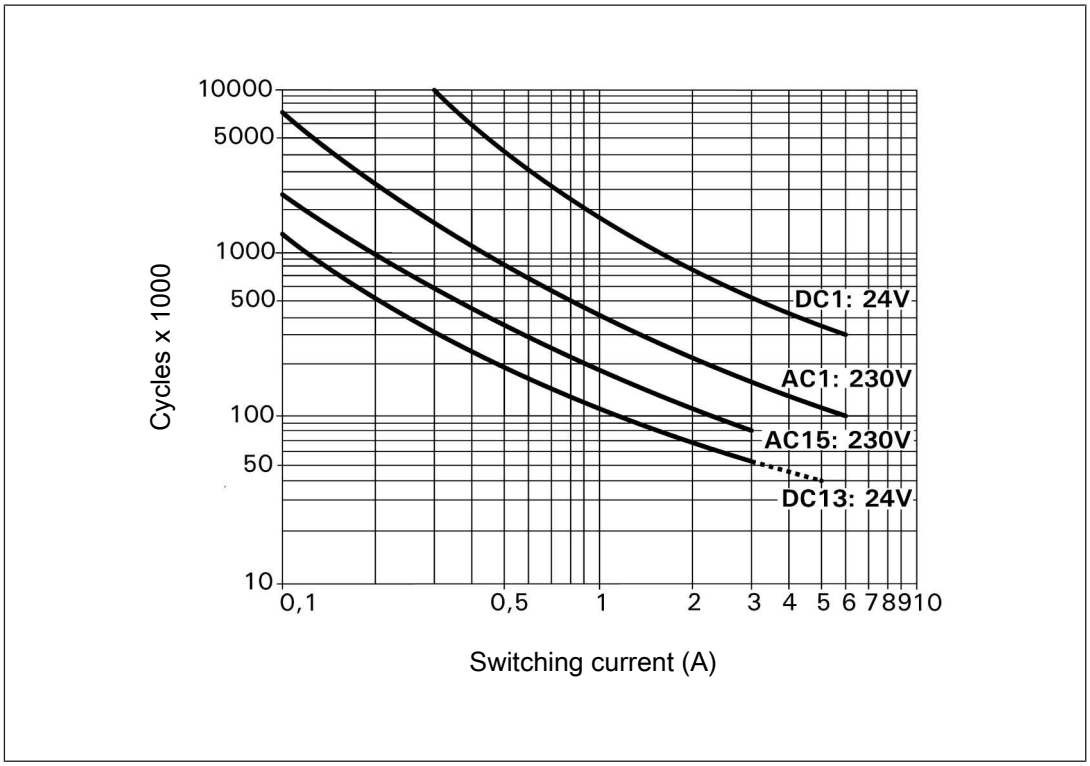
The PFH value depends on the switching frequency and the load on the relay output.
If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates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

Safety relays PNOZ X
PNOZ XV1P

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.

Service life graph: Safety contacts (N/O), instantaneous



Example

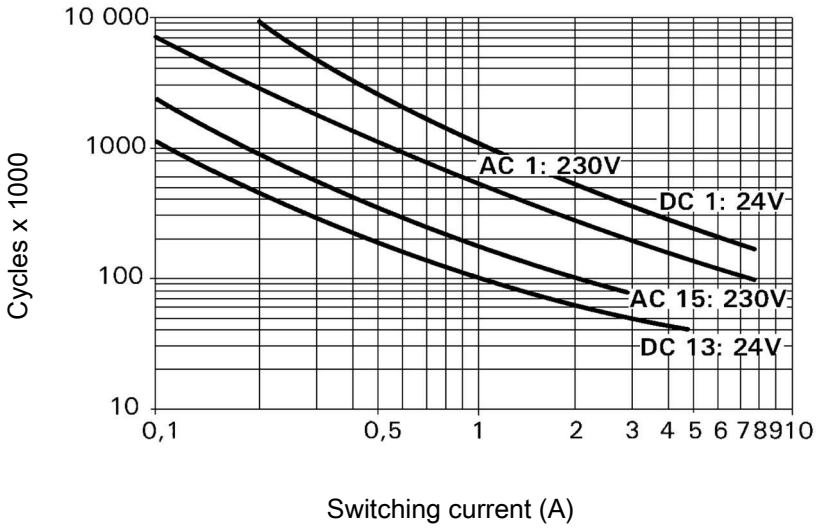
- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [279]) can be used in the calculation.

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

Safety relays PNOZ X
PNOZ XV1P

Service life graph: Safety contact (N/O), delay-on de-energisation



Example

- Inductive load: 0.2 A,
- Utilisation category: AC15
- Contact service life: 900 000 cycles

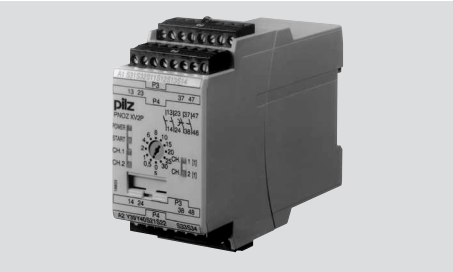
Provided the application to be implemented requires fewer than 900 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PNOZ XV1P	24 VDC; Delay: up to 3 s selectable	Screw terminals	777 601
PNOZ XV1P C	24 VDC; Delay: up to 3 s selectable	Spring-loaded terminals	787 601
PNOZ XV1P	24 VDC; Delay: up to 30 s selectable	Screw terminals	777 602
PNOZ XV1P C	24 VDC; Delay: up to 30 s selectable	Spring-loaded terminals	787 602

Safety relays PNOZ X
PNOZ XV2P

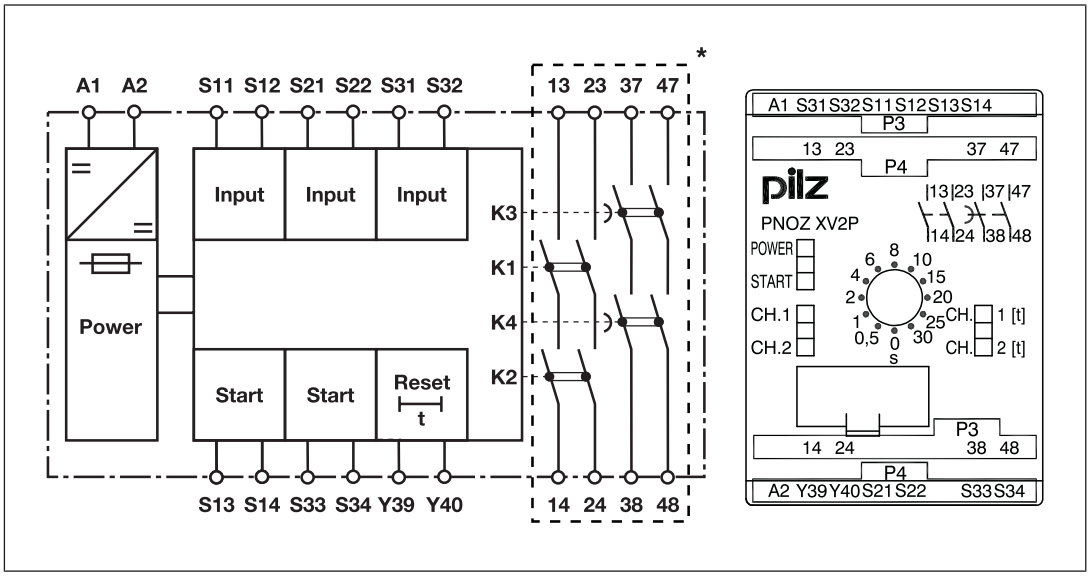


Unit features

- 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
  - Start button
- LED display for:
  - Supply voltage
  - Switch state of the safety contacts
  - Start circuit
- Delay time fixed or selectable
- Possible to cancel delay time
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ XV2P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ XV2P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the reset circuit Y39-Y40 and the start circuit S13-S14 are closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The "START" LED is lit.
  - The LEDs "CH.1", "CH.1 [t]" and "CH.2", "CH.2 [t]" are lit.
  - The safety contacts 13-14, 23-24, 37-38 and 47-48 are closed. The unit is active.
  - The "START" LED goes out.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 13-14 and 23-24 are redundantly opened.
  - Safety contacts 37-38 and 47-48 open after the delay time has elapsed.
  - The LEDs "CH.1 [t]" and "CH.2 [t]" go out.

Before the unit can be restarted, the delay time must have elapsed and the unit must again be ready for operation.

Set delay time:

On units with selectable delay time, the delay time of the safety contacts 37-38 and 47-48 can be set on the front of the unit using a screwdriver.

Safety relays PNOZ X
PNOZ XV2P

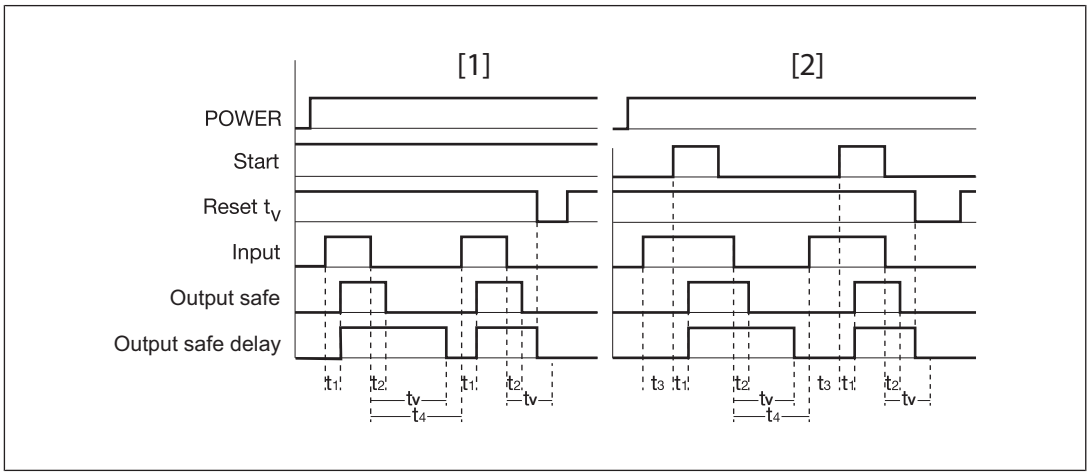
Reset function:

The delay time cycle can be ended prematurely by opening the reset circuit Y39-Y40. For this purpose, one N/C contact is connected between Y39-Y40 instead of a link.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ XV2P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - Shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [📖 299]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Reset t_v: Reset circuit
- Input: Input circuit
- Output safe: Safety contacts, instantaneous
- Output safe delay: Safety contacts, delayed
- [1]: Automatic start

- [2]: Monitored start
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time
- t_v: Delay time

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [299]" must be followed.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit) and link between Y39-Y40 (reset circuit)
- Outputs 13-14, 23-24 are instantaneous safety contacts, outputs 37-38, 47-48 are delay-on de-energisation safety contacts.
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [299]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [299])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

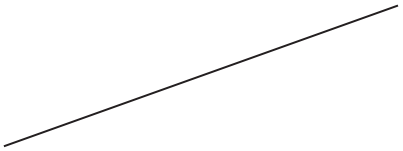
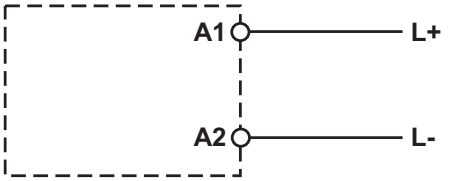
Safety relays PNOZ X
PNOZ XV2P

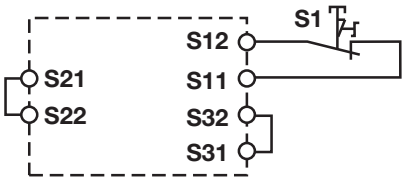
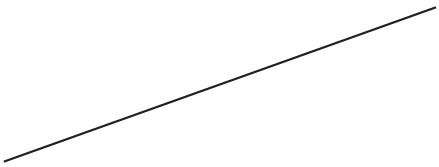
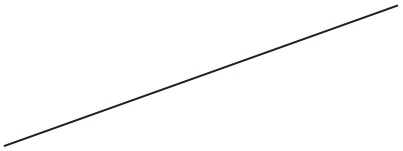
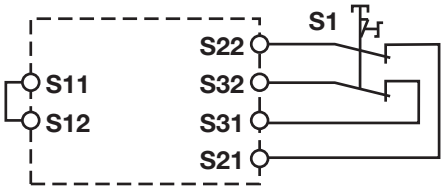
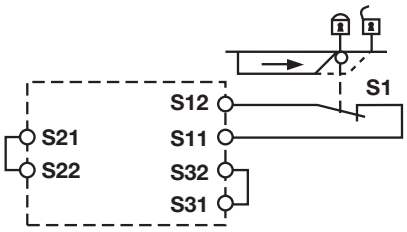
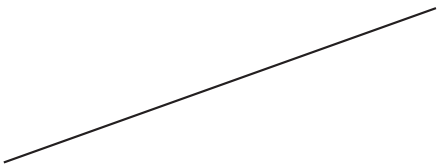
Important for detection of shorts across contacts:

As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

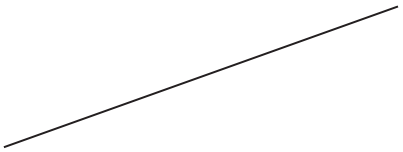
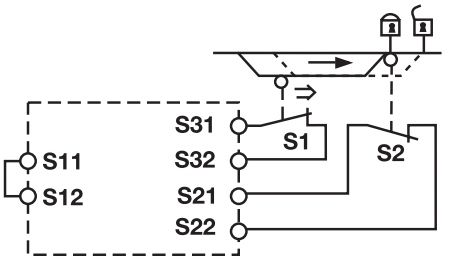
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

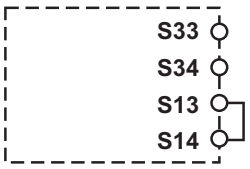
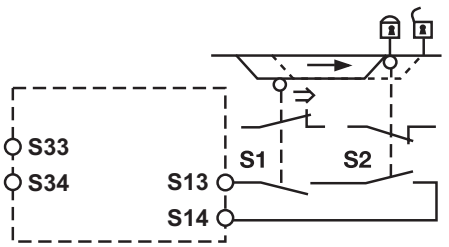
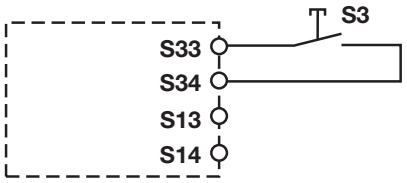
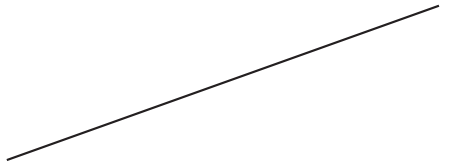
Preparing for operation

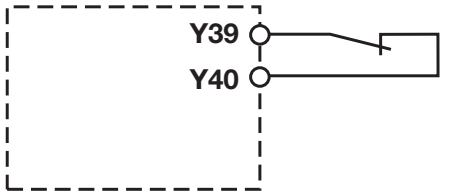
Supply voltage	AC	DC
		

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		

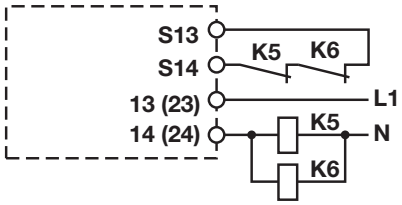
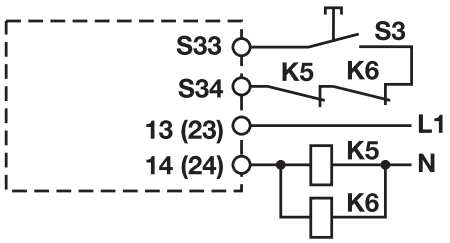
Safety relays PNOZ X
PNOZ XV2P

Input circuit	Single-channel	Dual-channel
Safety gate **with** detection of shorts across contacts		

Start circuit	E-STOP wiring Safety gate without start-up test	Safety gate with start-up test
Automatic start		 Simultaneity S1 and S2: max. 3 s
Monitored start		

Reset delay time	Without reset	With reset
Link or N/C contact		

Safety relays PNOZ X
PNOZ XV2P

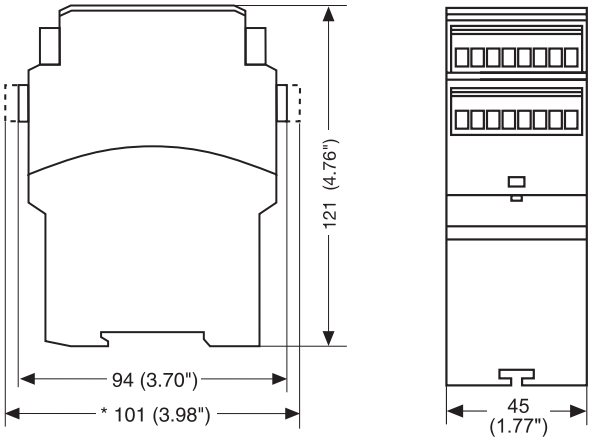
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ XV2P

Technical details

Order no. 777500 – 777503

See below for more order numbers

General	777500	777502	777503
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777500**	**777502**	**777503**
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	4,5 W	4,5 W	4,5 W
Residual ripple DC	160 %	160 %	160 %
Duty cycle	100 %	100 %	100 %
Max. inrush current impulse			
Current pulse, A1	5 A	5 A	5 A
Pulse duration, A1	1 ms	1 ms	1 ms
Inputs	**777500**	**777502**	**777503**
Number	2	2	2
Voltage at			
Input circuit DC	24 V	24 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	35 mA	35 mA	35 mA
Start circuit DC	40 mA	40 mA	40 mA
Feedback loop DC	3,5 mA	3,5 mA	3,5 mA
Min. input resistance at power-on	143 Ohm	143 Ohm	143 Ohm
Max. overall cable resistance RImax			
Single-channel at UB DC	100 Ohm	100 Ohm	100 Ohm
Dual-channel with detection of shorts across contacts at UB DC	10 Ohm	10 Ohm	10 Ohm

Safety relays PNOZ X
PNOZ XV2P

Relay outputs	777500	777502	777503
Number of output contacts			
Safety contacts (N/O), instantaneous	**2**	**2**	**2**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**

Safety relays PNOZ X
PNOZ XV2P

Relay outputs	777500	777502	777503
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ XV2P

Conventional thermal current while loading several contacts	777500	777502	777503
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**	**5 A**
Times	**777500**	**777502**	**777503**
Switch-on delay			
With automatic start typ.	**350 ms**	**350 ms**	**350 ms**
With automatic start max.	**650 ms**	**650 ms**	**650 ms**
With automatic start after power on typ.	**385 ms**	**385 ms**	**385 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**700 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**85 ms**	**85 ms**	**85 ms**
With power failure max.	**200 ms**	**200 ms**	**200 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure	**250 ms**	**250 ms**	**250 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**1 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**

Safety relays PNOZ X
PNOZ XV2P

Times	777500	777502	777503
Supply interruption before de-energisation	20 ms	20 ms	20 ms
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777500**	**777502**	**777503**
Climatic suitability	EN 60068-2-78	EN 60068-2-78	EN 60068-2-78
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**777500**	**777502**	**777503**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Screw terminal	Screw terminal	Screw terminal

Safety relays PNOZ X
PNOZ XV2P

Mechanical data	777500	777502	777503
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**360 g**	**360 g**	**350 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 777504 – 787502

See below for more order numbers

General	777504	787500	787502
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777504**	**787500**	**787502**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**4,5 W**	**4,5 W**	**4,5 W**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**5 A**	**5 A**	**5 A**
Pulse duration, A1	**1 ms**	**1 ms**	**1 ms**

Safety relays PNOZ X
PNOZ XV2P

Inputs	777504	787500	787502
Number	2	2	2
Voltage at			
Input circuit DC	24 V	24 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	35 mA	35 mA	35 mA
Start circuit DC	40 mA	40 mA	40 mA
Feedback loop DC	3,5 mA	3,5 mA	3,5 mA
Min. input resistance at power-on	143 Ohm	143 Ohm	143 Ohm
Max. overall cable resistance RImax			
Single-channel at UB DC	100 Ohm	100 Ohm	100 Ohm
Dual-channel with detection of shorts across contacts at UB DC	10 Ohm	10 Ohm	10 Ohm
Relay outputs	**777504**	**787500**	**787502**
Number of output contacts			
Safety contacts (N/O), instantaneous	2	2	2
Safety contacts (N/O), delayed	2	2	2
Max. short circuit current IK	1 kA	1 kA	1 kA
Utilisation category			
In accordance with the standard	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts			
AC1 at	240 V	240 V	240 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	8 A	8 A	8 A
Max. power	2000 VA	2000 VA	2000 VA
DC1 at	24 V	24 V	24 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	8 A	8 A	8 A
Max. power	200 W	200 W	200 W

Safety relays PNOZ X
PNOZ XV2P

Relay outputs	777504	787500	787502
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ XV2P

Relay outputs	777504	787500	787502
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777504**	**787500**	**787502**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**	**5 A**
Times	**777504**	**787500**	**787502**
Switch-on delay			
With automatic start typ.	**350 ms**	**350 ms**	**350 ms**
With automatic start max.	**650 ms**	**650 ms**	**650 ms**
With automatic start after power on typ.	**385 ms**	**385 ms**	**385 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**700 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**85 ms**	**85 ms**	**85 ms**
With power failure max.	**200 ms**	**200 ms**	**200 ms**

Safety relays PNOZ X
PNOZ XV2P

Times	777504	787500	787502
Recovery time at max. switching frequency 1/s			
After E-STOP	50 ms +tv	50 ms +tv	50 ms +tv
After power failure	250 ms	250 ms	250 ms
Delay time tv	0,5 s	0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s	0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s
Time accuracy	-15 %/+15 % +50 ms	-15 %/+15 % +50 ms	-15 %/+15 % +50 ms
Repetition accuracy	2 %	2 %	2 %
Waiting period with a monitored start	300 ms	300 ms	300 ms
Min. start pulse duration with a monitored start	30 ms	30 ms	30 ms
Supply interruption before de-energisation	20 ms	20 ms	20 ms
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777504**	**787500**	**787502**
Climatic suitability	EN 60068-2-78	EN 60068-2-78	EN 60068-2-78
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV

Safety relays PNOZ X
PNOZ XV2P

Environmental data	777504	787500	787502
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777504**	**787500**	**787502**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,5 Nm**	–	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**	**2**
Stripping length with spring-loaded terminals	–	**8 mm**	**8 mm**
Dimensions			
Height	**94 mm**	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**350 g**	**355 g**	**355 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ XV2P

Order no. 787503 – 787504

General	787503	787504
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**787503**	**787504**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	4,5 W	4,5 W
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	5 A	5 A
Pulse duration, A1	1 ms	1 ms
Inputs	**787503**	**787504**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	35 mA	35 mA
Start circuit DC	40 mA	40 mA
Feedback loop DC	3,5 mA	3,5 mA
Min. input resistance at power-on	143 Ohm	143 Ohm
Max. overall cable resistance Rl-max		
Single-channel at UB DC	100 Ohm	100 Ohm
Dual-channel with detection of shorts across contacts at UB DC	10 Ohm	10 Ohm
Relay outputs	**787503**	**787504**
Number of output contacts		
Safety contacts (N/O), instant-aneous	2	2
Safety contacts (N/O), delayed	2	2
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZ X
PNOZ XV2P

Relay outputs	787503	787504
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Pilot Duty	**C300, R300**	**C300, R300**

Safety relays PNOZ X
PNOZ XV2P

Relay outputs	787503	787504
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787503**	**787504**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**
Times	**787503**	**787504**
Switch-on delay		
With automatic start typ.	**350 ms**	**350 ms**
With automatic start max.	**650 ms**	**650 ms**
With automatic start after power on typ.	**385 ms**	**385 ms**
With automatic start after power on max.	**700 ms**	**700 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**

Safety relays PNOZ X
PNOZ XV2P

Times	787503	787504
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**85 ms**	**85 ms**
With power failure max.	**200 ms**	**200 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms +tv**	**50 ms +tv**
After power failure	**250 ms**	**250 ms**
Delay time tv	**1 s**	**0,5 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787503**	**787504**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZ X
PNOZ XV2P

Environmental data	787503	787504
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787503**	**787504**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**345 g**	**345 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ XV2P

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**20**
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 3**	**2,64E-09**	**20**
Safety contacts, delayed ≥30 s	**PL c**	**Cat. 1**	**SIL CL 1**	**2,87E-09**	**20**

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

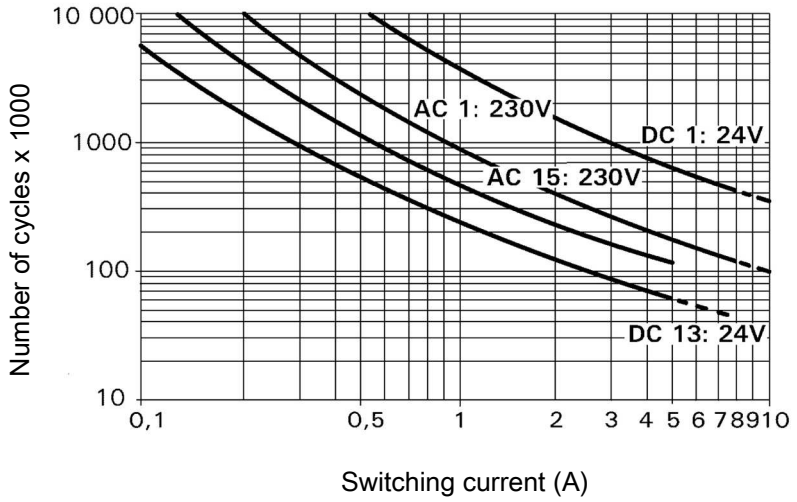
Supplementary data

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.

Safety relays PNOZ X
PNOZ XV2P

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 to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

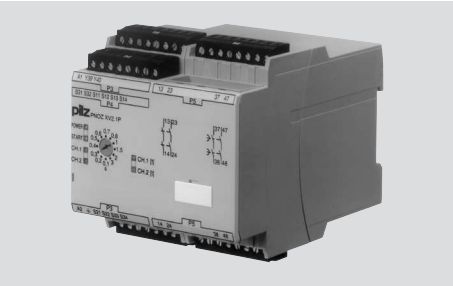
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ XV2P

Order reference

Product type	Features	Connection type	Order no.
PNOZ XV2P	24 VDC; Delay: up to 30 s selectable	Screw terminals	777 500
PNOZ XV2P C	24 VDC; Delay: up to 30 s selectable	Spring-loaded terminals	787 500
PNOZ XV2P	24 VDC; Delay: up to 3 s selectable	Screw terminals	777 502
PNOZ XV2P C	24 VDC; Delay: up to 3 s selectable	Spring-loaded terminals	787 502
PNOZ XV2P	24 VDC; Delay: 1 s fixed	Screw terminals	777 503
PNOZ XV2P C	24 VDC; Delay: 1 s fixed	Spring-loaded terminals	787 503
PNOZ XV2P	24 VDC; Delay: 0.5 s fixed	Screw terminals	777 504
PNOZ XV2P C	24 VDC; Delay: 0.5 s fixed	Spring-loaded terminals	787 504

Safety relays PNOZ X
PNOZ XV2.1P

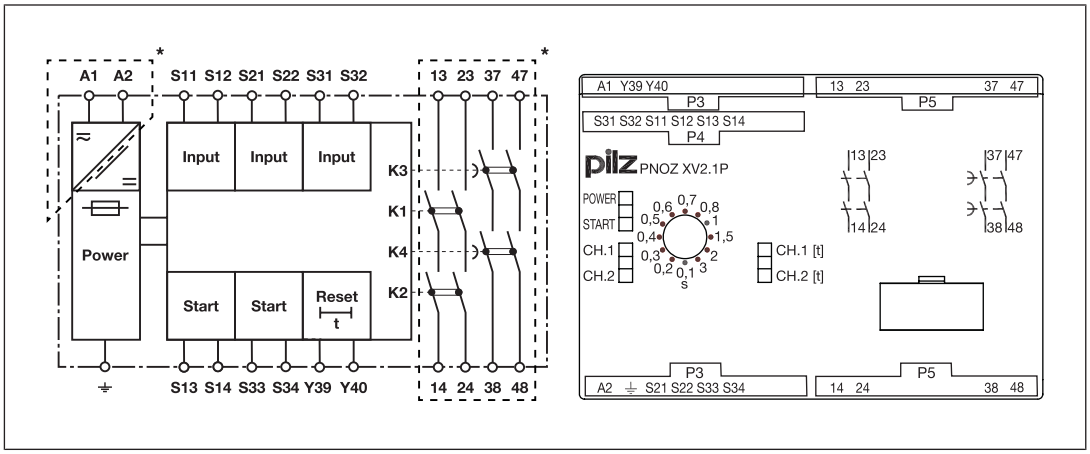


Unit features

- 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
  - Start button
- LED display for:
  - Supply voltage
  - Switch state of the safety contacts
  - Start circuit
- Delay time fixed or selectable
- Possible to cancel delay time
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ XV2.1P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ XV2.1P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the reset circuit Y39-Y40 and the start circuit S13-S14 are closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The "START" LED is lit.
  - The LEDs "CH.1", "CH.1 [t]" and "CH.2", "CH.2 [t]" are lit.
  - The safety contacts 13-14, 23-24, 37-38 and 47-48 are closed. The unit is active.
  - The "START" LED goes out.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 13-14 and 23-24 are redundantly opened.
  - Safety contacts 37-38 and 47-48 open after the delay time has elapsed.
  - The LEDs "CH.1 [t]" and "CH.2 [t]" go out.

Before the unit can be restarted, the delay time must have elapsed and the unit must again be ready for operation.

Safety relays PNOZ X
PNOZ XV2.1P

Set delay time:

On units with selectable delay time, the delay time of the safety contacts 37-38 and 47-48 can be set on the front of the unit using a screwdriver.

Reset function:

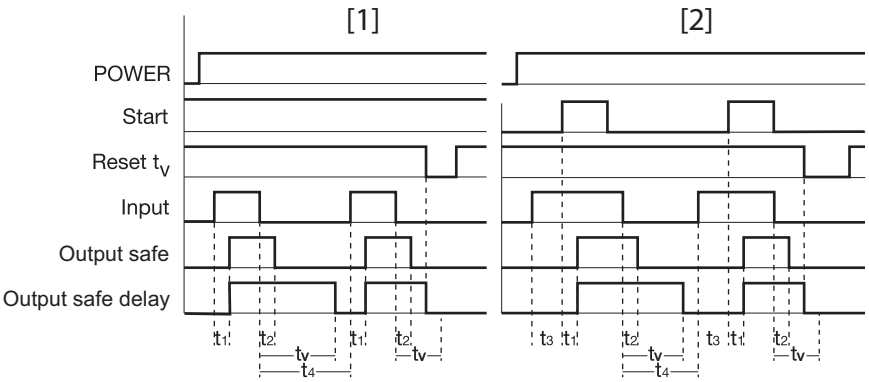
The delay time cycle can be ended prematurely by opening the reset circuit Y39-Y40. For this purpose, one N/C contact is connected between Y39-Y40 instead of a link.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ XV2.1P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - Shorts across contacts in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [📖 325]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ XV2.1P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Reset t_v: Reset circuit
- Input: Input circuit
- Output safe: Safety contacts, instantaneous
- Output safe delay: Safety contacts, delayed
- [1]: Automatic start
- [2]: Monitored start
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time
- t_v: Delay time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ XV2.1P

Wiring

Please note:

- Information given in the "Technical details [325]" must be followed.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit) and link between Y39-Y40 (reset circuit)
- Outputs 13-14, 23-24 are instantaneous safety contacts, outputs 37-38, 47-48 are delay-on de-energisation safety contacts.
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [325]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [325])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- Connect operational earth terminal to functional earth.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

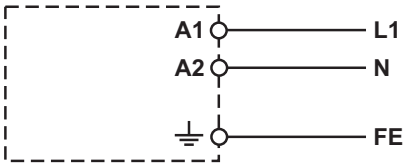
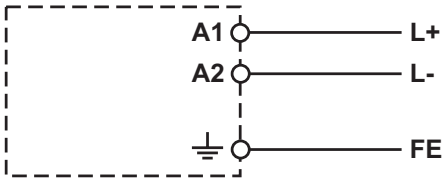
Important for detection of shorts across contacts:

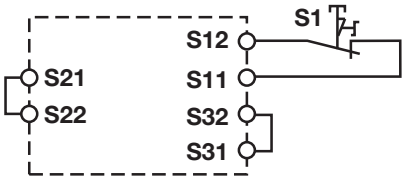
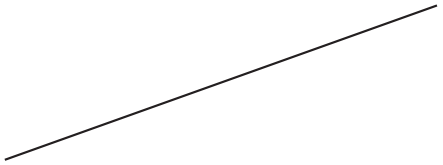
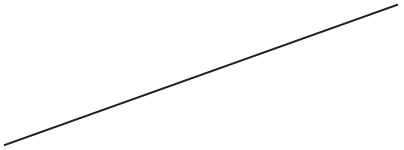
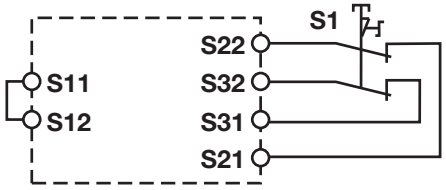
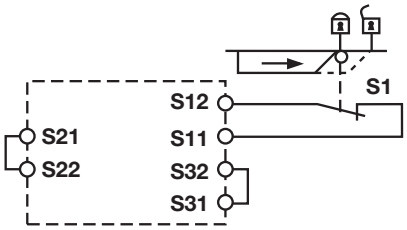
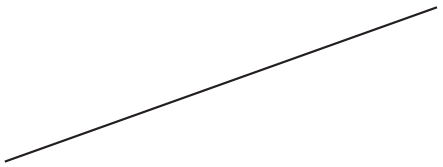
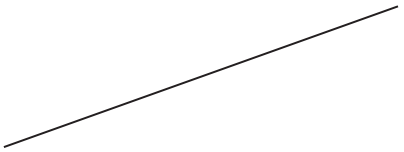
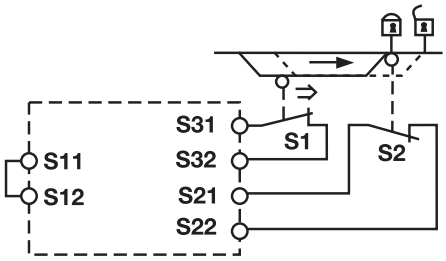
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

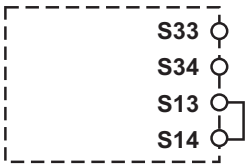
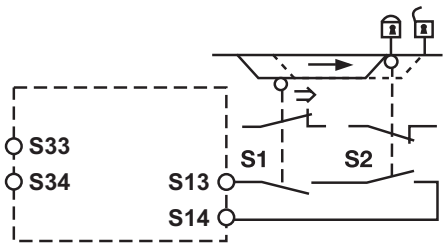
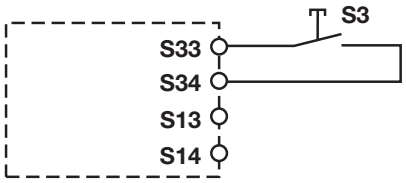
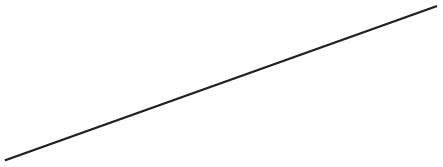
Safety relays PNOZ X
PNOZ XV2.1P

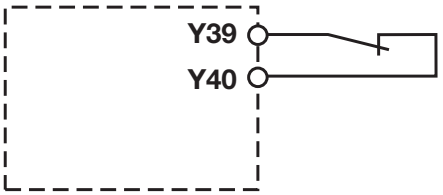
Preparing for operation

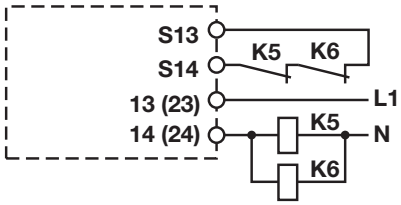
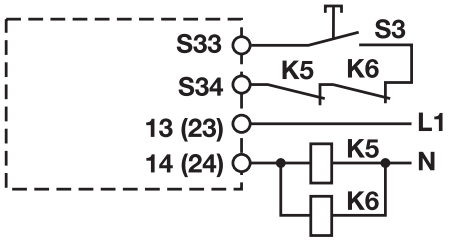
Supply voltage	AC	DC
		

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		

Safety relays PNOZ X
PNOZ XV2.1P

Start circuit	E-STOP wiring Safety gate without start-up test	Safety gate with start-up test
Automatic start		
Monitored start		

Reset delay time	Without reset	With reset
Link or N/C contact		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

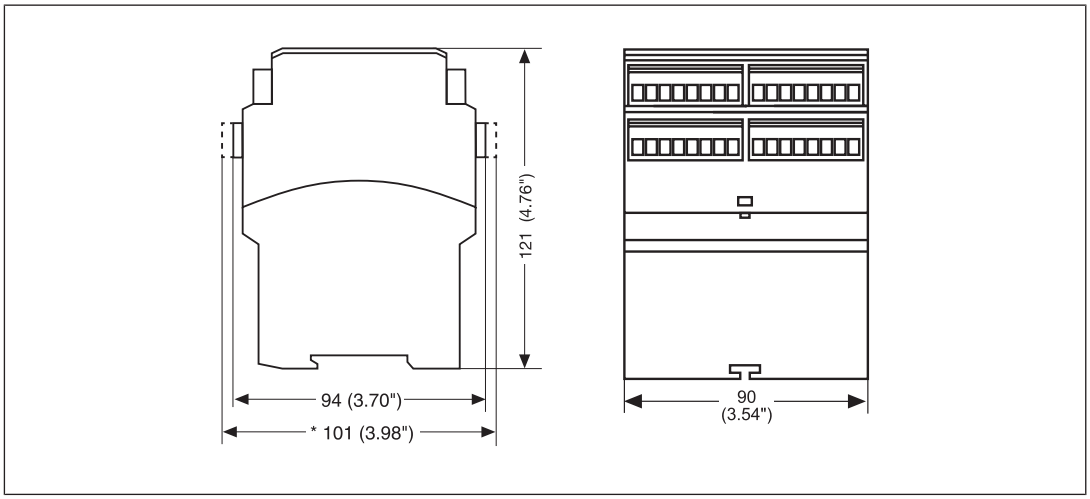
Legend

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

Safety relays PNOZ X
PNOZ XV2.1P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777540 – 777544

See below for more order numbers

General	777540	777542	777544
Approvals	CCC, CE, EAC (Euras-ian), TÜV, cULus Listed	CCC, CE, EAC (Euras-ian), TÜV, cULus Listed	CCC, CE, EAC (Euras-ian), TÜV, cULus Listed
Electrical data	**777540**	**777542**	**777544**
Supply voltage			
Voltage	24 - 240 V	24 - 240 V	24 - 240 V
Kind	AC/DC	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	8,5 VA	8,5 VA	8,5 VA
Output of external power supply (DC)	5 W	5 W	5 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %	160 %
Duty cycle	100 %	100 %	100 %
Inputs	**777540**	**777542**	**777544**
Number	2	2	2
Voltage at			
Input circuit DC	24 V	24 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V

Safety relays PNOZ X
PNOZ XV2.1P

Inputs	777540	777542	777544
Current at			
Input circuit DC	**35 mA**	**35 mA**	**35 mA**
Start circuit DC	**30 mA**	**30 mA**	**30 mA**
Feedback loop DC	**3 mA**	**3 mA**	**3 mA**
Max. overall cable resistance RImax			
Single-channel at UB DC	**200 Ohm**	**200 Ohm**	**200 Ohm**
Single-channel at UB AC	**200 Ohm**	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**20 Ohm**	**20 Ohm**	**20 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**	**20 Ohm**
Relay outputs	**777540**	**777542**	**777544**
Number of output contacts			
Safety contacts (N/O), instantaneous	**2**	**2**	**2**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV2.1P

Relay outputs	777540	777542	777544
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ XV2.1P

Relay outputs	777540	777542	777544
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777540**	**777542**	**777544**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**	**5 A**

Safety relays PNOZ X
PNOZ XV2.1P

Times	777540	777542	777544
Switch-on delay			
With automatic start typ.	**400 ms**	**400 ms**	**400 ms**
With automatic start max.	**550 ms**	**550 ms**	**550 ms**
With automatic start after power on typ.	**820 ms**	**820 ms**	**820 ms**
With automatic start after power on max.	**1.100 ms**	**1.100 ms**	**1.100 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**60 ms**	**60 ms**	**60 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ. UB 240 V	**1 s**	**1 s**	**1 s**
With power failure max. UB 240 V	**1450 ms**	**1450 ms**	**1450 ms**
With power failure typ. UB 24 V	**130 ms**	**130 ms**	**130 ms**
With power failure max. UB 24 V	**170 ms**	**170 ms**	**170 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure on wide-range power supply	**1500 ms**	**1500 ms**	**1500 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,5 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777540**	**777542**	**777544**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**

Safety relays PNOZ X
PNOZ XV2.1P

Environmental data	777540	777542	777544
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**777540**	**777542**	**777544**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Screw terminal	Screw terminal	Screw terminal
Mounting type	plug-in	plug-in	plug-in

Safety relays PNOZ X
PNOZ XV2.1P

Mechanical data	777540	777542	777544
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**90 mm**	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**520 g**	**520 g**	**510 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 777548 – 787540

See below for more order numbers

General	777548	787540
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777548**	**787540**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**8,5 VA**	**8,5 VA**
Output of external power supply (DC)	**5 W**	**5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Inputs	**777548**	**787540**
Number	**2**	**2**

Safety relays PNOZ X
PNOZ XV2.1P

Inputs	777548	787540
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**35 mA**	**35 mA**
Start circuit DC	**30 mA**	**30 mA**
Feedback loop DC	**3 mA**	**3 mA**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**200 Ohm**	**200 Ohm**
Single-channel at UB AC	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**20 Ohm**	**20 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**
Relay outputs	**777548**	**787540**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Safety contacts (N/O), delayed	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV2.1P

Relay outputs	777548	787540
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Pilot Duty	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ XV2.1P

Relay outputs	777548	787540
External contact fuse protection, delayed safety contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777548**	**787540**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**
Times	**777548**	**787540**
Switch-on delay		
With automatic start typ.	**400 ms**	**400 ms**
With automatic start max.	**550 ms**	**550 ms**
With automatic start after power on typ.	**820 ms**	**820 ms**
With automatic start after power on max.	**1.100 ms**	**1.100 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**60 ms**	**60 ms**

Safety relays PNOZ X
PNOZ XV2.1P

Times	777548	787540
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ. UB 240 V	**1 s**	**1 s**
With power failure max. UB 240 V	**1450 ms**	**1450 ms**
With power failure typ. UB 24 V	**130 ms**	**130 ms**
With power failure max. UB 24 V	**170 ms**	**170 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms +tv**	**50 ms +tv**
After power failure on wide-range power supply	**1500 ms**	**1500 ms**
Delay time tv	**0,3 s, 5 s, 10 s, 20 s, 40 s, 60 s, 80 s, 100 s, 150 s, 200 s, 250 s, 300 s**	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**777548**	**787540**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**

Safety relays PNOZ X
PNOZ XV2.1P

Environmental data	777548	787540
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777548**	**787540**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**520 g**	**515 g**

Safety relays PNOZ X
PNOZ XV2.1P

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787542 – 787548

General	787542	787548
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787542**	**787548**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**8,5 VA**	**8,5 VA**
Output of external power supply (DC)	**5 W**	**5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Inputs	**787542**	**787548**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**35 mA**	**35 mA**
Start circuit DC	**30 mA**	**30 mA**
Feedback loop DC	**3 mA**	**3 mA**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**200 Ohm**	**200 Ohm**
Single-channel at UB AC	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**20 Ohm**	**20 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**

Safety relays PNOZ X
PNOZ XV2.1P

Relay outputs	787542	787548
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Safety contacts (N/O), delayed	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**

Safety relays PNOZ X
PNOZ XV2.1P

Relay outputs	787542	787548
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Pilot Duty	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787542**	**787548**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**

Safety relays PNOZ X
PNOZ XV2.1P

Conventional thermal current while loading several contacts	787542	787548
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7 A**	**7 A**
Conv. therm. current with 3 contacts	**5,7 A**	**5,7 A**
Conv. therm. current with 4 contacts	**5 A**	**5 A**
Times	**787542**	**787548**
Switch-on delay		
With automatic start typ.	**400 ms**	**400 ms**
With automatic start max.	**550 ms**	**550 ms**
With automatic start after power on typ.	**820 ms**	**820 ms**
With automatic start after power on max.	**1.100 ms**	**1.100 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**60 ms**	**60 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ. UB 240 V	**1 s**	**1 s**
With power failure max. UB 240 V	**1450 ms**	**1450 ms**
With power failure typ. UB 24 V	**130 ms**	**130 ms**
With power failure max. UB 24 V	**170 ms**	**170 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms +tv**	**50 ms +tv**
After power failure on wide-range power supply	**1500 ms**	**1500 ms**
Delay time tv	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,3 s, 5 s, 10 s, 20 s, 40 s, 60 s, 80 s, 100 s, 150 s, 200 s, 250 s, 300 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**

Safety relays PNOZ X
PNOZ XV2.1P

Times	787542	787548
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787542**	**787548**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787542**	**787548**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**

Safety relays PNOZ X
PNOZ XV2.1P

Mechanical data	787542	787548
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**515 g**	**515 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**20**
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 3**	**2,64E-09**	**20**
Safety contacts, delayed ≥30 s	**PL c**	**Cat. 1**	**SIL CL 1**	**2,87E-09**	**20**

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

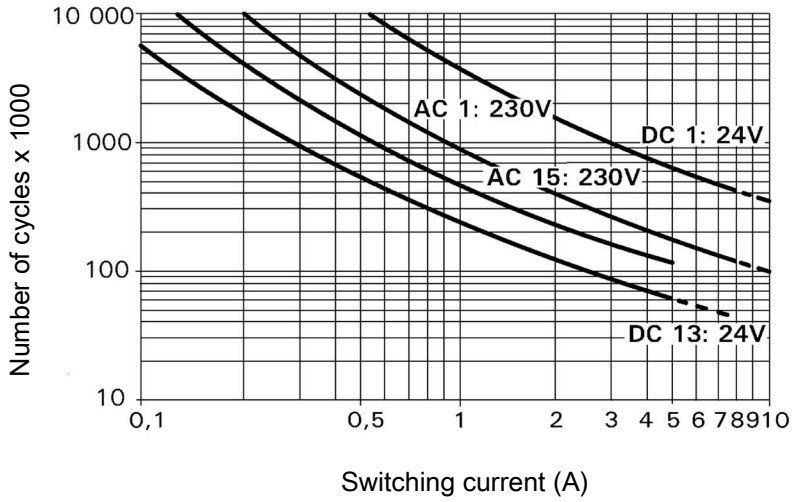
Supplementary data

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.

Safety relays PNOZ X
PNOZ XV2.1P

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 to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

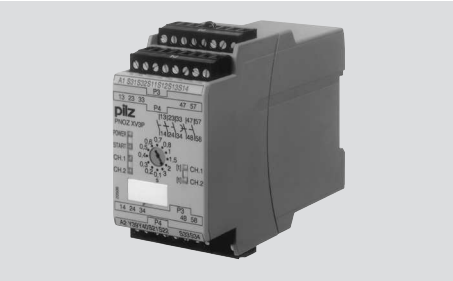
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ XV2.1P

Order reference

Product type	Features	Connection type	Order no.
PNOZ XV2.1P C	24-240 VAC/DC; Delay: up to 3 s selectable	Spring-loaded terminals	787 542
PNOZ XV2.1P	24-240 VAC/DC; Delay: up to 3 s selectable	Screw terminals	777 542
PNOZ XV2.1P C	24-240 VAC/DC; Delay: up to 30 s selectable	Spring-loaded terminals	787 540
PNOZ XV2.1P	24-240 VAC/DC; Delay: up to 30 s selectable	Screw terminals	777 540
PNOZ XV2.1P C	24-240 VAC/DC; Delay: up to 300 s selectable	Spring-loaded terminals	787 548
PNOZ XV2.1P	24-240 VAC/DC; Delay: up to 300 s selectable	Screw terminals	777 548
PNOZ XV2.1P	24-240 VAC/DC; Delay: 0.5 s fixed	Screw terminals	777 544

Safety relays PNOZ X
PNOZ XV3P

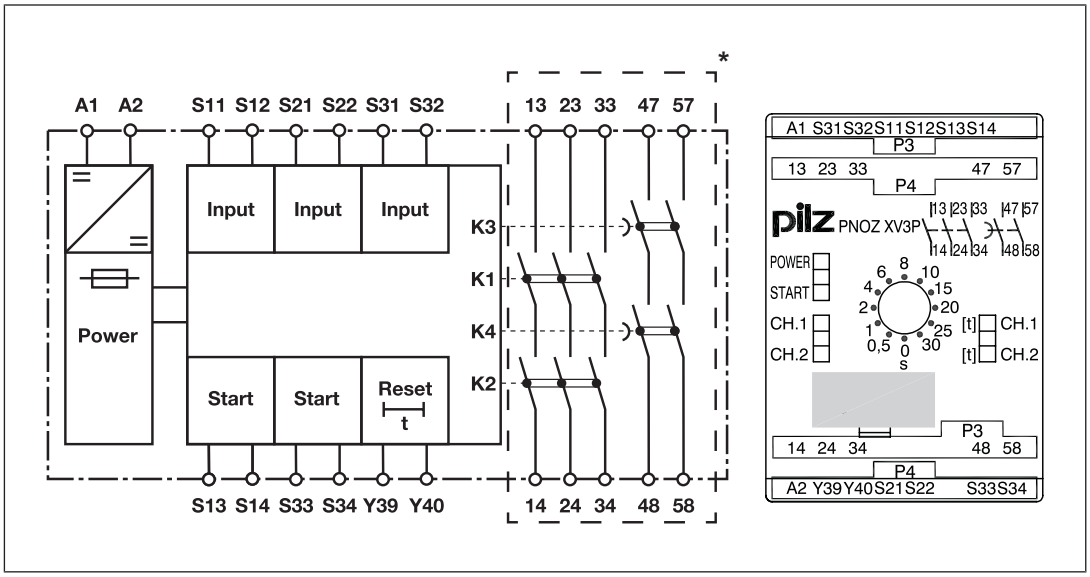


Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 2 safety contacts (N/O), delay-on de-energisation
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- Delay time fixed or selectable
- Possible to cancel delay time
- LED display for:
  - Supply voltage
  - Switch state of the safety contacts
  - Start circuit
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ XV3P

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

Function Description

The safety relay PNOZ XV3P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the reset circuit Y39-Y40 and the start circuit S13-S14 are closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The "START" LED is lit.
  - The LEDs "CH.1", "CH.1 [t]", "CH.2" and "CH.2 [t]" are lit.
  - Safety contacts 13-14, 23-24, 33-34, 47-48 and 57-58 are closed. The unit is active.
  - The "START" LED goes out.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly.
  - Safety contacts 47-48 and 57-58 open after the delay time has elapsed.
  - The LEDs "CH.1 [t]" and "CH.2 [t]" go out.

Before the unit can be restarted, the delay time must have elapsed and the unit must again be ready for operation.

Safety relays PNOZ X
PNOZ XV3P

Set delay time:

On units with selectable delay time, the delay time of the safety contacts 47-48 and 57-58 can be set on the front of the unit using a screwdriver.

Reset function:

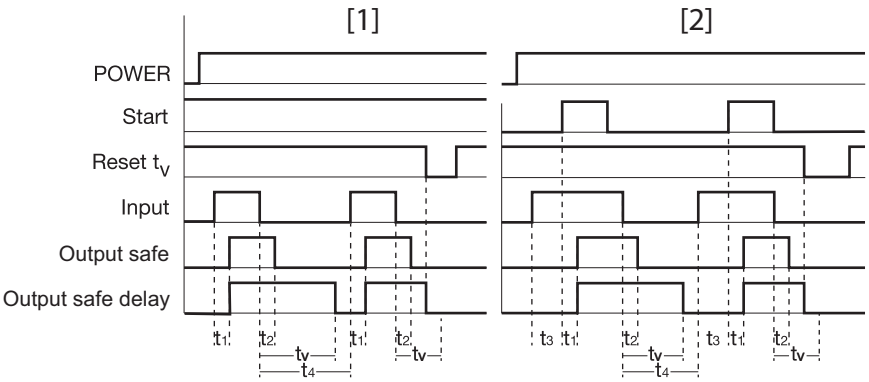
The delay time cycle can be ended prematurely by opening the reset circuit Y39-Y40. For this purpose, one N/C contact is connected between Y39-Y40 instead of a link.

Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ XV3P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - Shorts across contacts in the input circuit.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ XV3P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.
- Automatic start: Unit is active once the input circuit has been closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [📖 352]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Safety relays PNOZ X
PNOZ XV3P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Reset t_v: Reset circuit
- Input: Input circuit
- Output safe: Safety contacts, instantaneous
- Output safe delay: Safety contacts, delayed
- [1]: Automatic start
- [2]: Monitored start
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time
- t_v: Delay time

Installation

- The unit 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).

Safety relays PNOZ X
PNOZ XV3P

Wiring

Please note:

- Information given in the "Technical details [352]" must be followed.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit) and link between Y39-Y40 (reset circuit)
- Outputs 13-14, 23-24, 33-34 are instantaneous safety contacts, outputs 47-48, 57-58 are delay-on de-energisation safety contacts.
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [352]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [352])
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.
- Do not switch low currents using contacts that have been used previously with high currents.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

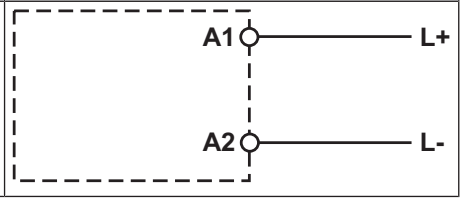
Important for detection of shorts across contacts:

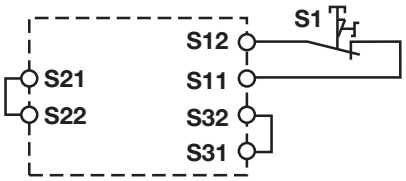
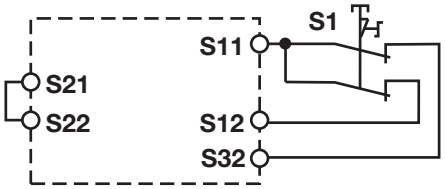
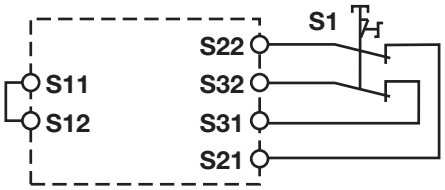
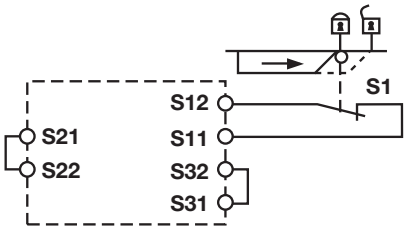
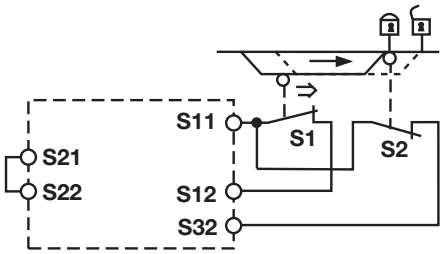
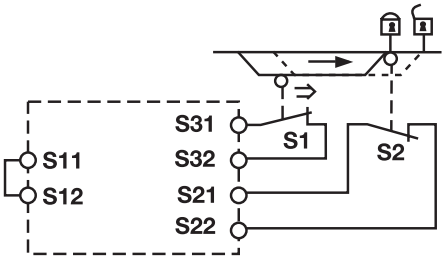
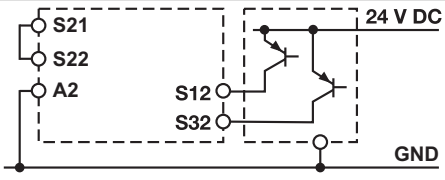
As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

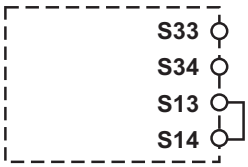
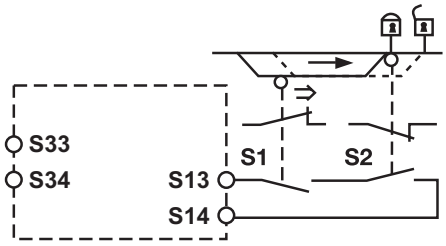
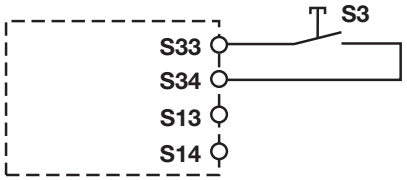
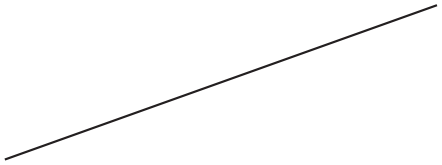
Safety relays PNOZ X
PNOZ XV3P

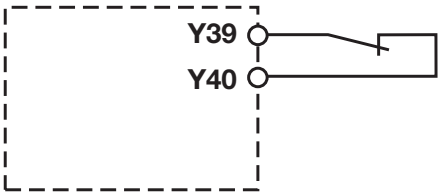
Preparing for operation

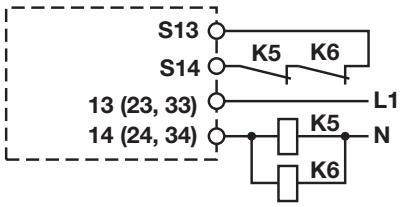
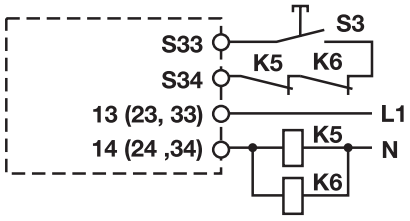
Supply voltage	AC	DC
		

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 guard or safety switch, detection of shorts across contacts via ESPE		

Safety relays PNOZ X
PNOZ XV3P

Start circuit	E-STOP wiring Safety gate without start-up test	Safety gate with start-up test
Automatic start		 Simultaneity S1 and S2: max. 3 s
Monitored start		

Reset delay time	Without reset	With reset
Link or N/C contact		

Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

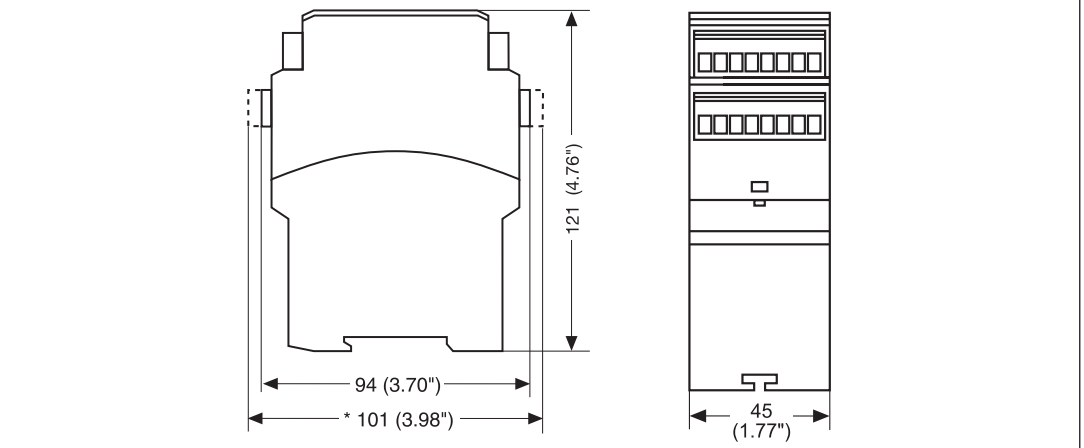
Legend

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

Safety relays PNOZ X
PNOZ XV3P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777510 – 777514

See below for more order numbers

General	**777510**	**777512**	**777514**
Approvals	**CCC, CE, EAC (Euras-ian), TÜV, cULus Listed**	**CCC, CE, EAC (Euras-ian), TÜV, cULus Listed**	**CCC, CE, EAC (Euras-ian), TÜV, cULus Listed**
Electrical data	**777510**	**777512**	**777514**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**4,5 W**	**4,5 W**	**4,5 W**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current im-pulse			
Current pulse, A1	**5 A**	**5 A**	**5 A**
Pulse duration, A1	**1 ms**	**1 ms**	**1 ms**
Inputs	**777510**	**777512**	**777514**
Number	**2**	**2**	**2**

Safety relays PNOZ X
PNOZ XV3P

Inputs	777510	777512	777514
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**35 mA**	**35 mA**	**35 mA**
Start circuit DC	**50 mA**	**50 mA**	**50 mA**
Feedback loop DC	**3,5 mA**	**3,5 mA**	**3,5 mA**
Min. input resistance at power-on	**135 Ohm**	**135 Ohm**	**135 Ohm**
Max. overall cable resistance RImax			
Single-channel at UB DC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**10 Ohm**	**10 Ohm**	**10 Ohm**
Relay outputs	**777510**	**777512**	**777514**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV3P

Relay outputs	777510	777512	777514
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ XV3P

Relay outputs	777510	777512	777514
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777510**	**777512**	**777514**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**6,8 A**	**6,8 A**	**6,8 A**
Conv. therm. current with 3 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 4 contacts	**4,8 A**	**4,8 A**	**4,8 A**
Conv. therm. current with 5 contacts	**4,3 A**	**4,3 A**	**4,3 A**
Times	**777510**	**777512**	**777514**
Switch-on delay			
With automatic start typ.	**350 ms**	**350 ms**	**350 ms**
With automatic start max.	**650 ms**	**650 ms**	**650 ms**
With automatic start after power on typ.	**385 ms**	**385 ms**	**385 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**700 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**	**70 ms**

Safety relays PNOZ X
PNOZ XV3P

Times	777510	777512	777514
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**85 ms**	**85 ms**	**85 ms**
With power failure max.	**200 ms**	**200 ms**	**200 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure	**250 ms**	**250 ms**	**250 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,5 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777510**	**777512**	**777514**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**

Safety relays PNOZ X
PNOZ XV3P

Environmental data	777510	777512	777514
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777510**	**777512**	**777514**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**370 g**	**370 g**	**360 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PNOZ XV3P

Order no. 777515 – 777518

See below for more order numbers

General	**777515**	**777517**	**777518**
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777515**	**777517**	**777518**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**4,5 W**	**4,5 W**	**4,5 W**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**5 A**	**5 A**	**5 A**
Pulse duration, A1	**1 ms**	**1 ms**	**1 ms**
Inputs	**777515**	**777517**	**777518**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**35 mA**	**35 mA**	**35 mA**
Start circuit DC	**50 mA**	**50 mA**	**50 mA**
Feedback loop DC	**3,5 mA**	**3,5 mA**	**3,5 mA**
Min. input resistance at power-on	**135 Ohm**	**135 Ohm**	**135 Ohm**
Max. overall cable resistance RImax			
Single-channel at UB DC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**10 Ohm**	**10 Ohm**	**10 Ohm**

Safety relays PNOZ X
PNOZ XV3P

Relay outputs	777515	777517	777518
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**

Safety relays PNOZ X
PNOZ XV3P

Relay outputs	777515	777517	777518
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ XV3P

Conventional thermal current while loading several contacts	777515	777517	777518
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**6,8 A**	**6,8 A**	**6,8 A**
Conv. therm. current with 3 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 4 contacts	**4,8 A**	**4,8 A**	**4,8 A**
Conv. therm. current with 5 contacts	**4,3 A**	**4,3 A**	**4,3 A**
Times	**777515**	**777517**	**777518**
Switch-on delay			
With automatic start typ.	**350 ms**	**350 ms**	**350 ms**
With automatic start max.	**650 ms**	**650 ms**	**650 ms**
With automatic start after power on typ.	**385 ms**	**385 ms**	**385 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**700 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**85 ms**	**85 ms**	**85 ms**
With power failure max.	**200 ms**	**200 ms**	**200 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure	**250 ms**	**250 ms**	**250 ms**
Delay time tv	**3 s**	**10 s**	**0,3 s, 5 s, 10 s, 20 s, 40 s, 60 s, 80 s, 100 s, 150 s, 200 s, 250 s, 300 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**

Safety relays PNOZ X
PNOZ XV3P

Times	777515	777517	777518
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777515**	**777517**	**777518**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777515**	**777517**	**777518**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZ X
PNOZ XV3P

Mechanical data	777515	777517	777518
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**360 g**	**360 g**	**370 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787510 – 787518

General	787510	787512	787518
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787510**	**787512**	**787518**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**4,5 W**	**4,5 W**	**4,5 W**
Residual ripple DC	**160 %**	**160 %**	**160 %**

Safety relays PNOZ X
PNOZ XV3P

Electrical data	787510	787512	787518
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**5 A**	**5 A**	**5 A**
Pulse duration, A1	**1 ms**	**1 ms**	**1 ms**
Inputs	**787510**	**787512**	**787518**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**35 mA**	**35 mA**	**35 mA**
Start circuit DC	**50 mA**	**50 mA**	**50 mA**
Feedback loop DC	**3,5 mA**	**3,5 mA**	**3,5 mA**
Min. input resistance at power-on	**135 Ohm**	**135 Ohm**	**135 Ohm**
Max. overall cable resistance RImax			
Single-channel at UB DC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**100 Ohm**	**100 Ohm**	**100 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**10 Ohm**	**10 Ohm**	**10 Ohm**
Relay outputs	**787510**	**787512**	**787518**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PNOZ XV3P

Relay outputs	787510	787512	787518
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**

Safety relays PNOZ X
PNOZ XV3P

Relay outputs	787510	787512	787518
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787510**	**787512**	**787518**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**6,8 A**	**6,8 A**	**6,8 A**
Conv. therm. current with 3 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 4 contacts	**4,8 A**	**4,8 A**	**4,8 A**
Conv. therm. current with 5 contacts	**4,3 A**	**4,3 A**	**4,3 A**

Safety relays PNOZ X
PNOZ XV3P

Times	787510	787512	787518
Switch-on delay			
With automatic start typ.	**350 ms**	**350 ms**	**350 ms**
With automatic start max.	**650 ms**	**650 ms**	**650 ms**
With automatic start after power on typ.	**385 ms**	**385 ms**	**385 ms**
With automatic start after power on max.	**700 ms**	**700 ms**	**700 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**85 ms**	**85 ms**	**85 ms**
With power failure max.	**200 ms**	**200 ms**	**200 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure	**250 ms**	**250 ms**	**250 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,3 s, 5 s, 10 s, 20 s, 40 s, 60 s, 80 s, 100 s, 150 s, 200 s, 250 s, 300 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**787510**	**787512**	**787518**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**

Safety relays PNOZ X
PNOZ XV3P

Environmental data	787510	787512	787518
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**787510**	**787512**	**787518**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Spring-loaded terminal	Spring-loaded terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in	plug-in
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	0,2 - 1,5 mm², 24 - 16 AWG	0,2 - 1,5 mm², 24 - 16 AWG	0,2 - 1,5 mm², 24 - 16 AWG
Spring-loaded terminals: Terminal points per connection	2	2	2
Stripping length with spring-loaded terminals	8 mm	8 mm	8 mm

Safety relays PNOZ X
PNOZ XV3P

Mechanical data	787510	787512	787518
Dimensions			
Height	**101 mm**	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**370 g**	**370 g**	**370 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**20**
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 3**	**2,64E-09**	**20**
Safety contacts, delayed ≥30 s	**PL c**	**Cat. 1**	**SIL CL 1**	**2,87E-09**	**20**

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

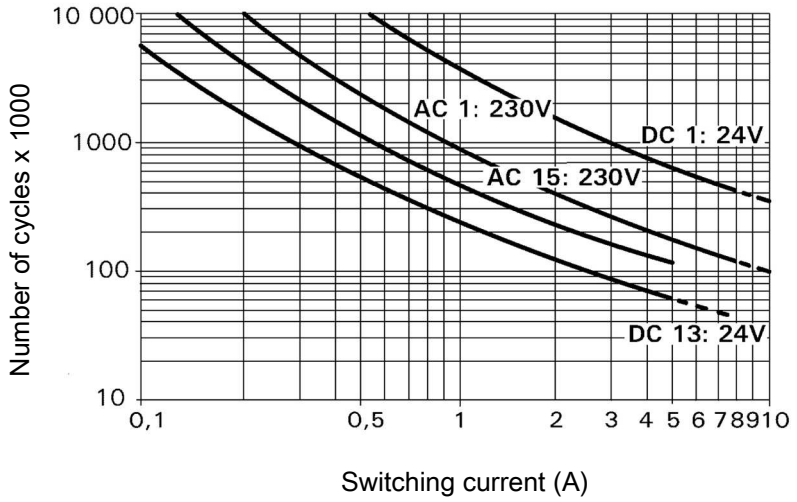
Supplementary data

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.

Safety relays PNOZ X
PNOZ XV3P

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 to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

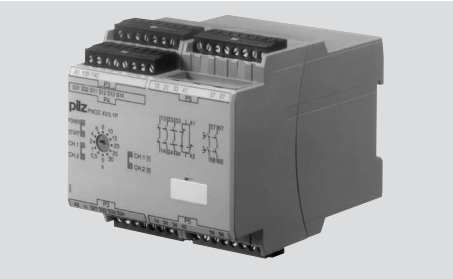
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ XV3P

Order reference

Product type	Features	Connection type	Order no.
PNOZ XV3P	24 VDC; Delay: 0.5 s fixed	Screw terminals	777 514
PNOZ XV3P	24 VDC; Delay: 3 s fixed	Screw terminals	777 515
PNOZ XV3P	24 VDC; Delay: 10 s fixed	Screw terminals	777 517
PNOZ XV3P C	24 VDC; Delay: up to 3 s selectable	Spring-loaded terminals	787 512
PNOZ XV3P	24 VDC; Delay: up to 3 s selectable	Screw terminals	777 512
PNOZ XV3P C	24 VDC; Delay: up to 30 s selectable	Spring-loaded terminals	787 510
PNOZ XV3P	24 VDC; Delay: up to 30 s selectable	Screw terminals	777 510
PNOZ XV3P C	24 VDC; Delay: up to 300 s selectable	Spring-loaded terminals	787 518
PNOZ XV3P	24 VDC; Delay: up to 300 s selectable	Screw terminals	777 518

Safety relays PNOZ X
PNOZ XV3.1P



Unit features

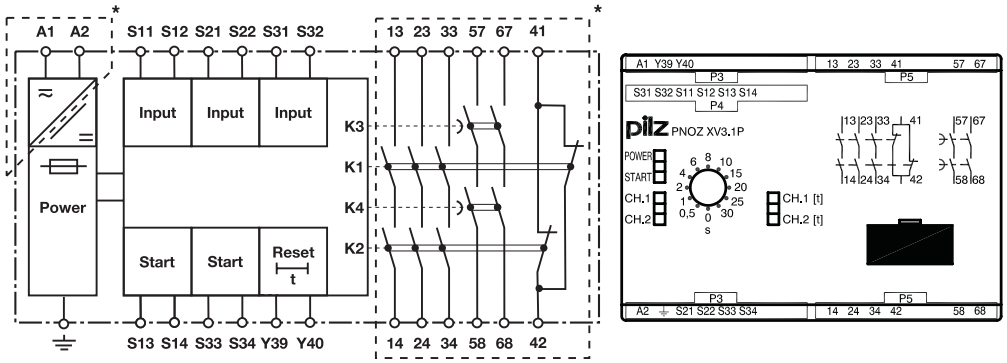
- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 2 safety contacts (N/O), delay-on de-energisation
  - 1 auxiliary contact (N/C), instantaneous
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- Delay time fixed or selectable
- Possible to cancel delay time
- LED display for:
  - Supply voltage
  - Switch state of the safety contacts
  - Start circuit
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PNOZ XV3.1P

Block diagram/terminal configuration

Types: AC/DC

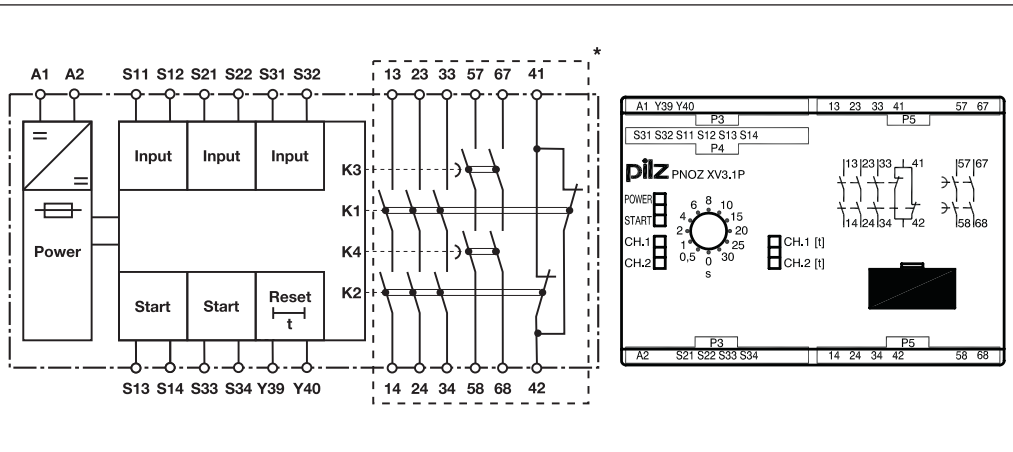
- U_B: 24 - 240 VAC/DC; Order no. 777530, 787530, 777532, 787532, 777538, 787538



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Types: DC

- U_B: 24 VDC; Order no. 777520, 787520, 777522, 787522, 777525



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PNOZ XV3.1P

Function Description

The safety relay PNOZ XV3.1P provides a safety-oriented interruption of a safety circuit. When supply voltage is supplied the "POWER" LED is lit. The unit is ready for operation when the reset circuit Y39-Y40 and the start circuit S13-S14 are closed.

- Input circuit is closed (e.g. E-STOP pushbutton not operated):
  - The "START" LED is lit.
  - The LEDs "CH.1", "CH.1 [t]", "CH.2" and "CH.2 [t]" are lit.
  - Safety contacts 13-14, 23-24, 33-34, 57-58 and 67-68 are closed, auxiliary contact 41-42 is opened. The unit is active.
  - The "START" LED goes out.
- Input circuit is opened (e.g. E-STOP pushbutton operated):
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 13-14, 23-24 and 33-34 are opened redundantly, auxiliary contact 41-42 is closed.
  - Safety contacts 57-58 and 67-68 open after the delay time has elapsed.
  - The LEDs "CH.1 [t]" and "CH.2 [t]" go out.

Before the unit can be restarted, the delay time must have elapsed and the unit must again be ready for operation.

Set delay time:

On units with selectable delay time, the delay time of the safety contacts 57-58 and 67-68 can be set on the front of the unit using a screwdriver.

Reset function:

The delay time cycle can be ended prematurely by opening the reset circuit Y39-Y40. For this purpose, one N/C contact is connected between Y39-Y40 instead of a link.

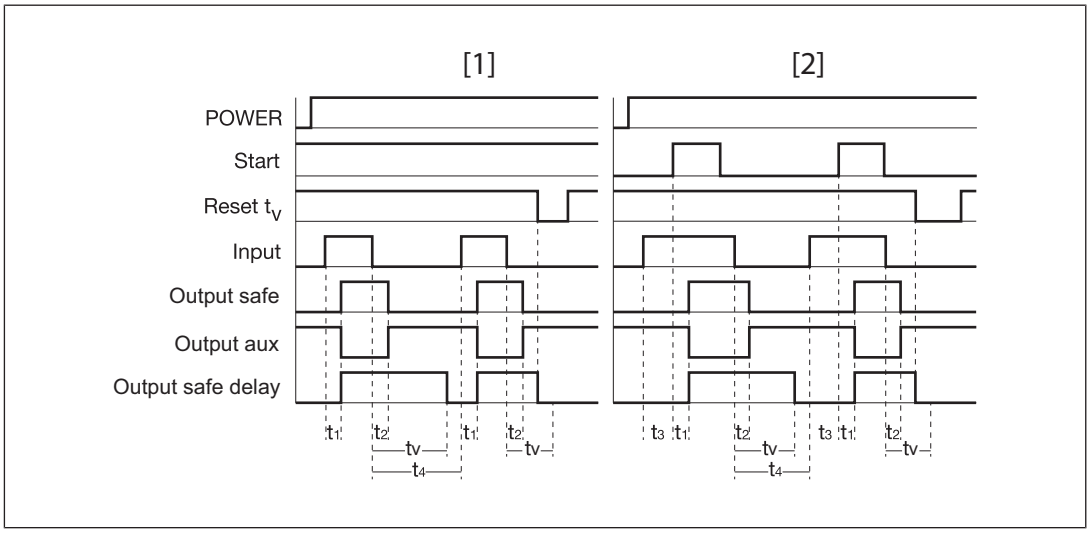
Operating modes

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ XV3.1P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit,
  - Shorts across contacts in the input circuit.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ XV3.1P
  - earth faults in the start and input circuit,
  - short circuits in the input circuit.

Safety relays PNOZ X
PNOZ XV3.1P

- Automatic start: Unit is active once the input circuit has been closed.
- Monitored start: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see Technical details [380]).
- Increase in the number of available contacts by connecting contact expander modules or external contactors/relays.

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Reset t_v: Reset circuit
- Input: Input circuit
- Output safe: Safety contacts, instantaneous
- Output safe delay: Safety contacts, delayed
- Output aux: Auxiliary contact
- [1]: Automatic start
- [2]: Monitored start
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Recovery time
- t_v: Delay time

Safety relays PNOZ X
PNOZ XV3.1P

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [380]" must be followed.
- Delivery status of units with screw terminals: Link between S11-S12 (dual-channel input circuit) and link between Y39-Y40 (reset circuit)
- 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).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [380]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [380])
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.
- On units with U_B 24 – 240 VAC/DC: Connect operational earth terminal to functional earth.
- Do not switch low currents using contacts that have been used previously with high currents.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

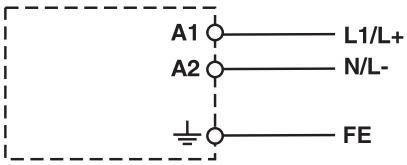
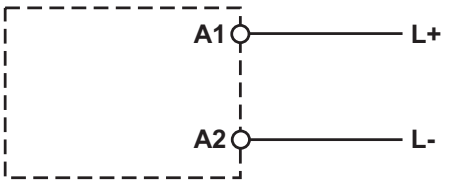
Safety relays PNOZ X
PNOZ XV3.1P

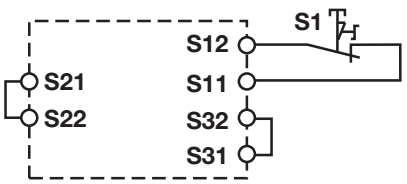
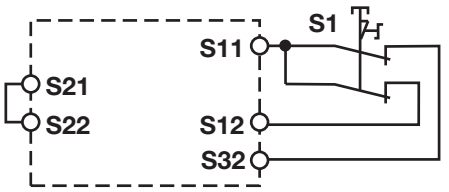
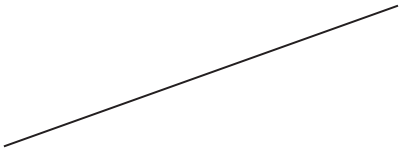
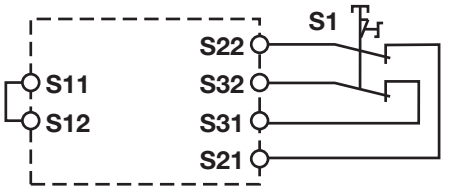
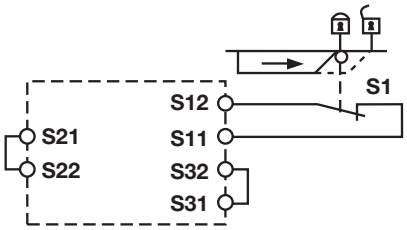
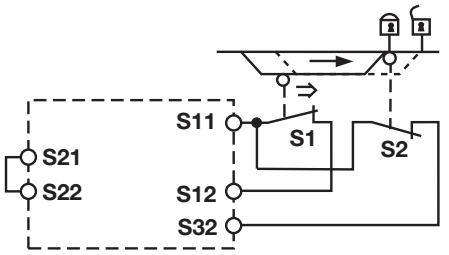
Important for detection of shorts across contacts:

As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable length, we recommend the following test once the unit is installed:

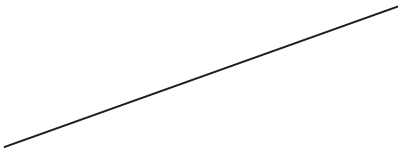
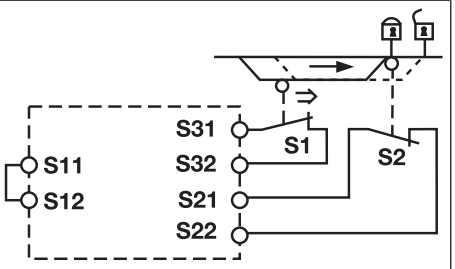
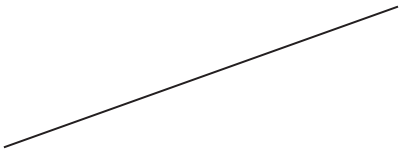
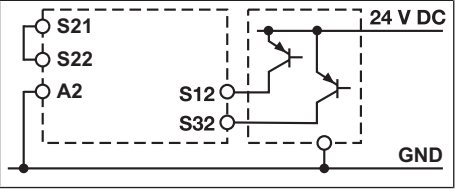
1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S22, S32 for detecting shorts across the inputs.
3. The unit‘s fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: Remove the short circuit and switch off the supply voltage for approx. 1 minute.

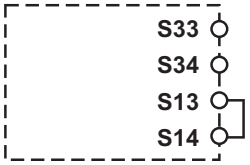
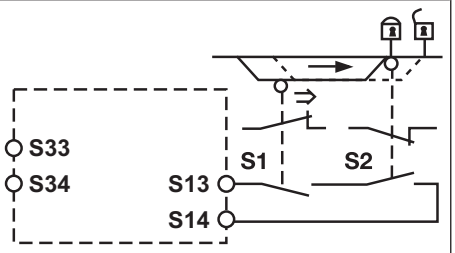
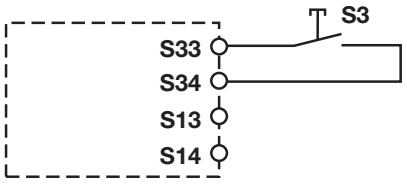
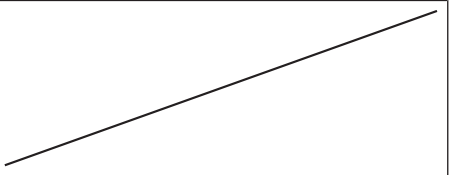
Preparing for operation

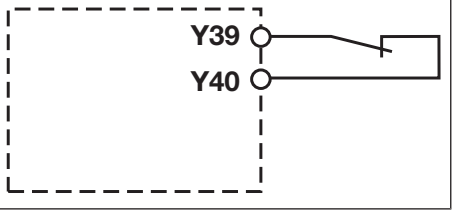
Supply voltage	U_B 24 - 240 VAC/DC	U_B 24 VDC
		

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		

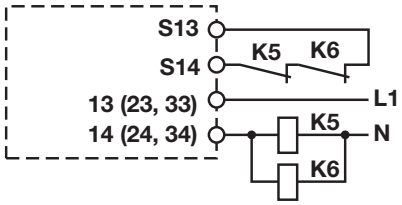
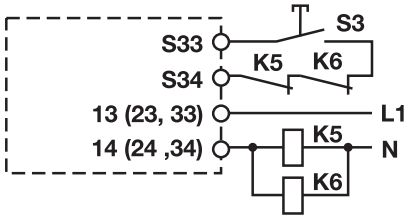
Safety relays PNOZ X
PNOZ XV3.1P

Input circuit	Single-channel	Dual-channel
Safety gate **with** detection of shorts across contacts		
Light guards or safety switch, detection of shorts across contacts via ESPE (only when U_B = 24 VDC)		

Start circuit	E-STOP wiring Safety gate without start-up test	Safety gate with start-up test
Automatic start		
Monitored start		

Reset delay time	Without reset	With reset
Link or N/C contact		

Safety relays PNOZ X
PNOZ XV3.1P

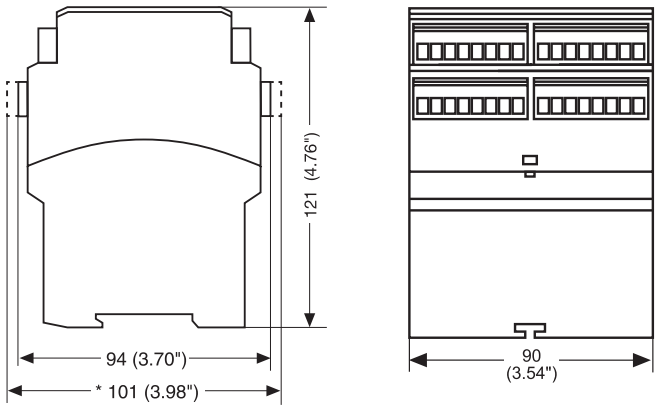
Feedback loop	Automatic start	Monitored start
Contacts from external contactors		

Legend

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

Dimensions in mm

* with spring-loaded terminals



Safety relays PNOZ X
PNOZ XV3.1P

Technical details Order no. 777520-777525

General	777520	777522	777525
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777520**	**777522**	**777525**
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	4,5 W	4,5 W	4,5 W
Residual ripple DC	160 %	160 %	160 %
Duty cycle	100 %	100 %	100 %
Max. inrush current impulse			
Current pulse, A1	5 A	5 A	5 A
Pulse duration, A1	1 ms	1 ms	1 ms
Inputs	**777520**	**777522**	**777525**
Number	2	2	2
Voltage at			
Input circuit DC	24 V	24 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	50 mA	50 mA	50 mA
Start circuit DC	40 mA	40 mA	40 mA
Feedback loop DC	3 mA	3 mA	3 mA
Max. overall cable resistance RImax			
Single-channel at UB DC	100 Ohm	100 Ohm	100 Ohm
Dual-channel without detection of shorts across contacts at UB DC	120 Ohm	120 Ohm	120 Ohm
Dual-channel with detection of shorts across contacts at UB DC	10 Ohm	10 Ohm	10 Ohm

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	777520	777522	777525
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Auxiliary contacts (N/C)	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	777520	777522	777525
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	777520	777522	777525
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777520**	**777522**	**777525**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,8 A**	**7,8 A**	**7,8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**	**5 A**

Safety relays PNOZ X
PNOZ XV3.1P

Times	777520	777522	777525
Switch-on delay			
With automatic start typ.	**400 ms**	**400 ms**	**400 ms**
With automatic start max.	**850 ms**	**850 ms**	**850 ms**
With automatic start after power on typ.	**400 ms**	**400 ms**	**400 ms**
With automatic start after power on max.	**870 ms**	**870 ms**	**870 ms**
With monitored start typ.	**40 ms**	**40 ms**	**40 ms**
With monitored start max.	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**110 ms**	**110 ms**	**110 ms**
With power failure max.	**150 ms**	**150 ms**	**150 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure	**200 ms**	**200 ms**	**200 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**3 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777520**	**777522**	**777525**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**

Safety relays PNOZ X
PNOZ XV3.1P

Environmental data	777520	777522	777525
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**777520**	**777522**	**777525**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Screw terminal	Screw terminal	Screw terminal
Mounting type	plug-in	plug-in	plug-in
Conductor cross section with screw terminals			
1 core flexible	0,25 - 2,5 mm², 24 - 12 AWG	0,25 - 2,5 mm², 24 - 12 AWG	0,25 - 2,5 mm², 24 - 12 AWG
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	0,25 - 1 mm², 24 - 16 AWG	0,25 - 1 mm², 24 - 16 AWG	0,25 - 1 mm², 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,2 - 1,5 mm², 24 - 16 AWG	0,2 - 1,5 mm², 24 - 16 AWG	0,2 - 1,5 mm², 24 - 16 AWG

Safety relays PNOZ X
PNOZ XV3.1P

Mechanical data	777520	777522	777525
Torque setting with screw terminals	0,5 Nm	0,5 Nm	0,5 Nm
Dimensions			
Height	94 mm	94 mm	94 mm
Width	90 mm	90 mm	90 mm
Depth	121 mm	121 mm	121 mm
Weight	510 g	510 g	500 g

Where standards are undated, the 2014-07 latest editions shall apply.

Technical details Order no. 777530-777538

General	777530	777532	777538
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777530**	**777532**	**777538**
Supply voltage			
Voltage	24 - 240 V	24 - 240 V	24 - 240 V
Kind	AC/DC	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	8,5 VA	8,5 VA	8,5 VA
Output of external power supply (DC)	5 W	5 W	5 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %	160 %
Duty cycle	100 %	100 %	100 %
Inputs	**777530**	**777532**	**777538**
Number	2	2	2
Voltage at			
Input circuit DC	24 V	24 V	24 V
Start circuit DC	24 V	24 V	24 V
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	40 mA	40 mA	40 mA
Start circuit DC	40 mA	40 mA	40 mA
Feedback loop DC	3 mA	3 mA	3 mA

Safety relays PNOZ X
PNOZ XV3.1P

Inputs	777530	777532	777538
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**150 Ohm**	**150 Ohm**	**150 Ohm**
Single-channel at UB AC	**150 Ohm**	**150 Ohm**	**150 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**200 Ohm**	**200 Ohm**	**200 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**200 Ohm**	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**20 Ohm**	**20 Ohm**	**20 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**	**20 Ohm**
Relay outputs	**777530**	**777532**	**777538**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Auxiliary contacts (N/C)	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	777530	777532	777538
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	777530	777532	777538
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ XV3.1P

Conventional thermal current while loading several contacts	**777530**	**777532**	**777538**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,8 A**	**7,8 A**	**7,8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,8 A**	**7,8 A**	**7,8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**	**5 A**
Times	**777530**	**777532**	**777538**
Switch-on delay			
With automatic start typ.	**400 ms**	**400 ms**	**400 ms**
With automatic start max.	**550 ms**	**550 ms**	**550 ms**
With automatic start after power on typ.	**750 ms**	**750 ms**	**750 ms**
With automatic start after power on max.	**1.050 ms**	**1.050 ms**	**1.050 ms**
With monitored start typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start max.	**60 ms**	**60 ms**	**60 ms**

Safety relays PNOZ X
PNOZ XV3.1P

Times	777530	777532	777538
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ. UB 240 V	**900 ms**	**900 ms**	**900 ms**
With power failure max. UB 240 V	**1400 ms**	**1400 ms**	**1400 ms**
With power failure typ. UB 24 V	**120 ms**	**120 ms**	**120 ms**
With power failure max. UB 24 V	**170 ms**	**170 ms**	**170 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure on wide-range power supply	**1450 ms**	**1450 ms**	**1450 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,3 s, 5 s, 10 s, 20 s, 40 s, 60 s, 80 s, 100 s, 150 s, 200 s, 250 s, 300 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**777530**	**777532**	**777538**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**

Safety relays PNOZ X
PNOZ XV3.1P

Environmental data	777530	777532	777538
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777530**	**777532**	**777538**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**

Safety relays PNOZ X
PNOZ XV3.1P

Mechanical data	777530	777532	777538
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**90 mm**	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**540 g**	**540 g**	**540 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Technical details Order no. 787520-787530

General	787520	787522	787530
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787520**	**787522**	**787530**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 - 240 V**
Kind	**DC**	**DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	–	**8,5 VA**
Output of external power supply (DC)	**4,5 W**	**4,5 W**	**5 W**
Frequency range AC	–	–	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**5 A**	**5 A**	–
Pulse duration, A1	**1 ms**	**1 ms**	–
Inputs	**787520**	**787522**	**787530**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**50 mA**	**50 mA**	**40 mA**
Start circuit DC	**40 mA**	**40 mA**	**40 mA**
Feedback loop DC	**3 mA**	**3 mA**	**3 mA**

Safety relays PNOZ X
PNOZ XV3.1P

Inputs	787520	787522	787530
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**100 Ohm**	**100 Ohm**	**150 Ohm**
Single-channel at UB AC	–	–	**150 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**120 Ohm**	**120 Ohm**	**200 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	–	–	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**10 Ohm**	**10 Ohm**	**20 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	–	–	**20 Ohm**
Relay outputs	**787520**	**787522**	**787530**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Auxiliary contacts (N/C)	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	787520	787522	787530
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**	**8 A**
Max. power	**200 W**	**200 W**	**200 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**7 A**	**7 A**	**7 A**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	787520	787522	787530
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**	**C300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**240 A²s**	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PNOZ XV3.1P

Conventional thermal current while loading several contacts	787520	787522	787530
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	–	–	**8 A**
Conv. therm. current with 2 contacts	–	–	**7,8 A**
Conv. therm. current with 3 contacts	–	–	**6,5 A**
Conv. therm. current with 4 contacts	–	–	**5,5 A**
Conv. therm. current with 5 contacts	–	–	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**8 A**	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,8 A**	**7,8 A**	**7,8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**	**5 A**
Times	**787520**	**787522**	**787530**
Switch-on delay			
With automatic start typ.	**400 ms**	**400 ms**	**400 ms**
With automatic start max.	**850 ms**	**850 ms**	**550 ms**
With automatic start after power on typ.	**400 ms**	**400 ms**	**750 ms**
With automatic start after power on max.	**870 ms**	**870 ms**	**1.050 ms**
With monitored start typ.	**40 ms**	**40 ms**	**35 ms**
With monitored start max.	**70 ms**	**70 ms**	**60 ms**

Safety relays PNOZ X
PNOZ XV3.1P

Times	787520	787522	787530
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**110 ms**	**110 ms**	–
With power failure max.	**150 ms**	**150 ms**	–
With power failure typ. UB 240 V	–	–	**900 ms**
With power failure max. UB 240 V	–	–	**1400 ms**
With power failure typ. UB 24 V	–	–	**120 ms**
With power failure max. UB 24 V	–	–	**170 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**50 ms +tv**	**50 ms +tv**	**50 ms +tv**
After power failure	**200 ms**	**200 ms**	–
After power failure on wide-range power supply	–	–	**1450 ms**
Delay time tv	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,1 s, 0,5 s, 1 s, 2 s, 4 s, 6 s, 8 s, 10 s, 15 s, 20 s, 25 s, 30 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**787520**	**787522**	**787530**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**

Safety relays PNOZ X
PNOZ XV3.1P

Environmental data	787520	787522	787530
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**787520**	**787522**	**787530**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Spring-loaded terminal	Spring-loaded terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in	plug-in
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	0,2 - 1,5 mm², 24 - 16 AWG	0,2 - 1,5 mm², 24 - 16 AWG	0,2 - 1,5 mm², 24 - 16 AWG
Spring-loaded terminals: Terminal points per connection	2	2	2
Stripping length with spring-loaded terminals	8 mm	8 mm	8 mm
Dimensions			
Height	101 mm	101 mm	101 mm
Width	90 mm	90 mm	90 mm
Depth	121 mm	121 mm	121 mm

Safety relays PNOZ X
PNOZ XV3.1P

Mechanical data	787520	787522	787530
Weight	**510 g**	**510 g**	**535 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Technical details Order no. 787532-787538

General	787532	787538
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787532**	**787538**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**8,5 VA**	**8,5 VA**
Output of external power supply (DC)	**5 W**	**5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Inputs	**787532**	**787538**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Input circuit DC	**40 mA**	**40 mA**
Start circuit DC	**40 mA**	**40 mA**
Feedback loop DC	**3 mA**	**3 mA**

Safety relays PNOZ X
PNOZ XV3.1P

Inputs	787532	787538
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**150 Ohm**	**150 Ohm**
Single-channel at UB AC	**150 Ohm**	**150 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**200 Ohm**	**200 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**200 Ohm**	**200 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**20 Ohm**	**20 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**20 Ohm**	**20 Ohm**
Relay outputs	**787532**	**787538**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Safety contacts (N/O), delayed	**2**	**2**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	787532	787538
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**C300, R300**	**C300, R300**

Safety relays PNOZ X
PNOZ XV3.1P

Relay outputs	787532	787538
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787532**	**787538**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,8 A**	**7,8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,5 A**	**5,5 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**

Safety relays PNOZ X
PNOZ XV3.1P

Conventional thermal current while loading several contacts	787532	787538
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**7,8 A**	**7,8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,5 A**	**5,5 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**
Times	**787532**	**787538**
Switch-on delay		
With automatic start typ.	**400 ms**	**400 ms**
With automatic start max.	**550 ms**	**550 ms**
With automatic start after power on typ.	**750 ms**	**750 ms**
With automatic start after power on max.	**1.050 ms**	**1.050 ms**
With monitored start typ.	**35 ms**	**35 ms**
With monitored start max.	**60 ms**	**60 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ. UB 240 V	**900 ms**	**900 ms**
With power failure max. UB 240 V	**1400 ms**	**1400 ms**
With power failure typ. UB 24 V	**120 ms**	**120 ms**
With power failure max. UB 24 V	**170 ms**	**170 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms +tv**	**50 ms +tv**
After power failure on wide-range power supply	**1450 ms**	**1450 ms**
Delay time tv	**0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 3 s**	**0,3 s, 5 s, 10 s, 20 s, 40 s, 60 s, 80 s, 100 s, 150 s, 200 s, 250 s, 300 s**
Time accuracy	**-15 %/+15 % +50 ms**	**-15 %/+15 % +50 ms**
Repetition accuracy	**2 %**	**2 %**
Waiting period with a monitored start	**300 ms**	**300 ms**

Safety relays PNOZ X
PNOZ XV3.1P

Times	787532	787538
Min. start pulse duration with a monitored start	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**787532**	**787538**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787532**	**787538**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZ X
PNOZ XV3.1P

Mechanical data	787532	787538
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**535 g**	**535 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**20**
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 3**	**2,64E-09**	**20**
Safety contacts, delayed ≥30 s	**PL c**	**Cat. 1**	**SIL CL 1**	**2,87E-09**	**20**

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

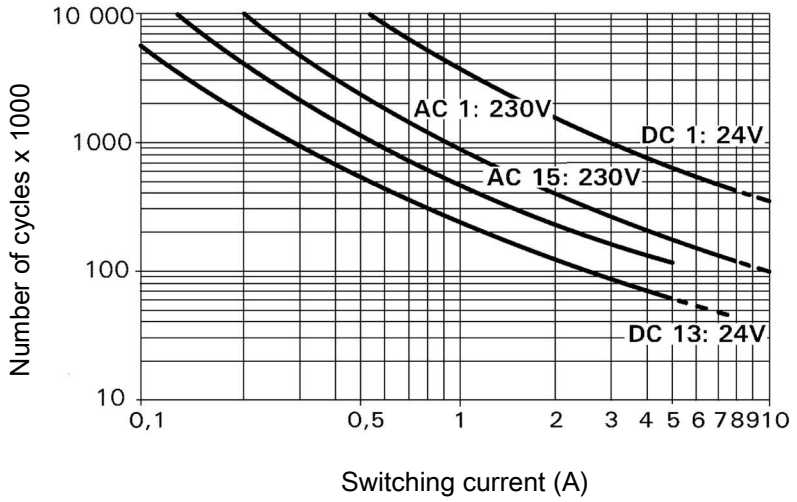
Supplementary data

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.

Safety relays PNOZ X
PNOZ XV3.1P

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 to be implemented 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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PNOZ XV3.1P

Order reference

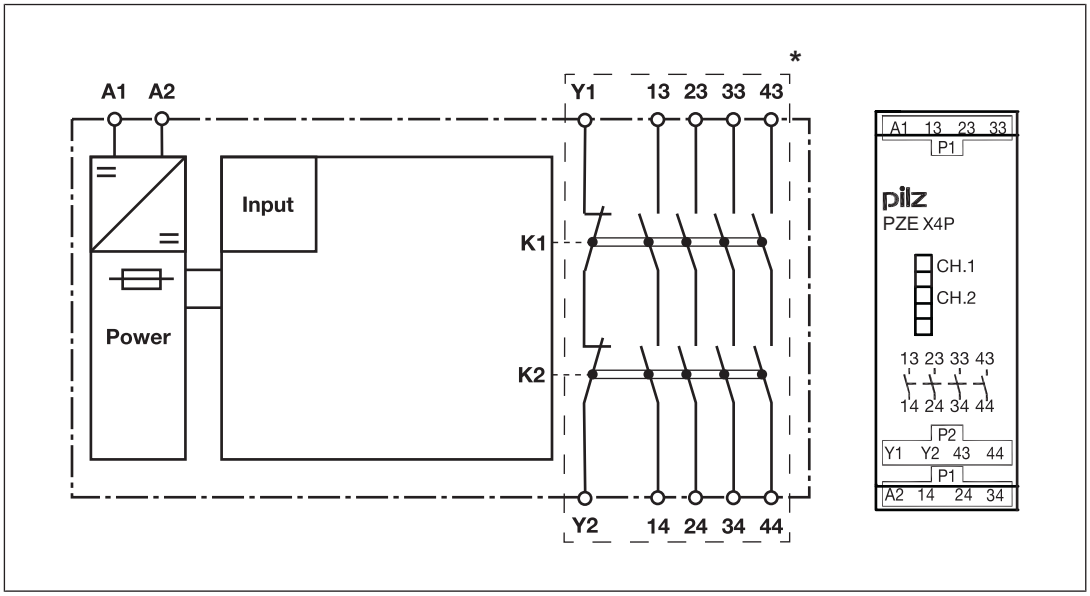
Product type	Features	Connection type	Order no.
PNOZ XV3.1P	24 VDC; Delay: up to 3 s selectable	Screw terminals	777 522
PNOZ XV3.1P C	24 VDC; Delay: up to 3 s selectable	Spring-loaded terminals	787 522
PNOZ XV3.1P	24 VDC; Delay: 3 s fixed	Screw terminals	777 525
PNOZ XV3.1P	24 VDC; Delay: up to 30 s selectable	Screw terminals	777 520
PNOZ XV3.1P C	24 VDC; Delay: up to 30 s selectable	Spring-loaded terminals	787 520
PNOZ XV3.1P	24 - 240 VAC/DC; Delay: up to 3 s selectable	Screw terminals	777 532
PNOZ XV3.1P C	24 - 240 VAC/DC; Delay: up to 3 s selectable	Spring-loaded terminals	787 532
PNOZ XV3.1P	24 - 240 VAC/DC; Delay: up to 30 s selectable	Screw terminals	777 530
PNOZ XV3.1P C	24 - 240 VAC/DC; Delay: up to 30 s selectable	Spring-loaded terminals	787 530
PNOZ XV3.1P	24 - 240 VAC/DC; Delay: up to 300 s selectable	Screw terminals	777 538
PNOZ XV3.1P C	24 - 240 VAC/DC; Delay: up to 300 s selectable	Spring-loaded terminals	787 538

Safety relays PNOZ X
PZE X4P

Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), instantaneous
- LED display for:
  - Switch status of the safety contacts
- Connection for feedback loop
- Operation: single-channel
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PZE X4P

Function description

The contact expansion module PZE X4P is an add-on device without delay-on de-energisation, and it is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay).

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - The supply voltage is present at input (A1) of the contact expansion module.
  - The safety contacts 13-14, 23-24, 33-34 and 43-44 close.
  - The LEDs "CH.1" and "CH.2" are lit.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - The supply voltage is not present at input (A1) of the contact expansion module.
  - Safety contacts 13-14, 23-24, 33-34 and 43-44 are opened redundantly.
  - The LEDs "CH.1" and "CH.2" go out.

Installation

- The unit 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).
- If more than 2 units are installed next to each other in the control cabinet, leave a distance of at least 6 mm between the units.

Wiring

Please note:

- Information given in the "Technical details [📖 412]" must be followed.
- The outputs 13-14, 23-24, 33-34 and 43-44 are safety contacts.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 412]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

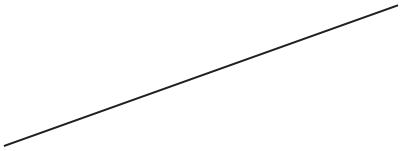
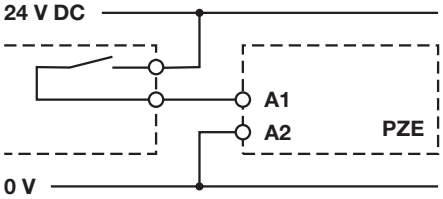
R_{lmax} = max. overall cable resistance (see Technical details [📖 412])
R_l / km = cable resistance/km

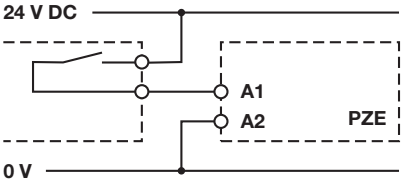
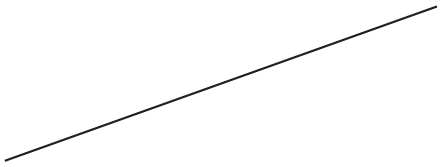
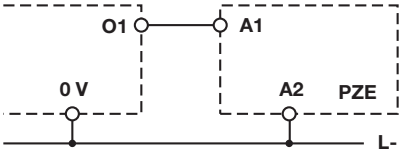
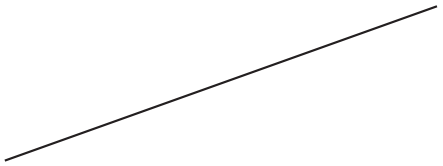
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

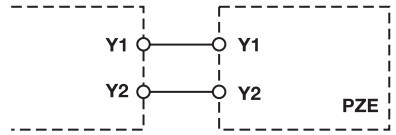
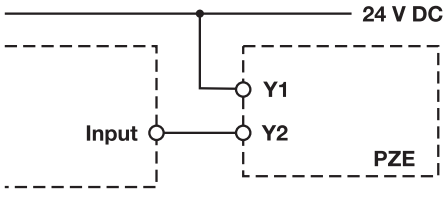
Safety relays PNOZ X
PZE X4P

- Do not switch low currents using contacts that have been used previously with high currents.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Preparing for operation

Supply voltage	AC	DC
		

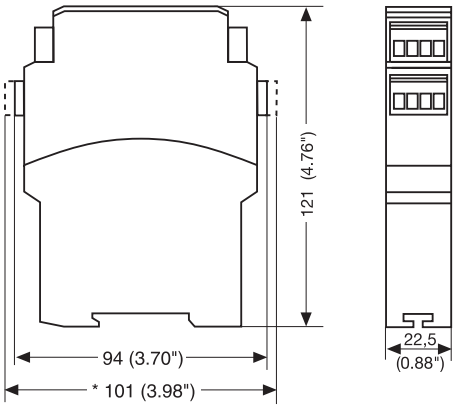
Input circuit	Single-channel	Dual-channel
Base unit: PNOZ X Driven via safety contacts		
Base unit: PNOZmulti or PNOZelog Driven via semiconductor outputs (24 V DC)		

Feedback loop	Base unit: PNOZ X	Base unit: PNOZmulti or PNOZelog
Y1, Y2 and Input are inputs on the base unit; they evaluate the feedback loop		

Safety relays PNOZ X
PZE X4P

Dimensions in mm

* with spring-loaded terminals



Technical details

General	777585	787585
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777585**	**787585**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**2,5 W**	**2,5 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	**1,7 A**
Pulse duration, A1	**1 ms**	**1 ms**
Inputs	**777585**	**787585**
Number	**1**	**1**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Current at		
Input circuit DC	**95 mA**	**95 mA**

Safety relays PNOZ X
PZE X4P

Inputs	777585	787585
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Relay outputs	**777585**	**787585**
Number of output contacts		
Safety contacts (N/O), instantaneous	**4**	**4**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
Pilot Duty	**R300**	**R300**

Safety relays PNOZ X
PZE X4P

Relay outputs	777585	787585
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777585**	**787585**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**5 A**
Conv. therm. current with 4 contacts	**4 A**	**4 A**
Times	**777585**	**787585**
Switch-on delay		
With automatic start after power on typ.	**30 ms**	**30 ms**
With automatic start after power on max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**30 ms**	**30 ms**
With E-STOP max.	**50 ms**	**50 ms**
With power failure typ.	**30 ms**	**30 ms**
With power failure max.	**50 ms**	**50 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777585**	**787585**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**

Safety relays PNOZ X
PZE X4P

Environmental data	777585	787585
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777585**	**787585**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**

Safety relays PNOZ X
PZE X4P

Mechanical data	777585	787585
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**170 g**	**170 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZ X
PZE X4P

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.

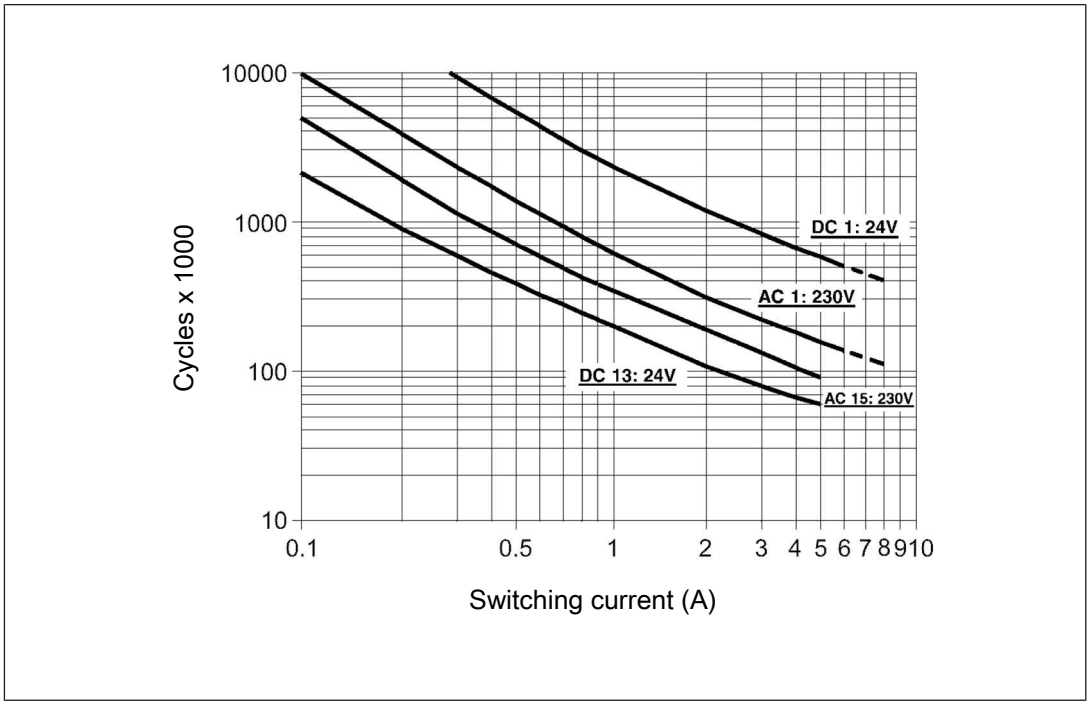


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZ X
PZE X4P

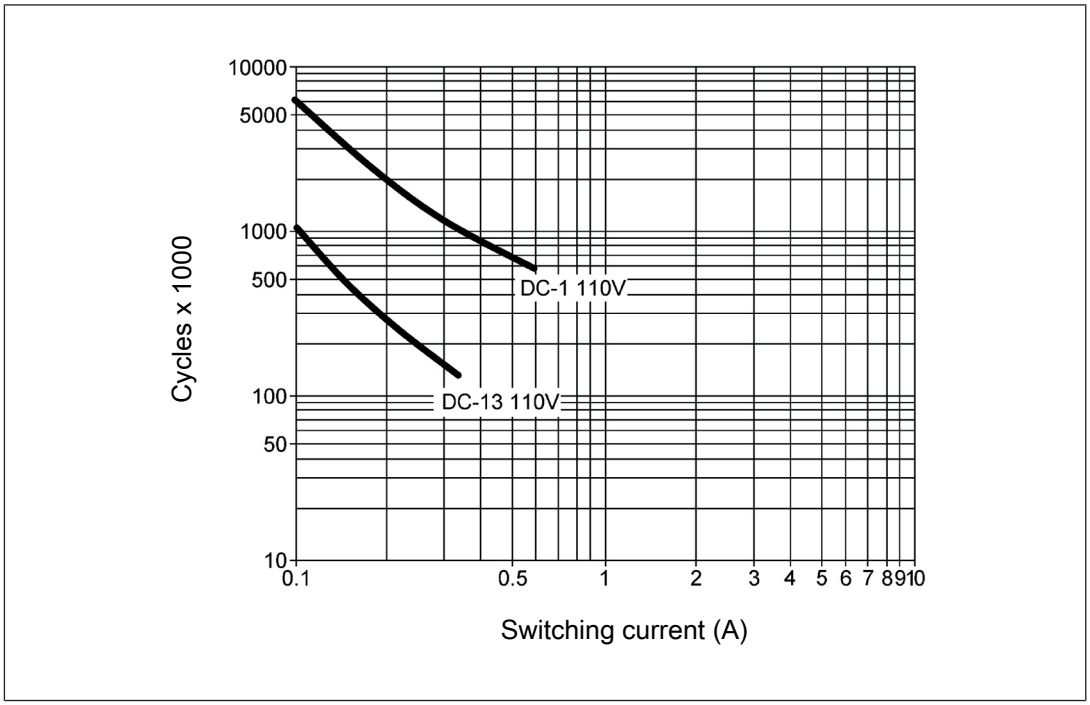


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [412]) 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Type	Features	Connection type	Order no.
PZE X4P	24 VDC	Screw terminals, plug-in	777 585
PZE X4P C	24 VDC	Spring-loaded terminals, plug-in	787 585

Safety relays PNOZ X
PZE X4.1P

Unit features

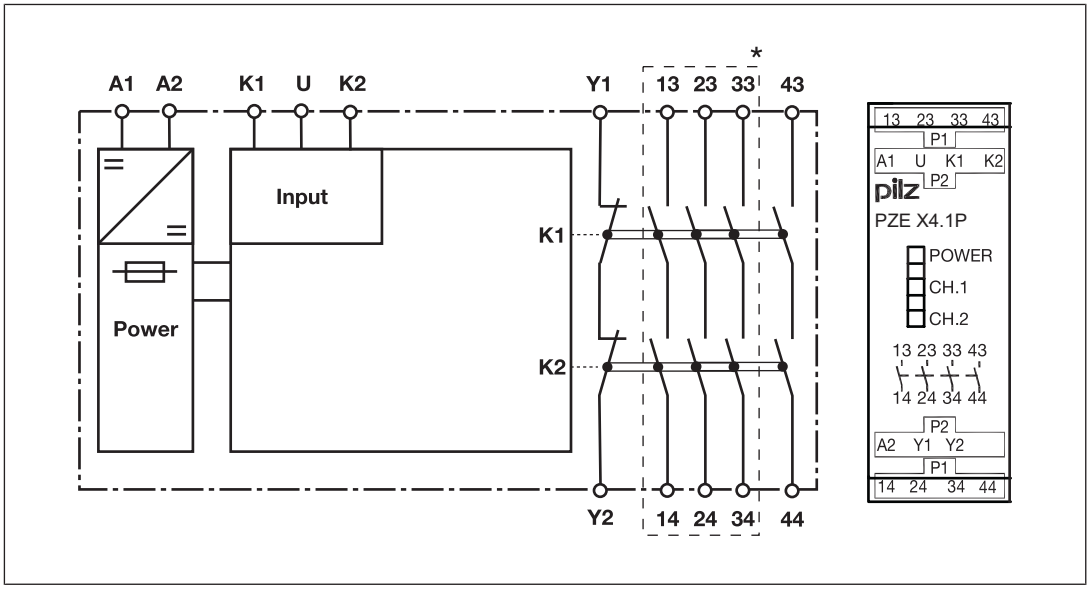
- Positive-guided relay outputs:
  - 4 safety contacts (N/O), instantaneous
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Connection for feedback loop
- Suitable to be driven via OSSD
- Operation: Single or dual-channel
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PZE X4.1P

Block diagram/terminal configuration

Type: DC

- U_B: 24 DC; Order no. 777587, 787587

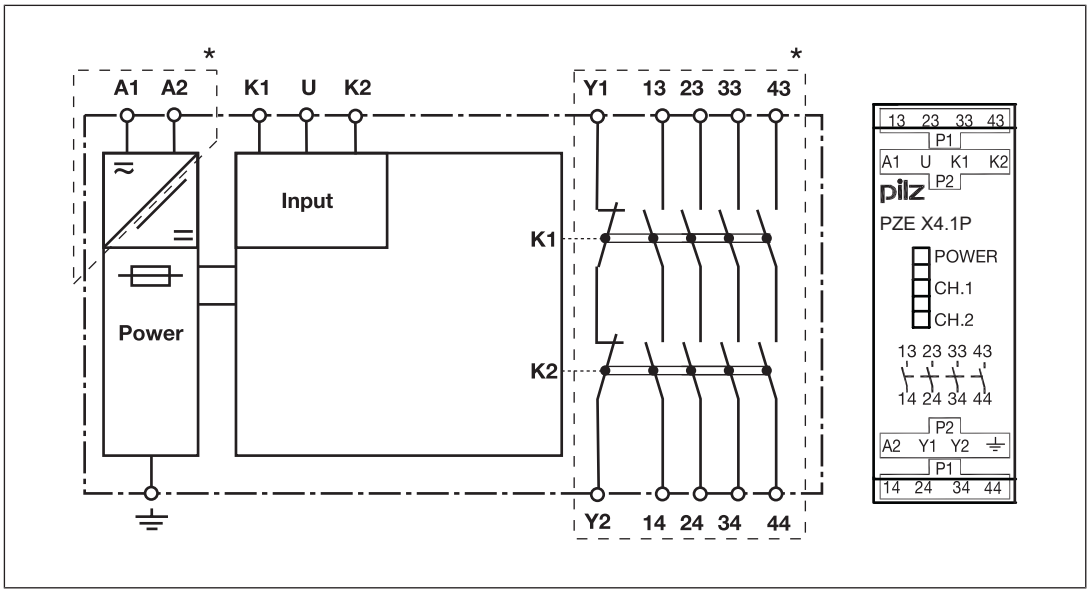


*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Safety relays PNOZ X
PZE X4.1P

Type: AC/DC

- U_B: 24 - 240 VAC/DC; Order no. 777588, 787588



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function description

The contact expansion module PZE X4.1P is an add-on device without delay-on de-energisation. It is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay). When operating voltage is supplied the "POWER" LED will light.

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - The safety contacts 13-14, 23-24, 33-34 and 43-44 close.
  - The LEDs "CH.1" and "CH.2" are lit.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - Safety contacts 13-14, 23-24, 33-34 and 43-44 are opened redundantly.
  - The LEDs "CH.1" and "CH.2" go out.

Safety relays PNOZ X
PZE X4.1P

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [📖 424]" must be followed.
- The outputs 13-14, 23-24, 33-34 and 43-44 are safety contacts.
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 424]).
- Calculation of the max. cable length l_{max} in the input circuit:

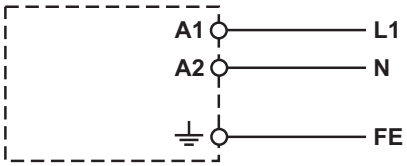
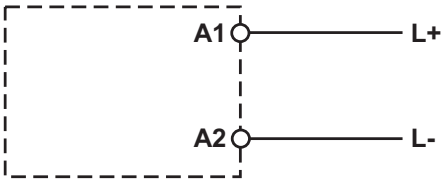
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

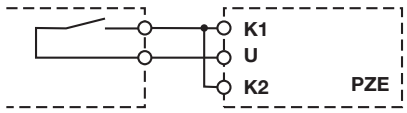
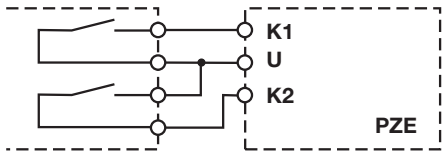
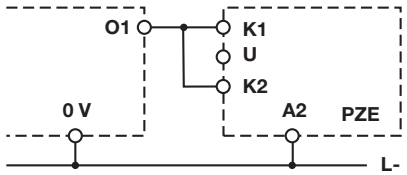
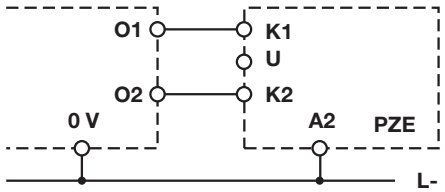
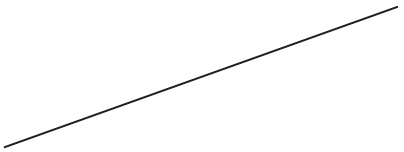
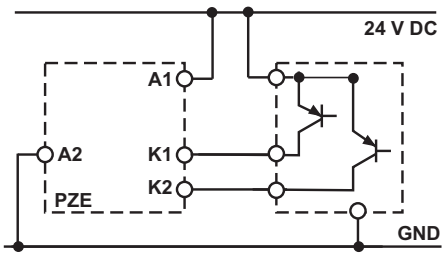
R_{lmax} = max. overall cable resistance (see Technical details [📖 424])
R_l / km = cable resistance/km

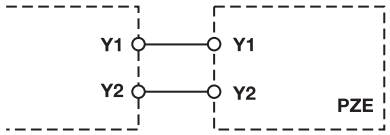
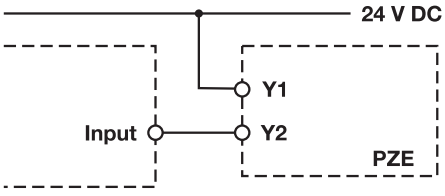
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Safety relays PNOZ X
PZE X4.1P

Preparing for operation

Supply voltage	24 – 240 V AC/DC	24 VDC
Only when driven via safety relay with safety contacts		

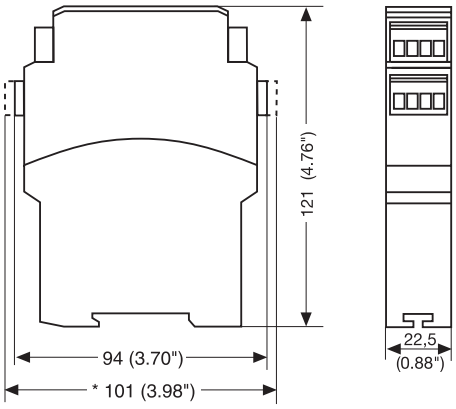
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X Driven via safety contacts		
Base unit: PNOZelog safety relay, programmable safety system or PNOZmulti Driven via safe semiconductor outputs (24 VDC)		
Driven via OSSD semiconductor outputs (24 VDC)		

Feedback loop	Base unit: Safety relay PNOZ X	Base unit: PNOZelog safety relay, programmable safety system or PNOZmulti
Y1, Y2 and Input are inputs on the base unit; they evaluate the feedback loop		

Safety relays PNOZ X
PZE X4.1P

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777587 – 787587

See below for more order numbers

General	777587	787587
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777587**	**787587**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	2,5 W	2,5 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	1,7 A	1,7 A
Pulse duration, A1	1,5 ms	1,5 ms
Inputs	**777587**	**787587**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V

Safety relays PNOZ X
PZE X4.1P

Inputs	777587	787587
Current at		
Input circuit DC	**35 mA**	**35 mA**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**60 Ohm**	**60 Ohm**
Relay outputs	**777587**	**787587**
Number of output contacts		
Safety contacts (N/O), instantaneous	**4**	**4**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PZE X4.1P

Relay outputs	777587	787587
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777587**	**787587**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**3,5 A**	**3,5 A**
Times	**777587**	**787587**
Switch-on delay		
With automatic start typ.	**15 ms**	**15 ms**
With automatic start max.	**20 ms**	**20 ms**
With automatic start after power on typ.	**15 ms**	**15 ms**
With automatic start after power on max.	**30 ms**	**30 ms**
Delay-on de-energisation		
With E-STOP typ.	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ.	**60 ms**	**60 ms**
With power failure max.	**80 ms**	**80 ms**
Supply interruption before de-energisation in the input circuit	**2 ms**	**2 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777587**	**787587**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**

Safety relays PNOZ X
PZE X4.1P

Environmental data	777587	787587
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777587**	**787587**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–

Safety relays PNOZ X
PZE X4.1P

Mechanical data	777587	787587
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**185 g**	**185 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 777588 – 787588

General	777588	787588
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777588**	**787588**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**4 VA**	**4 VA**
Output of external power supply (DC)	**2 W**	**2 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Inputs	**777588**	**787588**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Current at		
Input circuit DC	**30 mA**	**30 mA**

Safety relays PNOZ X
PZE X4.1P

Inputs	777588	787588
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**70 Ohm**	**70 Ohm**
Single-channel at UB AC	**70 Ohm**	**70 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**140 Ohm**	**140 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**140 Ohm**	**140 Ohm**
Relay outputs	**777588**	**787588**
Number of output contacts		
Safety contacts (N/O), instantaneous	**4**	**4**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PZE X4.1P

Relay outputs	777588	787588
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777588**	**787588**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**3,5 A**	**3,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**3,5 A**	**3,5 A**
Times	**777588**	**787588**
Switch-on delay		
With automatic start typ.	**15 ms**	**15 ms**
With automatic start max.	**20 ms**	**20 ms**
With automatic start after power on typ.	**230 ms**	**230 ms**
With automatic start after power on max.	**360 ms**	**360 ms**

Safety relays PNOZ X
PZE X4.1P

Times	777588	787588
Delay-on de-energisation		
With E-STOP typ.	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ. UB 240 V	**1300 ms**	**1300 ms**
With power failure max. UB 240 V	**1900 ms**	**1900 ms**
With power failure typ. UB 24 V	**270 ms**	**270 ms**
With power failure max. UB 24 V	**350 ms**	**350 ms**
Supply interruption before de-energisation in the input circuit	**2 ms**	**2 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777588**	**787588**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777588**	**787588**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZ X
PZE X4.1P

Mechanical data	777588	787588
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**215 g**	**215 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Safety relays PNOZ X
PZE X4.1P

Supplementary data

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.

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.

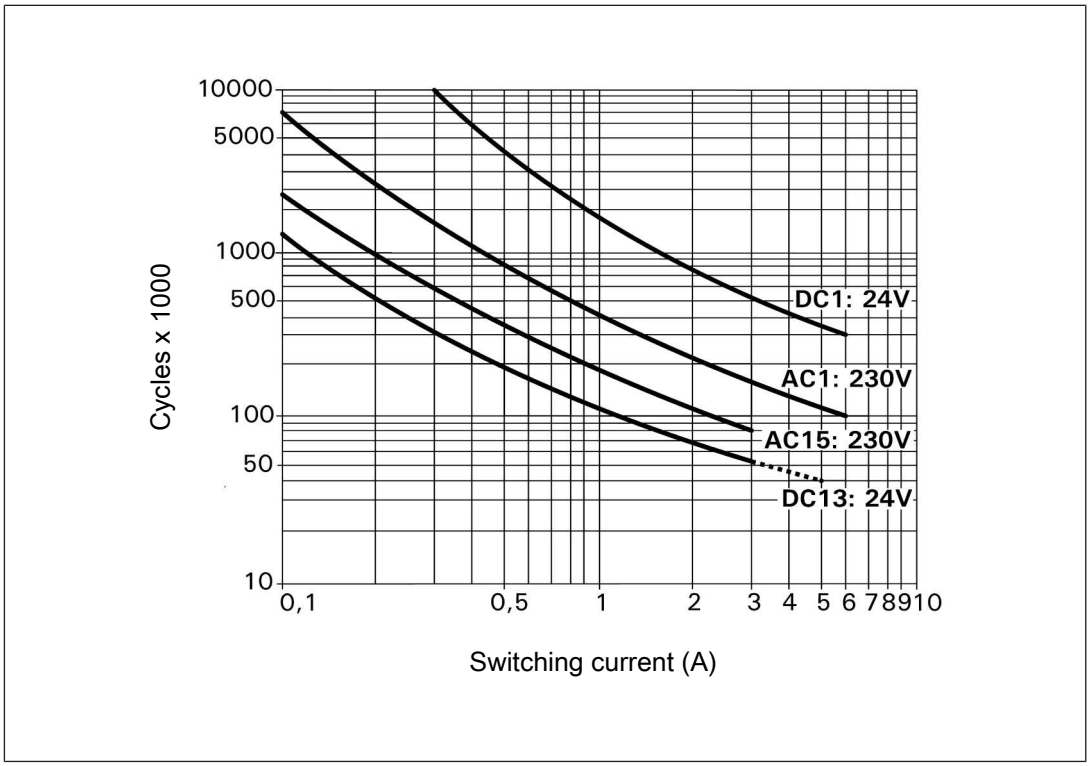


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZ X
PZE X4.1P

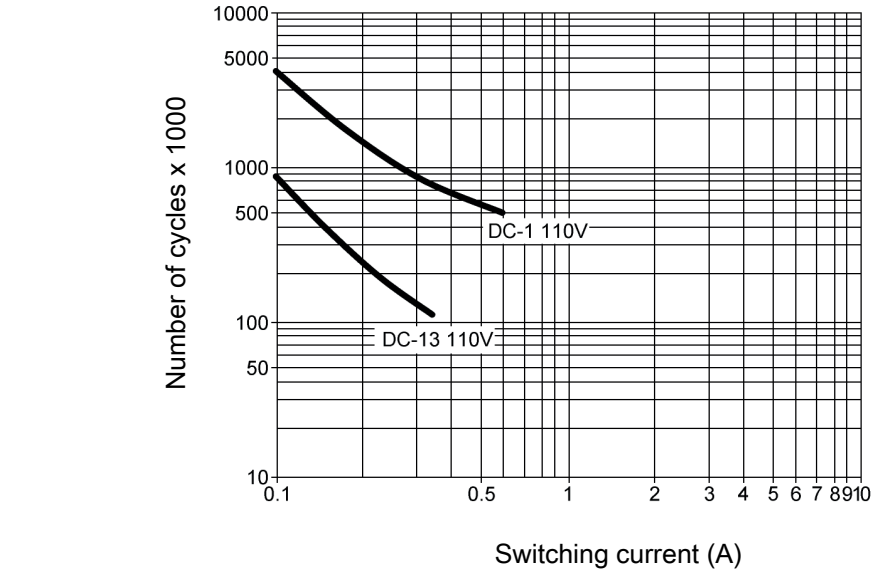


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

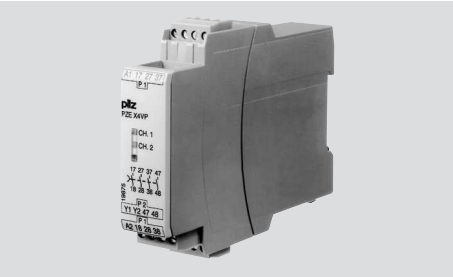
Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 424]) can be used in the calculation.

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

Order reference

Type	Features	Connection type	Order no.
PZE X4.1P	24 VDC	Screw terminals, plug-in	777 587
PZE X4.1P C	24 VDC	Spring-loaded terminals, plug-in	787 587
PZE X4.1P	24-240 V AC/DC	Screw terminals, plug-in	777 588
PZE X4.1P C	24-240 V AC/DC	Spring-loaded terminals, plug-in	787 588

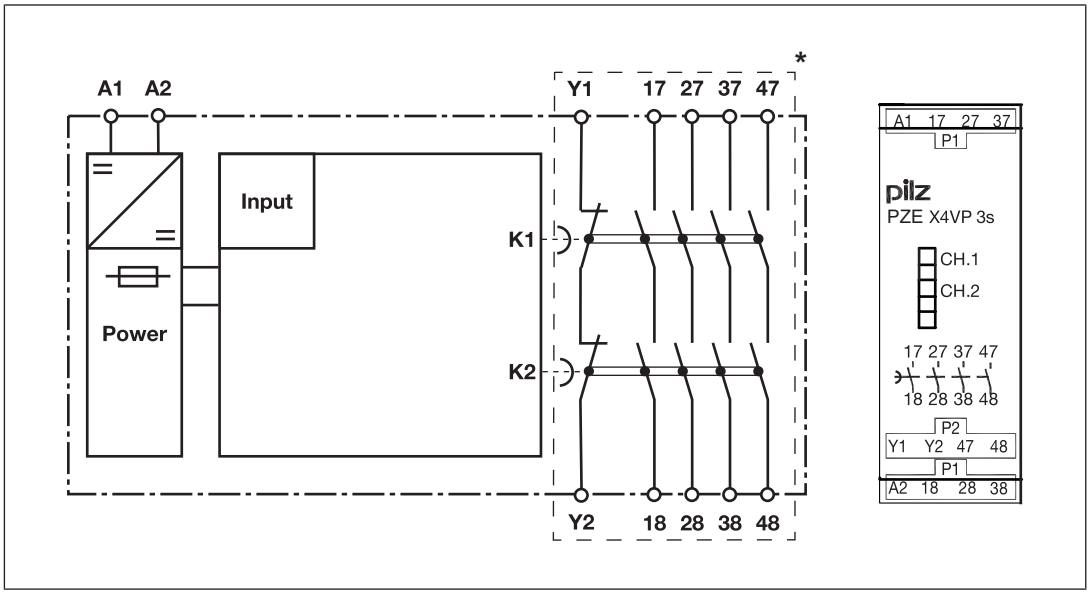
Safety relays PNOZ X
PZE X4VP



Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), delay-on de-energisation
- LED display for:
  - Switch status of the safety contacts
- Connection for feedback loop
- Operation: single-channel
- Unit types with various delay times
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PZE X4VP

Function description

The contact expansion module PZE X4VP is an add-on device with delay-on de-energisation, and it is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay).

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - The supply voltage is present at input (A1) of the contact expansion module.
  - The safety contacts 17-18, 27-28, 37-38 and 47-48 close.
  - The LEDs "CH.1" and "CH.2" are lit.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - The supply voltage is not present at input (A1) of the contact expansion module.
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 17-18, 27-28, 37-38 and 47-48 are opened redundantly once the delay time has elapsed.

Installation

- The unit 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).
- If more than 2 units are installed next to each other in the control cabinet, leave a distance of at least 6 mm between the units.

Wiring

Please note:

- Information given in the "Technical details [📖 438]" must be followed.
- Outputs 17-18, 27-28, 37-38 and 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 [📖 438]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

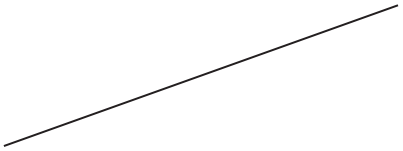
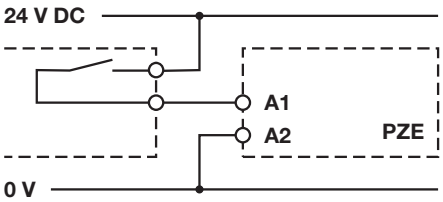
R_{lmax} = max. overall cable resistance (see Technical details [📖 438])
R_l / km = cable resistance/km

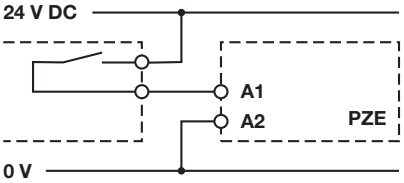
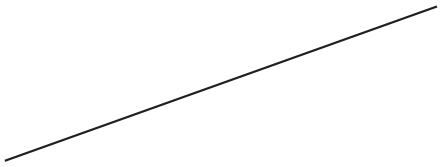
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

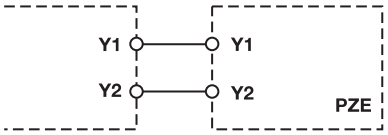
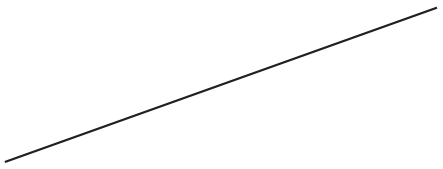
Safety relays PNOZ X
PZE X4VP

- Do not switch low currents using contacts that have been used previously with high currents.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Preparing for operation

Supply voltage	AC	DC
		

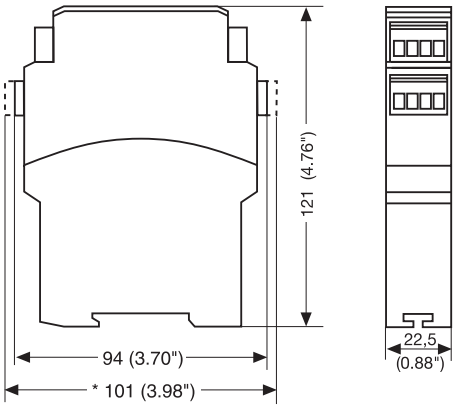
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X Driven via safety contacts		

Feedback loop	Base unit: Safety relay PNOZ X	
Y1 and Y2 are inputs on the base unit; they evaluate the feedback loop		

Safety relays PNOZ X
PZE X4VP

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777580 – 777582

See below for more order numbers

General	777580	777581	777582
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777580**	**777581**	**777582**
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	2,5 W	2,5 W	2,5 W
Residual ripple DC	20 %	20 %	20 %
Duty cycle	100 %	100 %	100 %
Max. inrush current impulse			
Current pulse, A1	1,7 A	1,7 A	1,7 A
Pulse duration, A1	50 ms	100 ms	140 ms
Inputs	**777580**	**777581**	**777582**
Number	1	1	1
Voltage at			
Input circuit DC	24 V	24 V	24 V

Safety relays PNOZ X
PZE X4VP

Inputs	777580	777581	777582
Current at			
Input circuit DC	**95 mA**	**95 mA**	**95 mA**
Max. overall cable resistance RImax			
Single-channel at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**
Relay outputs	**777580**	**777581**	**777582**
Number of output contacts			
Safety contacts (N/O), delayed	**4**	**4**	**4**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**3 A**	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**4 A**
Utilisation category in accordance with UL			
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**

Safety relays PNOZ X
PZE X4VP

Relay outputs	777580	777581	777582
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777580**	**777581**	**777582**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5 A**	**5 A**	**5 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**4 A**	**4 A**	**4 A**
Times	**777580**	**777581**	**777582**
Switch-on delay			
With automatic start after power on typ.	**55 ms**	**55 ms**	**55 ms**
With automatic start after power on max.	**200 ms**	**200 ms**	**200 ms**
Delay time tv	**0,5 s**	**1 s**	**2 s**
Time accuracy	**-50 %/+50 %**	**-50 %/+50 %**	**-50 %/+50 %**
Supply interruption before de-energisation	**250 ms**	**500 ms**	**1.000 ms**
Environmental data	**777580**	**777581**	**777582**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**

Safety relays PNOZ X
PZE X4VP

Environmental data	777580	777581	777582
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**777580**	**777581**	**777582**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**

Safety relays PNOZ X
PZE X4VP

Mechanical data	777580	777581	777582
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	**0,5 Nm**
Dimensions			
Height	**94 mm**	**94 mm**	**94 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**185 g**	**190 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 777583 – 787581

See below for more order numbers

General	777583	787580	787581
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777583**	**787580**	**787581**
Supply voltage			
Voltage	**24 V**	**24 V**	**24 V**
Kind	**DC**	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**2,5 W**	**2,5 W**	**2,5 W**
Residual ripple DC	**20 %**	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**	**100 %**
Max. inrush current impulse			
Current pulse, A1	**1,7 A**	**1,7 A**	**1,7 A**
Pulse duration, A1	**180 ms**	**50 ms**	**100 ms**

Safety relays PNOZ X
PZE X4VP

Inputs	777583	787580	787581
Number	1	1	1
Voltage at			
Input circuit DC	24 V	24 V	24 V
Current at			
Input circuit DC	95 mA	95 mA	95 mA
Max. overall cable resistance RImax			
Single-channel at UB DC	30 Ohm	30 Ohm	30 Ohm
Relay outputs	**777583**	**787580**	**787581**
Number of output contacts			
Safety contacts (N/O), delayed	4	4	4
Max. short circuit current IK	1 kA	1 kA	1 kA
Utilisation category			
In accordance with the standard	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts delayed			
AC1 at	240 V	240 V	240 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	6 A	6 A	6 A
Max. power	1500 VA	1500 VA	1500 VA
DC1 at	24 V	24 V	24 V
Min. current	0,01 A	0,01 A	0,01 A
Max. current	6 A	6 A	6 A
Max. power	150 W	150 W	150 W
Utilisation category			
In accordance with the standard	EN 60947-5-1	EN 60947-5-1	EN 60947-5-1
Utilisation category of safety contacts delayed			
AC15 at	230 V	230 V	230 V
Max. current	3 A	3 A	3 A
DC13 (6 cycles/min) at	24 V	24 V	24 V
Max. current	4 A	4 A	4 A

Safety relays PNOZ X
PZE X4VP

Relay outputs	777583	787580	787581
Utilisation category in accordance with UL			
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777583**	**787580**	**787581**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5 A**	**5 A**	**5 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**4 A**	**4 A**	**4 A**
Times	**777583**	**787580**	**787581**
Switch-on delay			
With automatic start after power on typ.	**55 ms**	**55 ms**	**55 ms**
With automatic start after power on max.	**200 ms**	**200 ms**	**200 ms**
Delay time tv	**3 s**	**0,5 s**	**1 s**
Time accuracy	**-50 %/+50 %**	**-50 %/+50 %**	**-50 %/+50 %**

Safety relays PNOZ X
PZE X4VP

Times	777583	787580	787581
Supply interruption before de-energisation	1.500 ms	250 ms	500 ms
Environmental data	**777583**	**787580**	**787581**
Climatic suitability	EN 60068-2-78	EN 60068-2-78	EN 60068-2-78
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**777583**	**787580**	**787581**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Screw terminal	Spring-loaded terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in	plug-in

Safety relays PNOZ X
PZE X4VP

Mechanical data	777583	787580	787581
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,5 Nm**	–	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**	**2**
Stripping length with spring-loaded terminals	–	**8 mm**	**8 mm**
Dimensions			
Height	**94 mm**	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**210 g**	**185 g**	**190 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PZE X4VP

Order no. 787582 – 787583

General	787582	787583
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**787582**	**787583**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	2,5 W	2,5 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	1,7 A	1,7 A
Pulse duration, A1	140 ms	180 ms
Inputs	**787582**	**787583**
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	95 mA	95 mA
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Relay outputs	**787582**	**787583**
Number of output contacts		
Safety contacts (N/O), delayed	4	4
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts delayed		
AC1 at	240 V	240 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	150 W	150 W

Safety relays PNOZ X
PZE X4VP

Relay outputs	787582	787583
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**250 V AC G.U. (same polarity)**	**250 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787582**	**787583**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5 A**	**5 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**4 A**	**4 A**

Safety relays PNOZ X
PZE X4VP

Times	787582	787583
Switch-on delay		
With automatic start after power on typ.	**55 ms**	**55 ms**
With automatic start after power on max.	**200 ms**	**200 ms**
Delay time tv	**2 s**	**3 s**
Time accuracy	**-50 %/+50 %**	**-50 %/+50 %**
Supply interruption before de-energisation	**1.000 ms**	**1.500 ms**
Environmental data	**787582**	**787583**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**787582**	**787583**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**

Safety relays PNOZ X
PZE X4VP

Mechanical data	787582	787583
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**
Dimensions		
Height	**101 mm**	**101 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**121 mm**	**121 mm**
Weight	**205 g**	**210 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 2**	**2,48E-09**	**SIL 2**	**1,47E-05**	**20**

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

Supplementary data

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.

Safety relays PNOZ X
PZE X4VP

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.

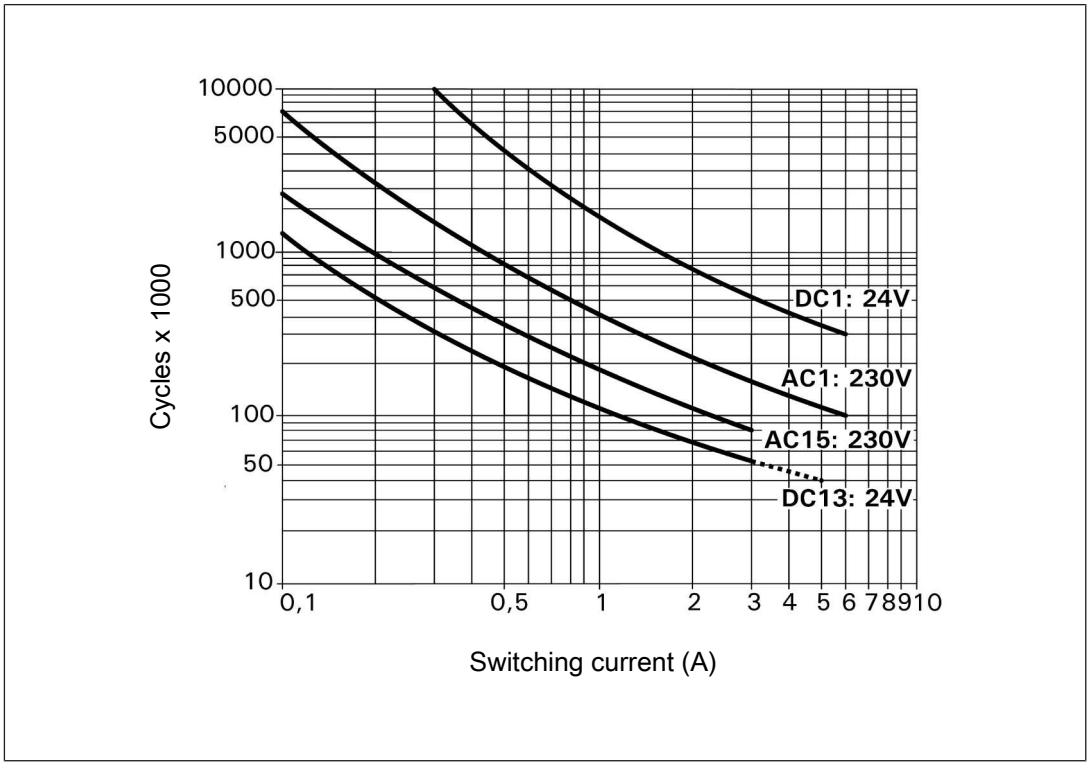


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZ X
PZE X4VP

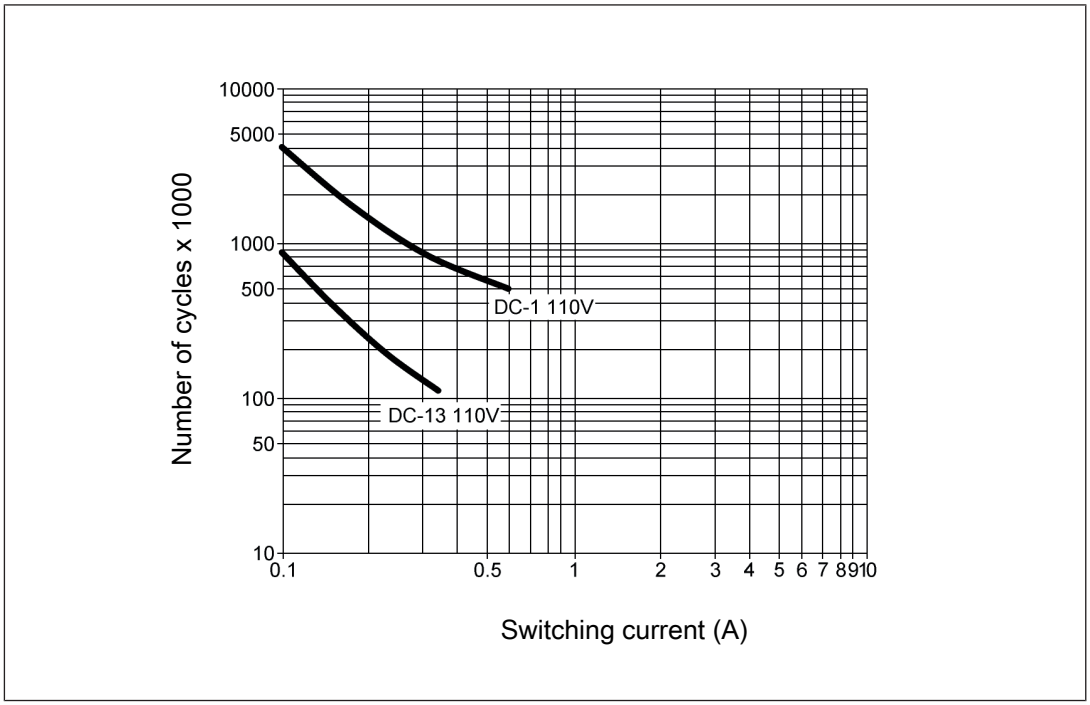


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 438]) can be used in the calculation.

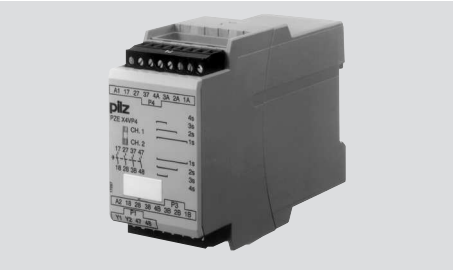
To increase the service life, sufficient spark suppression must be provided on all relay contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PZE X4VP

Order reference

Type	Features	Connection type	Order no.
PZE X4VP	24 V DC; t_v = 0.5 s	Screw terminals, plug-in	777580
PZE X4VP C	24 V DC; t_v = 0.5 s	Spring-loaded terminals, plug-in	787580
PZE X4VP	24 V DC; t_v = 1 s	Screw terminals, plug-in	777581
PZE X4VP C	24 V DC; t_v = 1 s	Spring-loaded terminals, plug-in	787581
PZE X4VP	24 V DC; t_v = 2 s	Screw terminals, plug-in	777582
PZE X4VP C	24 V DC; t_v = 2 s	Spring-loaded terminals, plug-in	787582
PZE X4VP	24 V DC; t_v = 3 s	Screw terminals, plug-in	777583
PZE X4VP C	24 V DC; t_v = 3 s	Spring-loaded terminals, plug-in	787583

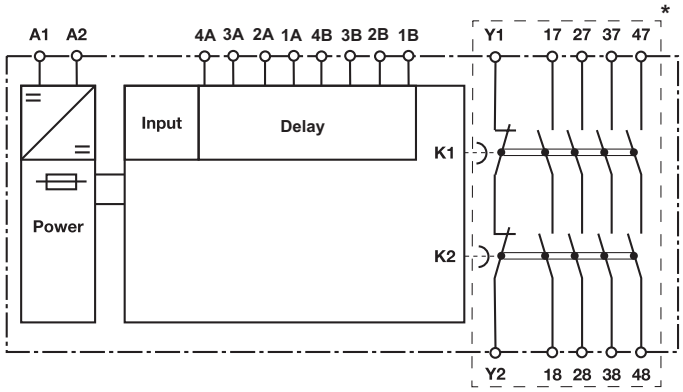
Safety relays PNOZ X
PZE X4VP4

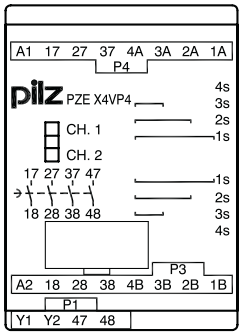


Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), delay-on de-energisation
- LED display for:
  - Switch status of the safety contacts
- Connection for feedback loop
- Operation: single-channel
- Selectable delay time
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration





*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PZE X4VP4

Function description

The contact expansion module PZE X4VP4 is an add-on device with selectable delay-on de-energisation, and it is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay).

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - The supply voltage is present at input (A1) of the contact expansion module.
  - The safety contacts 17-18, 27-28, 37-38 and 47-48 close.
  - The LEDs "CH.1" and "CH.2" are lit.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - The supply voltage is not present at input (A1) of the contact expansion module.
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 17-18, 27-28, 37-38 and 47-48 are opened redundantly once the delay time has elapsed.

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [📖 457]" must be followed.
- Outputs 17-18, 27-28, 37-38 and 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 [📖 457]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

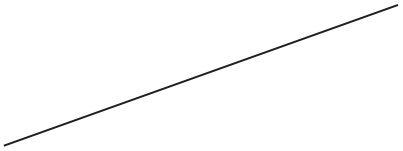
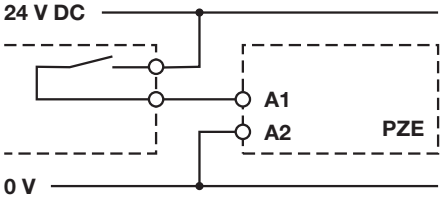
R_{lmax} = max. overall cable resistance (see Technical details [📖 457])
R_l / km = cable resistance/km

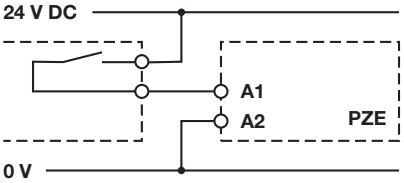
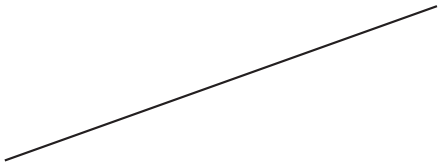
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.

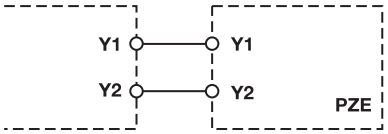
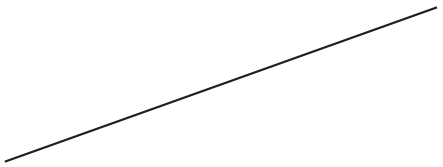
Safety relays PNOZ X
PZE X4VP4

- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Preparing for operation

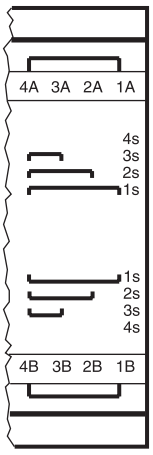
Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X Driven via safety contacts		

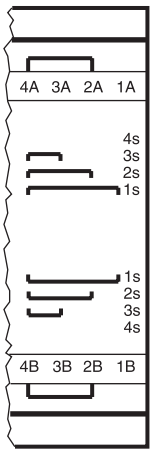
Feedback loop	Base unit: Safety relay PNOZ X	
Y1 and Y2 are inputs on the base unit; they evaluate the feedback loop		

Setting the delay time

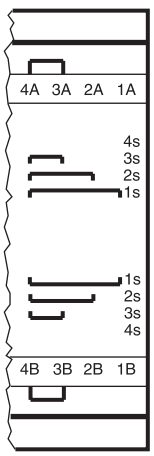
1 s



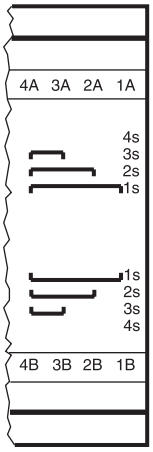
2 s



3 s



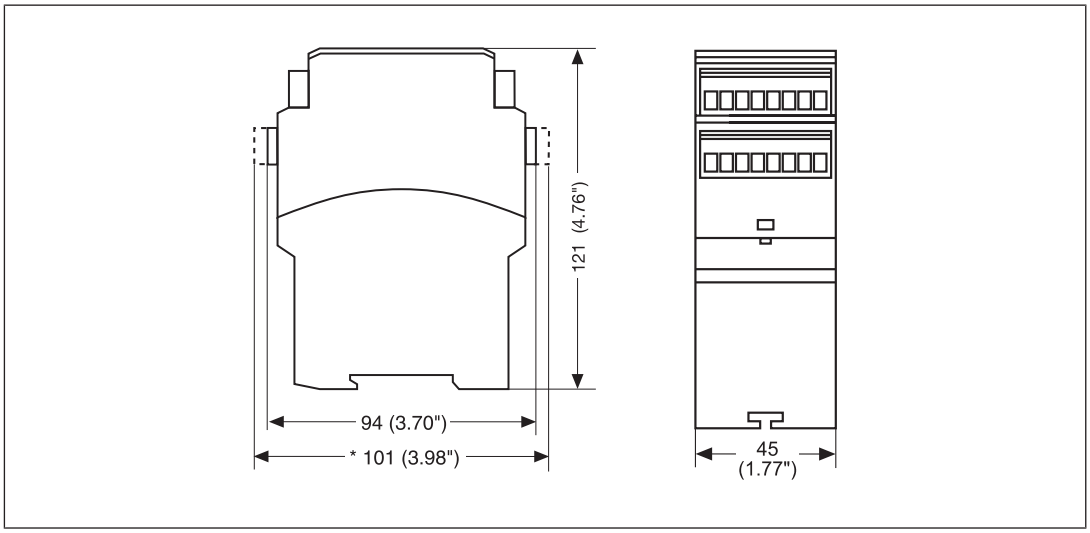
4 s



Safety relays PNOZ X
PZE X4VP4

Dimensions in mm

* with spring-loaded terminals



Technical details

General	777586	787586
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777586**	**787586**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**2,5 W**	**2,5 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	**1,7 A**
Pulse duration, A1	**180 ms**	**180 ms**
Inputs	**777586**	**787586**
Number	**1**	**1**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Current at		
Input circuit DC	**70 mA**	**70 mA**

Safety relays PNOZ X
PZE X4VP4

Inputs	777586	787586
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Relay outputs	**777586**	**787586**
Number of output contacts		
Safety contacts (N/O), delayed	**4**	**4**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**1200 VA**	**1200 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**120 W**	**120 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**5 A**	**5 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**

Safety relays PNOZ X
PZE X4VP4

Relay outputs	777586	787586
External contact fuse protection, delayed safety contacts		
Max. melting integral	**100 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**5 A**	**5 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Times	**777586**	**787586**
Switch-on delay		
With automatic start after power on typ.	**230 ms**	**230 ms**
With automatic start after power on max.	**400 ms**	**400 ms**
Delay time tv	**1 s, 2 s, 3 s, 4 s**	**1 s, 2 s, 3 s, 4 s**
Time accuracy	**-50 %/+50 %**	**-50 %/+50 %**
Supply interruption before de-energisation	**500 ms**	**500 ms**
Environmental data	**777586**	**787586**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZ X
PZE X4VP4

Environmental data	777586	787586
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777586**	**787586**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**300 g**	**300 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PZE X4VP4

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 2**	**2,48E-09**	**SIL 2**	**1,47E-05**	**20**

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

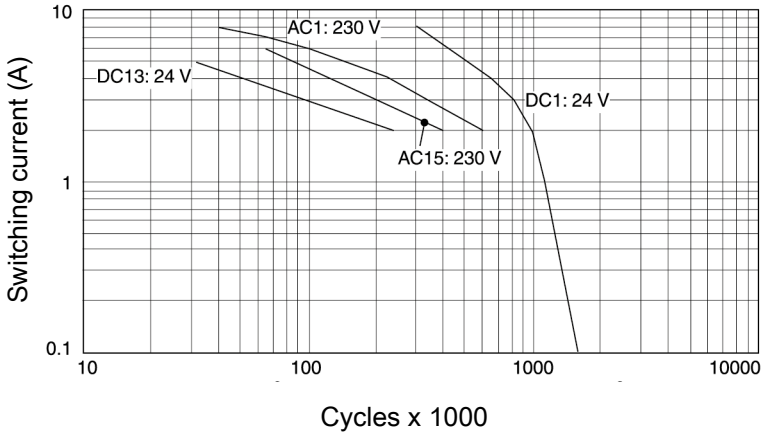
Supplementary data

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.

Safety relays PNOZ X
PZE X4VP4

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: 2 A
- Utilisation category AC15
- Contact service life: 400 000 cycles

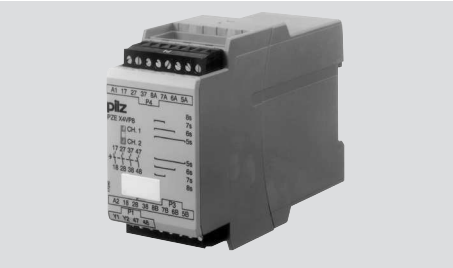
Provided the application to be implemented requires fewer than 400 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Type	Features	Connection type	Order no.
PZE X4VP4	24 V DC tv: 1 - 4 s, selectable	Screw terminals, plug-in	777586
PZE X4VP4 C	24 V DC tv: 1 - 4 s, selectable	Spring-loaded terminals, plug-in	787586

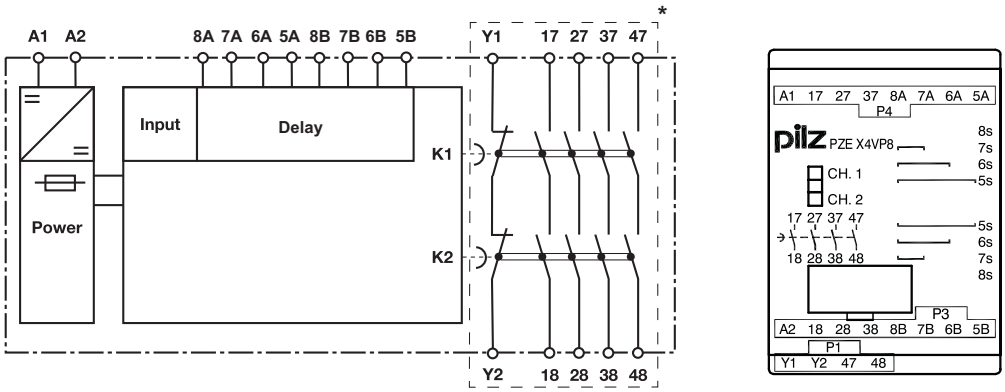
Safety relays PNOZ X
PZE X4VP8



Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), delay-on de-energisation
- LED display for:
  - Switch status of the safety contacts
- Connection for feedback loop
- Operation: single-channel
- Selectable delay time
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PZE X4VP8

Function description

The contact expansion module PZE X4VP8 is an add-on device with selectable delay-on de-energisation, and it is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay).

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - The supply voltage is present at input (A1) of the contact expansion module.
  - The safety contacts 17-18, 27-28, 37-38 and 47-48 close.
  - The LEDs "CH.1" and "CH.2" are lit.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - The supply voltage is not present at input (A1) of the contact expansion module.
  - The LEDs "CH.1" and "CH.2" go out.
  - Safety contacts 17-18, 27-28, 37-38 and 47-48 are opened redundantly once the delay time has elapsed.

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [📖 466]" must be followed.
- Outputs 17-18, 27-28, 37-38 and 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 [📖 466]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

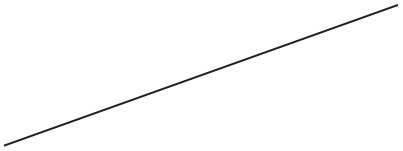
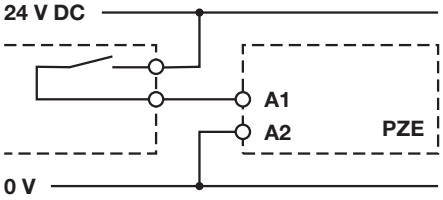
R_{lmax} = max. overall cable resistance (see Technical details [📖 466])
R_l / km = cable resistance/km

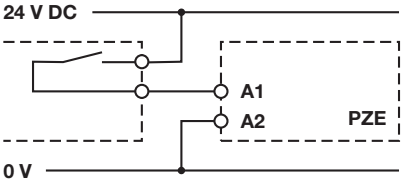
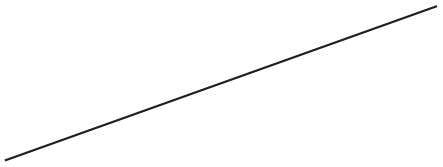
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.

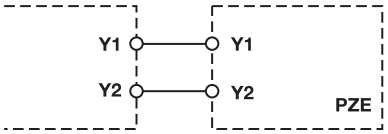
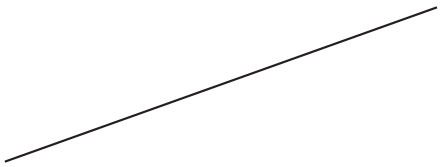
Safety relays PNOZ X
PZE X4VP8

- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

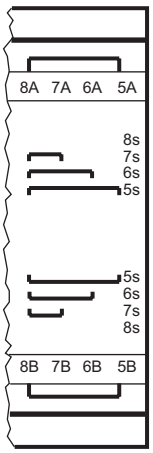
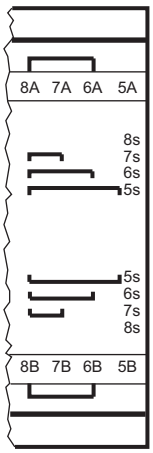
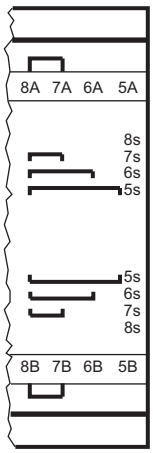
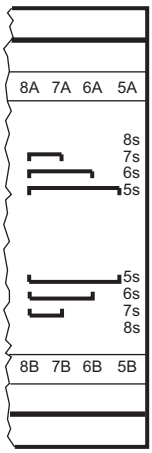
Preparing for operation

Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X Driven via safety contacts		

Feedback loop	Base unit: Safety relay PNOZ X	
Y1 and Y2 are inputs on the base unit; they evaluate the feedback loop		

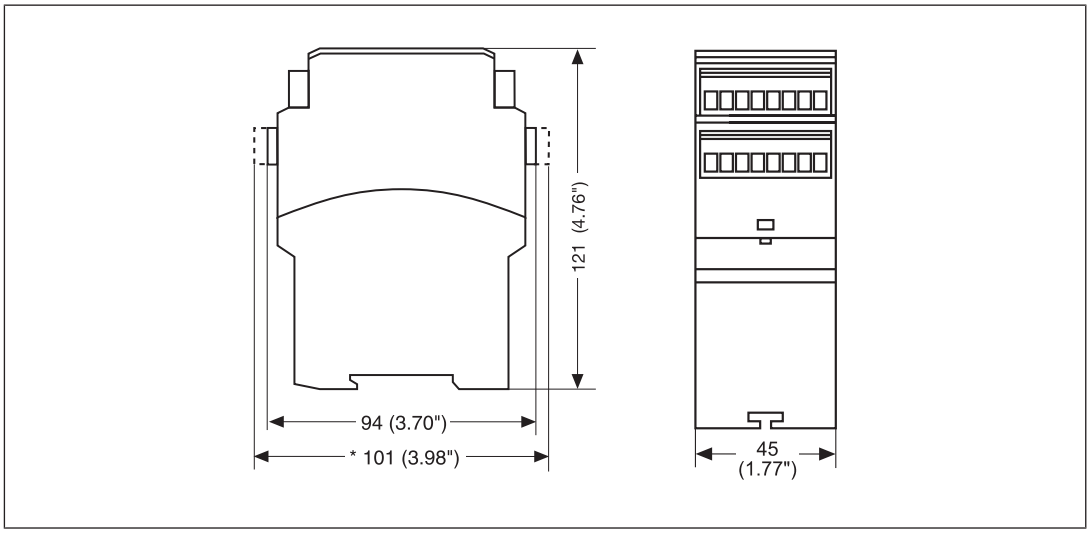
Setting the delay time

5 s	6 s	7 s	8 s
			

Safety relays PNOZ X
PZE X4VP8

Dimensions in mm

* with spring-loaded terminals



Technical details

General	777584	787584
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777584**	**787584**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**2,5 W**	**2,5 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Max. inrush current impulse		
Current pulse, A1	**1,7 A**	**1,7 A**
Pulse duration, A1	**280 ms**	**280 ms**
Inputs	**777584**	**787584**
Number	**1**	**1**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Current at		
Input circuit DC	**70 mA**	**70 mA**

Safety relays PNOZ X
PZE X4VP8

Inputs	777584	787584
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Relay outputs	**777584**	**787584**
Number of output contacts		
Safety contacts (N/O), delayed	**4**	**4**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**1200 VA**	**1200 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**5 A**	**5 A**
Max. power	**120 W**	**120 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**5 A**	**5 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**

Safety relays PNOZ X
PZE X4VP8

Relay outputs	777584	787584
External contact fuse protection, delayed safety contacts		
Max. melting integral	**100 A²s**	**100 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**5 A**	**5 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Times	**777584**	**787584**
Switch-on delay		
With automatic start after power on typ.	**320 ms**	**320 ms**
With automatic start after power on max.	**500 ms**	**500 ms**
Delay time tv	**5 s, 6 s, 7 s, 8 s**	**5 s, 6 s, 7 s, 8 s**
Time accuracy	**-50 %/+50 %**	**-50 %/+50 %**
Supply interruption before de-energisation	**2.500 ms**	**2.500 ms**
Environmental data	**777584**	**787584**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZ X
PZE X4VP8

Environmental data	777584	787584
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777584**	**787584**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**320 g**	**320 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PZE X4VP8

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, delayed <30 s	**PL d**	**Cat. 3**	**SIL CL 2**	**2,48E-09**	**SIL 2**	**1,47E-05**	**20**

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

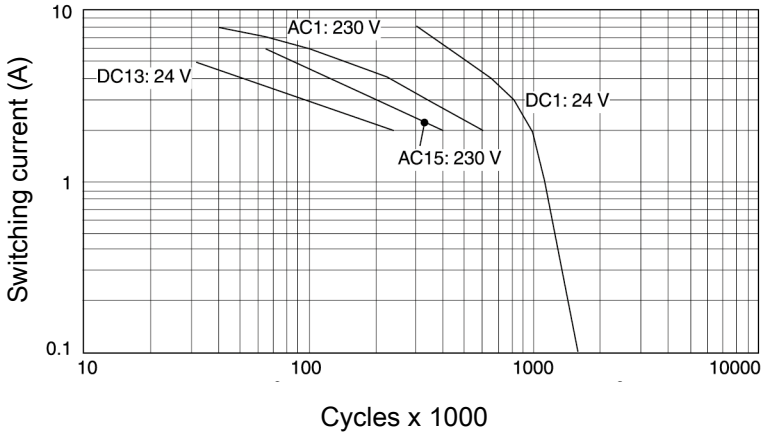
Supplementary data

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.

Safety relays PNOZ X
PZE X4VP8

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: 2 A
- Utilisation category AC15
- Contact service life: 400 000 cycles

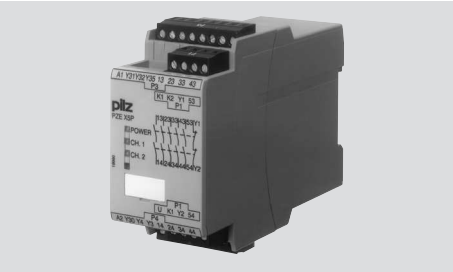
Provided the application to be implemented requires fewer than 400 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Type	Features	Connection type	Order no.
PZE X4VP8	24 V DC tv: 5 - 8 s, selectable	Screw terminals, plug-in	777584
PZE X4VP8 C	24 V DC tv: 5 - 8 s, selectable	Spring-loaded terminals, plug-in	787584

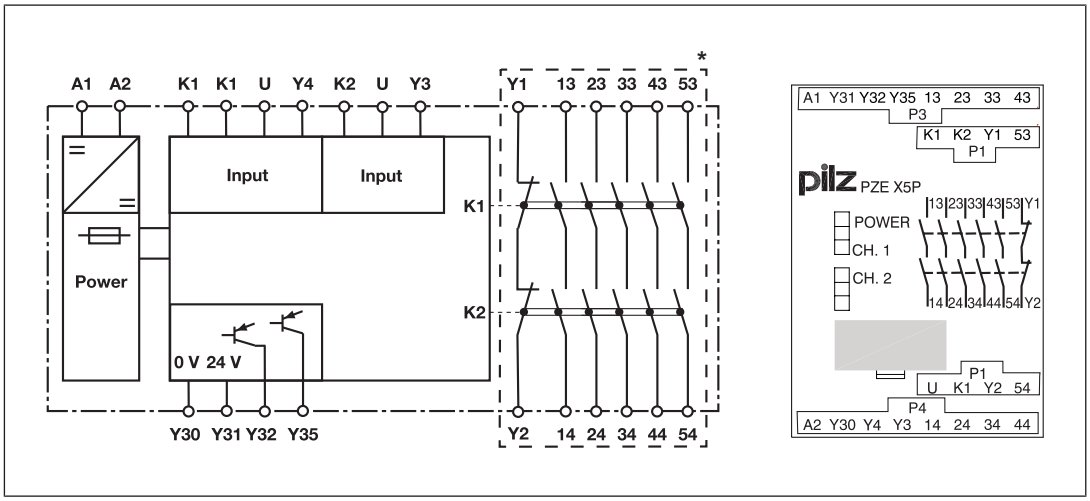
Safety relays PNOZ X
PZE X5P



Unit features

- Positive-guided relay outputs:
  - 5 safety contacts (N/O), instantaneous
- 2 semiconductor outputs
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Semiconductor outputs signal:
  - Supply voltage is present
  - Switch status of the safety contacts
- Connection for feedback loop
- Operation: single or dual-channel

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

Safety relays PNOZ X
PZE X5P

Function description

The contact expansion module PZE X5P is an add-on device without delay-on de-energisation, and it is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay). When operating voltage is supplied the "POWER" LED will light.

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - Safety contacts 13-14, 23-24, 33-34, 43-44 and 53-54 close.
  - The LEDs "CH.1" and "CH.2" are lit.
  - A high signal is present at the semiconductor output switch state Y32.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - Safety contacts 13-14, 23-24, 33-34, 43-44 and 53-54 are opened redundantly.
  - The LEDs "CH.1" and "CH.2" go out.
  - A low signal is present at the semiconductor output switch state Y32.

Semiconductor output supply voltage Y35

- A high signal is present at semi-conductor output Y35 if the supply voltage is present and the internal fuse has not blown.

Installation

- The unit 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).

Wiring

Please note:

- Information given in the "Technical details [📖 475]" must be followed.
- The outputs 13-14, 23-24, 33-34, 43-44, 53-54 are safety contacts.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 475]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

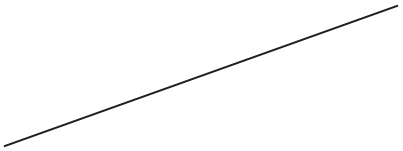
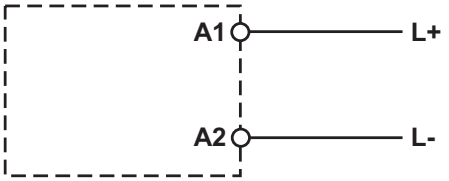
R_{lmax} = max. overall cable resistance (see Technical details [📖 475])
R_l / km = cable resistance/km

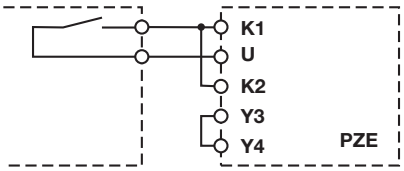
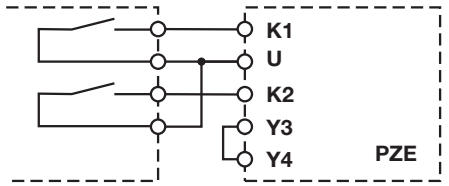
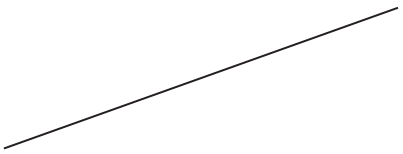
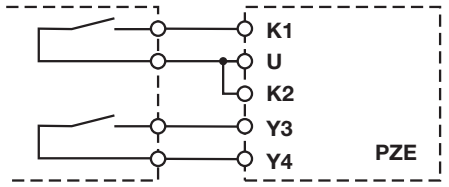
- Use copper wire that can withstand 60/75 °C.

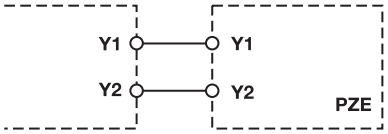
Safety relays PNOZ X
PZE X5P

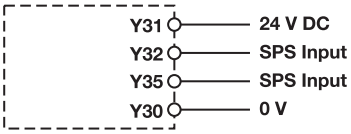
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Preparing for operation

Supply voltage	AC	DC
		

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

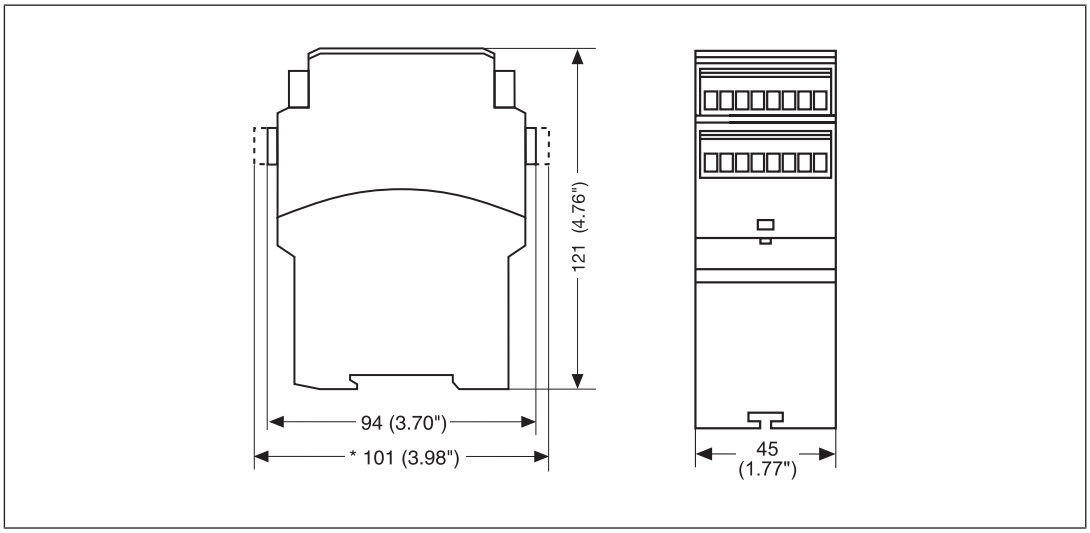
Feedback loop	
Y1 and Y2 are feedback loop inputs on the base unit	

Semiconductor output	
Y31, Y30: External supply voltage	

Safety relays PNOZ X
PZE X5P

Dimensions in mm

* with spring-loaded terminals



Technical details

General	777150	787150
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777150**	**787150**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	3,5 W	3,5 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	10 A	10 A
Pulse duration, A1	0,5 ms	0,5 ms
Inputs	**777150**	**787150**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	40 mA	40 mA

Safety relays PNOZ X
PZE X5P

Inputs	777150	787150
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**120 Ohm**	**120 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**240 Ohm**	**240 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**4 Ohm**	**4 Ohm**
Semiconductor outputs	**777150**	**787150**
Number	**2**	**2**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777150**	**787150**
Number of output contacts		
Safety contacts (N/O), instantaneous	**5**	**5**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**

Safety relays PNOZ X
PZE X5P

Relay outputs	777150	787150
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC G. P. Resistive**	**24 V DC G. P. Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777150**	**787150**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**6,5 A**	**6,5 A**
Conv. therm. current with 4 contacts	**5,6 A**	**5,6 A**
Conv. therm. current with 5 contacts	**5 A**	**5 A**
Times	**777150**	**787150**
Switch-on delay		
With automatic start typ.	**15 ms**	**15 ms**
With automatic start max.	**30 ms**	**30 ms**
With automatic start after power on typ.	**15 ms**	**15 ms**
With automatic start after power on max.	**30 ms**	**30 ms**

Safety relays PNOZ X
PZE X5P

Times	777150	787150
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**110 ms**	**110 ms**
With power failure max.	**150 ms**	**150 ms**
Supply interruption before de-energisation in the input circuit	**8 ms**	**8 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777150**	**787150**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777150**	**787150**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZ X
PZE X5P

Mechanical data	777150	787150
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**260 g**	**260 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

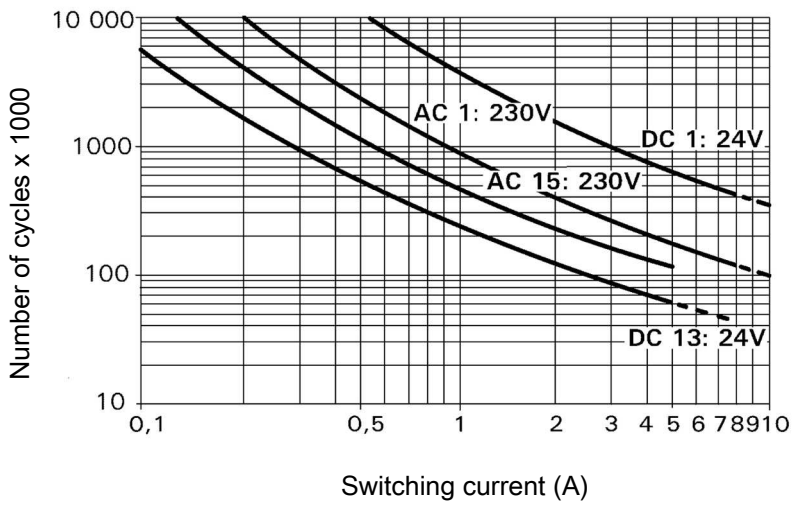
Safety relays PNOZ X
PZE X5P

Supplementary data

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.

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 to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

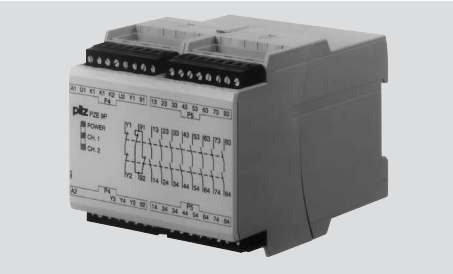
To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZ X
PZE X5P

Order reference

Type	Features	Terminals	Order no.
PZE X5P C	24 V DC	Spring-loaded terminals	787 150
PZE X5P	24 V DC	Screw terminals	777 150

Safety relays PNOZ X
PZE 9P



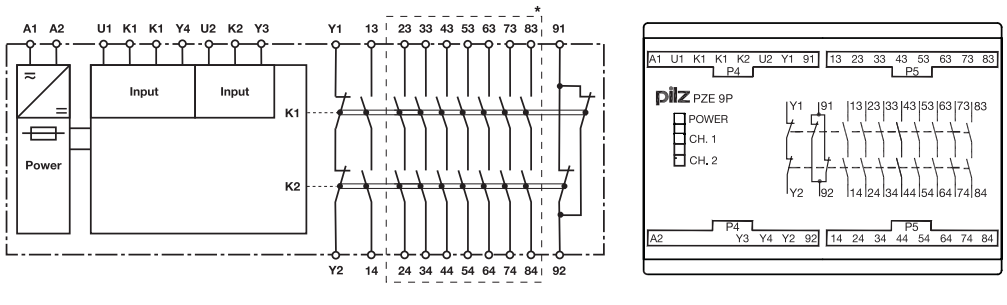
Unit features

- Positive-guided relay outputs:
  - 8 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- LED display for:
  - Supply voltage
  - Switch status of the safety contacts
- Connection for feedback loop
- Operation: Single or dual-channel
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration

Type: 24 V AC/DC

- U_B: 24 VAC/DC; Order no. 777140, 787140

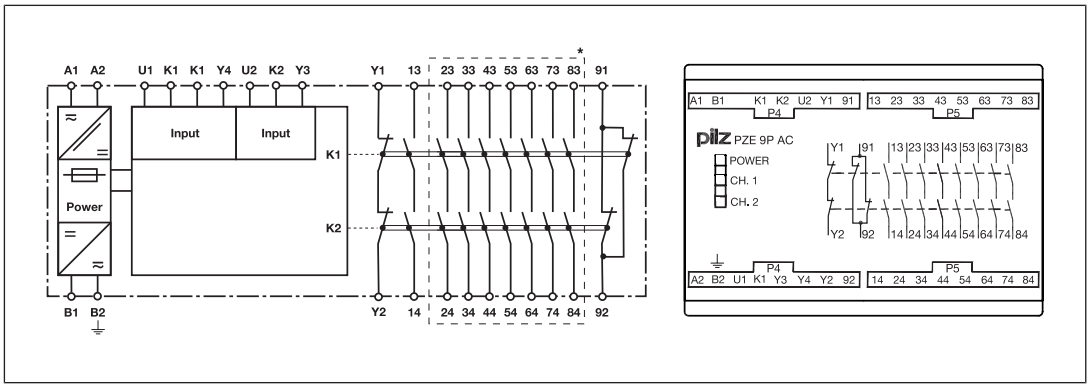


*Safe separation from non-marked area, except for safety contact 13-14, in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Safety relays PNOZ X
PZE 9P

Type: 24 - 240 V AC/DC

- U_B: 24 - 240 VAC/DC, 24 VAC/DC; Order no. 777148, 787148



*Safe separation from non-marked area, except for safety contact 13-14, in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

The contact expansion module PZE 9P is an add-on device without delay-on de-energisation. It is used to expand a safety circuit. The contact expansion module is driven by a base unit (e. g. emergency stop relay). When operating voltage is supplied the "POWER" LED will light.

- Functional procedure once the input circuit is closed (e.g. safety contacts on the base unit are closed):
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54, 63-64, 73-74 and 83-84 close, auxiliary contact 91-92 opens.
  - The LEDs "CH.1" and "CH.2" are lit.
- Functional procedure once the input circuit is opened (e.g. safety contacts on the base unit are opened):
  - Safety contacts 13-14, 23-24, 33-34, 43-44, 53-54, 63-64, 73-74 and 83-84 are opened redundantly, auxiliary contact 91-92 is closed.
  - The LEDs "CH.1" and "CH.2" go out.

Installation

- The unit 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).

Safety relays PNOZ X
PZE 9P

Wiring

Please note:

- Information given in the "Technical details [📖 486]" must be followed.
- Outputs 13-14, 23-24, 33-34, 43-44, 53-54, 63-64, 73-74, 83-84 are safety contacts; output 91-92 is an auxiliary contact (e.g. for display).
- Do **not** use auxiliary contact 91-92 for safety circuits!
- Do not connect undesignated terminals.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 486]).
- Calculation of the max. cable length l_{max} in the input circuit:

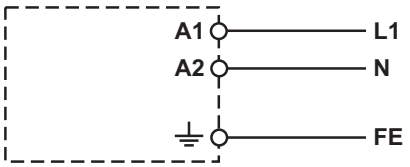
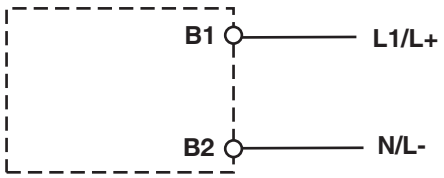
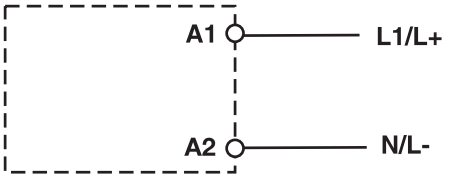
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

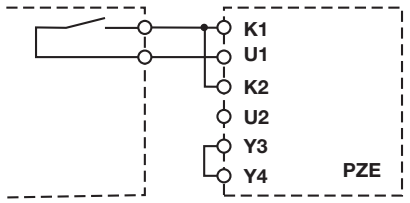
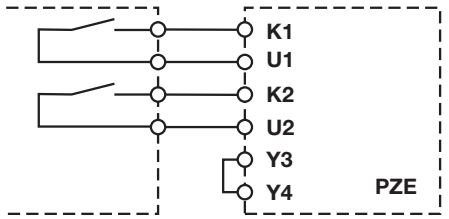
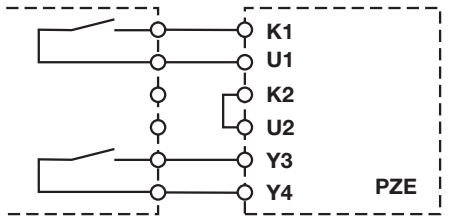
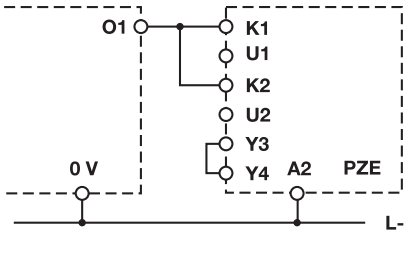
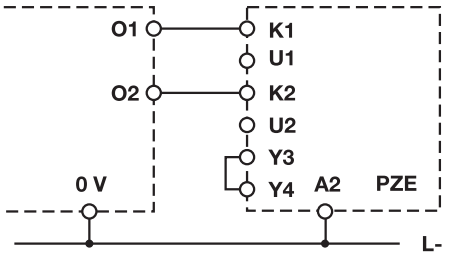
R_{lmax} = max. overall cable resistance (see Technical details [📖 486])
R_l / km = cable resistance/km

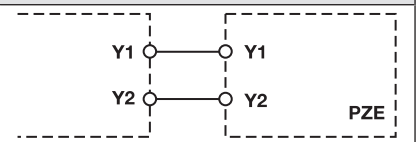
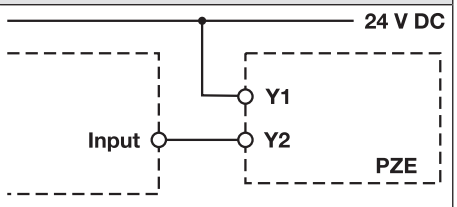
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- 777140, 787140 units or 777148, 787148 units, when the supply voltage is connected via B1 and B2: The power supply must comply with the regulations for extra low voltages with safe electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Safety relays PNOZ X
PZE 9P

Preparing for operation

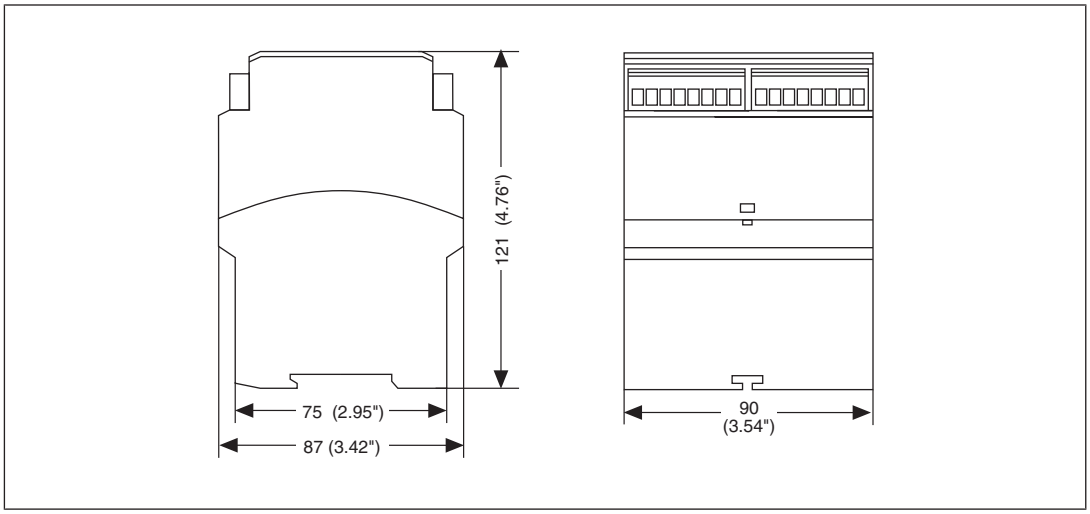
Supply voltage	24 - 240 V AC/DC	24 VAC/DC
Order no.: 777148, 787148		
Order no.: 777140, 787140		

Input circuit	Single-channel	Dual-channel
without detection of shorts across contacts Base unit: Safety relay PNOZ X Driven via safety contacts		
with detection of shorts across contacts Base unit: Safety relay PNOZ X Driven via safety contacts		
without detection of shorts across contacts Base unit: Safety system or PNOZmulti Driven via safe semiconductor outputs (24 VDC)		

Feedback loop	Base unit: Safety relay PNOZ X	Base unit: Safety system or PNOZmulti
Y1, Y2 and Input are inputs on the base unit; they evaluate the feedback loop		

Safety relays PNOZ X
PZE 9P

Dimensions in mm



Technical details

Order no. 777140 – 787140

See below for more order numbers

General	777140	787140
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777140**	**787140**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**9,5 VA**	**9,5 VA**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Inputs	**777140**	**787140**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Current at		
Input circuit DC	**40 mA**	**40 mA**

Safety relays PNOZ X
PZE 9P

Inputs	777140	787140
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**50 Ohm**	**50 Ohm**
Single-channel at UB AC	**80 Ohm**	**80 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**160 Ohm**	**160 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**5 Ohm**	**5 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**10 Ohm**	**10 Ohm**
Relay outputs	**777140**	**787140**
Number of output contacts		
Safety contacts (N/O), instantaneous	**8**	**8**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**500 VA**	**500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**50 W**	**50 W**

Safety relays PNOZ X
PZE 9P

Relay outputs	777140	787140
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC G. P. Resistive**	**24 V DC G. P. Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**2 A**	**2 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PZE 9P

Conventional thermal current while loading several contacts	777140	787140
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7,1 A**	**7,1 A**
Conv. therm. current with 5 contacts	**6,3 A**	**6,3 A**
Conv. therm. current with 6 contacts	**5,8 A**	**5,8 A**
Conv. therm. current with 7 contacts	**5,4 A**	**5,4 A**
Conv. therm. current with 8 contacts	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7,1 A**	**7,1 A**
Conv. therm. current with 5 contacts	**6,3 A**	**6,3 A**
Conv. therm. current with 6 contacts	**5,8 A**	**5,8 A**
Conv. therm. current with 7 contacts	**5,4 A**	**5,4 A**
Conv. therm. current with 8 contacts	**5 A**	**5 A**
Times	**777140**	**787140**
Switch-on delay		
With automatic start typ.	**30 ms**	**30 ms**
With automatic start max.	**40 ms**	**40 ms**
With automatic start after power on typ.	**30 ms**	**30 ms**
With automatic start after power on max.	**40 ms**	**40 ms**

Safety relays PNOZ X
PZE 9P

Times	777140	787140
Delay-on de-energisation		
With E-STOP typ.	**20 ms**	**20 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**110 ms**	**110 ms**
With power failure max.	**200 ms**	**200 ms**
Supply interruption before de-energisation in the input circuit	**10 ms**	**10 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777140**	**787140**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777140**	**787140**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZ X
PZE 9P

Mechanical data	777140	787140
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**87 mm**	**87 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**430 g**	**430 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PZE 9P

Order no. 777148 – 787148

General	777148	787148
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**777148**	**787148**
Supply voltage		
Voltage	24 - 240 V	24 - 240 V
Kind	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	9,5 VA	9,5 VA
Output of external power supply (DC)	6 W	6 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %
Supply voltage		
Voltage	24 V	24 V
Kind	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	9,5 VA	9,5 VA
Output of external power supply (DC)	3,5 W	3,5 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
Inputs	**777148**	**787148**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	40 mA	40 mA

Safety relays PNOZ X
PZE 9P

Inputs	777148	787148
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**50 Ohm**	**50 Ohm**
Single-channel at UB AC	**80 Ohm**	**80 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**100 Ohm**	**100 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**160 Ohm**	**160 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**3 Ohm**	**3 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**8 Ohm**	**8 Ohm**
Relay outputs	**777148**	**787148**
Number of output contacts		
Safety contacts (N/O), instantaneous	**8**	**8**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**500 VA**	**500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**50 W**	**50 W**

Safety relays PNOZ X
PZE 9P

Relay outputs	777148	787148
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7 A**	**7 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC G. P. Resistive**	**24 V DC G. P. Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**2 A**	**2 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PZE 9P

Conventional thermal current while loading several contacts	777148	787148
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7,1 A**	**7,1 A**
Conv. therm. current with 5 contacts	**6,3 A**	**6,3 A**
Conv. therm. current with 6 contacts	**5,8 A**	**5,8 A**
Conv. therm. current with 7 contacts	**5,4 A**	**5,4 A**
Conv. therm. current with 8 contacts	**5 A**	**5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**8 A**	**8 A**
Conv. therm. current with 3 contacts	**8 A**	**8 A**
Conv. therm. current with 4 contacts	**7,1 A**	**7,1 A**
Conv. therm. current with 5 contacts	**6,3 A**	**6,3 A**
Conv. therm. current with 6 contacts	**5,8 A**	**5,8 A**
Conv. therm. current with 7 contacts	**5,4 A**	**5,4 A**
Conv. therm. current with 8 contacts	**5 A**	**5 A**
Times	**777148**	**787148**
Switch-on delay		
With automatic start typ.	**30 ms**	**30 ms**
With automatic start max.	**40 ms**	**40 ms**
With automatic start after power on typ.	**300 ms**	**300 ms**
With automatic start after power on max.	**350 ms**	**350 ms**

Safety relays PNOZ X
PZE 9P

Times	777148	787148
Delay-on de-energisation		
With E-STOP typ.	**20 ms**	**20 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**200 ms**	**200 ms**
With power failure max.	**310 ms**	**310 ms**
With power failure typ. UB 240 V	**500 ms**	**500 ms**
With power failure max. UB 240 V	**630 ms**	**630 ms**
With power failure typ. UB 24 V	**150 ms**	**150 ms**
With power failure max. UB 24 V	**200 ms**	**200 ms**
Supply interruption before de-energisation in the input circuit	**10 ms**	**10 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Environmental data	**777148**	**787148**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777148**	**787148**
Mounting position	**Any**	**Any**

Safety relays PNOZ X
PZE 9P

Mechanical data	777148	787148
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**87 mm**	**87 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**455 g**	**455 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZ X
PZE 9P

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	PL e	Cat. 4	SIL CL 3	2,31E-09	SIL 3	2,03E-06	20

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

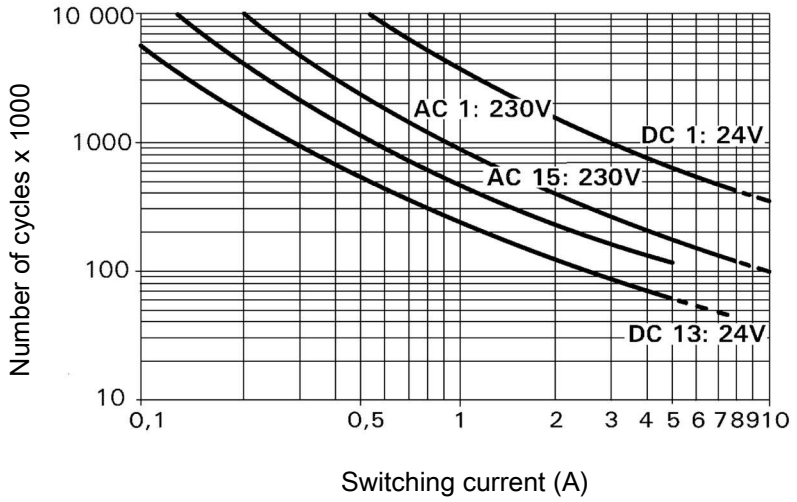
Supplementary data

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.

Safety relays PNOZ X
PZE 9P

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

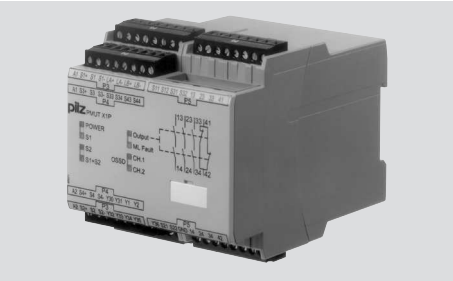
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Type	Features	Connection type	Order no.
PZE 9P C	24 V AC/DC	Spring-loaded terminals	787 140
PZE 9P	24 V AC/DC	Screw terminals	777 140
PZE 9P C	24 V AC/DC, 24 - 240 V AC/DC	Spring-loaded terminals	787 148
PZE 9P	24 V AC/DC, 24 - 240 V AC/DC	Screw terminals	777 148

Safety relays PNOZ X
PMUT X1P



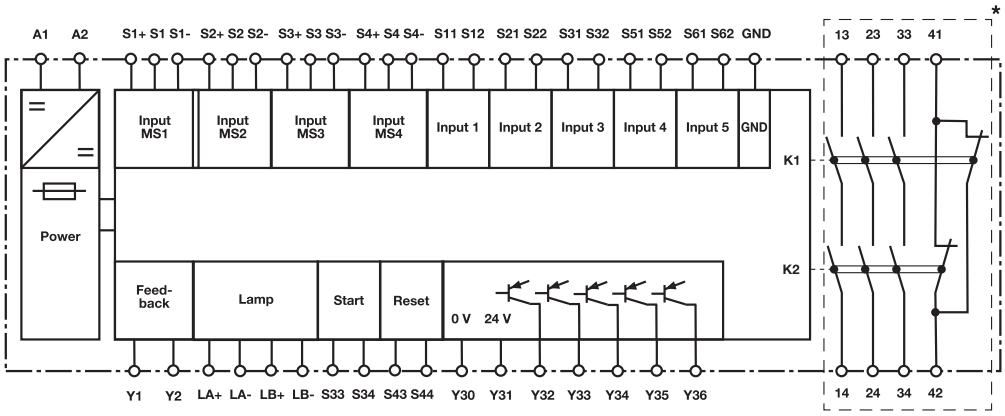
Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 4 inputs for muting sensors
- 1 ESPE input for light grids (2-channel, contact or semiconductor outputs)
- 1 input for additional safety light grid (2-channel, contact outputs) or safety contacts
- Connection option for 2 muting lamps
- Connection options for:
  - Start button
  - Key switch
  - Feedback loop
- 5 semiconductor outputs
- Monitors muting lamps
- Muting mode: sequential or parallel
- LED display for:
  - Switch status channel 1/2
  - Muting sensors
  - Light grid
  - Simultaneity requirement
  - Muting lamp error
- Semiconductor outputs signal:
  - Switch state of the safety contacts
  - Muting active
  - One of the muting lamps defective
  - Both muting lamps defective
  - Light grid (ESPE) active
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)

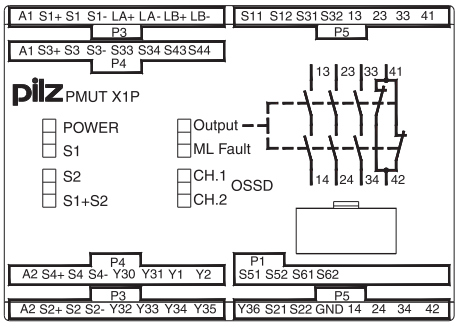
Safety relays PNOZ X
PMUT X1P

- See order reference for unit types

Block diagram/terminal configuration



*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)



Safety relays PNOZ X
PMUT X1P

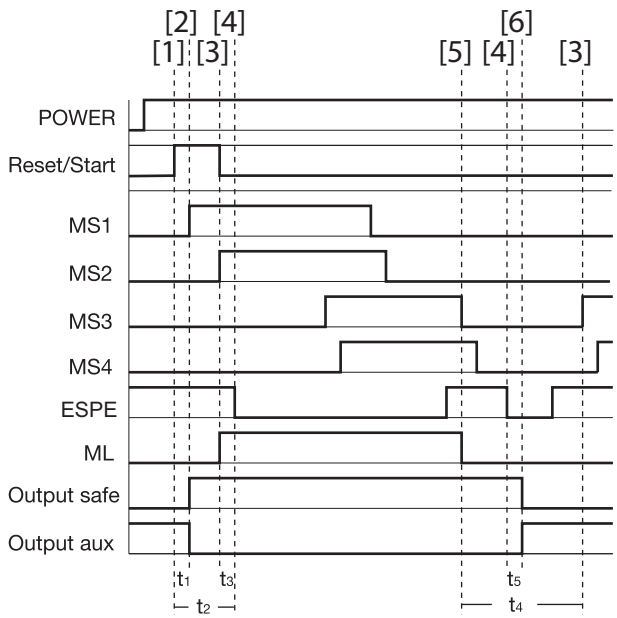
Function description

The muting controller PMUT X1P is used for the temporary suspension of safety functions. This allows objects to be transported into and out of a danger zone without adversely affecting the safety function. When the supply voltage is applied the "POWER" LED will light. The unit is ready for operation when the feedback loop Y1-Y2 and the input circuit (e.g. light guard at S12 and S22 not interrupted) are closed. The muting sensors are not active.

- Start circuit S33-S34 is closed:
  - Safety contacts 13-14/23-24/33-34 are closed, auxiliary contact 41-42 is open.
  - Status indicators "Output", "OSSD CH.1" and "OSSD CH.2" are lit.
  - A high signal is present at the semiconductor output Y32 (ESPE state).
  - A high signal is present at the semiconductor output Y36 (switch state of safety contacts)
- Input circuit is opened (e.g. light guard at S12 and S22 interrupted):
  - Safety contacts 13-14/23-24/33-34 are opened redundantly, auxiliary contact 41-42 is closed.
  - Status indicators "Output", "OSSD CH.1" and "OSSD CH.2" go out.
  - A low signal is present at the semiconductor output Y36 (switch state of safety contacts).
  - A low signal is present at semiconductor output Y32 (ESPE state).

Safety relays PNOZ X
PMUT X1P

Timing diagram



Legend

- Power: Supply voltage
- Start: Start button
- ESPE: Light guard
- MS1 ... MS2: Muting sensors
- ML: Muting lamps
- Output Safe: Safety contacts 13-14, 23-24, 33-34
- Output aux: Auxiliary contact 41-42
- [1]: Press start button
- [2]: Close safety contacts
- [3]: Muting on
- [4]: Light guard interrupted
- [5]: Muting off
- [6]: Open safety contacts
- t_1: Switch-on delay safety contacts
- t_2: Minimum start pulse duration
- t_3: Minimum period before light guard may be interrupted
- t_4: Recovery time after muting off
- t_5: Delay-on de-energisation

Safety relays PNOZ X
PMUT X1P

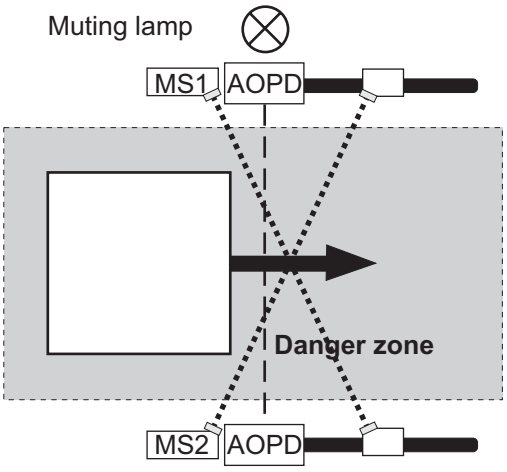
Operating modes

- Dual-channel operation (contact or semiconductor outputs from ESPE) without detection of shorts across contacts
- Dual-channel operation (contact or semiconductor outputs from ESPE) with detection of shorts across contacts: redundant input circuit, earth faults in the input circuit or shorts across the input circuits are detected.
- Monitored manual start: The supply voltage must be present and the safety circuits closed before the start contact is closed. The unit is not active until the start button has been operated once the waiting period has expired (see technical details).

Muting

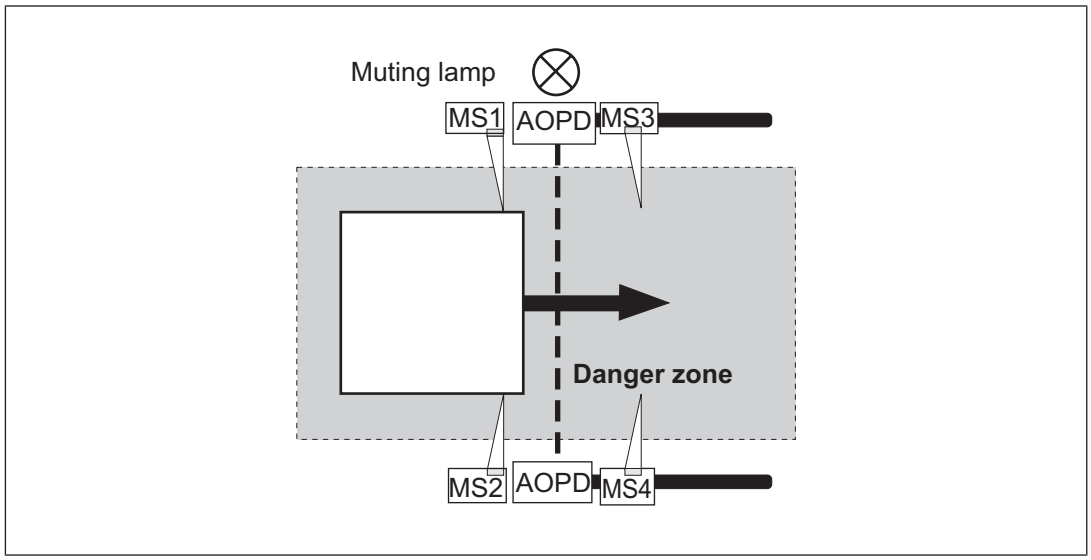
The muting controller can be used for parallel or sequential muting:

- Parallel muting with 2 muting sensors

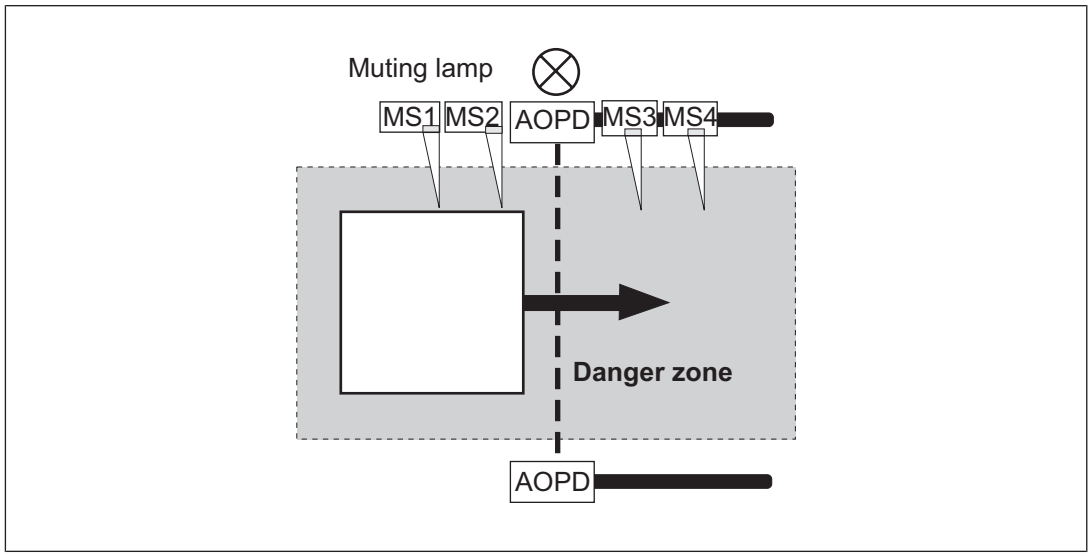


Safety relays PNOZ X
PMUT X1P

- Parallel muting with 4 muting sensors



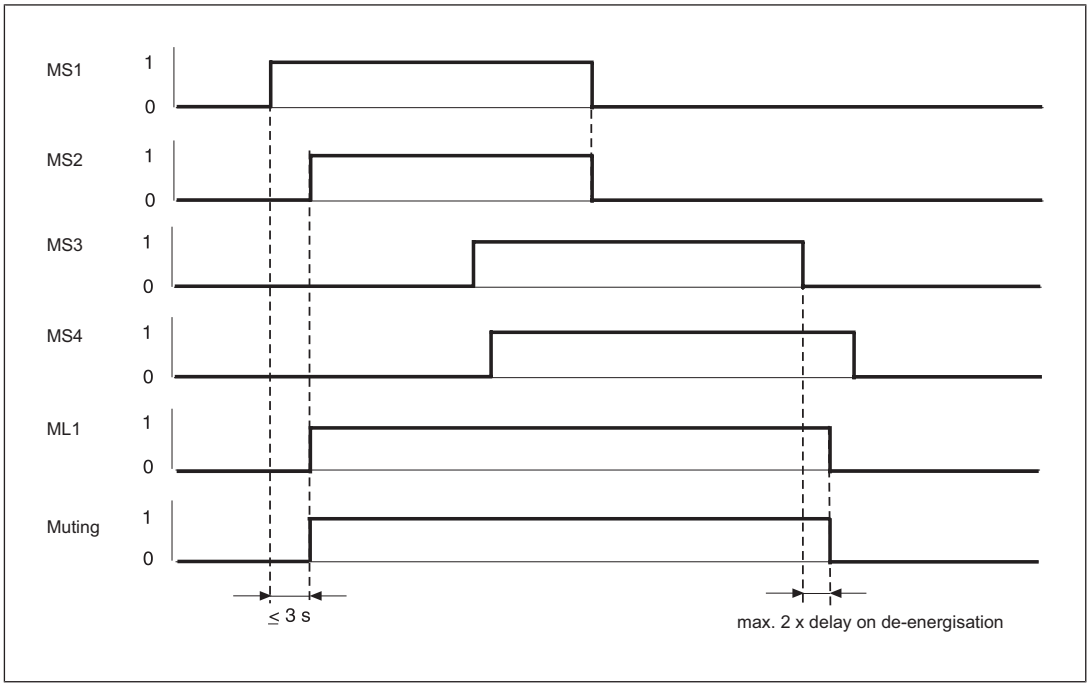
- Sequential muting with 4 muting sensors



Muting sensors MS1 and MS2 must energise within 3 s (simultaneity). Muting starts when both muting sensors are active. The inputs of light guards S11-S12, S21-S22 and S31-S32 are muted. Status indicators "S1+S2" (Muting active), "S1", "S2" "OSSD CH.1" and "OSSD CH.2" are lit. A high signal is present at semiconductor output Y32 (muting active).

If the light guards are interrupted (inputs S12 and S22 not active), status indicators "OSSD CH.1" and "OSSD CH.2" will go out. A low signal is present at semiconductor output Y32 (ESPE state). Muting sensors MS3 and MS4 must energise while MS1 and MS2 are still active. Only then may MS1 and MS2 become inactive. The muting cycle will then continue. Muting is ended when one muting sensor at most (MS3 or MS4) is active.

Safety relays PNOZ X
PMUT X1P



Legend:

MS1: Muting sensor 1
MS2: Muting sensor 2
MS3: Muting sensor 3
MS4: Muting sensor 4
ML1: Muting lamp 1

Reset input

If the simultaneity requirement of 3 s is exceeded, the unit will go to a fault condition. Once the fault has been rectified, the simultaneity must be reset by operating the key switch at S43-S44. The start button S33-34 must then be operated. The muting controller is ready for operation.

Additional inputs for light guard or safety contacts

Additional safety contacts can be connected to the muting controller at S51-S52 and S61-S62 (e.g. a dual-channel safety light guard with safe output contacts). These input circuits can monitor the muted ESPE. However, these inputs do not have a muting function. If the contacts connected at S51-S52 and S61-S62 are interrupted, safety contacts 13-14/23-24/33-34 are opened redundantly, auxiliary contact 41-42 is closed. Status indicator "Output" goes out. A low signal is present at semiconductor output Y36.

Safety relays PNOZ X
PMUT X1P

Muting lamps

The muting controller PMUT X1P is designed for use with one or two muting lamps. As soon as the inputs of the light guard are muted, the Muting lamp ML1 will light. The PMUT X1P monitors the connected muting lamps during the muting cycle. If muting lamp ML1 is defective (e.g. coiled filament broken or lamp switched off), then the PMUT X1P automatically switches to muting lamp ML2. A high signal is present at semiconductor output Y34 (muting lamp 1 defective). If muting lamp ML2 is defective or is not connected, a high signal is present at semiconductor output Y35 (both muting lamps defective). The "ML Fault" LED is lit. If the light guards (ESPE) are interrupted when the muting lamps are defective, then safety contacts 13-14/23-24/33-34 are opened redundantly, auxiliary contact 41-42 is closed. Status indicators "Output", "OSSD CH.1" and "OSSD CH.2" go out.

Installation

- The unit 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).
- When installing the light guards (muting sensors, ESPE), it is essential that the respective standards and regulations are observed. If you are using reflective light barriers (parallel muting with 2 muting sensors), the light beams must cross within the danger zone.
- The start button has to be installed in such a way that the operator can see into the danger zone when operating the start button.

Wiring

Please note:

- Information given in the "Technical details [📖 512]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- Semiconductor outputs should **not** be used for safety circuits!
- Delivery status: S51-S52/S61-S62/Y1-Y2/S31-S32 are linked
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 512]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 512])
R_l / km = cable resistance/km

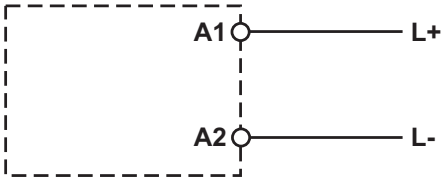
- Use copper wire that can withstand 60/75 °C.

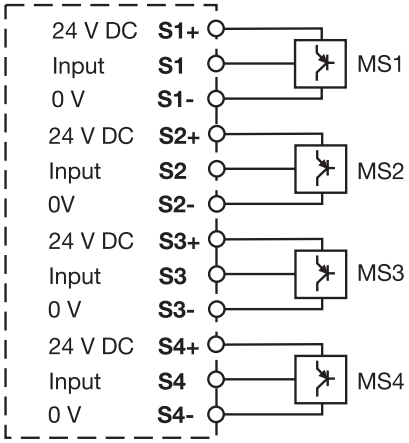
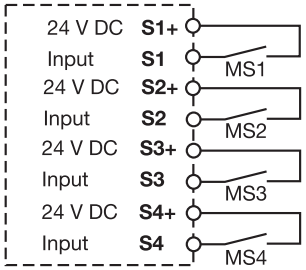
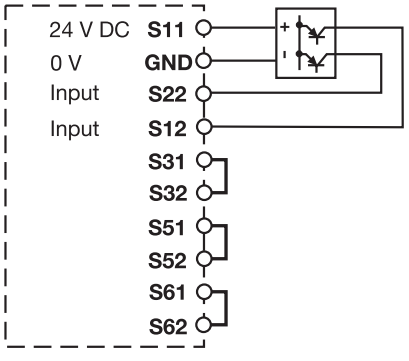
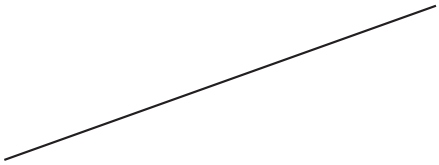
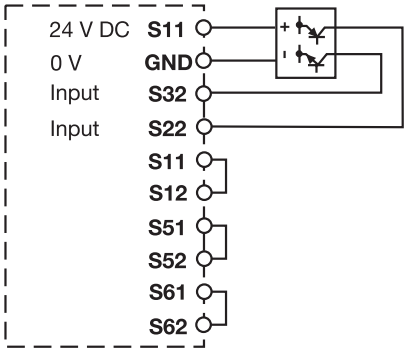
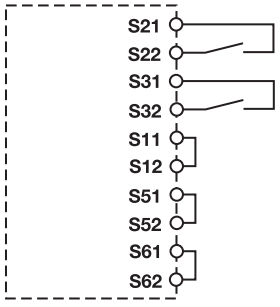
Safety relays PNOZ X
PMUT X1P

- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- Mechanical and optoelectronic sensors (safety light beam devices, safety light grids) are suitable for use.
- The safety contacts can be used to shut down the potentially hazardous movement.
- Only safe contact outputs (e.g. from safety light grids) may be used at S51-S52 and S61-S62. Do **not** connect safety light grids with semiconductor outputs.
- The cables for connecting the muting sensors to terminals S1/S3 and S2/S4 must be laid in separate sheathed cables!
- Only use muting lamps that have a luminous area of at least 1cm^2 and a luminosity of at least 200 cd/m^2, in accordance with EN 61496-1.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.

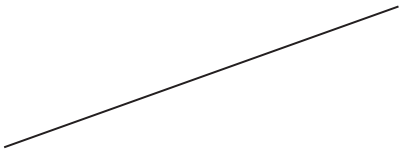
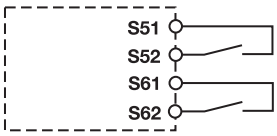
Safety relays PNOZ X
PMUT X1P

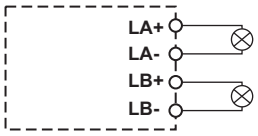
Preparing for operation

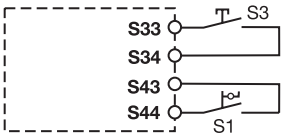
Supply voltage	AC	DC
		

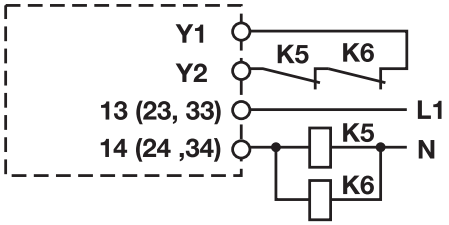
Input circuit	Semiconductor	Contacts
Muting sensors		
Light grid (ESPE) Semiconductor output 2 x PNP Detection of shorts across contacts via light grid		
Light grid (ESPE) Semiconductor output PNP/NPN Detection of shorts across contacts; - Semiconductor: via light grid - Contacts: via PMUT X1P		

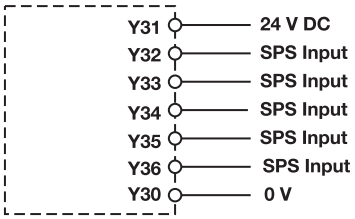
Safety relays PNOZ X
PMUT X1P

Input circuit	Semiconductor	Contacts
Additional light grid, 2-channel, E-STOP pushbutton		

Muting lamp	
	

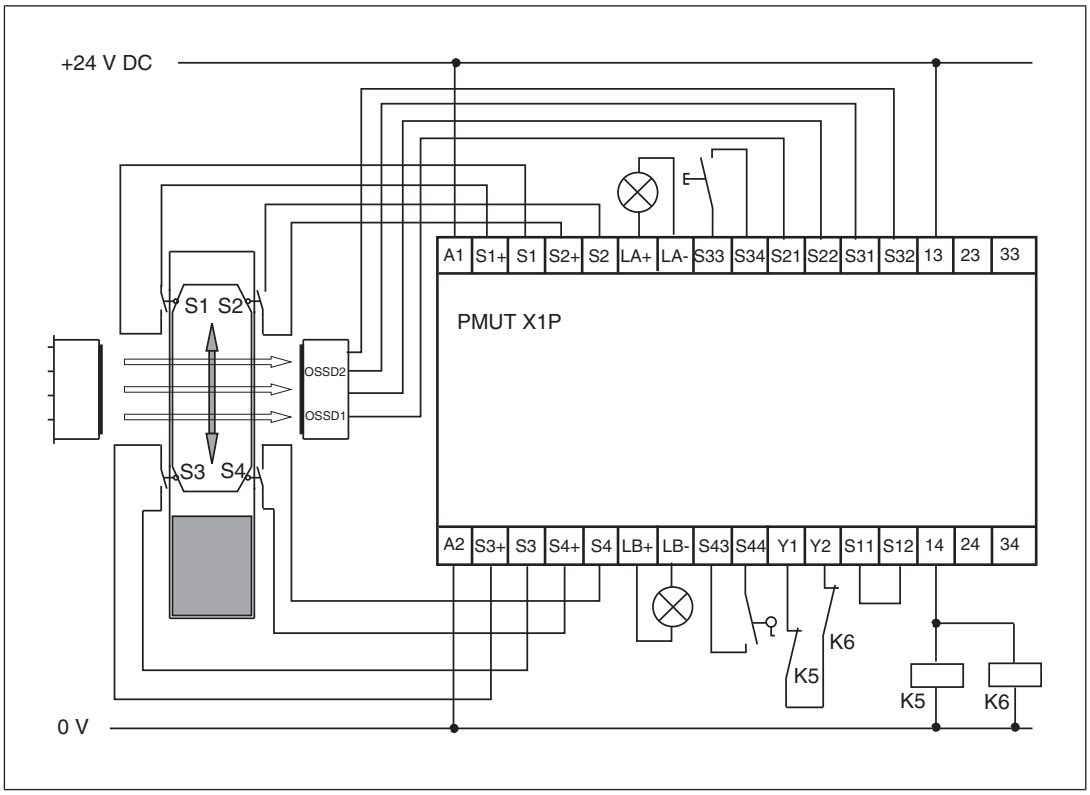
Start circuit	
S1: Key switch S3: Start button	

Feedback loop	without feedback loop monitoring	with feedback loop monitoring
Link or contacts from external contactors		

Semiconductor output	
Y32: Light grid active Y33: Muting active Y34: Muting lamp warning Y35: Both muting lamps defective Y36: Safety contacts closed	

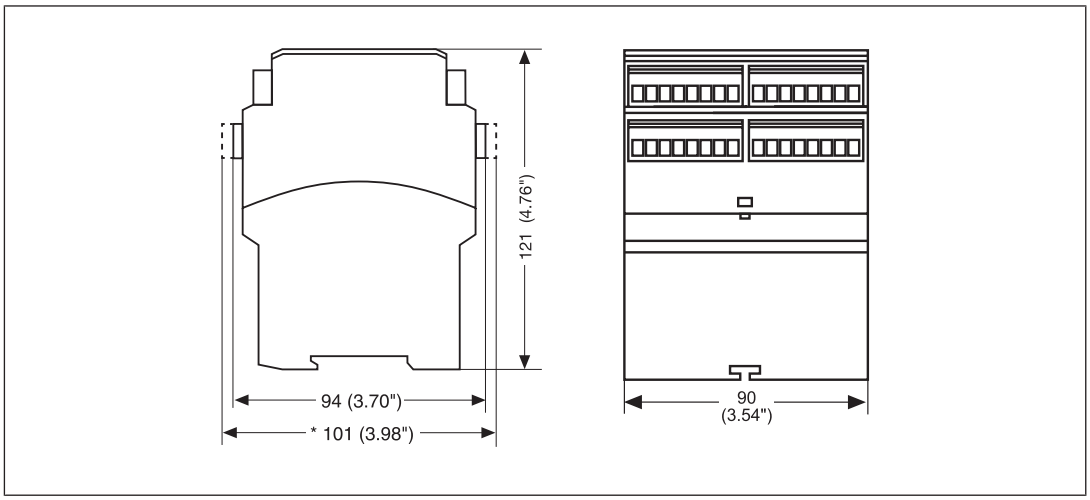
Safety relays PNOZ X
PMUT X1P

Application example



Dimensions in mm

* With spring-loaded terminals



Safety relays PNOZ X
PMUT X1P

Technical details

General	778010	788010
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**778010**	**788010**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	33 W	33 W
Power consumption	6 W	6 W
Residual ripple DC	48 %	48 %
Duty cycle	100 %	100 %
Voltage at		
Muting lamp DC	24 V	24 V
Muting lamp LED DC	24 V	24 V
Muting sensor DC	24 V	24 V
Current at		
Muting lamp DC max.	500 mA	500 mA
Muting lamp LED DC min.	40 mA	40 mA
Muting sensor DC	40 mA	40 mA
Connected load min.		
Muting lamp LED	0,96 W	0,96 W
Connected load max.		
Muting sensors	5 W	5 W
Light beam device	10 W	10 W
Muting lamp	12 W	12 W
Inputs	**778010**	**788010**
Number	9	9
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	25 mA	25 mA
Start circuit DC	40 mA	40 mA
Feedback loop DC	40 mA	40 mA
Max. inrush current impulse		
Current pulse, input circuit	0,07 A	0,07 A
Min. input resistance at power-on	460 Ohm	460 Ohm

Safety relays PNOZ X
PMUT X1P

Inputs	778010	788010
Max. overall cable resistance Rl-max		
Dual-channel without detection of shorts across contacts at UB DC	**70 Ohm**	**70 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**15 Ohm**	**15 Ohm**
Semiconductor outputs	**778010**	**788010**
Number	**4**	**4**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**778010**	**788010**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**2000 VA**	**2000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**8 A**	**8 A**
Max. power	**200 W**	**200 W**

Safety relays PNOZ X
PMUT X1P

Relay outputs	778010	788010
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**240 V**	**240 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**8 A**	**8 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**5 A**	**5 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**

Safety relays PNOZ X
PMUT X1P

Conventional thermal current while loading several contacts	778010	788010
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**8 A**	**8 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**5 A**
Times	**778010**	**788010**
Switch-on delay		
With monitored start with rising edge typ.	**40 ms**	**40 ms**
With monitored start with rising edge max.	**80 ms**	**80 ms**
Delay-on de-energisation		
With E-STOP typ.	**8 ms**	**8 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ.	**490 ms**	**490 ms**
With power failure max.	**700 ms**	**700 ms**
After safety function is triggered typ.	**15 ms**	**15 ms**
After safety function is triggered max.	**20 ms**	**20 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**320 ms**	**320 ms**
After power failure	**1 s**	**1 s**
Waiting period with a monitored start		
With rising edge	**300 ms**	**300 ms**
Min. start pulse duration with a monitored start		
With rising edge	**40 ms**	**40 ms**
Supply interruption before de-energisation in the input circuit	**5 ms**	**5 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**3 s**	**3 s**
Environmental data	**778010**	**788010**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**

Safety relays PNOZ X
PMUT X1P

Environmental data	778010	788010
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 61000-6-2, EN 61326-3-1, EN 61496-1**	**EN 61000-6-2, EN 61326-3-1, EN 61496-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**778010**	**788010**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,2 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,2 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–

Safety relays PNOZ X
PMUT X1P

Mechanical data	778010	788010
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**8 mm**
Dimensions		
Height	**94 mm**	**101 mm**
Width	**90 mm**	**90 mm**
Depth	**121 mm**	**121 mm**
Weight	**565 g**	**565 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Muting active	**PL e**	**Cat. 3**	**SIL CL 3**	**8,35E-09**	**SIL 3**	**5,54E-04**	**20**
Muting inactive	**PL e**	**Cat. 4**	**SIL CL 3**	**1,45E-09**	**SIL 3**	**2,49E-06**	**20**

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

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.

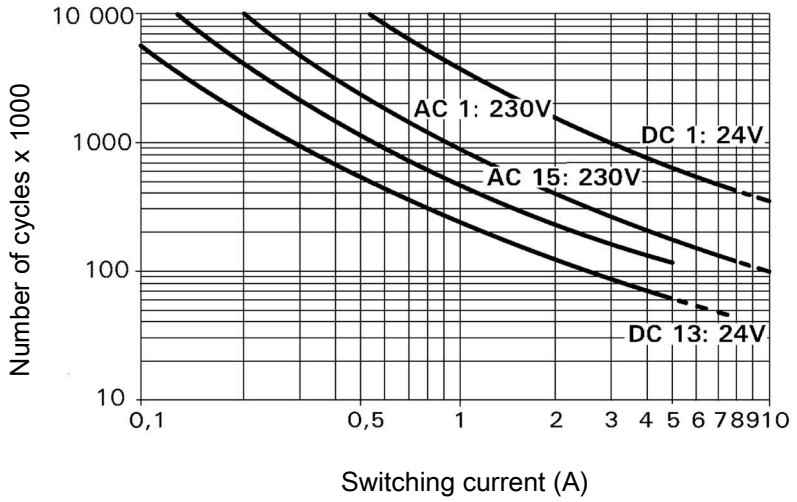
Supplementary data

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.

Safety relays PNOZ X
PMUT X1P

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

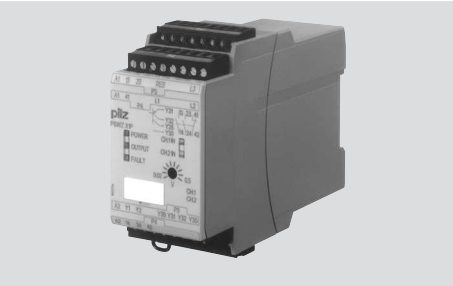
Provided the application to be implemented requires fewer than 4 000 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order no.
PMUT X1P C	24 VDC	Spring-loaded terminal	788 010
PMUT X1P	24 VDC	Screw terminals	778 010

Safety relays PNOZ X
PSWZ X1P

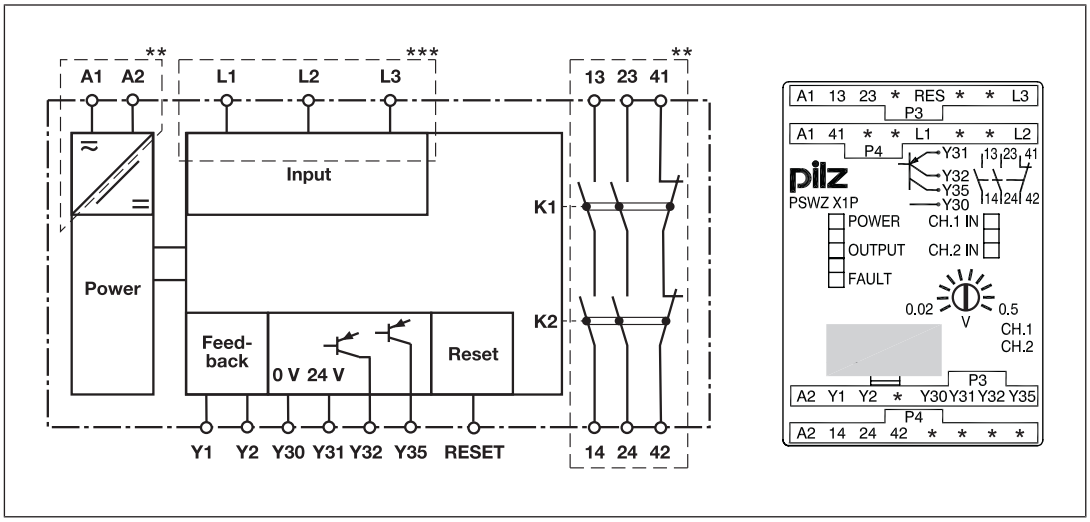


Unit features

- Measuring inputs for 3- or 1-phase motors
- Measuring voltage on both channels can be set jointly
- 1 Reset input
- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 2 semiconductor outputs
- LED display for:
  - Standstill on channel 1/2
  - Supply voltage/fault
- Semiconductor outputs signal:
  - Supply voltage/fault
  - Switch status
- Feedback loop for monitoring external contactors
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZ X
PSWZ X1P

Block diagram/terminal configuration



**Insulation against the non-marked area and between the relay contacts: Basic insulation (overvoltage category III), protective separation (overvoltage category II); at 250 V, 4 kV

***Insulation against the non-marked area and between the measurement connections: Basic insulation (overvoltage category III), protective separation (overvoltage category II); at 690 V, 6 kV

- Channel 1: L1-L3
- Channel 2: L2-L3

Function description

The device uses two separate measuring channels to measure the regenerated voltage, induced from the motor during the rundown period. If the voltage falls below the set response value (standstill threshold), the PSWZ X1P enables the monitored plant.

When used with frequency converters, the PSWZ X1P cannot detect standstill until the controller inhibit has been switched off.

After the supply voltage U_B is switched on, the unit performs a self test. The unit simulates a situation in which the release value is exceeded and the measuring circuit has an open circuit. The correct function of the output relay and feedback loop is also tested. The test takes approx. 1.5 s.

The unit is ready for operation when the feedback loop is closed and the measuring circuits are not interrupted.

- Procedure when the measuring voltage falls below the response value U_{on} on both channels L1-L3 and L2-L3:
  - LEDs "POWER", "CH.1 IN", "CH.2 IN" and "OUTPUT" are lit.
  - Safety contacts 13-14 and 23-24 are closed, auxiliary contact 41-42 is open.
  - A high signal is present at semiconductor output Y32.

- Procedure when after the motor has started, the voltage in one of the two measuring circuits exceeds the release value U_{off}:
  - Safety contacts 13-14 and 23-24 are opened redundantly, auxiliary contact 41-42 is closed.
  - A low signal is present at semiconductor output Y32.
  - LEDs "CH.1 IN", "CH.2 IN" and "OUTPUT" go out.

To reactivate, the voltage at both channels L1-L3 and L2-L3 must fall below the response value U_{on} within the time t_g (simultaneity monitoring) and the feedback loop must be closed. The response value U_{on} can be set jointly for both channels in order to suit the motor that is to be monitored. The release value U_{off} (hysteresis) corresponds to twice the response value.

If the simultaneity requirement is exceeded, the "FAULT" LED is lit and on the semiconductor output Y35 there is a High signal. The PSWZ X1P does not enable the monitored plant. The fault is reset by applying a High signal and then a Low signal at the reset input.

Self test

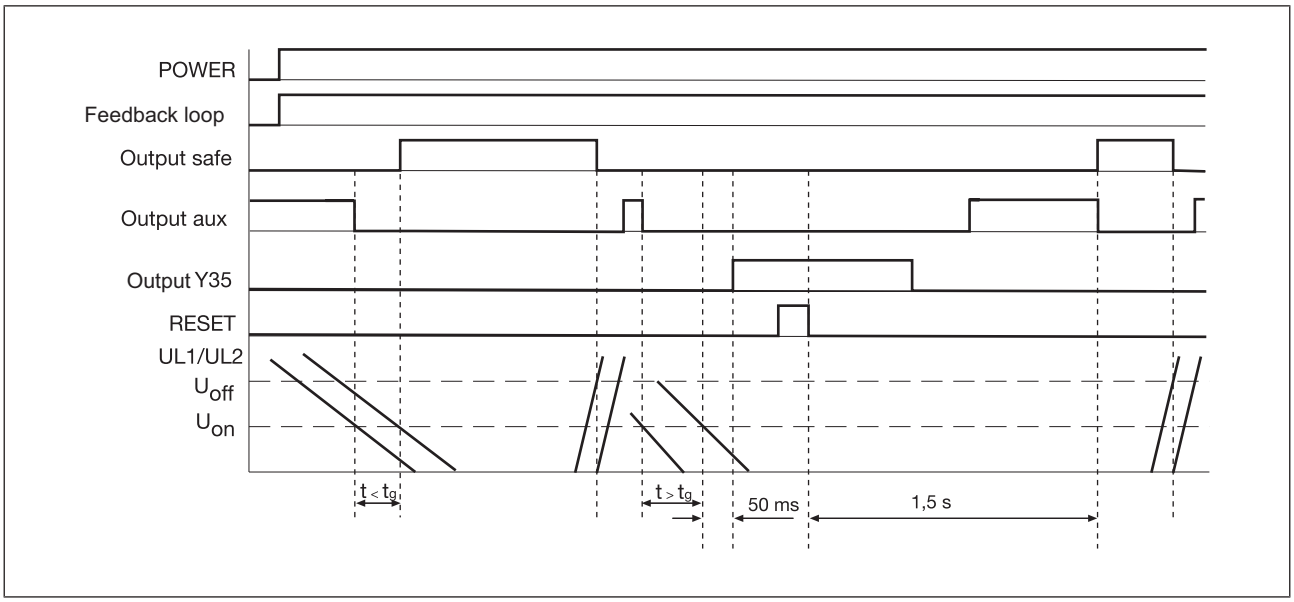
An internal self test is carried out during initial commissioning and each time the supply voltage is switched off and on. The process simulates switching all measuring voltages on and then off again. Provided no error occurs during the self test, the unit will then be ready for operation.

Operating modes

- Single-phase operation:
  - One measuring circuit (calculated at two different measuring points) affects both channels
- Three-phase operation:
  - Two redundant (identical) measuring circuits affect channel 1 and 2
  - Voltages in the measuring circuit are monitored (failsafe in the event of a short circuit)

Safety relays PNOZ X
PSWZ X1P

Timing diagram



Legend

- POWER: Supply voltage
- UL1/UL2: Input circuit L1, L2, L3
- Feedback loop: Feedback loop Y1-Y2
- Output safe: Safety contacts 13-14, 23-24
- Output aux: Auxiliary contact 41-42
- Output Y35: Semiconductor output for fault signal
- RESET: Reset input
- U_{on}: Response value
- U_{off}: Release value
- t_g: Simultaneity

Installation

- The unit 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).

Safety relays PNOZ X
PSWZ X1P

Wiring

Please note:

- Information given in the "Technical details [📖 527]" must be followed.
- Outputs 13-14, 23-24 are safety contacts, the output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 527]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

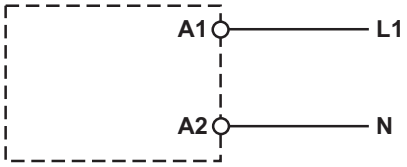
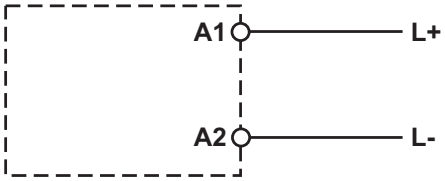
R_{lmax} = max. overall cable resistance (see Technical details [📖 527])
R_l / km = cable resistance/km

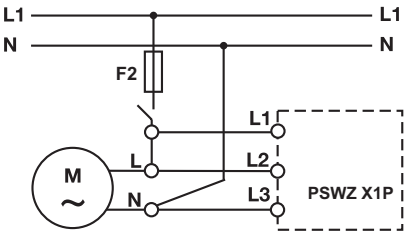
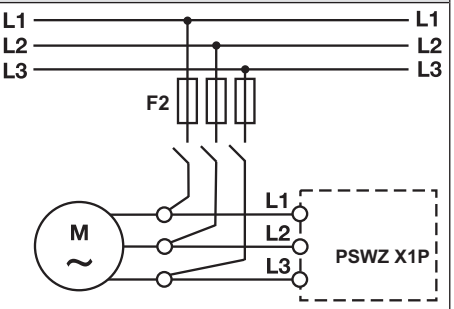
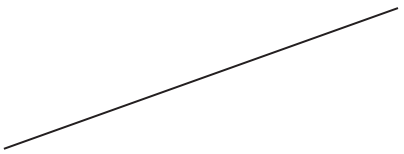
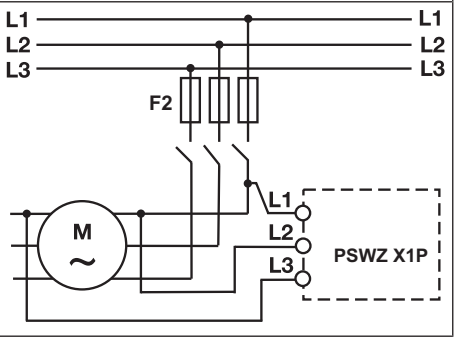
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not switch low currents using contacts that have been used previously with high currents.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- When used with converters: Please comply with the information regarding installation and wiring in the documentation of the converter. Use screened cable for the wiring between the PSWZ X1P and the motor. Connect the cable screening on the motor.
- Protect the measuring circuits according to the conductor cross section.
- Single-phase motor: Connect terminal L1 directly to motor connection terminal L, and terminal L3 directly to motor connection terminal N. Connect terminal L2 directly to the element that switches the motor on (contactor, converter, etc.). Separate cables with separate insulation should be used for the measuring voltages L1 and L2. The cables should also be physically separate.
- Three-phase motor: Connect the connection terminals L1, L2 and L3 directly to the motor connection terminals L1, L2 and L3.
- Do **not** connect the terminals labelled "*".

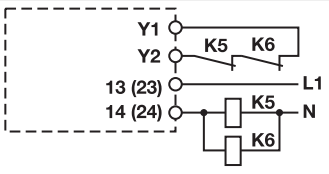
Safety relays PNOZ X
PSWZ X1P

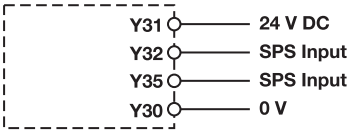
Preparing for operation

Connection

Supply voltage	AC	DC
		

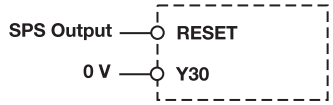
Input circuit	Single-phase motor	Three-phase motor
Single-phase motor = single-phase measurement signal evaluation Three-phase motor = two-phase measurement signal evaluation		
Single-phase measurement signal evaluation		

Feedback loop	with feedback loop monitoring	without feedback loop monitoring
Contacts from external contactors or link		

Semiconductor output	
Y32: Semiconductor output for switch status Y35: Semiconductor output for fault signal	

Safety relays PNOZ X
PSWZ X1P

Semiconductor input

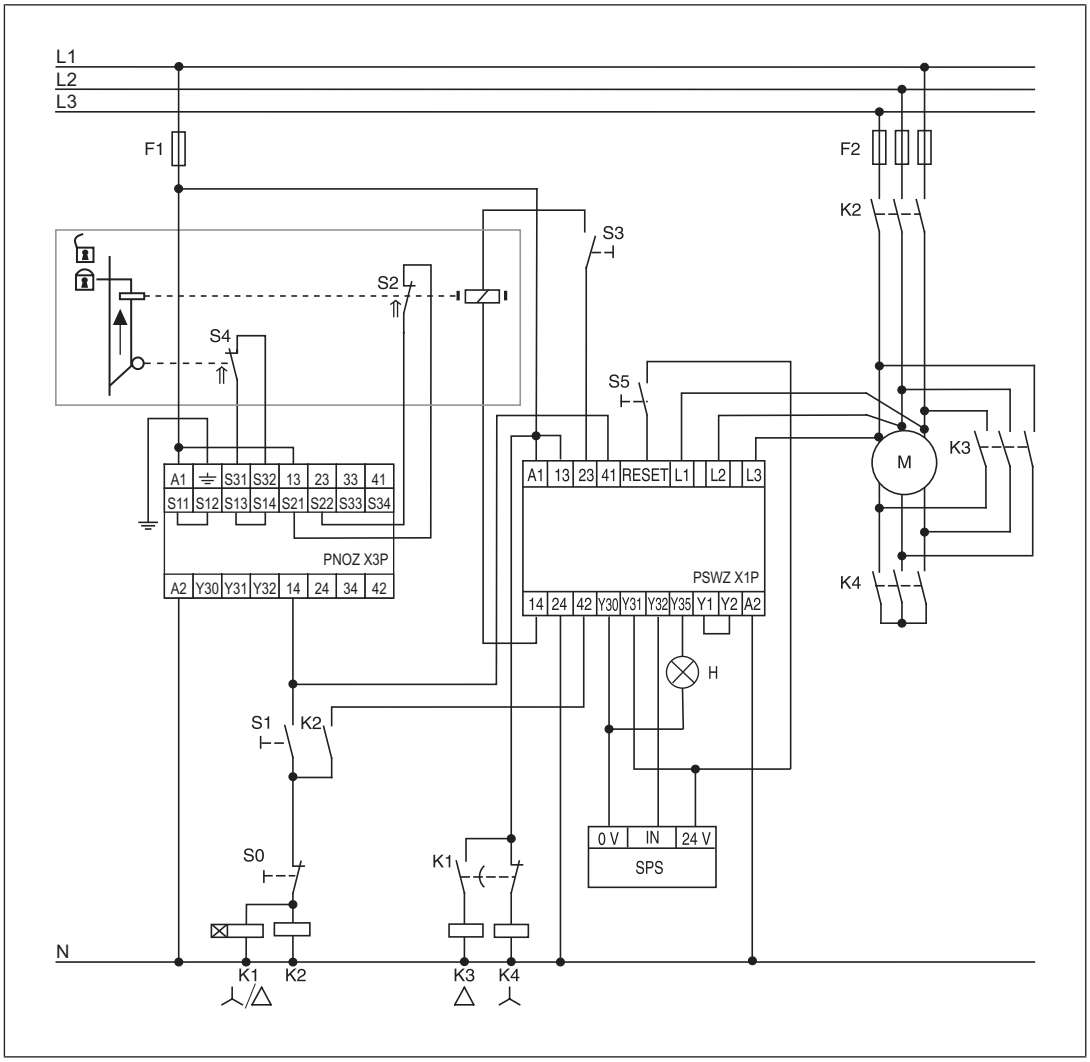


Set standstill detection

- Turn the potentiometer to the left-hand stop (default setting)
- Set standstill detection
  - At motor standstill, the LEDs "CH.1 IN" and "CH.2 IN" must light up. If the LEDs do not light in the default setting, turn the potentiometer gradually to the right until the LEDs "CH.1 IN" and "CH.2 IN" light up.
  - If the simultaneity requirement is met, the "OUTPUT" LED will also light up. Safety contacts 13-14 and 23-24 are closed, auxiliary contact 41-42 is open, there is a High signal at the semiconductor output Y32.
  - If the simultaneity requirement is exceeded, the "FAULT" LED will light up. Safety contacts 13-14 and 23-24 are open, auxiliary contact 41-42 is closed, a low signal is present at semiconductor output Y32. Reset the error by a pulse (High- Low- signal) at the reset input.
- Test standstill detection
  - Close the feedback loop, start up the motor and then switch it off again. As soon as the motor is at standstill, the LEDs "CH.1 IN", "CH.2 IN" and "OUTPUT" light up. Safety contacts 13-14 and 23-24 are closed, auxiliary contact 41-42 is open, there is a High signal at the semiconductor output Y32.

Safety relays PNOZ X
PSWZ X1P

Application example



Standstill detection only with closed star contactor contacts

Legend

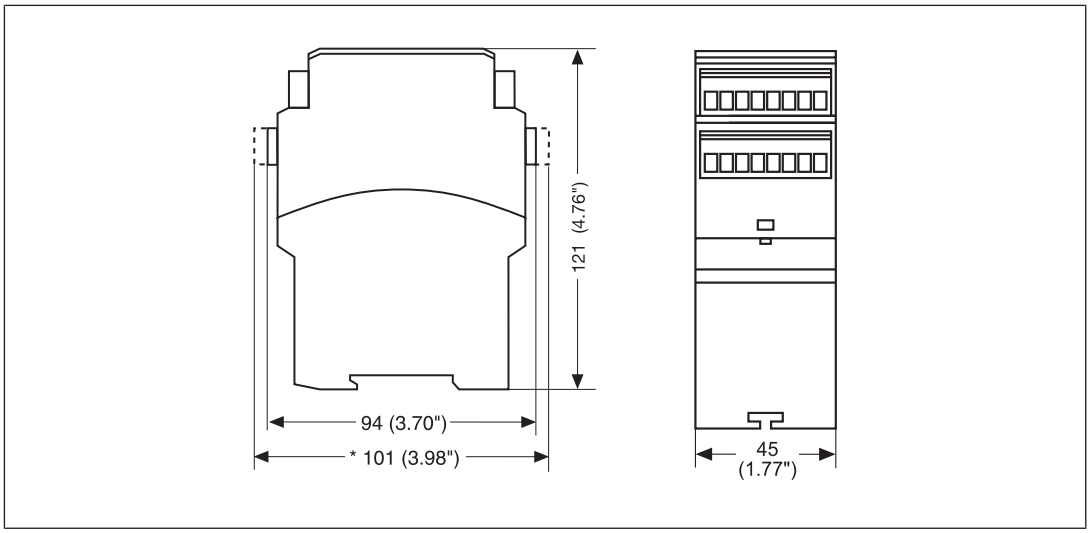
- S0: Off switch
- S1: On switch
- S2/S4: Safety gate switch
- S3: Release
- S5: Reset button
- K1: Star/delta control relay
- K2: Motor contactor
- K3: Delta contactor
- K4: Star contactor
- H: Fault indicator

Safety relays PNOZ X
PSWZ X1P

- ⇑: Operated element
- : Gate open
- : Gate closed

Dimensions in mm

* with spring-loaded terminals



Technical details

Order no. 777949 – 777950

See below for more order numbers

General	777949	777950
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777949**	**777950**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5 VA**	**5 VA**
Output of external power supply (DC)	**3 W**	**3 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**

Safety relays PNOZ X
PSWZ X1P

Electrical data	777949	777950
Max. inrush current at UB	**10 A**	**10 A**
Duty cycle	**100 %**	**100 %**
Measuring circuit	**777949**	**777950**
Min. measuring voltage	**0,0 V**	**0,0 V**
Max. measuring voltage	**690 V**	**690 V**
Measuring voltage in accordance with UL	**600 V**	**600 V**
Frequency range	**0 - 3 kHz**	**0 - 3 kHz**
Input resistance	**1.300 kOhm**	**1.300 kOhm**
Switching threshold per channel		
Response value Uon (adjustable)	**20 - 500 mV**	**120 - 3000 mV**
Release value Uoff	**2 x Uon**	**2 x Uon**
Inputs	**777949**	**777950**
Voltage at		
Feedback loop DC	**24 V**	**24 V**
Current at		
Feedback loop DC	**35 mA**	**35 mA**
Max. inrush current impulse		
Current pulse, feedback loop	**0,12 A**	**0,12 A**
Pulse duration, feedback loop	**0,1 s**	**0,1 s**
Reset input	**777949**	**777950**
Low signal	**< 5 V**	**< 5 V**
High signal	**> 15 V**	**> 15 V**
Current	**20 mA**	**20 mA**
Semiconductor outputs	**777949**	**777950**
Number	**2**	**2**
Voltage	**24 V**	**24 V**
Current	**50 mA**	**50 mA**
External supply voltage	**24 V**	**24 V**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Relay outputs	**777949**	**777950**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZ X
PSWZ X1P

Relay outputs	777949	777950
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**

Safety relays PNOZ X
PSWZ X1P

Relay outputs	777949	777950
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777949**	**777950**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**4 A**
Times	**777949**	**777950**
Delay-on de-energisation		
After motor on max.	**170 ms**	**170 ms**
Max. switch-on delay		
After motor standstill max.	**1.500 ms**	**1.500 ms**
After power on max.	**2.200 ms**	**2.200 ms**
Recovery time at max. switching frequency 1/s		
After motor on	**2.200 ms**	**2.200 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**7 s**	**7 s**
Environmental data	**777949**	**777950**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**

Safety relays PNOZ X
PSWZ X1P

Environmental data	777949	777950
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**690 V**	**690 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777949**	**777950**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZ X
PSWZ X1P

Mechanical data	777949	777950
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 14 AWG**	**0,25 - 2,5 mm², 24 - 14 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,5 - 1,5 mm², 24 - 16 AWG**	**0,5 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,6 Nm**	**0,6 Nm**
Dimensions		
Height	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**325 g**	**325 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 777951 – 777959

See below for more order numbers

General	777951	777959
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**777951**	**777959**
Supply voltage		
Voltage	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5 VA**	**5 VA**
Output of external power supply (DC)	**3 W**	**3 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Max. inrush current at UB	**10 A**	**10 A**
Duty cycle	**100 %**	**100 %**
Measuring circuit	**777951**	**777959**
Min. measuring voltage	**0,0 V**	**0,0 V**
Max. measuring voltage	**690 V**	**690 V**

Safety relays PNOZ X
PSWZ X1P

Measuring circuit	777951	777959
Measuring voltage in accordance with UL	600 V	600 V
Frequency range	0 - 3 kHz	0 - 3 kHz
Input resistance	1.300 kOhm	1.300 kOhm
Switching threshold per channel		
Response value Uon (adjustable)	7,5 - 500 mV	20 - 500 mV
Release value Uoff	2 x Uon	2 x Uon
Inputs	**777951**	**777959**
Voltage at		
Feedback loop DC	24 V	24 V
Current at		
Feedback loop DC	35 mA	35 mA
Max. inrush current impulse		
Current pulse, feedback loop	0,12 A	0,12 A
Pulse duration, feedback loop	0,1 s	0,1 s
Reset input	**777951**	**777959**
Low signal	< 5 V	< 5 V
High signal	> 15 V	> 15 V
Current	20 mA	20 mA
Semiconductor outputs	**777951**	**777959**
Number	2	2
Voltage	24 V	24 V
Current	50 mA	50 mA
External supply voltage	24 V	24 V
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Relay outputs	**777951**	**777959**
Number of output contacts		
Safety contacts (N/O), instantaneous	2	2
Auxiliary contacts (N/C)	1	1
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZ X
PSWZ X1P

Relay outputs	777951	777959
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**

Safety relays PNOZ X
PSWZ X1P

Relay outputs	777951	777959
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**777951**	**777959**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**4 A**
Times	**777951**	**777959**
Delay-on de-energisation		
After motor on max.	**170 ms**	**170 ms**
Max. switch-on delay		
After motor standstill max.	**1.500 ms**	**1.500 ms**
After power on max.	**2.200 ms**	**2.200 ms**
Recovery time at max. switching frequency 1/s		
After motor on	**2.200 ms**	**2.200 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**7 s**	**7 s**
Environmental data	**777951**	**777959**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**

Safety relays PNOZ X
PSWZ X1P

Environmental data	777951	777959
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Short-term**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**690 V**	**690 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**777951**	**777959**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PPO UL 94 V0**	**PPO UL 94 V0**
Front	**ABS UL 94 V0**	**ABS UL 94 V0**
Top	**PPO UL 94 V0**	**PPO UL 94 V0**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZ X
PSWZ X1P

Mechanical data	777951	777959
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 14 AWG**	**0,25 - 2,5 mm², 24 - 14 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,5 - 1,5 mm², 24 - 16 AWG**	**0,5 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,6 Nm**	**0,6 Nm**
Dimensions		
Height	**94 mm**	**94 mm**
Width	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**
Weight	**325 g**	**325 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 787949 – 787951

General	787949	787950	787951
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**787949**	**787950**	**787951**
Supply voltage			
Voltage	**24 - 240 V**	**24 - 240 V**	**24 - 240 V**
Kind	**AC/DC**	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**5 VA**	**5 VA**	**5 VA**
Output of external power supply (DC)	**3 W**	**3 W**	**3 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**	**160 %**
Max. inrush current at UB	**10 A**	**10 A**	**10 A**
Duty cycle	**100 %**	**100 %**	**100 %**
Measuring circuit	**787949**	**787950**	**787951**
Min. measuring voltage	**0,0 V**	**0,0 V**	**0,0 V**
Max. measuring voltage	**690 V**	**690 V**	**690 V**
Measuring voltage in accordance with UL	**600 V**	**600 V**	**600 V**

Safety relays PNOZ X
PSWZ X1P

Measuring circuit	787949	787950	787951
Frequency range	0 - 3 kHz	0 - 3 kHz	0 - 3 kHz
Input resistance	1.300 kOhm	1.300 kOhm	1.300 kOhm
Switching threshold per channel			
Response value Uon (adjustable)	20 - 500 mV	120 - 3000 mV	7,5 - 500 mV
Release value Uoff	2 x Uon	2 x Uon	2 x Uon
Inputs	**787949**	**787950**	**787951**
Voltage at			
Feedback loop DC	24 V	24 V	24 V
Current at			
Feedback loop DC	35 mA	35 mA	35 mA
Max. inrush current impulse			
Current pulse, feedback loop	0,12 A	0,12 A	0,12 A
Pulse duration, feedback loop	0,1 s	0,1 s	0,1 s
Reset input	**787949**	**787950**	**787951**
Low signal	< 5 V	< 5 V	< 5 V
High signal	> 15 V	> 15 V	> 15 V
Current	20 mA	20 mA	20 mA
Semiconductor outputs	**787949**	**787950**	**787951**
Number	2	2	2
Voltage	24 V	24 V	24 V
Current	50 mA	50 mA	50 mA
External supply voltage	24 V	24 V	24 V
Voltage tolerance	-20 %/+20 %	-20 %/+20 %	-20 %/+20 %
Relay outputs	**787949**	**787950**	**787951**
Number of output contacts			
Safety contacts (N/O), instantaneous	2	2	2
Auxiliary contacts (N/C)	1	1	1
Max. short circuit current IK	1 kA	1 kA	1 kA
Utilisation category			
In accordance with the standard	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZ X
PSWZ X1P

Relay outputs	787949	787950	787951
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**3 A**	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**4 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**3 A**	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**4 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G. P.**	**240 V AC G. P.**	**240 V AC G. P.**
With current	**6 A**	**6 A**	**6 A**

Safety relays PNOZ X
PSWZ X1P

Relay outputs	787949	787950	787951
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
Conventional thermal current	**6 A**	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**787949**	**787950**	**787951**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**4 A**	**4 A**	**4 A**
Times	**787949**	**787950**	**787951**
Delay-on de-energisation			
After motor on max.	**170 ms**	**170 ms**	**170 ms**
Max. switch-on delay			
After motor standstill max.	**1.500 ms**	**1.500 ms**	**1.500 ms**
After power on max.	**2.200 ms**	**2.200 ms**	**2.200 ms**
Recovery time at max. switching frequency 1/s			
After motor on	**2.200 ms**	**2.200 ms**	**2.200 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**

Safety relays PNOZ X
PSWZ X1P

Times	787949	787950	787951
Simultaneity, channel 1 and 2 max.	7 s	7 s	7 s
Environmental data	**787949**	**787950**	**787951**
Climatic suitability	EN 60068-2-78	EN 60068-2-78	EN 60068-2-78
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	690 V	690 V	690 V
Rated impulse withstand voltage	6 kV	6 kV	6 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**787949**	**787950**	**787951**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0	ABS UL 94 V0
Top	PPO UL 94 V0	PPO UL 94 V0	PPO UL 94 V0
Connection type	Cage clamp terminal	Cage clamp terminal	Cage clamp terminal
Mounting type	plug-in	plug-in	plug-in

Safety relays PNOZ X
PSWZ X1P

Mechanical data	787949	787950	787951
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**	**2**
Stripping length with spring-loaded terminals	**8 mm**	**8 mm**	**8 mm**
Dimensions			
Height	**101 mm**	**101 mm**	**101 mm**
Width	**45 mm**	**45 mm**	**45 mm**
Depth	**121 mm**	**121 mm**	**121 mm**
Weight	**325 g**	**325 g**	**325 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
–	**PL e**	**Cat. 4**	**SIL CL 3**	**6,23E-09**	**SIL 3**	**6,47E-05**	**20**

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

Supplementary data

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.

Safety relays PNOZ X
PSWZ X1P

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.

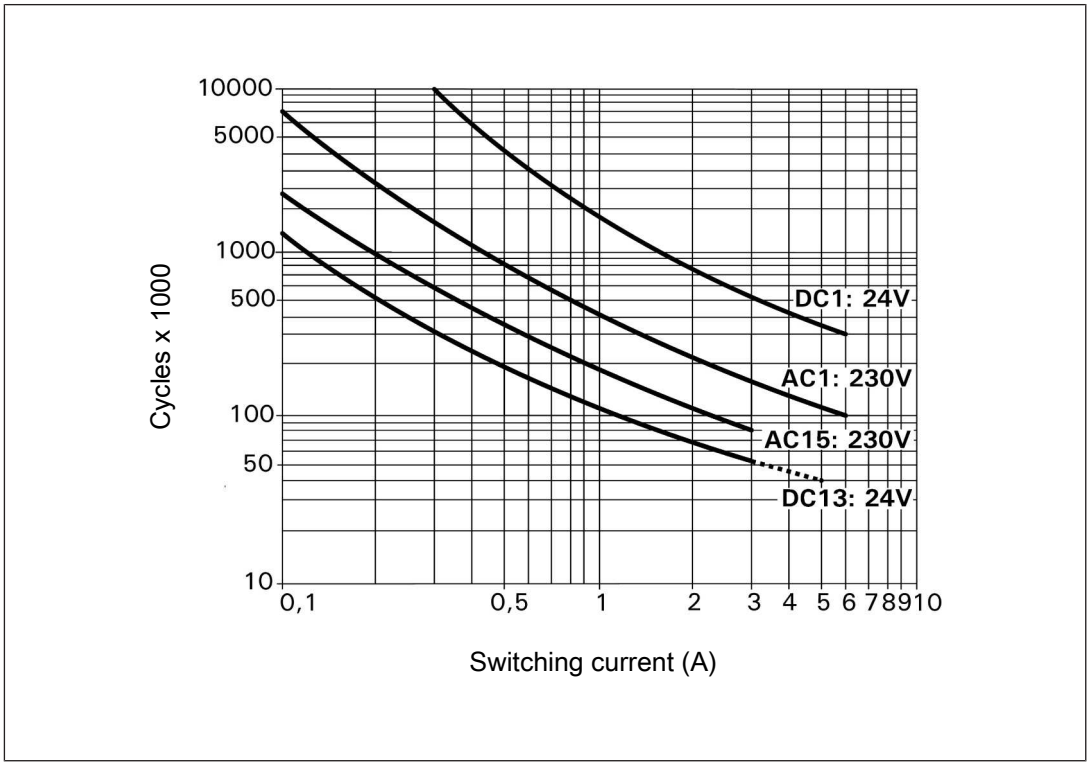


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZ X
PSWZ X1P

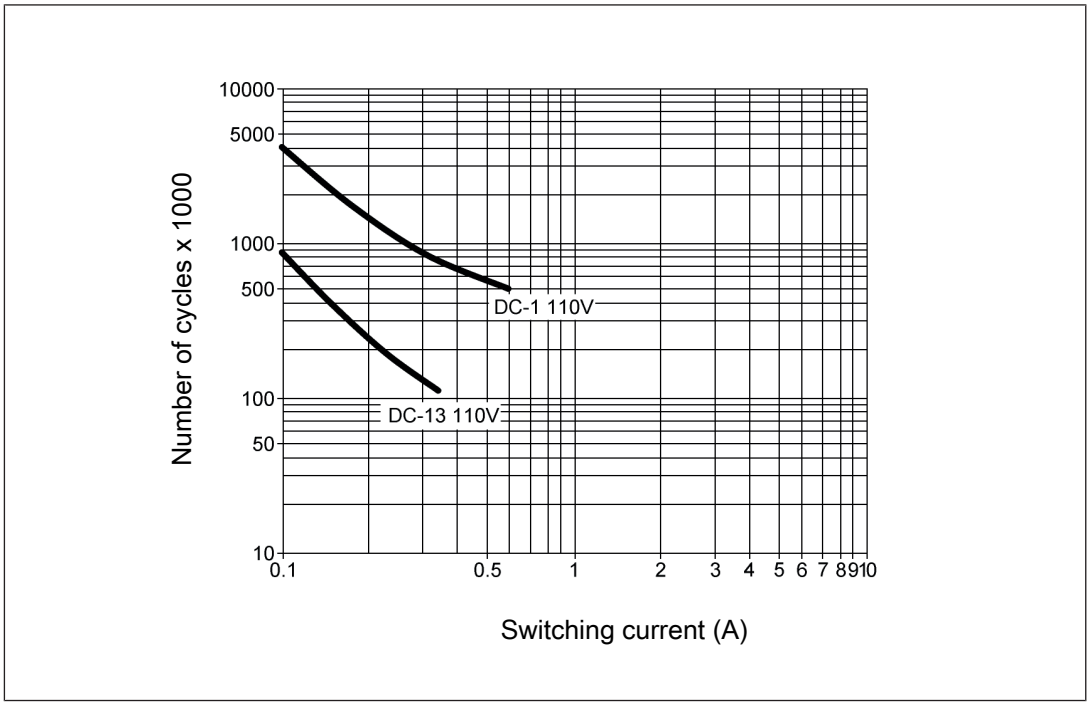


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 527]) can be used in the calculation.

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

Safety relays PNOZ X
PSWZ X1P

Order reference

Type	Features	Connection type	Order no.
PSWZ X1P C	24 - 240 V AC/DC; 0,02 - 0,5 V; U_{on}: 20 - 500 mV	Spring-loaded terminal	787 949
PSWZ X1P	24 - 240 V AC/DC; 0,02 - 0,5 V; U_{on}: 20 - 500 mV	Screw terminals	777 949
PSWZ X1P C	24 - 240 V AC/DC; 0,12 - 3 V; U_{on}: 120 - 3000 mV	Spring-loaded terminal	787 950
PSWZ X1P	24 - 240 V AC/DC; 0,12 - 3 V; U_{on}: 120 - 3000 mV	Screw terminals	777 950
PSWZ X1P C	24 - 240 V AC/DC; 0,0075 - 0,5 V; U_{on}: 7.5 - 500 mV	Spring-loaded terminal	787 951
PSWZ X1P	24 - 240 V AC/DC; 0,0075 - 0,5 V; U_{on}: 7.5 - 500 mV	Screw terminals	777 951
PSWZ X1P (coated version)	24 - 240 V AC/DC; 0,02 - 0,5 V; U_{on}: 20 - 500 mV	Screw terminals	777 959

Selection guide: Determine remanence voltage

The remanence voltage has to be within the response range of the device.

Safety relays PNOZsigma

Safety relays PNOZsigma

Contents	Page
PNOZ s1	548
PNOZ s2	559
PNOZ s3	573
PNOZ s4	588
PNOZ s4.1	614
PNOZ s5	634
PNOZ s6	661
PNOZ s6.1	682
PNOZ s7	703
PNOZ s7.1	716
PNOZ s7.2	730
PNOZ s8	742
PNOZ s9	752
PNOZ s10	769
PNOZ s11	781
PNOZ s20	792
PNOZ s22	801
PNOZ s30	810
PNOZ s50	893

Safety relays PNOZsigma
PNOZ s1

Unit features

- Relay outputs:
  - 2 safety contacts (N/O), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- A connector can be used to connect 1 PNOZsigma contact expansion module
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Start circuit
  - Errors
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s1

Block diagram/terminal configuration

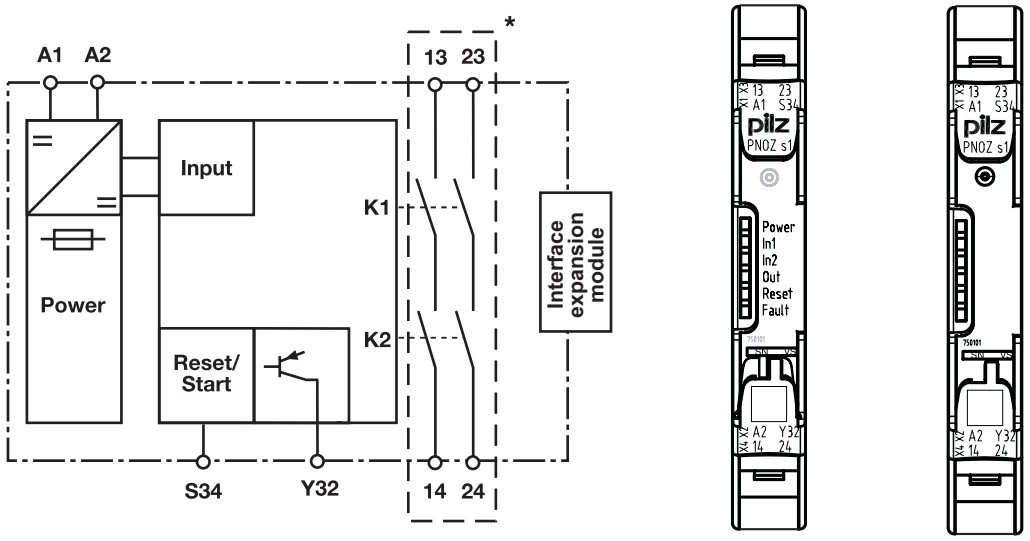


Fig.: Centre: Front view with cover, right: Front view without cover

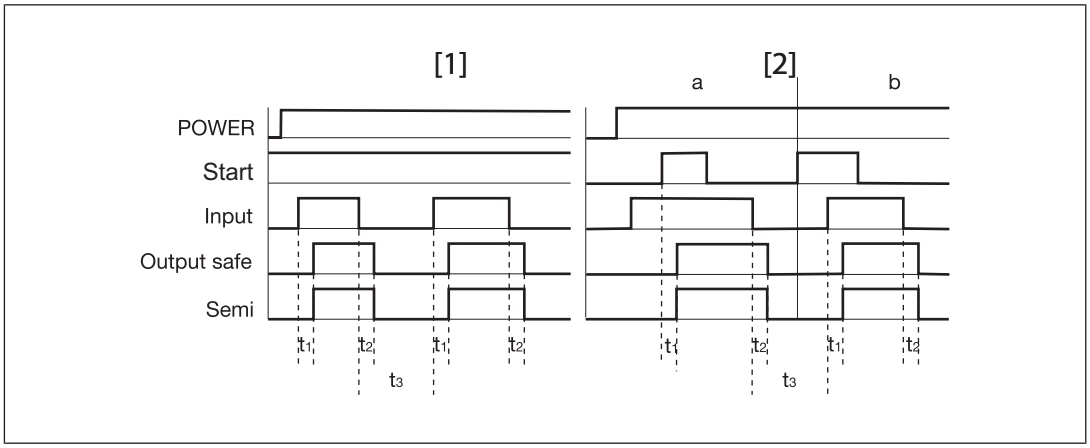
*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function description

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- Automatic start: Unit is active once the input circuit has been closed.
- Manual start: Unit is active once the input circuit and the start circuit are closed.
- Increase in the number of available instantaneous safety contacts by connecting contact expander modules or external contactors/relays;
  A connector can be used to connect 1 PNOZsigma contact expander module.

Safety relays PNOZsigma
PNOZ s1

Timing diagram



Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts
- Semi: Semiconductor output
- [1]: Automatic start
- [2]: Manual start
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Recovery time

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).

- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 554]" must be followed.
- Outputs 13-14 and 23-24 are safety contacts, the semiconductor output Y32 is an auxiliary output (e.g. for display).
- Semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 554]).
- Calculation of the max. cable length l_{max} in the input circuit:

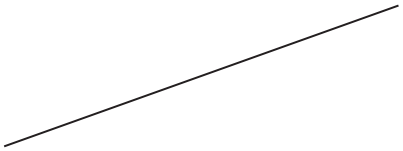
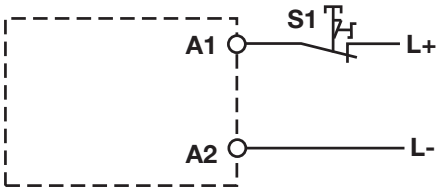
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

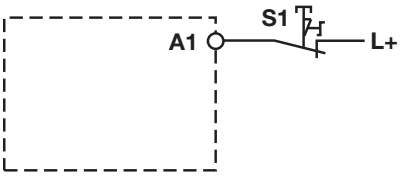
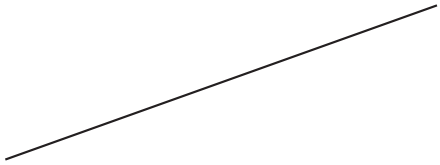
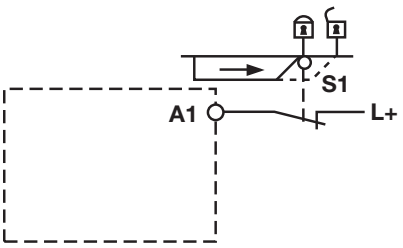
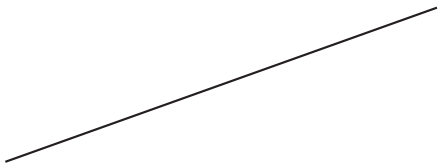
R_{lmax} = max. overall cable resistance (see Technical details [📖 554])
R_l / km = cable resistance/km

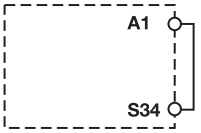
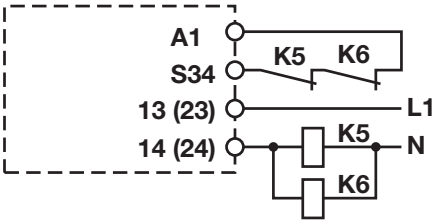
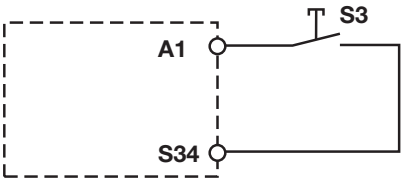
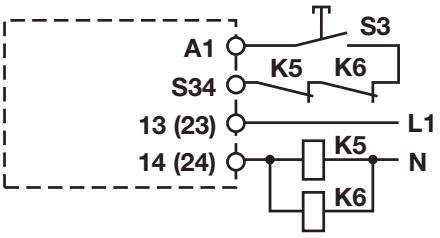
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Safety relays PNOZsigma
PNOZ s1

Preparing for operation

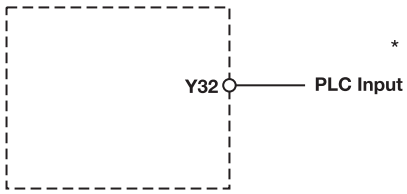
Supply voltage	AC	DC
		

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

Start circuit/feedback loop	Start circuit	Feedback loop
Automatic start		
Manual start		

Safety relays PNOZsigma
PNOZ s1

Semiconductor output



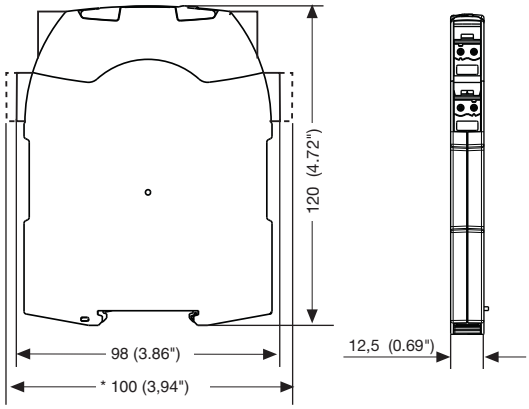
*Connect together the 0V connections on all the external power supplies

Key

- S1: E-STOP pushbutton
- S3: Start button
- : Switch operated
- : Gate open
- : Gate closed

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s1

Technical Details

General	750101	751101
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750101**	**751101**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	2 W	2 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Inputs	**750101**	**751101**
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	60 mA	60 mA
Start circuit DC	20 mA	20 mA
Feedback loop DC	20 mA	20 mA
Max. inrush current impulse		
Current pulse, input circuit	1 A	1 A
Pulse duration, input circuit	5 ms	5 ms
Current pulse, feedback loop	0,2 A	0,2 A
Pulse duration, feedback loop	0,5 ms	0,5 ms
Current pulse, start circuit	0,2 A	0,2 A
Pulse duration, start circuit	0,5 ms	0,5 ms
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Semiconductor outputs	**750101**	**751101**
Number	1	1
Voltage	24 V	24 V
Current	20 mA	20 mA
Relay outputs	**750101**	**751101**
Number of output contacts		
Safety contacts (N/O), instant-aneous	2	2

Safety relays PNOZsigma
PNOZ s1

Relay outputs	750101	751101
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,02 A**	**0,02 A**
Max. current	**3 A**	**3 A**
Max. power	**720 VA**	**720 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,02 A**	**0,02 A**
Max. current	**3 A**	**3 A**
Max. power	**72 W**	**72 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**1,5 A**	**1,5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**1,5 A**	**1,5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**3 A**	**3 A**
Voltage	**24 V DC G. P.**	**24 V DC G. P.**
With current	**3 A**	**3 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Blow-out fuse, quick	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**
Circuit breaker 24V AC/DC, characteristic B/C	**2 A**	**2 A**
Conventional thermal current	**3 A**	**3 A**
Contact material	**AgSnO2**	**AgSnO2**

Safety relays PNOZsigma
PNOZ s1

Times	750101	751101
Switch-on delay		
With automatic start typ.	**100 ms**	**100 ms**
With automatic start max.	**150 ms**	**150 ms**
With automatic start after power on typ.	**100 ms**	**100 ms**
With automatic start after power on max.	**150 ms**	**150 ms**
With manual start typ.	**50 ms**	**50 ms**
With manual start max.	**60 ms**	**60 ms**
Delay-on de-energisation		
With E-STOP typ.	**30 ms**	**30 ms**
With E-STOP max.	**40 ms**	**40 ms**
With power failure typ.	**30 ms**	**30 ms**
With power failure max.	**40 ms**	**40 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**100 ms**	**100 ms**
After power failure	**100 ms**	**100 ms**
Supply interruption before de-energisation	**10 ms**	**10 ms**
Environmental data	**750101**	**751101**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZsigma
PNOZ s1

Environmental data	750101	751101
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750101**	**751101**
Mounting position	**Any**	**Any**
Mechanical life	**5,000,000 cycles**	**5,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**12,5 mm**	**12,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**105 g**	**105 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s1

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL c**	**Cat. 3**	**SIL CL 2**	**2,00E-07**	**SIL 2**	**5,95E-03**	**20**

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

Supplementary data

The PFH value depends on the switching frequency and the load on the relay output.
If the values in the service life table 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.

Service life table

The service life table indicates 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.

Load type	Switching current	Number of cycles
DC1	3 A	200,000
DC13	1.5 A	75,000
AC1	3 A	50,000
AC15	1.5 A	50,000

Order reference

Product type	Features	Connection type	Order No.
PNOZ s1	24 VDC	Screw terminals	750 101
PNOZ s1 C	24 VDC	Spring-loaded terminals	751 101

Safety relays PNOZsigma
PNOZ s2

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- Protective separation of safety contacts from all other circuits
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbutton
  - Safety gate limit switch
  - Start button
- A connector can be used to connect 1 PNOZsigma contact expansion module
- Operating modes can be set via rotary switch
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Start circuit
  - Errors
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s2

Block diagram/terminal configuration

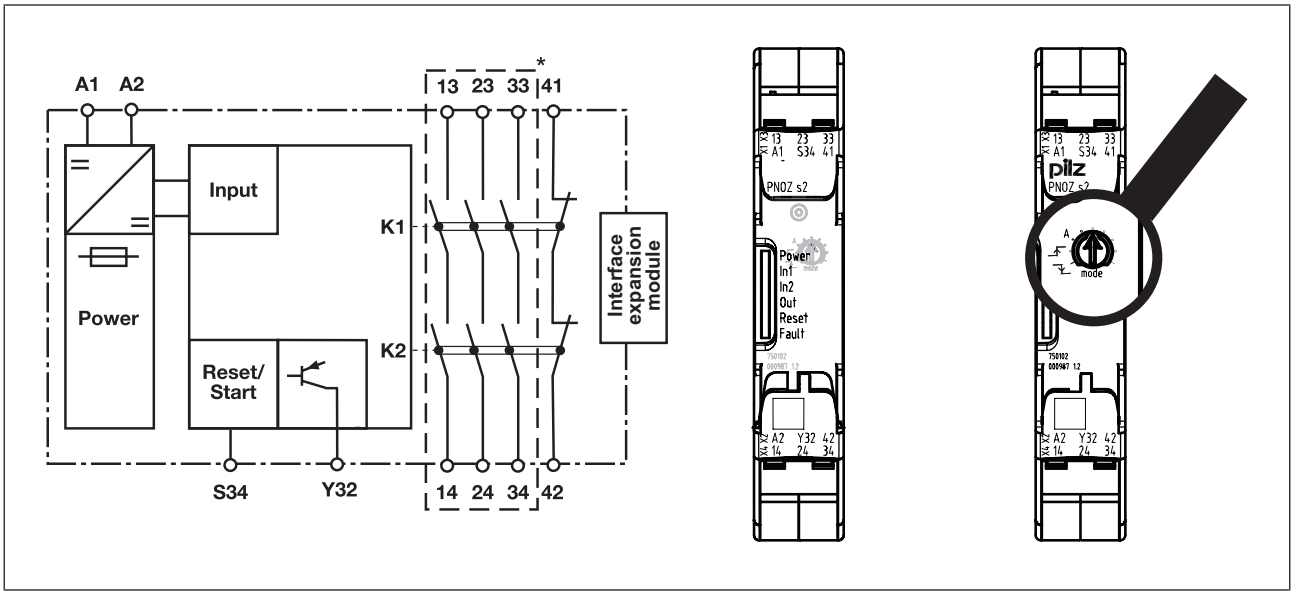


Fig.: Centre: Front view with cover, right: Front view without cover

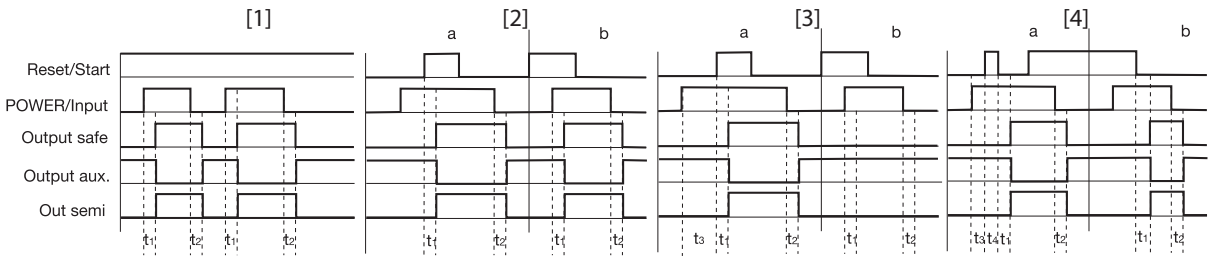
*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

- Single-channel operation: No redundancy in the input circuit, earth faults in the start and input circuit are detected.
- **A** Automatic start: Unit is active once the input circuit has been closed.
- Manual start Unit is active once the input circuit and the start circuit are closed.
- Monitored start with falling edge: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.
- Monitored start with rising edge: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see technical details).
- Increase in the number of available instantaneous safety contacts by connecting contact expander modules or external contactors/relays;
  A connector can be used to connect 1 PNOZsigma contact expander module.

Safety relays PNOZsigma
PNOZ s2

Timing diagram



Legend

- Power: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts
- Output aux: Auxiliary contacts
- Out semi: Semiconductor output
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start with rising edge
- [4]: Monitored start with falling edge
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period
- t_4: Min. start pulse duration with a monitored start

Safety relays PNOZsigma
PNOZ s2

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 565]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 and semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 565]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 565])
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.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

Safety relays PNOZsigma
PNOZ s2

Preparing for operation

Operating modes

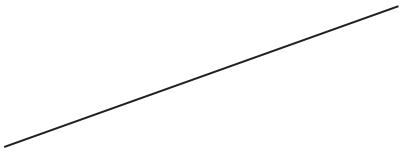
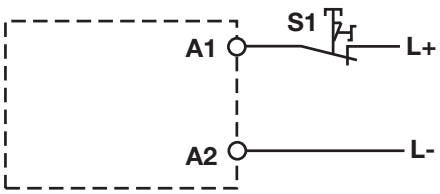
The operating mode is set via the rotary switch on the unit. You can do this by opening the cover on the front of the unit.

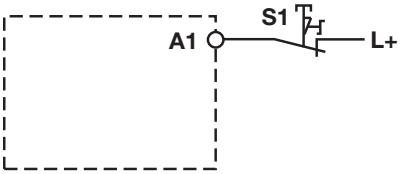
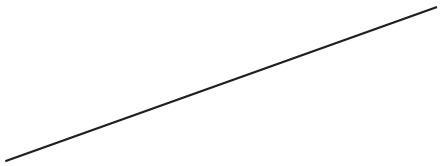
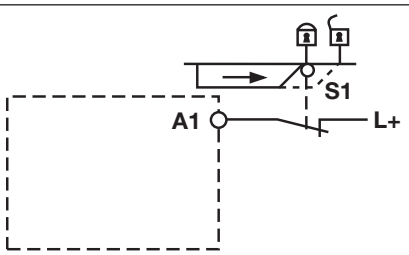
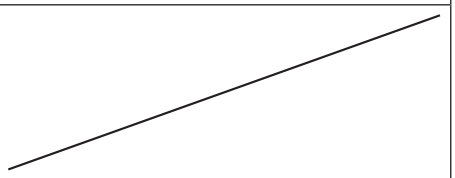
Set operating modes

- Switch off supply voltage.
- Select operating mode via the operating mode selector switch "mode".
- If the operating mode selector switch "mode" is in its start position (vertical position), an error message will appear.

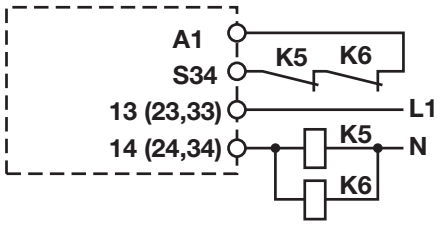
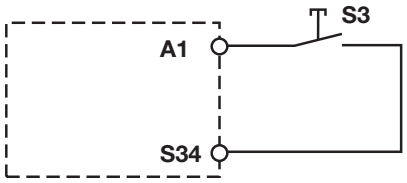
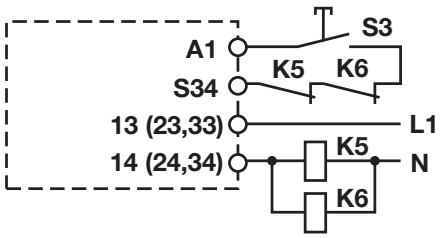
Operating mode selector switch "mode"	Automatic/manual start	Monitored start rising edge	Monitored start falling edge
without detection of shorts across contacts			

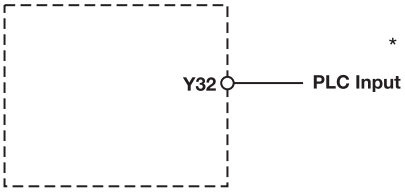
Connection

Supply voltage	AC	DC
		

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

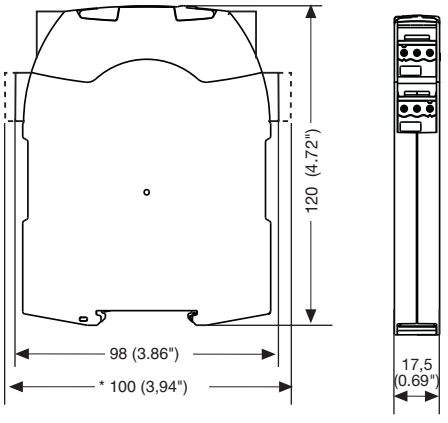
Safety relays PNOZsigma
PNOZ s2

Start circuit/feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Automatic start		
Monitored, manual start/restart		

Semiconductor output

*Connect together the 0V connections on all the external power supplies

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s2

Technical Details

General	750102	751102
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750102**	**751102**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	2 W	2 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Inputs	**750102**	**751102**
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	75 mA	75 mA
Start circuit DC	7 mA	7 mA
Feedback loop DC	7 mA	7 mA
Max. inrush current impulse		
Current pulse, input circuit	0,5 A	0,5 A
Pulse duration, input circuit	7 ms	7 ms
Current pulse, feedback loop	0,5 A	0,5 A
Pulse duration, feedback loop	30 ms	30 ms
Current pulse, start circuit	0,5 A	0,5 A
Pulse duration, start circuit	30 ms	30 ms
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Semiconductor outputs	**750102**	**751102**
Number	1	1
Voltage	24 V	24 V
Current	20 mA	20 mA

Safety relays PNOZsigma
PNOZ s2

Relay outputs	750102	751102
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**

Safety relays PNOZsigma
PNOZ s2

Relay outputs	750102	751102
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**160 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750102**	**751102**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**5 A**

Safety relays PNOZsigma
PNOZ s2

Times	750102	751102
Switch-on delay		
With automatic start typ.	**75 ms**	**75 ms**
With automatic start max.	**250 ms**	**250 ms**
With automatic start after power on typ.	**75 ms**	**75 ms**
With automatic start after power on max.	**250 ms**	**250 ms**
With manual start typ.	**75 ms**	**75 ms**
With manual start max.	**250 ms**	**250 ms**
With monitored start with rising edge typ.	**75 ms**	**75 ms**
With monitored start with rising edge max.	**250 ms**	**250 ms**
With monitored start with falling edge typ.	**55 ms**	**55 ms**
With monitored start with falling edge max.	**70 ms**	**70 ms**
Delay-on de-energisation		
With E-STOP typ.	**50 ms**	**50 ms**
With E-STOP max.	**70 ms**	**70 ms**
With power failure typ.	**50 ms**	**50 ms**
With power failure max.	**70 ms**	**70 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**100 ms**	**100 ms**
After power failure	**100 ms**	**100 ms**
Waiting period with a monitored start		
With rising edge	**100 ms**	**100 ms**
With falling edge	**110 ms**	**110 ms**
Min. start pulse duration with a monitored start		
With rising edge	**100 ms**	**100 ms**
With falling edge	**100 ms**	**100 ms**
Supply interruption before de-energisation	**10 ms**	**10 ms**
Environmental data	**750102**	**751102**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**

Safety relays PNOZsigma
PNOZ s2

Environmental data	750102	751102
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750102**	**751102**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**

Safety relays PNOZsigma
PNOZ s2

Mechanical data	750102	751102
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**17,5 mm**	**17,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**175 g**	**175 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,50E-09**	**SIL 3**	**2,13E-05**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s2

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.

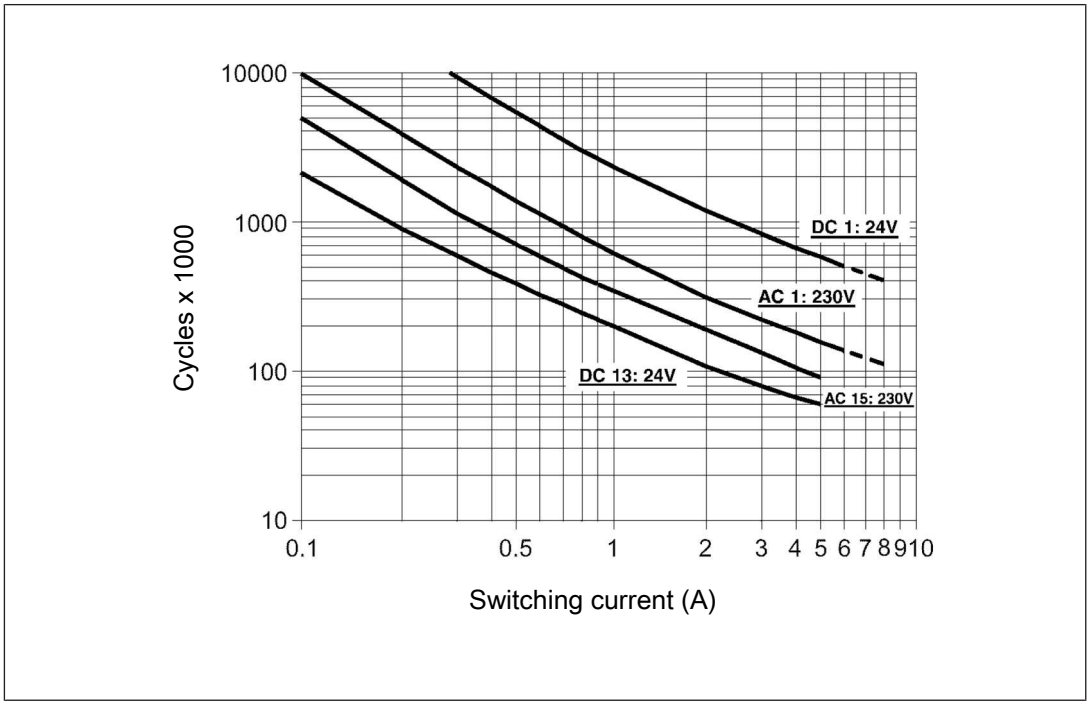


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s2

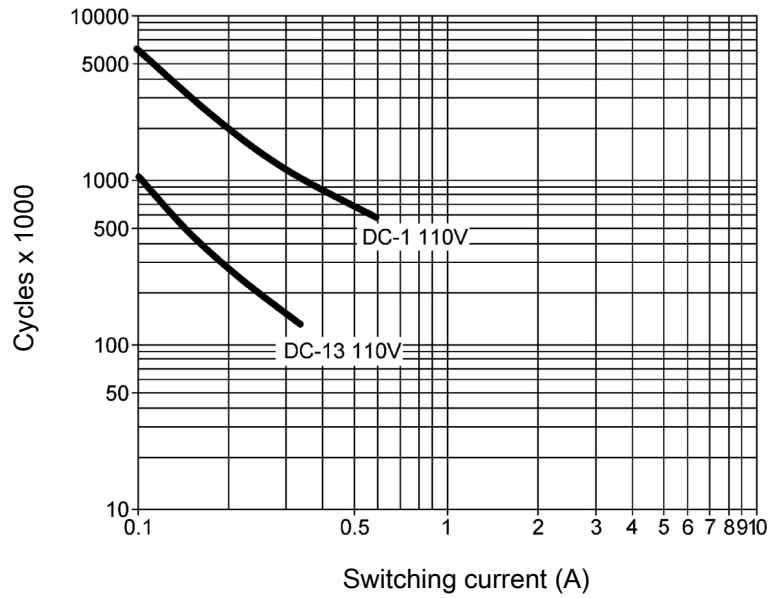


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 565]) 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order No.
PNOZ s2	24 V DC	Screw terminals	750 102
PNOZ s2 C	24 V DC	Spring-loaded terminals	751 102

Safety relays PNOZsigma
PNOZ s3

Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- A connector can be used to connect 1 PNOZsigma contact expansion module
- Operating modes can be set via rotary switch
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status channel 1/2
  - Start circuit
  - Error
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s3

Block diagram/terminal configuration

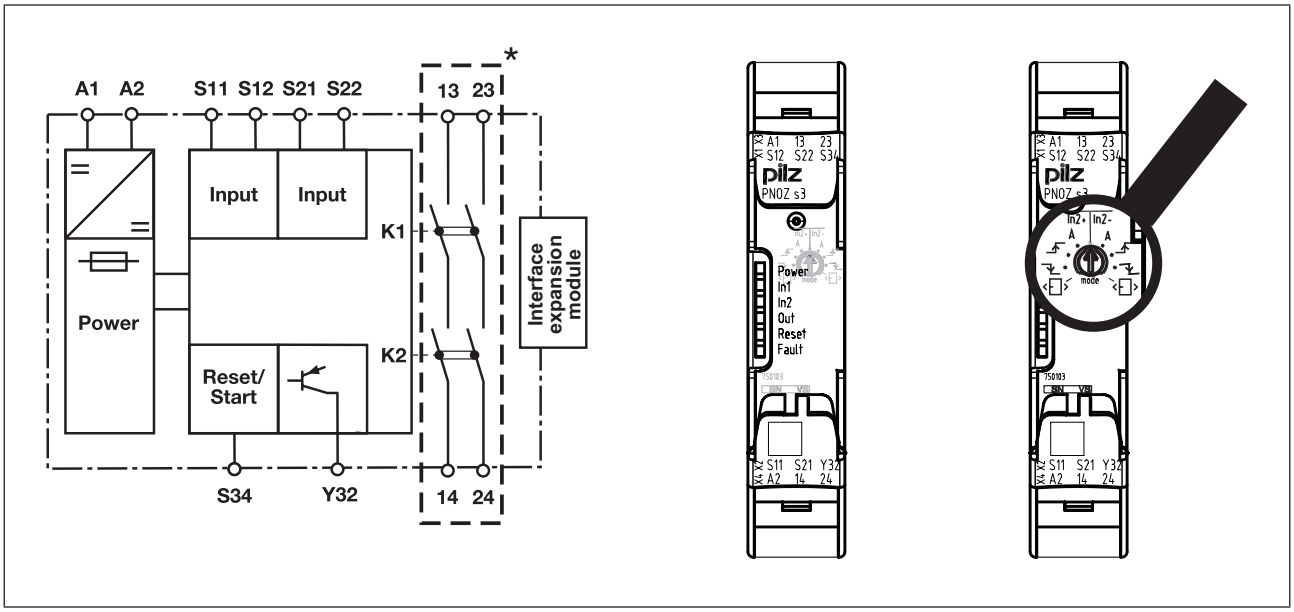


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (over-voltage category III), Protective separation (overvoltage category II)

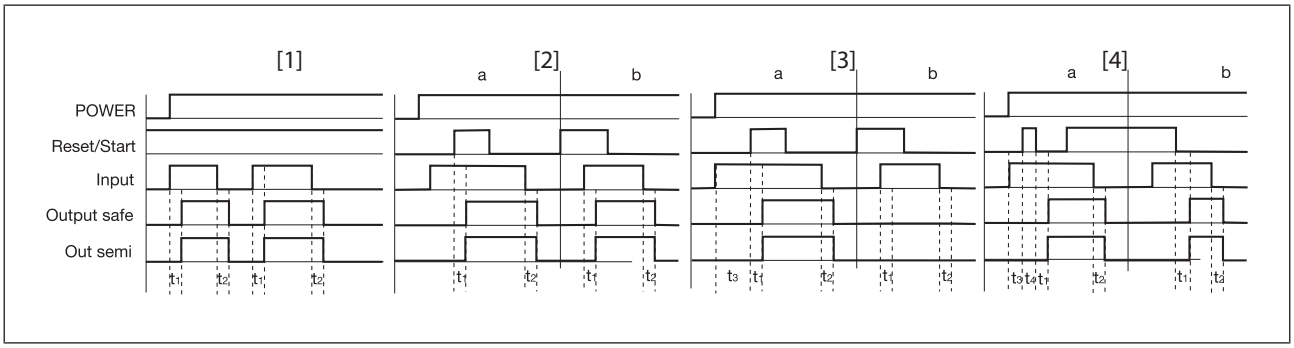
Function description

- In2+ Single-channel operation: no redundancy in the input circuit, earth faults in the start circuit and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ s3
  - earth faults in the start and input circuit,
  - short circuits in the input circuit and, with a monitored start, in the start circuit too.
- In2- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ s3
  - earth faults in the start and input circuit,
  - Short circuits in the input circuit and, with a monitored start, in the start circuit too,
  - Shorts across contacts in the input circuit.
- **A** Automatic start: Unit is active once the input circuit has been closed.
- Manual start Unit is active once the input circuit and the start circuit are closed.
- Monitored start with falling edge: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.

Safety relays PNOZsigma
PNOZ s3

- Monitored start with rising edge: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see technical details).
- Start with start-up test: The unit checks whether safety gates that are closed are opened and then closed again when supply voltage is applied.
- Increase in the number of available instantaneous safety contacts by connecting contact expander modules or external contactors/relays;
  A connector can be used to connect 1 PNOZsigma contact expander module.

Timing diagram



Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts
- Out semi: Semiconductor output
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start with rising edge
- [4]: Monitored start with falling edge
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Min. start pulse duration with a monitored start

Safety relays PNOZsigma
PNOZ s3

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 580]" must be followed.
- Outputs 13-14 and 23-24 are safety contacts, the semiconductor output Y32 is an auxiliary output (e.g. for display).
- Semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 580]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 580])
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.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Safety relays PNOZsigma
PNOZ s3

Preparing for operation

Operating modes

The operating mode is set via the rotary switch on the unit. You can do this by opening the cover on the front of the unit.

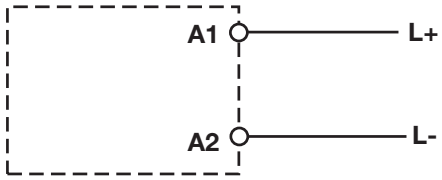
Set operating modes

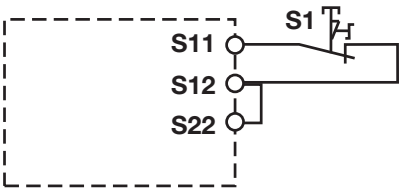
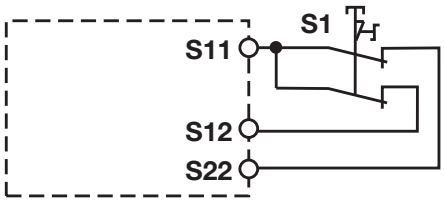
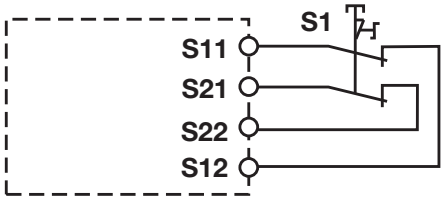
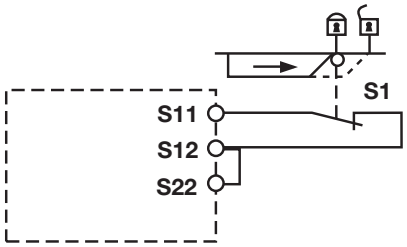
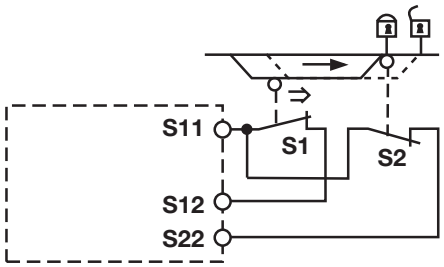
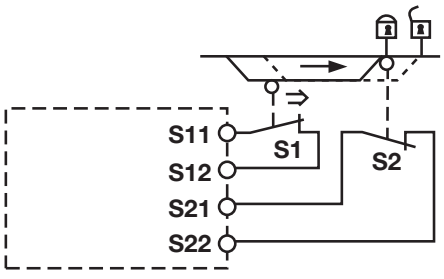
- Switch off supply voltage.
- Select operating mode via the operating mode selector switch "mode".
- If the operating mode selector switch "mode" is in its start position (vertical position), an error message will appear.

Operating mode selector switch "mode"	Automatic or manual start	Monitored start rising edge	Monitored start falling edge	Automatic start with start-up test
Without detection of shorts across contacts				
With detection of shorts across contacts				

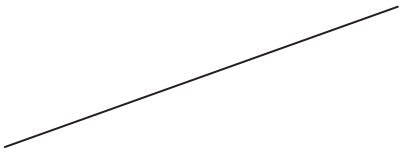
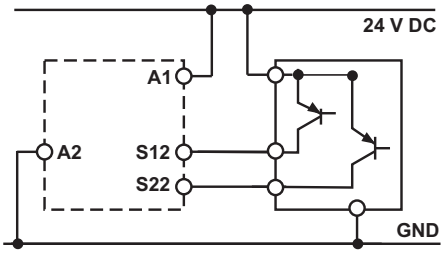
Safety relays PNOZsigma
PNOZ s3

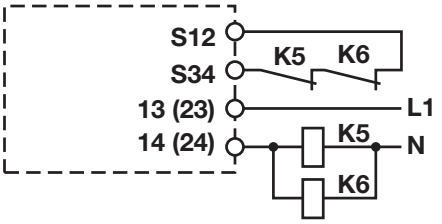
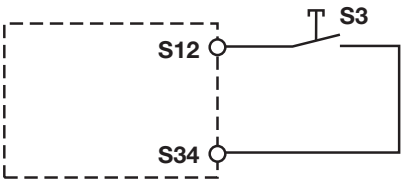
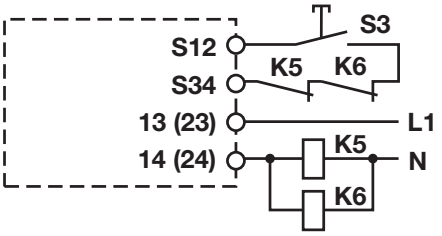
Connection

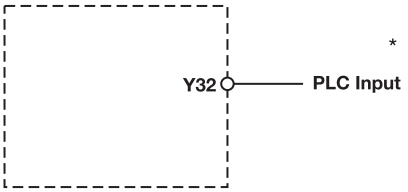
Supply voltage	AC	DC
		

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		

Safety relays PNOZsigma
PNOZ s3

Input circuit	Single-channel	Dual-channel
Light beam device or safety switch, detection of shorts across contacts via ESPE		

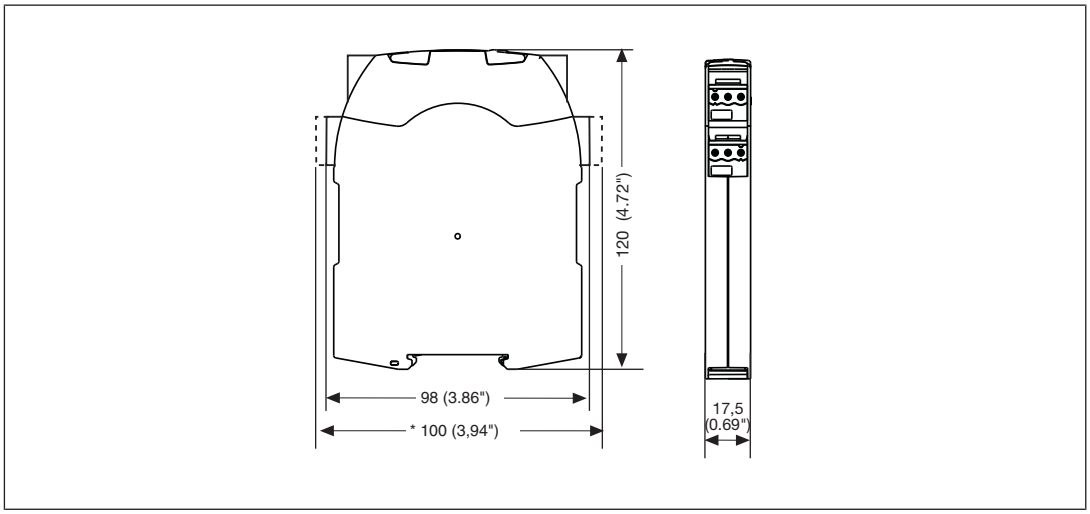
Start circuit/feedback loop	Without feedback loop monitoring	with feedback loop monitoring
Automatic start		
Monitored, manual start/restart		

Semiconductor output

*Connect together the 0V connections on all the external power supplies

Safety relays PNOZsigma
PNOZ s3

Dimensions in mm

*with spring-loaded terminals



Technical Details

General	750103	751103
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750103**	**751103**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	2,5 W	2,5 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	0,5 A	0,5 A
Pulse duration, A1	5 ms	5 ms
Inputs	**750103**	**751103**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V

Safety relays PNOZsigma
PNOZ s3

Inputs	750103	751103
Current at		
Input circuit DC	**50 mA**	**50 mA**
Start circuit DC	**50 mA**	**50 mA**
Feedback loop DC	**50 mA**	**50 mA**
Max. inrush current impulse		
Current pulse, input circuit	**0,2 A**	**0,2 A**
Pulse duration, input circuit	**100 ms**	**100 ms**
Current pulse, feedback loop	**0,2 A**	**0,2 A**
Pulse duration, feedback loop	**15 ms**	**15 ms**
Current pulse, start circuit	**0,2 A**	**0,2 A**
Pulse duration, start circuit	**15 ms**	**15 ms**
Min. input resistance at power-on	**110 Ohm**	**110 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**60 Ohm**	**60 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**
Semiconductor outputs	**750103**	**751103**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
Relay outputs	**750103**	**751103**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**

Safety relays PNOZsigma
PNOZ s3

Relay outputs	750103	751103
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
Conventional thermal current	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Times	**750103**	**751103**
Switch-on delay		
With automatic start typ.	**170 ms**	**170 ms**
With automatic start max.	**300 ms**	**300 ms**
With automatic start after power on typ.	**350 ms**	**350 ms**
With automatic start after power on max.	**600 ms**	**600 ms**
With manual start typ.	**40 ms**	**40 ms**
With monitored start with rising edge typ.	**35 ms**	**35 ms**
With monitored start with rising edge max.	**50 ms**	**50 ms**
With monitored start with falling edge typ.	**55 ms**	**55 ms**
With monitored start with falling edge max.	**70 ms**	**70 ms**

Safety relays PNOZsigma
PNOZ s3

Times	750103	751103
Delay-on de-energisation		
With E-STOP typ.	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ.	**40 ms**	**40 ms**
With power failure max.	**60 ms**	**60 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**100 ms**	**100 ms**
After power failure	**100 ms**	**100 ms**
Waiting period with a monitored start		
With rising edge	**120 ms**	**120 ms**
With falling edge	**250 ms**	**250 ms**
Min. start pulse duration with a monitored start		
With rising edge	**30 ms**	**30 ms**
With falling edge	**100 ms**	**100 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**750103**	**751103**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZsigma
PNOZ s3

Environmental data	750103	751103
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750103**	**751103**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**17,5 mm**	**17,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**140 g**	**140 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s3

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s3

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.

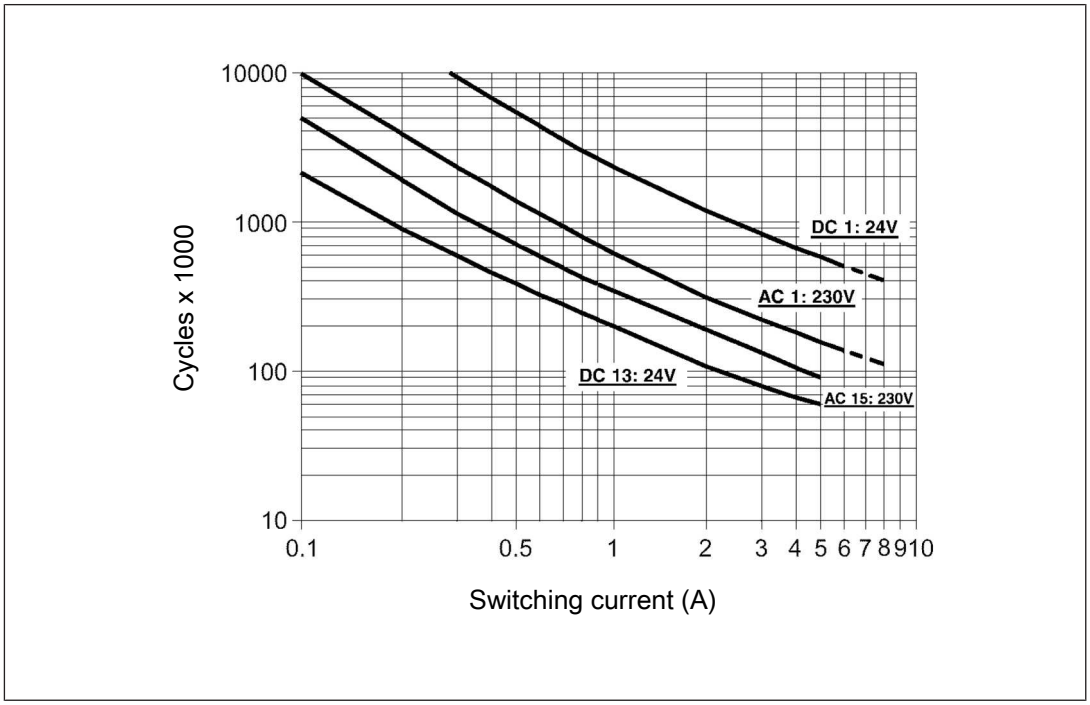


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s3

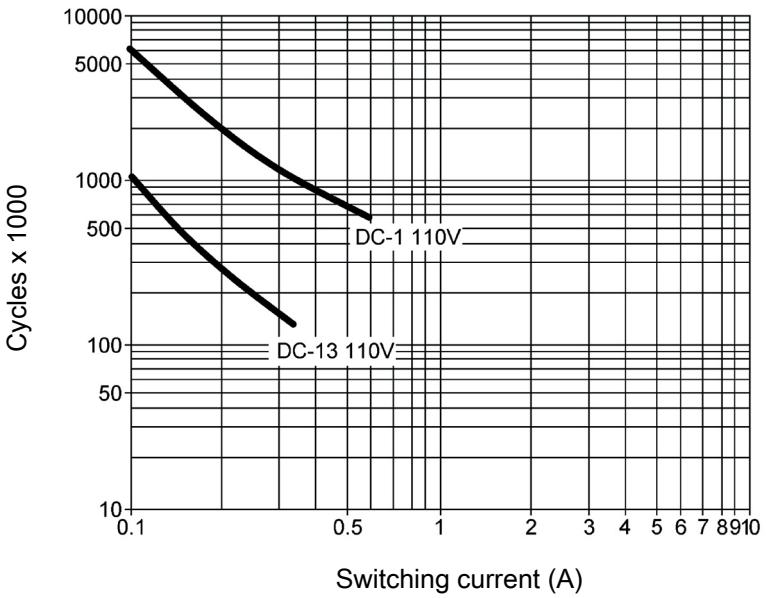


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 580]) 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order No.
PNOZ s3	24 VDC	Screw terminals	750 103
PNOZ s3 C	24 VDC	Spring-loaded terminals	751 103

Safety relays PNOZsigma
PNOZ s4

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- A connector can be used to connect 1 PNOZsigma contact expansion module
- Operating modes can be set via rotary switch
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Start circuit
  - Errors
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s4

Block diagram/terminal configuration

Unit types with UB 24 VDC

- U_B: 24 VDC; Order no. 750104, 751104, 751184

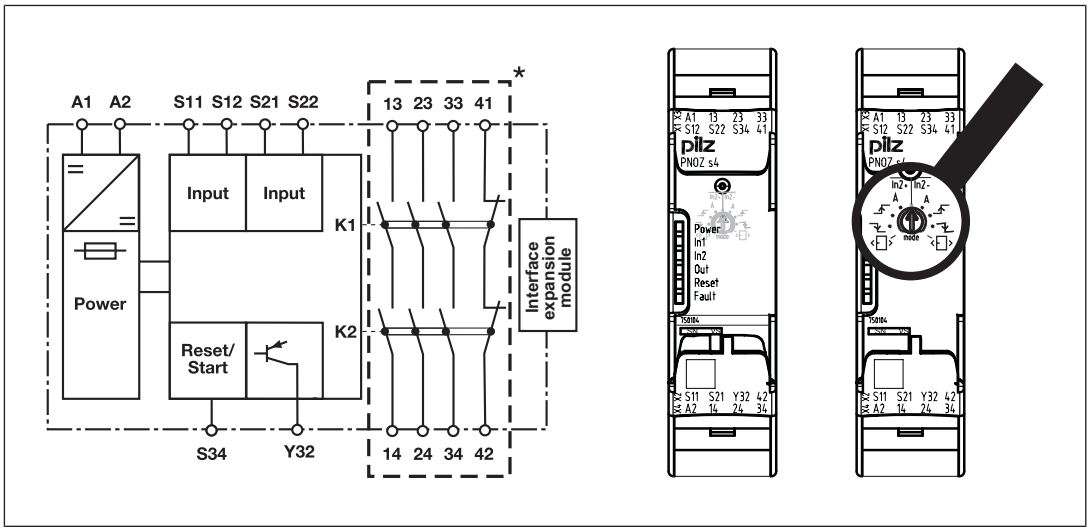


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Unit types with UB 48 - 240 VAC/DC

- U_B: 48 - 240 VAC/DC; Order no. 750134, 751134

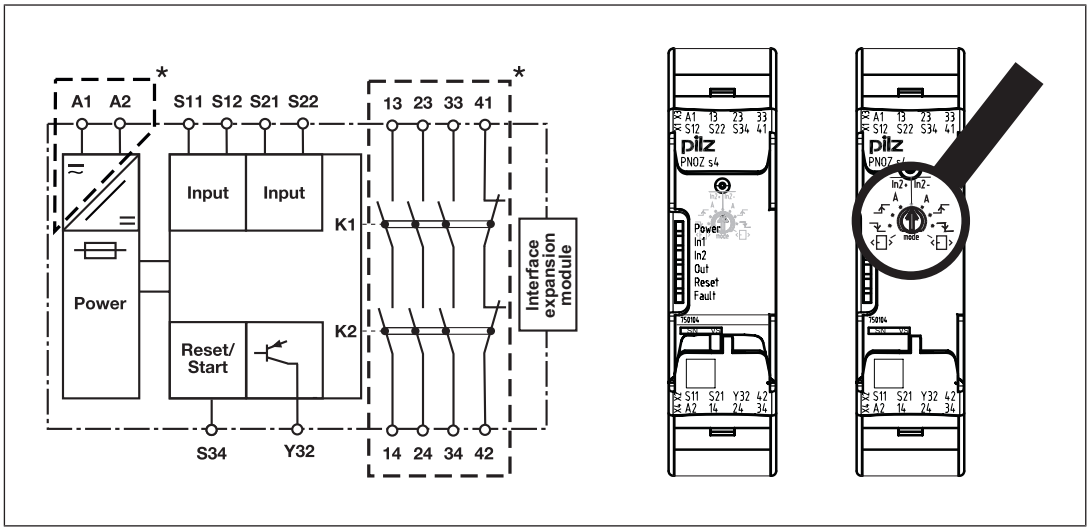


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

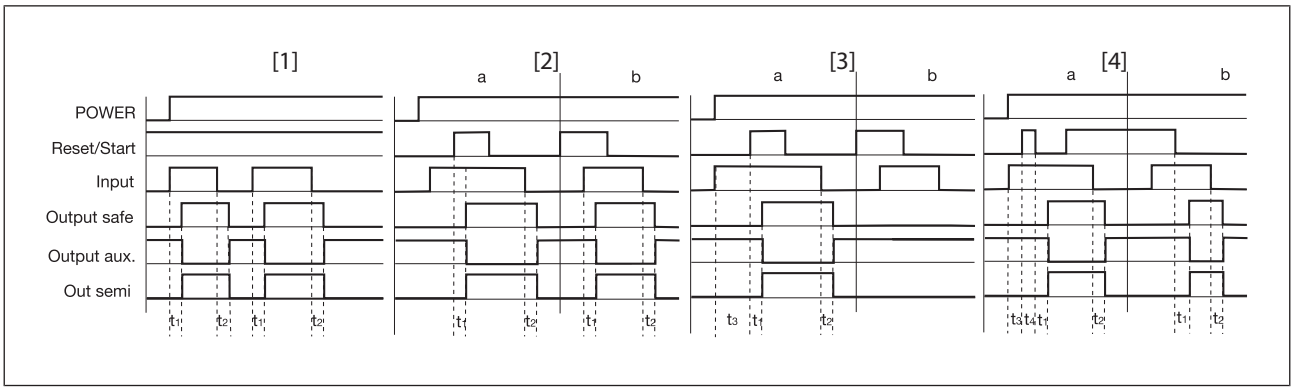
Safety relays PNOZsigma
PNOZ s4

Function description

- In2+ Single-channel operation: no redundancy in the input circuit, earth faults in the start circuit and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ s4
  - earth faults in the start and input circuit,
  - short circuits in the input circuit and, with a monitored start, in the start circuit too.
- In2- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ s4
  - earth faults in the start and input circuit,
  - Short circuits in the input circuit and, with a monitored start, in the start circuit too,
  - Shorts across contacts in the input circuit.
- **A** Automatic start: Unit is active once the input circuit has been closed.
- Manual start Unit is active once the input circuit and the start circuit are closed.
- Monitored start with falling edge: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.
- Monitored start with rising edge: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see technical details).
- Start with start-up test: The unit checks whether safety gates that are closed are opened and then closed again when supply voltage is applied.
- Increase in the number of available instantaneous safety contacts by connecting contact expander modules or external contactors/relays;
  A connector can be used to connect 1 PNOZsigma contact expander module.

Safety relays PNOZsigma
PNOZ s4

Timing diagram



Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts
- Output aux: Auxiliary contacts
- Out semi: Semiconductor output
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start with rising edge
- [4]: Monitored start with falling edge
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Min. start pulse duration with a monitored start

Safety relays PNOZsigma
PNOZ s4

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 596]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 and semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 596]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 596])
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.
- With U_B 48 – 240 VAC/DC: Connect S21 to the functional earth.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Preparing for operation

Operating modes

The operating mode is set via the rotary switch on the unit. You can do this by opening the cover on the front of the unit.

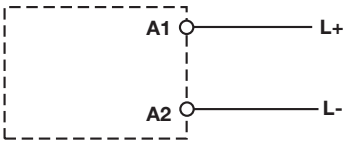
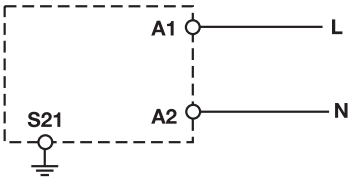
Set operating modes

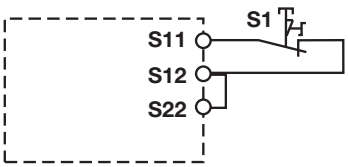
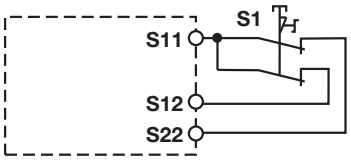
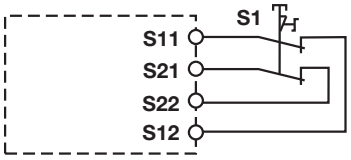
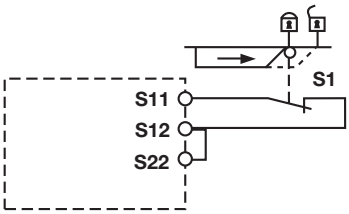
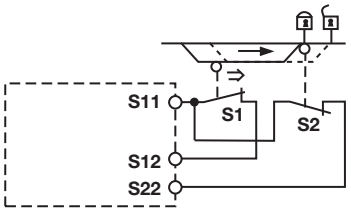
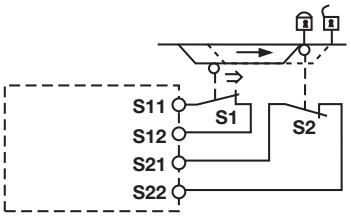
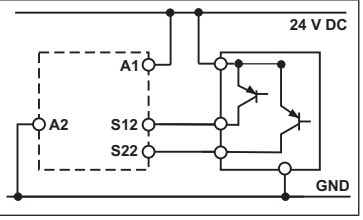
- Switch off supply voltage.
- Select operating mode via the operating mode selector switch "mode".
- If the operating mode selector switch "mode" is in its start position (vertical position), an error message will appear.

Operating mode selector switch "mode"	Automatic or manual start	Monitored start rising edge	Monitored start falling edge	Automatic start with start-up test
Without detection of shorts across contacts				
With detection of shorts across contacts				

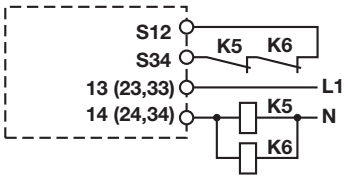
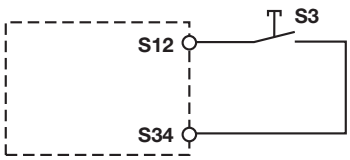
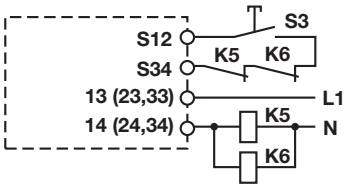
Safety relays PNOZsigma
PNOZ s4

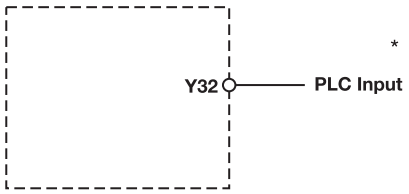
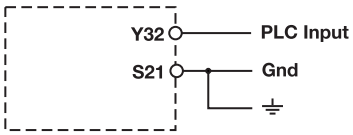
Connection

Supply voltage	Unit types with U_B 24 VDC	Unit types with U_B 48 - 240 VAC/DC
		

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 or safety switch, detection of shorts across contacts via ESPE (only for unit types with U_B = 24 VDC)		

Safety relays PNOZsigma
PNOZ s4

Start circuit/feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Automatic start		
Monitored, manual start/restart		

Unit types with U_B 24 VDC	Unit types with U_B 48 - 240 VAC/DC
 *Connect together the 0V connections on all the external power supplies	

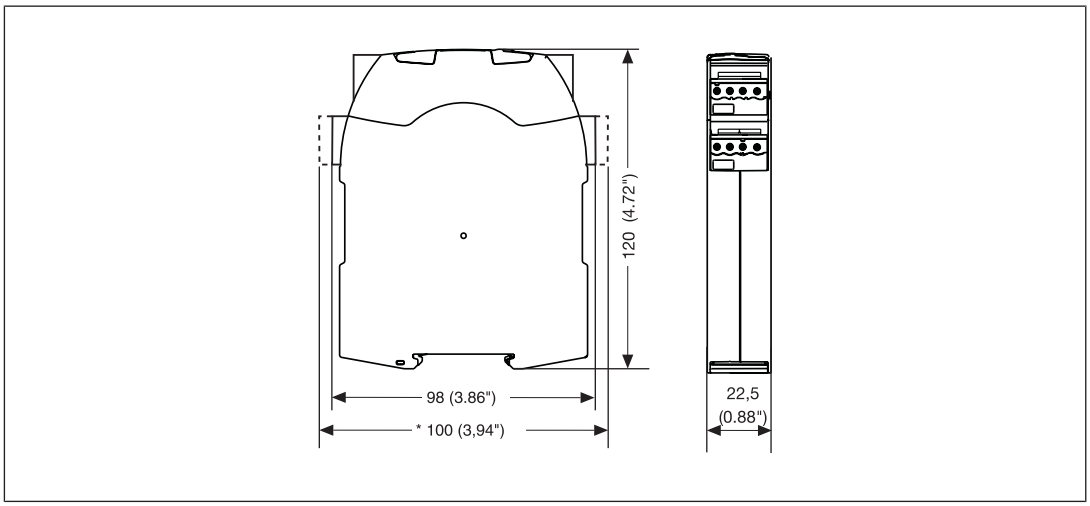
Legend

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

Safety relays PNOZsigma
PNOZ s4

Dimensions in mm

*with spring-loaded terminals



Technical details

Order no. 750104 – 751104

See below for more order numbers

General	750104	750134	751104
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750104**	**750134**	**751104**
Supply voltage			
Voltage	24 V	48 - 240 V	24 V
Kind	DC	AC/DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	–	5 VA	–
Output of external power supply (DC)	2,5 W	2,5 W	2,5 W
Frequency range AC	–	50 - 60 Hz	–
Residual ripple DC	20 %	160 %	20 %
Duty cycle	100 %	100 %	100 %

Safety relays PNOZsigma
PNOZ s4

Electrical data	750104	750134	751104
Max. inrush current impulse			
Current pulse, A1	**0,5 A**	–	**0,5 A**
Pulse duration, A1	**5 ms**	–	**5 ms**
Inputs	**750104**	**750134**	**751104**
Number	**2**	**2**	**2**
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**50 mA**	**50 mA**	**50 mA**
Start circuit DC	**50 mA**	**50 mA**	**50 mA**
Feedback loop DC	**50 mA**	**50 mA**	**50 mA**
Max. inrush current impulse			
Current pulse, input circuit	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, input circuit	**100 ms**	**100 ms**	**100 ms**
Current pulse, feedback loop	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, feedback loop	**15 ms**	**15 ms**	**15 ms**
Current pulse, start circuit	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, start circuit	**15 ms**	**15 ms**	**15 ms**
Min. input resistance at power-on	**110 Ohm**	**110 Ohm**	**110 Ohm**

Safety relays PNOZsigma
PNOZ s4

Inputs	750104	750134	751104
Max. overall cable resistance Rlmax			
Single-channel at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**
Single-channel at UB AC	–	**30 Ohm**	–
Dual-channel without detection of shorts across contacts at UB DC	**60 Ohm**	**30 Ohm**	**60 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	–	**30 Ohm**	–
Dual-channel with detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	–	**30 Ohm**	–
Semiconductor outputs	**750104**	**750134**	**751104**
Number	**1**	**1**	**1**
Voltage	**24 V**	**24 V**	**24 V**
Current	**20 mA**	**20 mA**	**20 mA**
Relay outputs	**750104**	**750134**	**751104**
Number of output contacts			
Safety contacts (N/O), instantaneous	**3**	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**

Safety relays PNOZsigma
PNOZ s4

Relay outputs	750104	750134	751104
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**3 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**5 A**	**4 A**	**5 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**3 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**5 A**	**4 A**	**5 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**6 A**	**10 A**
Blow-out fuse, slow	**6 A**	**4 A**	**6 A**
Blow-out fuse, gG	**10 A**	**6 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**	**6 A**

Safety relays PNOZsigma
PNOZ s4

Relay outputs	750104	750134	751104
External contact fuse protection, auxiliary contacts			
Max. melting integral	**160 A²s**	**66 A²s**	**160 A²s**
Blow-out fuse, quick	**10 A**	**6 A**	**10 A**
Blow-out fuse, slow	**6 A**	**4 A**	**6 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750104**	**750134**	**751104**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	–	**6 A**	–
Conv. therm. current with 2 contacts	–	**6 A**	–
Conv. therm. current with 3 contacts	–	**4,5 A**	–
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**5 A**	**4,5 A**	**5 A**

Safety relays PNOZsigma
PNOZ s4

Times	750104	750134	751104
Switch-on delay			
With automatic start typ.	**170 ms**	**170 ms**	**170 ms**
With automatic start max.	**300 ms**	**300 ms**	**300 ms**
With automatic start after power on typ.	**350 ms**	**350 ms**	**350 ms**
With automatic start after power on max.	**600 ms**	**600 ms**	**600 ms**
With manual start typ.	**40 ms**	**40 ms**	**40 ms**
With monitored start with rising edge typ.	**35 ms**	**35 ms**	**35 ms**
With monitored start with rising edge max.	**50 ms**	**50 ms**	**50 ms**
With monitored start with falling edge typ.	**55 ms**	**55 ms**	**55 ms**
With monitored start with falling edge max.	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation			
With E-STOP typ.	**10 ms**	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**	**20 ms**
With power failure typ.	**40 ms**	**40 ms**	**40 ms**
With power failure max.	**80 ms**	**80 ms**	**80 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**100 ms**	**50 ms**	**100 ms**
After power failure	**100 ms**	**100 ms**	**100 ms**
Waiting period with a monitored start			
With rising edge	**120 ms**	**120 ms**	**120 ms**
With falling edge	**250 ms**	**150 ms**	**250 ms**
Min. start pulse duration with a monitored start			
With rising edge	**30 ms**	**30 ms**	**30 ms**
With falling edge	**100 ms**	**100 ms**	**100 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**750104**	**750134**	**751104**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**

Safety relays PNOZsigma
PNOZ s4

Environmental data	750104	750134	751104
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1
Vibration			
In accordance with the standard	EN 60068-2-6	EN 60068-2-6	EN 60068-2-6
Frequency	10 - 55 Hz	10 - 55 Hz	10 - 55 Hz
Amplitude	0,35 mm	0,35 mm	0,35 mm
Airgap creepage			
In accordance with the standard	EN 60947-1	EN 60947-1	EN 60947-1
Overvoltage category	III / II	III / II	III / II
Pollution degree	2	2	2
Rated insulation voltage	250 V	250 V	250 V
Rated impulse withstand voltage	4 kV	4 kV	4 kV
Protection type			
Mounting area (e.g. control cabinet)	IP54	IP54	IP54
Housing	IP40	IP40	IP40
Terminals	IP20	IP20	IP20
Mechanical data	**750104**	**750134**	**751104**
Mounting position	Any	Any	Any
Mechanical life	10,000,000 cycles	10,000,000 cycles	10,000,000 cycles
Material			
Bottom	PC	PC	PC
Front	PC	PC	PC
Top	PC	PC	PC
Connection type	Screw terminal	Screw terminal	Spring-loaded terminal
Mounting type	plug-in	plug-in	plug-in

Safety relays PNOZsigma
PNOZ s4

Mechanical data	750104	750134	751104
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	–	**2**
Stripping length with spring-loaded terminals	–	–	**9 mm**
Dimensions			
Height	**98 mm**	**98 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**	**120 mm**
Weight	**190 g**	**210 g**	**190 g**

Safety relays PNOZsigma
PNOZ s4

Order no. 751134 – 751184

General	751134	751184
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**751134**	**751184**
Supply voltage		
Voltage	48 - 240 V	24 V
Kind	AC/DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	5 VA	–
Output of external power supply (DC)	2,5 W	2,5 W
Frequency range AC	50 - 60 Hz	–
Residual ripple DC	160 %	20 %
Duty cycle	100 %	100 %
Max. inrush current impulse		
Current pulse, A1	–	0,5 A
Pulse duration, A1	–	5 ms
Inputs	**751134**	**751184**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Start circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Input circuit DC	50 mA	50 mA
Start circuit DC	50 mA	50 mA
Feedback loop DC	50 mA	50 mA
Max. inrush current impulse		
Current pulse, input circuit	0,2 A	0,2 A
Pulse duration, input circuit	100 ms	100 ms
Current pulse, feedback loop	0,2 A	0,2 A
Pulse duration, feedback loop	15 ms	15 ms
Current pulse, start circuit	0,2 A	0,2 A
Pulse duration, start circuit	15 ms	15 ms
Min. input resistance at power-on	110 Ohm	110 Ohm

Safety relays PNOZsigma
PNOZ s4

Inputs	751134	751184
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Single-channel at UB AC	**30 Ohm**	–
Dual-channel without detection of shorts across contacts at UB DC	**30 Ohm**	**60 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**30 Ohm**	–
Dual-channel with detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	–
Semiconductor outputs	**751134**	**751184**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
Relay outputs	**751134**	**751184**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**

Safety relays PNOZsigma
PNOZ s4

Relay outputs	751134	751184
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**5 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**260 A²s**
Blow-out fuse, quick	**6 A**	**10 A**
Blow-out fuse, slow	**4 A**	**6 A**
Blow-out fuse, gG	**6 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**6 A**

Safety relays PNOZsigma
PNOZ s4

Relay outputs	751134	751184
External contact fuse protection, auxiliary contacts		
Max. melting integral	**66 A²s**	**160 A²s**
Blow-out fuse, quick	**6 A**	**10 A**
Blow-out fuse, slow	**4 A**	**6 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**751134**	**751184**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	–
Conv. therm. current with 2 contacts	**6 A**	–
Conv. therm. current with 3 contacts	**4,5 A**	–
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**5 A**
Times	**751134**	**751184**
Switch-on delay		
With automatic start typ.	**170 ms**	**170 ms**
With automatic start max.	**300 ms**	**300 ms**
With automatic start after power on typ.	**350 ms**	**350 ms**
With automatic start after power on max.	**600 ms**	**600 ms**
With manual start typ.	**40 ms**	**40 ms**
With monitored start with rising edge typ.	**35 ms**	**35 ms**
With monitored start with rising edge max.	**50 ms**	**50 ms**
With monitored start with falling edge typ.	**55 ms**	**55 ms**
With monitored start with falling edge max.	**70 ms**	**70 ms**

Safety relays PNOZsigma
PNOZ s4

Times	751134	751184
Delay-on de-energisation		
With E-STOP typ.	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ.	**40 ms**	**40 ms**
With power failure max.	**80 ms**	**80 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**100 ms**
After power failure	**100 ms**	**100 ms**
Waiting period with a monitored start		
With rising edge	**120 ms**	**120 ms**
With falling edge	**150 ms**	**250 ms**
Min. start pulse duration with a monitored start		
With rising edge	**30 ms**	**30 ms**
With falling edge	**100 ms**	**100 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**751134**	**751184**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-25 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZsigma
PNOZ s4

Environmental data	751134	751184
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**751134**	**751184**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**9 mm**	**9 mm**
Dimensions		
Height	**100 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**210 g**	**190 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Safety relays PNOZsigma
PNOZ s4

Supplementary data

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.

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.

Unit types with UB 24 VDC

- U_B: 24 VDC; Order no. 750104, 751104, 751184

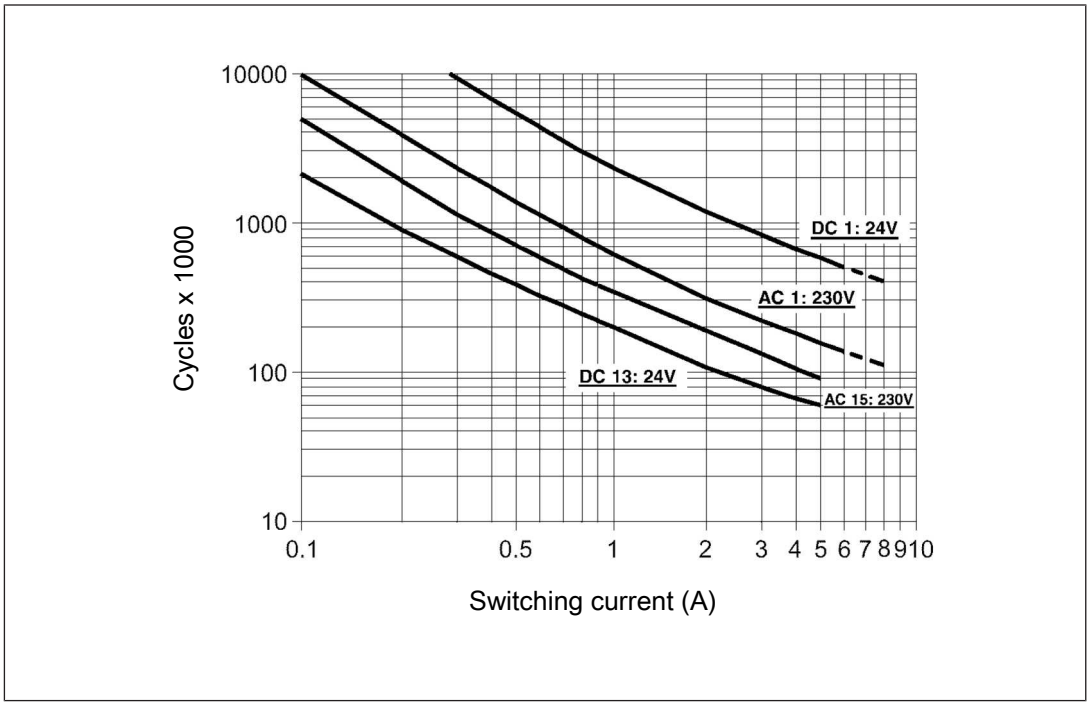


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma
PNOZ s4

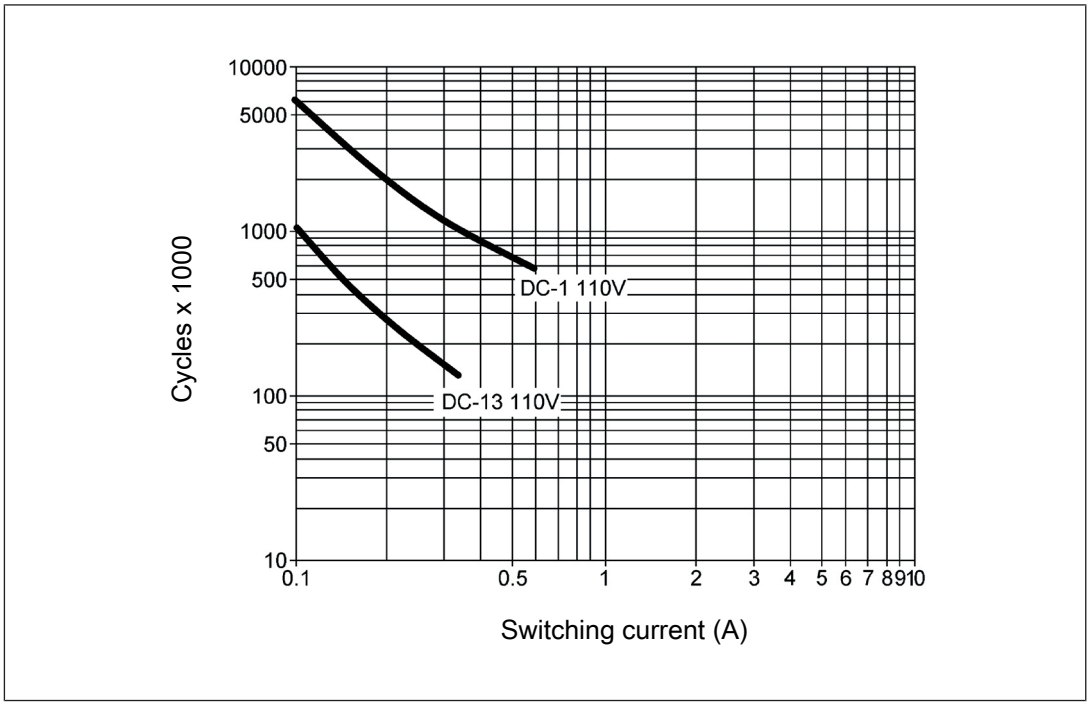


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 596]) 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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZsigma
PNOZ s4

Unit types with UB 48-240 VAC/DC

- U_B: 48 – 240 VAC/DC; Order no. 750134, 751134

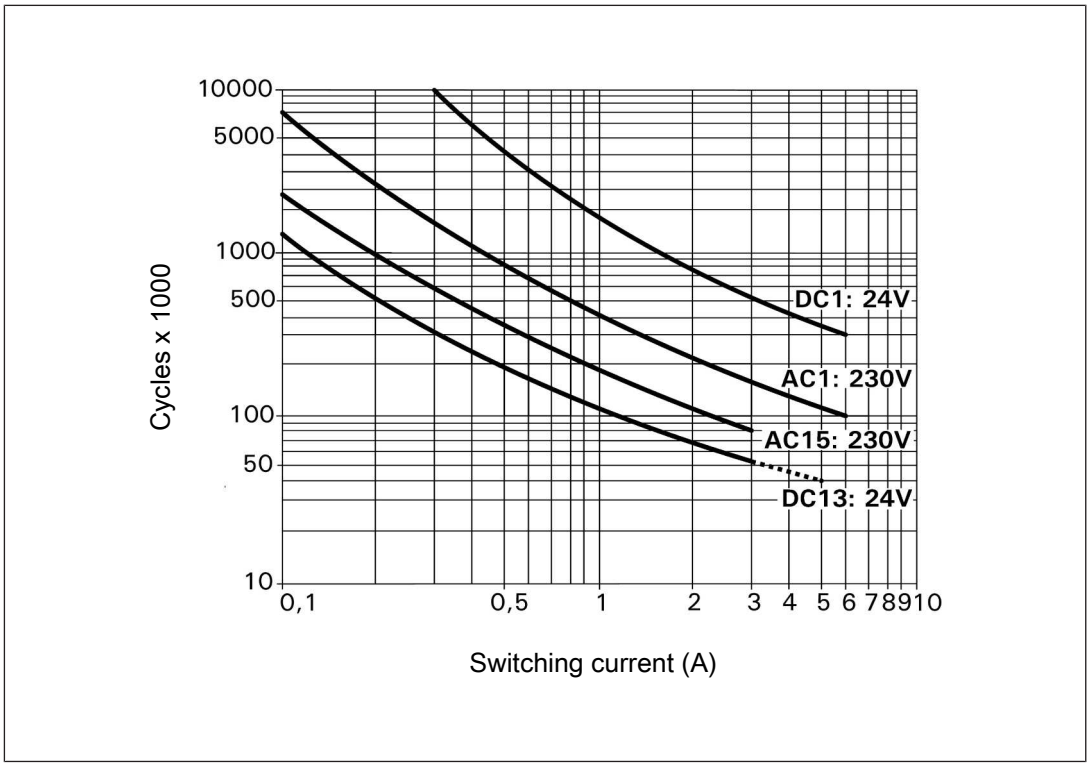


Fig.: Service life graphs at 24 VDC and 230 VAC

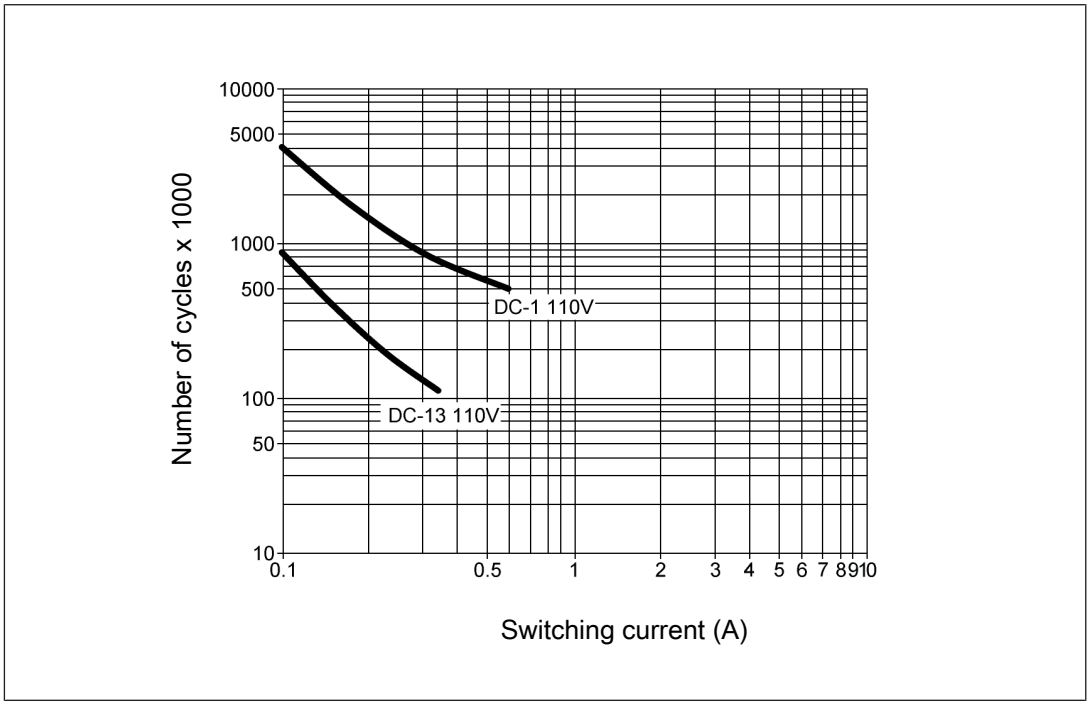


Fig.: Service life graphs at 110 VDC

Safety relays PNOZsigma
PNOZ s4

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 596]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order No.
PNOZ s4	24 VDC	Screw terminals	750 104
PNOZ s4	48 – 240 VAC/DC	Screw terminals	750 134
PNOZ s4 C	24 VDC	Spring-loaded terminals	751 104
PNOZ s4 C	48 – 240 VAC/DC	Spring-loaded terminals	751 134
PNOZ s4 C Coated	24 VDC	Spring-loaded terminals	751 184

Safety relays PNOZsigma
PNOZ s4.1

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches
  - PSEN
  - Safety valves for furnaces
- A connector can be used to connect 1 PNOZsigma contact expansion module
- Operating modes can be set via rotary switch
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Start circuit
  - Errors
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s4.1

Block diagram/terminal configuration

Unit types with UB 24 VDC

- U_B: 24 VDC; Order no. 750124, 751124

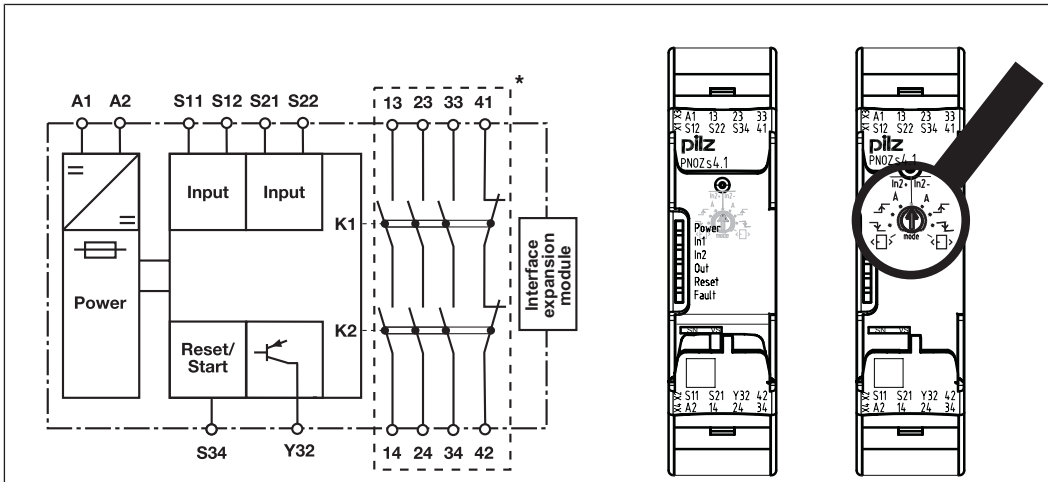


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Unit types with UB 48 - 240 VAC/DC

- U_B: 48 - 240 VAC/DC; Order no. 750154, 751154

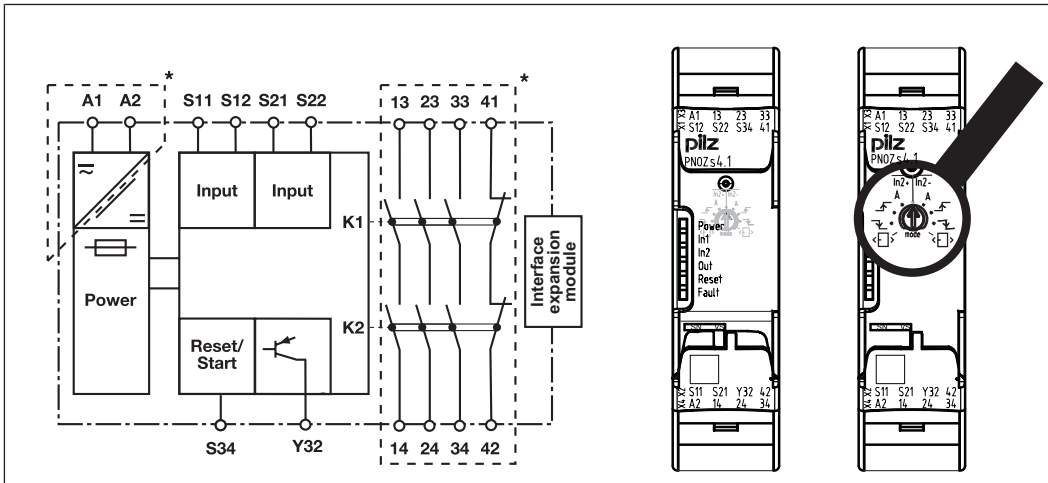


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

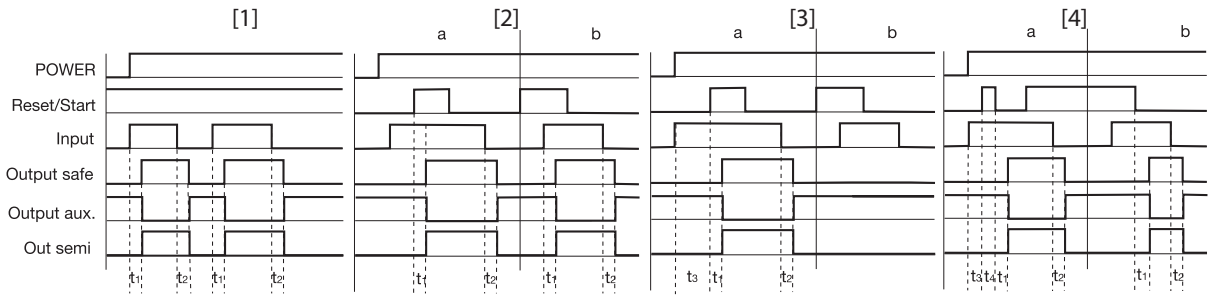
Safety relays PNOZsigma
PNOZ s4.1

Function description

- In2+ Single-channel operation: no redundancy in the input circuit, earth faults in the start circuit and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ s4.1
  - earth faults in the start and input circuit,
  - short circuits in the input circuit and, with a monitored start, in the start circuit too.
- In2- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ s4.1
  - earth faults in the start and input circuit,
  - Short circuits in the input circuit and, with a monitored start, in the start circuit too,
  - Shorts across contacts in the input circuit.
- **A** Automatic start: Unit is active once the input circuit has been closed.
- Manual start Unit is active once the input circuit and the start circuit are closed.
- Monitored start with falling edge: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.
- Monitored start with rising edge: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see technical details).
- Start with start-up test: The unit checks whether safety gates that are closed are opened and then closed again when supply voltage is applied.
- Increase in the number of available instantaneous safety contacts by connecting contact expander modules or external contactors/relays;
  A connector can be used to connect 1 PNOZsigma contact expander module.

Safety relays PNOZsigma
PNOZ s4.1

Timing diagram



Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts
- Output aux: Auxiliary contacts
- Out semi: Semiconductor output
- [1]: Automatic start
- [2]: Manual start
- [3]: Monitored start with rising edge
- [4]: Monitored start with falling edge
- a: Input circuit closes before start circuit
- b: Start circuit closes before input circuit
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Min. start pulse duration with a monitored start

Safety relays PNOZsigma
PNOZ s4.1

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 622]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 and semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 622]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 622])
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.
- With U_B 48 – 240 VAC/DC: Connect S21 to the functional earth.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Safety relays PNOZsigma
PNOZ s4.1

Preparing for operation

Operating modes

The operating mode is set via the rotary switch on the unit. You can do this by opening the cover on the front of the unit.

Set operating modes

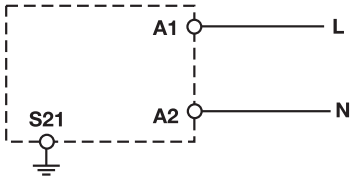
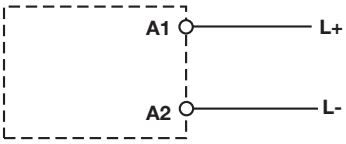
- Switch off supply voltage.
- Select operating mode via the operating mode selector switch "mode".
- If the operating mode selector switch "mode" is in its start position (vertical position), an error message will appear.

Operating mode selector switch "mode"	Automatic or manual start	Monitored start rising edge	Monitored start falling edge	Automatic start with start-up test
Without detection of shorts across contacts				
With detection of shorts across contacts				

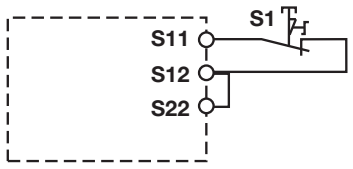
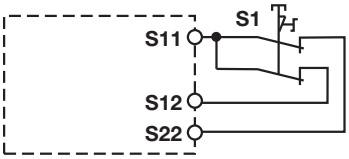
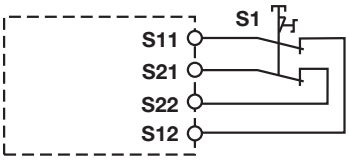
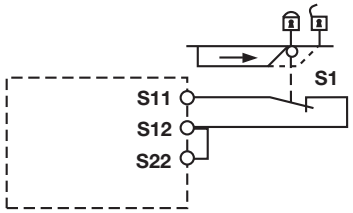
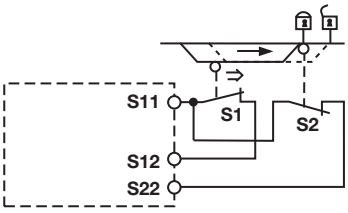
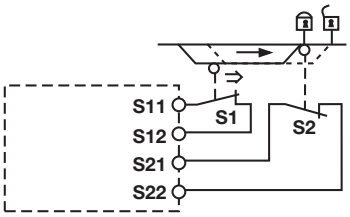
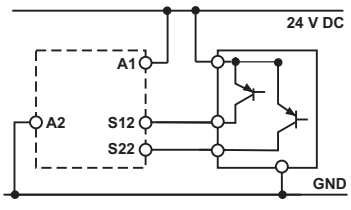
Safety relays PNOZsigma
PNOZ s4.1

Connection

- Supply voltage

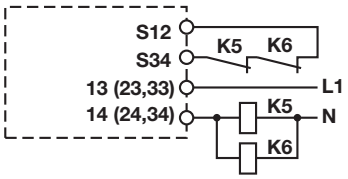
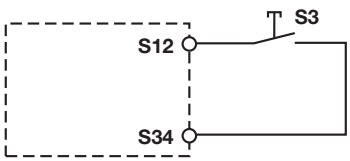
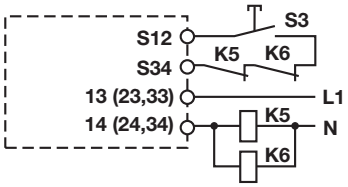
Supply voltage	Unit types with U_B 48 - 240 VAC/DC	Unit types with U_B 24 VDC
		

- Input circuit

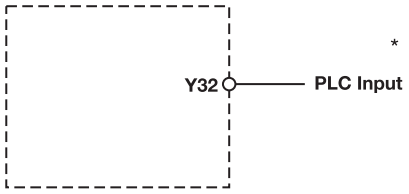
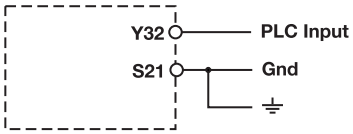
Input circuit	Single-channel	Dual-channel
E-Stop **without** detection of shorts across contacts		
E-Stop **with** detection of shorts across contacts		
Safety gate **without** detection of shorts across contacts		
Safety gate with detection of shorts across contacts		
Light beam device or safety switch with detection of shorts across contacts via ESPE (only when UB = 24 VDC)		

Safety relays PNOZsigma
PNOZ s4.1

- Start circuit/feedback loop

Start circuit/feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Automatic start		
Monitored, manual start/restart		

- Semiconductor output

Unit types with U_B 24 VDC	Unit types with U_B 48 - 240 VAC/DC
 *Connect together the 0V connections on all the external power supplies	

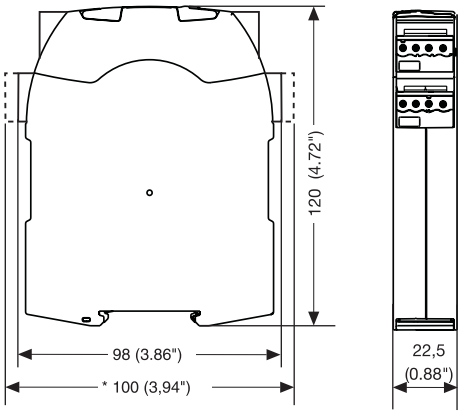
Legend

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

Safety relays PNOZsigma
PNOZ s4.1

Dimensions in mm

*with spring-loaded terminals



Technical details

General	750124	750154	751124	751154
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**750124**	**750154**	**751124**	**751154**
Supply voltage				
Voltage	24 V	48 - 240 V	24 V	48 - 240 V
Kind	DC	AC/DC	DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	–	5 VA	–	5 VA
Output of external power supply (DC)	2,5 W	2,5 W	2,5 W	2,5 W
Frequency range AC	–	50 - 60 Hz	–	50 - 60 Hz
Residual ripple DC	20 %	160 %	20 %	160 %
Duty cycle	100 %	100 %	100 %	100 %
Inputs	**750124**	**750154**	**751124**	**751154**
Number	2	2	2	2

Safety relays PNOZsigma
PNOZ s4.1

Inputs	750124	750154	751124	751154
Voltage at				
Input circuit DC	**24 V**	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**	**24 V**
Current at				
Input circuit DC	**50 mA**	**50 mA**	**50 mA**	**50 mA**
Start circuit DC	**50 mA**	**50 mA**	**50 mA**	**50 mA**
Feedback loop DC	**50 mA**	**50 mA**	**50 mA**	**50 mA**
Max. inrush current impulse				
Current pulse, input circuit	**0,2 A**	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, input circuit	**100 ms**	**100 ms**	**100 ms**	**100 ms**
Current pulse, feedback loop	**0,2 A**	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, feedback loop	**15 ms**	**15 ms**	**15 ms**	**15 ms**
Current pulse, start circuit	**0,2 A**	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, start circuit	**15 ms**	**15 ms**	**15 ms**	**15 ms**

Safety relays PNOZsigma
PNOZ s4.1

Inputs	750124	750154	751124	751154
Max. overall cable resistance RImax				
Single-channel at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**	**30 Ohm**
Single-channel at UB AC	–	**30 Ohm**	–	**30 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**60 Ohm**	**60 Ohm**	**60 Ohm**	**60 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	–	**60 Ohm**	–	**60 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	–	**30 Ohm**	–	**30 Ohm**
Semiconductor outputs	**750124**	**750154**	**751124**	**751154**
Number	**1**	**1**	**1**	**1**
Voltage	**24 V**	**24 V**	**24 V**	**24 V**
Current	**20 mA**	**20 mA**	**20 mA**	**20 mA**
Relay outputs	**750124**	**750154**	**751124**	**751154**
Number of output contacts				
Safety contacts (N/O), instantaneous	**3**	**3**	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**	**1 kA**
Utilisation category				
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZsigma
PNOZ s4.1

Relay outputs	750124	750154	751124	751154
Utilisation category of safety contacts				
AC1 at	**240 V**	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**1,5 A**	**1,5 A**	**1,5 A**	**1,5 A**
Max. power	**375 VA**	**375 VA**	**375 VA**	**375 VA**
DC1 at	**24 V**	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**	**150 W**
Utilisation category of auxiliary contacts				
AC1 at	**240 V**	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**1,5 A**	**1,5 A**	**1,5 A**	**1,5 A**
Max. power	**375 VA**	**375 VA**	**375 VA**	**375 VA**
DC1 at	**24 V**	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**	**150 W**
Utilisation category				
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts				
AC15 at	**230 V**	**230 V**	**230 V**	**230 V**
Max. current	**0,6 A**	**0,6 A**	**0,6 A**	**0,6 A**
DC13 (6 cycles/ min) at	**24 V**	**24 V**	**24 V**	**24 V**
Max. current	**0,4 A**	**0,4 A**	**0,4 A**	**0,4 A**
Utilisation category of auxiliary contacts				
AC15 at	**230 V**	**230 V**	**230 V**	**230 V**
Max. current	**0,6 A**	**0,6 A**	**0,6 A**	**0,6 A**
DC13 (6 cycles/ min) at	**24 V**	**24 V**	**24 V**	**24 V**
Max. current	**0,4 A**	**0,4 A**	**0,4 A**	**0,4 A**

Safety relays PNOZsigma
PNOZ s4.1

Relay outputs	750124	750154	751124	751154
Utilisation category in accordance with UL				
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**1,5 A**	**1,5 A**	**1,5 A**	**1,5 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**	**6 A**
External contact fuse protection, safety contacts				
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts				
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZsigma
PNOZ s4.1

Conventional thermal current while loading several contacts	750124	750154	751124	751154
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V				
Conv. therm. current with 1 contact	–	**6 A**	–	**6 A**
Conv. therm. current with 2 contacts	–	**6 A**	–	**6 A**
Conv. therm. current with 3 contacts	–	**4,5 A**	–	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V				
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**	**4,5 A**	**4,5 A**

Safety relays PNOZsigma
PNOZ s4.1

Times	750124	750154	751124	751154
Switch-on delay				
With automatic start typ.	**170 ms**	**170 ms**	**170 ms**	**170 ms**
With automatic start max.	**300 ms**	**300 ms**	**300 ms**	**300 ms**
With automatic start after power on typ.	**350 ms**	**350 ms**	**350 ms**	**350 ms**
With automatic start after power on max.	**600 ms**	**600 ms**	**600 ms**	**600 ms**
With manual start typ.	**40 ms**	**40 ms**	**40 ms**	**40 ms**
With manual start max.	**300 ms**	**300 ms**	**300 ms**	**300 ms**
With monitored start with rising edge typ.	**35 ms**	**35 ms**	**35 ms**	**35 ms**
With monitored start with rising edge max.	**50 ms**	**50 ms**	**50 ms**	**50 ms**
With monitored start with falling edge typ.	**55 ms**	**55 ms**	**55 ms**	**55 ms**
With monitored start with falling edge max.	**70 ms**	**70 ms**	**70 ms**	**70 ms**
Delay-on de-energisation				
With E-STOP typ.	**10 ms**	**10 ms**	**10 ms**	**10 ms**
With E-STOP max.	**20 ms**	**20 ms**	**20 ms**	**20 ms**
With power failure typ.	**40 ms**	**40 ms**	**40 ms**	**40 ms**
With power failure max.	**80 ms**	**80 ms**	**80 ms**	**80 ms**
Recovery time at max. switching frequency 1/s				
After E-STOP	**50 ms**	**50 ms**	**50 ms**	**50 ms**
After power failure	**100 ms**	**100 ms**	**100 ms**	**100 ms**
Waiting period with a monitored start				
With rising edge	**120 ms**	**120 ms**	**120 ms**	**120 ms**
With falling edge	**250 ms**	**150 ms**	**250 ms**	**150 ms**

Safety relays PNOZsigma
PNOZ s4.1

Times	750124	750154	751124	751154
Min. start pulse duration with a monitored start				
With rising edge	**30 ms**	**30 ms**	**30 ms**	**30 ms**
With falling edge	**100 ms**	**100 ms**	**100 ms**	**100 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞	∞	∞
Environmental data	**750124**	**750154**	**751124**	**751154**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature				
Temperature range	**-10 - 60 °C**	**-10 - 60 °C**	**-10 - 60 °C**	**-10 - 60 °C**
Storage temperature				
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability				
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration				
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 150 Hz**	**10 - 150 Hz**	**10 - 150 Hz**	**10 - 150 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage				
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**	**4 kV**

Safety relays PNOZsigma
PNOZ s4.1

Environmental data	750124	750154	751124	751154
Protection type				
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**	**IP20**
Mechanical data	**750124**	**750154**	**751124**	**751154**
Mounting position	**Any**	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material				
Bottom	**PC**	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**	**PC**
Top	**PC**	**PC**	**PC**	**PC**
Connection type	**Screw terminal**	**Screw terminal**	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals				
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**	–	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	–	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	–	**2**	**2**

Safety relays PNOZsigma
PNOZ s4.1

Mechanical data	750124	750154	751124	751154
Stripping length with spring-loaded terminals	–	–	**9 mm**	**9 mm**
Dimensions				
Height	**98 mm**	**98 mm**	**100 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**	**120 mm**	**120 mm**
Weight	**190 g**	**210 g**	**190 g**	**210 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s4.1

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.

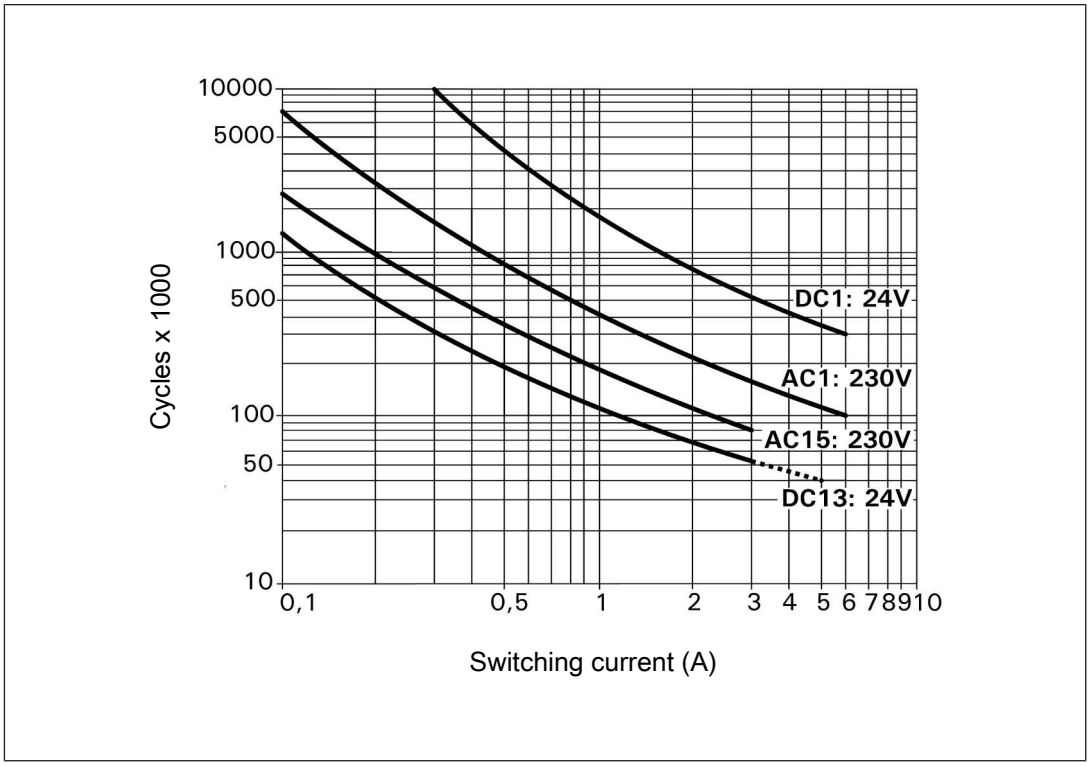


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s4.1

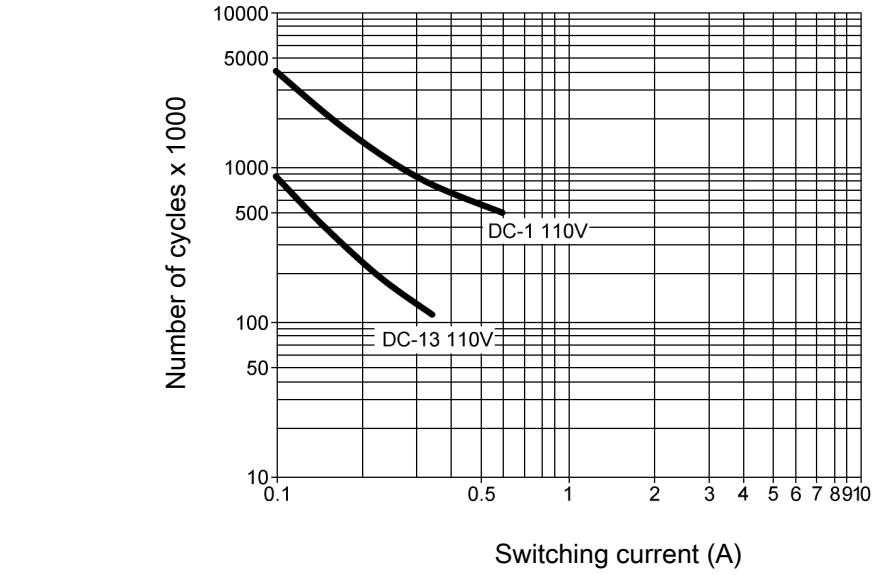


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [622]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order no.
PNOZ s4.1	24 VDC	Screw terminals	750 124
PNOZ s4.1 C	24 VDC	Spring-loaded terminal	751 124
PNOZ s4.1	48 - 240 V AC/DC	Screw terminals	750 154
PNOZ s4.1 C	48 - 240 V AC/DC	Spring-loaded terminals	751 154

Safety relays PNOZsigma
PNOZ s5

Unit features

- Positive-guided relay outputs:
  - 2 safety contacts (N/O), instantaneous
  - 2 safety contacts (N/O), delay-on de-energisation
- 1 semiconductor output
- Connection options for:
  - E-STOP pushbuttons
  - Safety gate limit switches
  - Start buttons
  - Light grids and safety switches with detection of shorts across contacts
- A connector can be used to connect 1 PNOZsigma contact expansion module
- Operating modes and delay times can be selected via rotary switches
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status channel 1/2
  - Start circuit
  - Error
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s5

Block diagram/terminal configuration

Type: 24 VDC

- U_B: 24 VDC; Order No. 750105, 751105, 751185

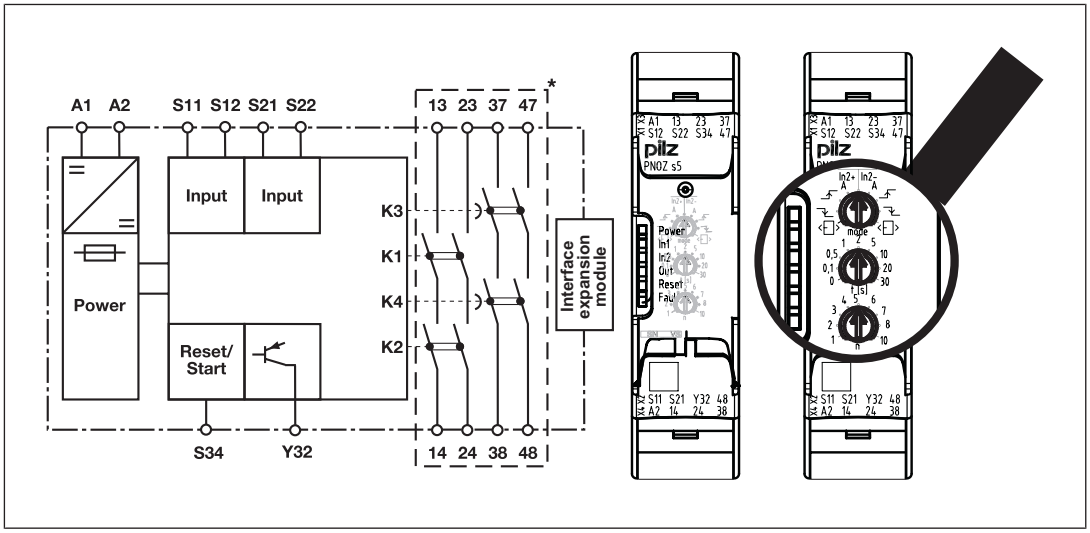


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Type: 48 - 240 VAC/DC

- U_B: 48 – 240 VAC/DC; Order No. 750135, 751135

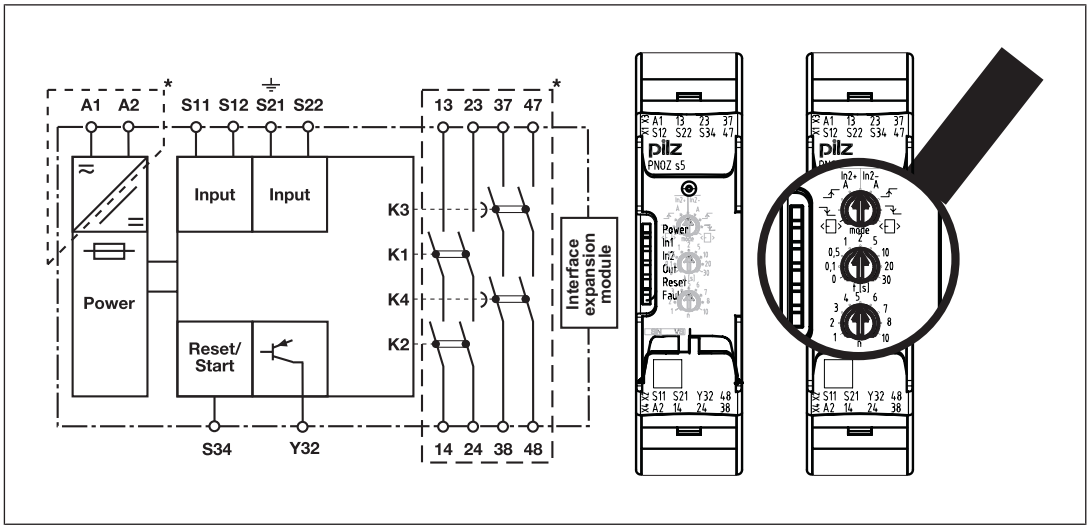


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZsigma
PNOZ s5

Function description

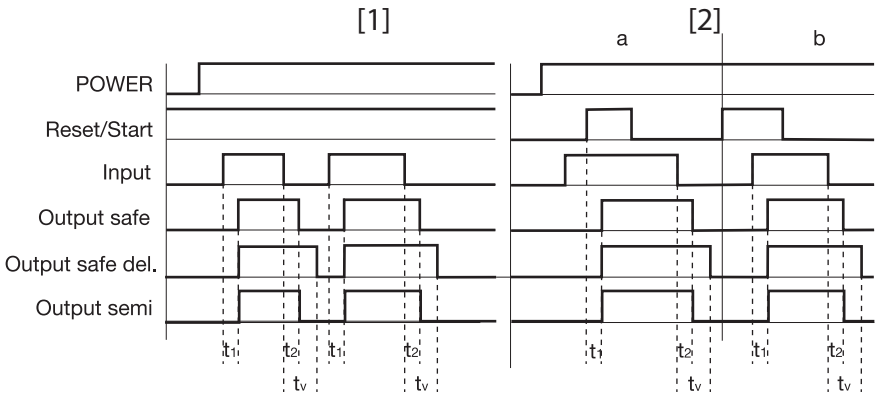
- In2+ Single-channel operation: no redundancy in the input circuit, earth faults in the start circuit and input circuit are detected.
- Dual-channel operation without detection of shorts across contacts: Redundant input circuit, detects PNOZ s5
  - earth faults in the start and input circuit,
  - short circuits in the input circuit and, with a monitored start, in the start circuit too.
- In2- Dual-channel operation with detection of shorts across contacts: Redundant input circuit, detects PNOZ s5
  - earth faults in the start and input circuit,
  - Short circuits in the input circuit and, with a monitored start, in the start circuit too,
  - Shorts across contacts in the input circuit.
- **A** Automatic start: Unit is active once the input circuit has been closed.
- Manual start Unit is active once the input circuit and the start circuit are closed.
- Monitored start with falling edge: Unit is active once
  - the input circuit is closed and then the start circuit is closed and opened again.
  - the start circuit is closed and then opened again once the input circuit is closed.
- Monitored start with rising edge: Unit is active once the input circuit is closed and once the start circuit is closed after the waiting period has elapsed (see technical details).
- Start with start-up test: The unit checks whether safety gates that are closed are opened and then closed again when supply voltage is applied.
- Ability to increase the number of contacts available on the
  - instantaneous safety contacts by using connectors to link to a PNOZsigma contact expansion module
  - delayed/instantaneous safety contacts by connecting contact expansion modules or external contactors

Safety relays PNOZsigma
PNOZ s5

Timing diagrams

Automatic and manual start

- [1]: Automatic start
- [2]: Manual start
  - a: Input circuit closes before start circuit
  - b: Start circuit closes before input circuit



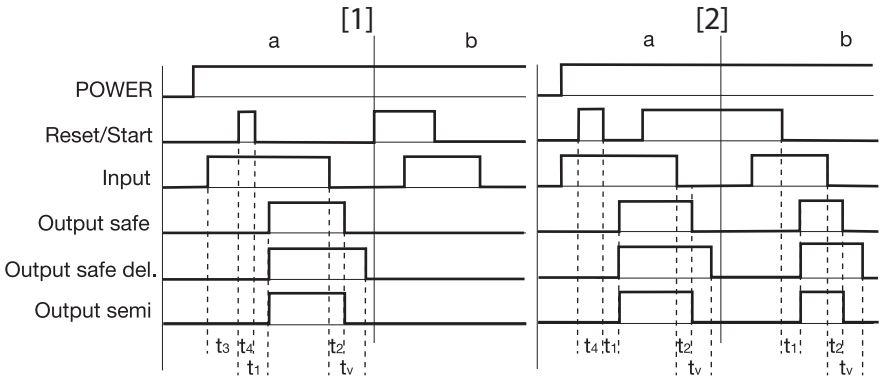
Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts, instantaneous
- Output safe del: Safety contacts, delayed
- Output semi: Semiconductor output
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_v: Delay time

Safety relays PNOZsigma
PNOZ s5

Monitored start

- [1]: Monitored start with rising edge
  - a: Input circuit closes before start circuit
  - b: Start circuit closes before input circuit
- [2]: Monitored start with falling edge
  - a: Input circuit closes before start circuit
  - b: Start circuit closes before input circuit

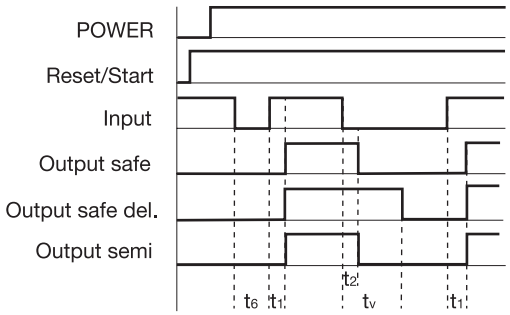


Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts, instantaneous
- Output safe del: Safety contacts, delayed
- Output semi: Semiconductor output
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_3: Waiting period with a monitored start
- t_4: Min. start pulse duration with a monitored start
- t_v: Delay time

Safety relays PNOZsigma
PNOZ s5

Reset with start-up test



Legend

- POWER: Supply voltage
- Start: Start circuit
- Input: Input circuits
- Output safe: Safety contacts, instantaneous
- Output safe del: Safety contacts, delayed
- Output semi: Semiconductor output
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_v: Delay time
- t_6: Recovery time

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s5

Wiring

Please note:

- Information given in the "Technical details [644]" must be followed.
- Outputs 13-14, 23-24 are instantaneous safety contacts; outputs 37-38, 47-48 are delay-on de-energisation safety contacts, semiconductor output Y32 is an auxiliary output (e.g. for display).
- Semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [644]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [644])
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.
- With U_B 48 – 240 VAC/DC: Connect S21 to the functional earth.
- When connecting magnetically operated, reed proximity switches, ensure that the max. peak inrush current (on the input circuit) does not overload the proximity switch.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Important for detection of shorts across contacts:

As this function for detecting shorts across contacts is not failsafe, it is tested by Pilz during the final control check. If there is a danger of exceeding the cable runs, we recommend the following test after the installation of the device:

1. Unit ready for operation (output contacts closed)
2. Short circuit the test terminals S12, S22 for detecting shorts across the inputs.
3. The unit's fuse must be triggered and the output contacts must open. Cable lengths in the scale of the maximum length can delay the fuse triggering for up to 2 minutes.
4. Reset the fuse: remove the short circuit and switch off the supply voltage for approx. 1 minute.

Safety relays PNOZsigma
PNOZ s5

Preparing for operation

Operating modes and delay time

The operating mode and delay time are set via the rotary switches on the unit. You can do this by opening the cover on the front of the unit.

Set operating modes

- Switch off supply voltage.
- Select operating mode via the operating mode selector switch "mode".
- If the operating mode selector switch "mode" is in its start position (vertical position), an error message will appear.

Operating mode selector switch "mode"	Automatic or manual start	Monitored start rising edge	Monitored start falling edge	Automatic start with start-up test
Without detection of shorts across contacts				
With detection of shorts across contacts				

Set delay time

Time selector switch "t[s]"

Factor selector switch "n"

n x t[s] = Delay time

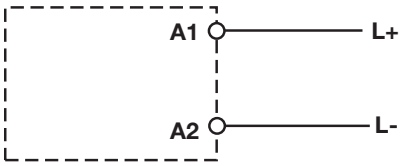
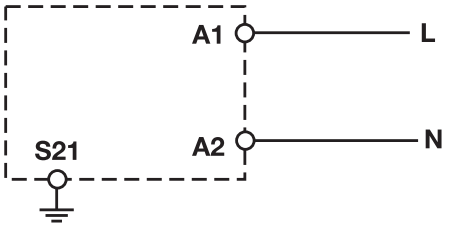
Example:

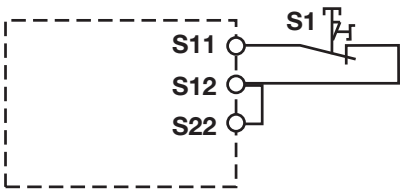
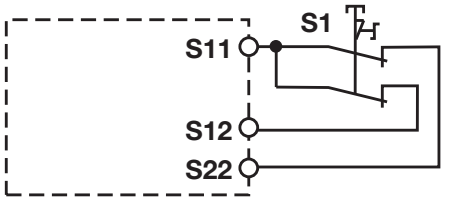
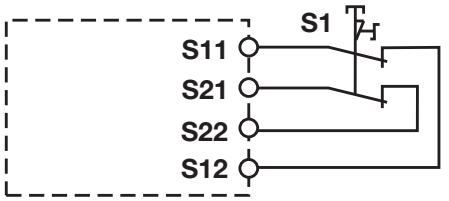
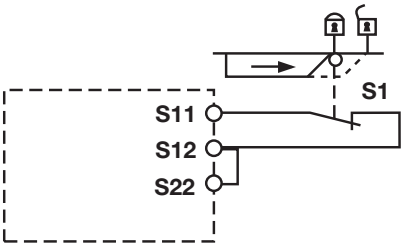
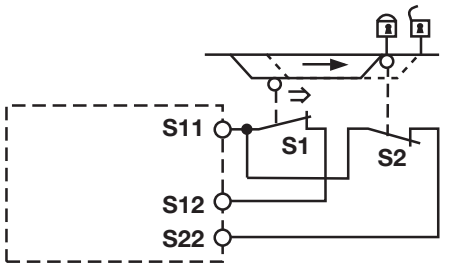
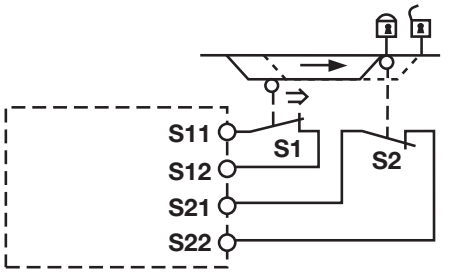
t = 4 s, n = 5
Delay time = 5 x 4 = 20 s

The min. delay time that can be set is (when t = 0): 0.04 s.

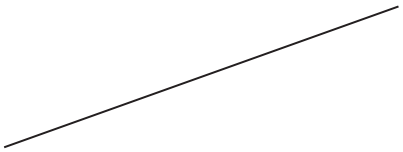
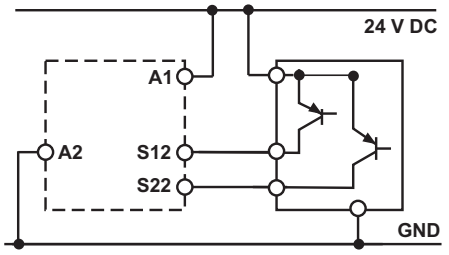
Safety relays PNOZsigma
PNOZ s5

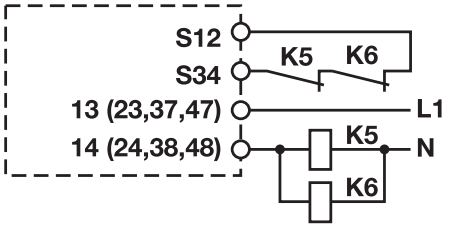
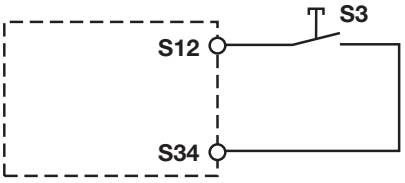
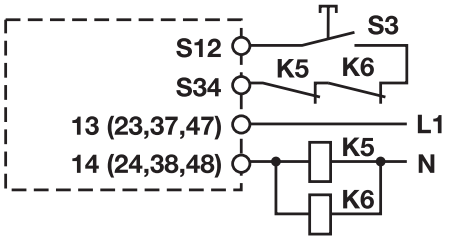
Connection

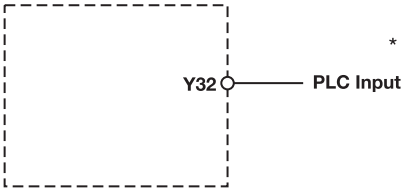
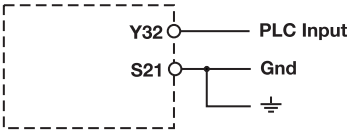
Supply voltage	Unit types with UB 24 VDC	Unit types with UB 48 – 240 VAC/ DC
		

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		

Safety relays PNOZsigma
PNOZ s5

Input circuit	Single-channel	Dual-channel
Light beam device or safety switch, detection of shorts across contacts via ESPE (only on unit types with UB = 24 VDC)		

Start circuit/feedback loop	Without feedback loop monitoring	With feedback loop monitoring
Automatic start		
Monitored, manual start/restart		

Semiconductor output	Unit types with U_B 24 VDC	Unit types with U_B 48 – 240 VAC/DC
	 *Connect together the 0V connections on all the external power supplies	

Legend

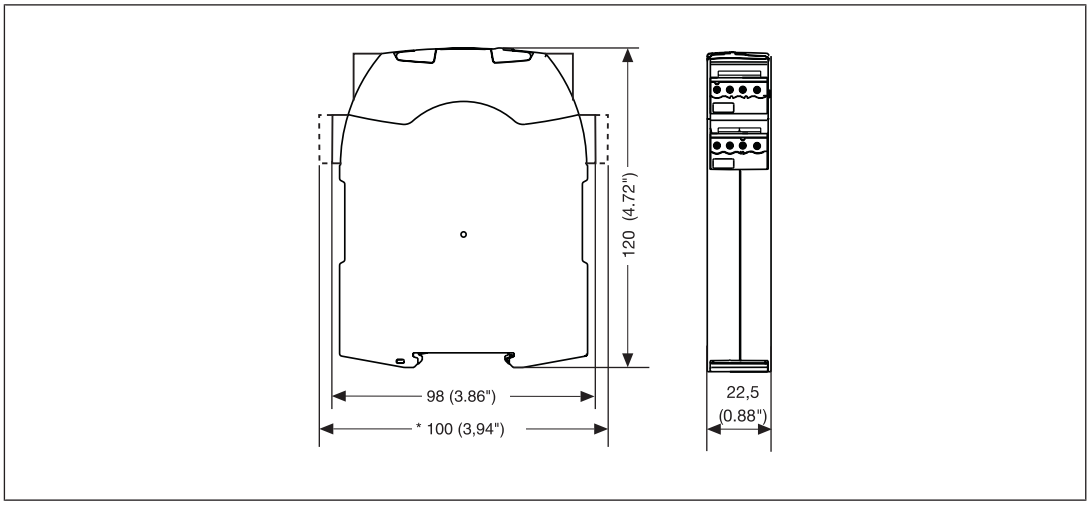
- S1/S2: E-STOP/safety gate switch
- S3: Reset button
- ⇑: Switch operated
- : Gate open

Safety relays PNOZsigma
PNOZ s5

- : Gate closed

Dimensions in mm

*with spring-loaded terminals



Technical details

Order no. 750105 – 751185

See below for more order numbers

General	750105	751105	751185
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750105**	**751105**	**751185**
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %	-15 %/+10 %
Output of external power supply (DC)	4 W	4 W	4 W
Residual ripple DC	20 %	20 %	20 %
Duty cycle	100 %	100 %	100 %
Inputs	**750105**	**751105**	**751185**
Number	2	2	2

Safety relays PNOZsigma
PNOZ s5

Inputs	750105	751105	751185
Voltage at			
Input circuit DC	**24 V**	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**	**24 V**
Current at			
Input circuit DC	**40 mA**	**40 mA**	**40 mA**
Start circuit DC	**40 mA**	**40 mA**	**40 mA**
Feedback loop DC	**40 mA**	**40 mA**	**40 mA**
Max. inrush current impulse			
Current pulse, input circuit	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, input circuit	**100 ms**	**100 ms**	**100 ms**
Current pulse, feedback loop	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, feedback loop	**60 ms**	**60 ms**	**60 ms**
Current pulse, start circuit	**0,2 A**	**0,2 A**	**0,2 A**
Pulse duration, start circuit	**60 ms**	**60 ms**	**60 ms**
Min. input resistance at power-on	**110 Ohm**	**110 Ohm**	**110 Ohm**
Max. overall cable resistance RImax			
Single-channel at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**	**30 Ohm**
Semiconductor outputs	**750105**	**751105**	**751185**
Number	**1**	**1**	**1**
Voltage	**24 V**	**24 V**	**24 V**
Current	**20 mA**	**20 mA**	**20 mA**

Safety relays PNOZsigma
PNOZ s5

Relay outputs	750105	751105	751185
Number of output contacts			
Safety contacts (N/O), instantaneous	**2**	**2**	**2**
Safety contacts (N/O), delayed	**2**	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category of safety contacts delayed			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**3 A**	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**4 A**

Safety relays PNOZsigma
PNOZ s5

Relay outputs	750105	751105	751185
Utilisation category of safety contacts delayed			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**3 A**	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**4 A**	**4 A**	**4 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
External contact fuse protection, delayed safety contacts			
Max. melting integral	**66 A²s**	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZsigma
PNOZ s5

Conventional thermal current while loading several contacts	750105	751105	751185
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**	**6 A**
Conv. therm. current with 4 contacts	**6 A**	**6 A**	**6 A**
Times	**750105**	**751105**	**751185**
Switch-on delay			
With automatic start typ.	**180 ms**	**180 ms**	**180 ms**
With automatic start max.	**330 ms**	**330 ms**	**330 ms**
With automatic start after power on typ.	**1.430 ms**	**1.430 ms**	**1.430 ms**
With automatic start after power on max.	**1.900 ms**	**1.900 ms**	**1.900 ms**
With automatic start after power on typ.	–	–	–
With automatic start after power on max.	–	–	–
With manual start typ.	**45 ms**	**45 ms**	**45 ms**
With manual start max.	**85 ms**	**85 ms**	**85 ms**
With monitored start with rising edge typ.	**45 ms**	**45 ms**	**45 ms**
With monitored start with rising edge max.	**70 ms**	**70 ms**	**70 ms**
With monitored start with falling edge typ.	**60 ms**	**60 ms**	**60 ms**
With monitored start with falling edge max.	**80 ms**	**80 ms**	**80 ms**
Delay-on de-energisation			
With E-STOP typ.	**15 ms**	**15 ms**	**15 ms**
With E-STOP max.	**20 ms**	**20 ms**	**20 ms**
With power failure typ.	**75 ms**	**75 ms**	**75 ms**
With power failure max.	**110 ms**	**110 ms**	**110 ms**
Recovery time at max. switching frequency 1/s			
After E-STOP	**150 ms +tv**	**150 ms +tv**	**150 ms +tv**
After power failure	**200 ms**	**200 ms**	**200 ms**

Safety relays PNOZsigma
PNOZ s5

Times	750105	751105	751185
Delay time tv	0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s	0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s	0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s
Time accuracy	+/-1 % + +/-20 ms	+/-1 % + +/-20 ms	+/-1 % + +/-20 ms
Repetition accuracy	+/-1 % + +/-20 ms	+/-1 % + +/-20 ms	+/-1 % + +/-20 ms
Repetition accuracy in the event of an error	+/-15 % + +/-20 ms	+/-15 % + +/-20 ms	+/-15 % + +/-20 ms
Max. delay time	tv + 15 % + 20 ms	tv + 15 % + 20 ms	tv + 15 % + 20 ms
Waiting period with a monitored start			
With rising edge	150 ms	150 ms	150 ms
With falling edge	240 ms	240 ms	240 ms
Min. start pulse duration with a monitored start			
With rising edge	30 ms	30 ms	30 ms
With falling edge	70 ms	70 ms	70 ms
Supply interruption before de-energisation	20 ms	20 ms	20 ms
Simultaneity, channel 1 and 2 max.	∞	∞	∞
Environmental data	**750105**	**751105**	**751185**
Climatic suitability	EN 60068-2-78	EN 60068-2-78	EN 60068-2-78
Ambient temperature			
Temperature range	-10 - 55 °C	-10 - 55 °C	-10 - 55 °C
Storage temperature			
Temperature range	-40 - 85 °C	-40 - 85 °C	-40 - 85 °C
Climatic suitability			
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Not permitted	Not permitted	Not permitted
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1	EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1

Safety relays PNOZsigma
PNOZ s5

Environmental data	750105	751105	751185
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**	**III / II**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**	**4 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**750105**	**751105**	**751185**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Top	**PC**	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,5 Nm**	–	–

Safety relays PNOZsigma
PNOZ s5

Mechanical data	750105	751105	751185
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**	**2**
Stripping length with spring-loaded terminals	–	**9 mm**	**9 mm**
Dimensions			
Height	**98 mm**	**100 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**	**120 mm**
Weight	**235 g**	**235 g**	**235 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 750135 –751135

General	750135	751135
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**750135**	**751135**
Supply voltage		
Voltage	**48 - 240 V**	**48 - 240 V**
Kind	**AC/DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	**8 VA**	**8 VA**
Output of external power supply (DC)	**4 W**	**4 W**
Frequency range AC	**50 - 60 Hz**	**50 - 60 Hz**
Residual ripple DC	**160 %**	**160 %**
Duty cycle	**100 %**	**100 %**
Inputs	**750135**	**751135**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Start circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**

Safety relays PNOZsigma
PNOZ s5

Inputs	750135	751135
Current at		
Input circuit DC	**40 mA**	**40 mA**
Start circuit DC	**40 mA**	**40 mA**
Feedback loop DC	**40 mA**	**40 mA**
Max. inrush current impulse		
Current pulse, input circuit	**0,2 A**	**0,2 A**
Pulse duration, input circuit	**100 ms**	**100 ms**
Current pulse, feedback loop	**0,2 A**	**0,2 A**
Pulse duration, feedback loop	**60 ms**	**60 ms**
Current pulse, start circuit	**0,2 A**	**0,2 A**
Pulse duration, start circuit	**60 ms**	**60 ms**
Min. input resistance at power-on	**110 Ohm**	**110 Ohm**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Single-channel at UB AC	**30 Ohm**	**30 Ohm**
Dual-channel without detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**
Dual-channel without detection of shorts across contacts at UB AC	**30 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB DC	**30 Ohm**	**30 Ohm**
Dual-channel with detection of shorts across contacts at UB AC	**30 Ohm**	**30 Ohm**
Semiconductor outputs	**750135**	**751135**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
Relay outputs	**750135**	**751135**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Safety contacts (N/O), delayed	**2**	**2**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**

Safety relays PNOZsigma
PNOZ s5

Relay outputs	750135	751135
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of safety contacts delayed		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category of safety contacts delayed		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
Pilot Duty	**B300, R300**	**B300, R300**

Safety relays PNOZsigma
PNOZ s5

Relay outputs	750135	751135
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, delayed safety contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750135**	**751135**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**
Conv. therm. current with 4 contacts	**6 A**	**6 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**
Conv. therm. current with 4 contacts	**6 A**	**6 A**

Safety relays PNOZsigma
PNOZ s5

Times	750135	751135
Switch-on delay		
With automatic start typ.	**180 ms**	**180 ms**
With automatic start max.	**330 ms**	**330 ms**
With automatic start after power on typ.	**1.430 ms**	**1.430 ms**
With automatic start after power on max.	**1.900 ms**	**1.900 ms**
With automatic start after power on typ.	–	–
With automatic start after power on max.	–	–
With manual start typ.	**45 ms**	**45 ms**
With manual start max.	**85 ms**	**85 ms**
With monitored start with rising edge typ.	**45 ms**	**45 ms**
With monitored start with rising edge max.	**70 ms**	**70 ms**
With monitored start with falling edge typ.	**60 ms**	**60 ms**
With monitored start with falling edge max.	**80 ms**	**80 ms**
Delay-on de-energisation		
With E-STOP typ.	**15 ms**	**15 ms**
With E-STOP max.	**20 ms**	**20 ms**
With power failure typ.	**75 ms**	**75 ms**
With power failure max.	**110 ms**	**110 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**150 ms +tv**	**150 ms +tv**
After power failure	**200 ms**	**200 ms**
Delay time tv	**0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s**	**0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s**
Time accuracy	**+/-1 % + +/-20 ms**	**+/-1 % + +/-20 ms**
Repetition accuracy	**+/-1 % + +/-20 ms**	**+/-1 % + +/-20 ms**
Repetition accuracy in the event of an error	**+/-15 % + +/-20 ms**	**+/-15 % + +/-20 ms**
Max. delay time	**tv + 15 % + 20 ms**	**tv + 15 % + 20 ms**

Safety relays PNOZsigma
PNOZ s5

Times	750135	751135
Waiting period with a monitored start		
With rising edge	**150 ms**	**150 ms**
With falling edge	**240 ms**	**240 ms**
Min. start pulse duration with a monitored start		
With rising edge	**30 ms**	**30 ms**
With falling edge	**70 ms**	**70 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	∞	∞
Environmental data	**750135**	**751135**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750135**	**751135**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZsigma
PNOZ s5

Mechanical data	750135	751135
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**255 g**	**255 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s5

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**
Safety contacts, delayed	**PL e**	**Cat. 4**	**SIL CL 3**	**2,34E-09**	**SIL 3**	**2,75E-05**	**20**

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

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.

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s5

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.

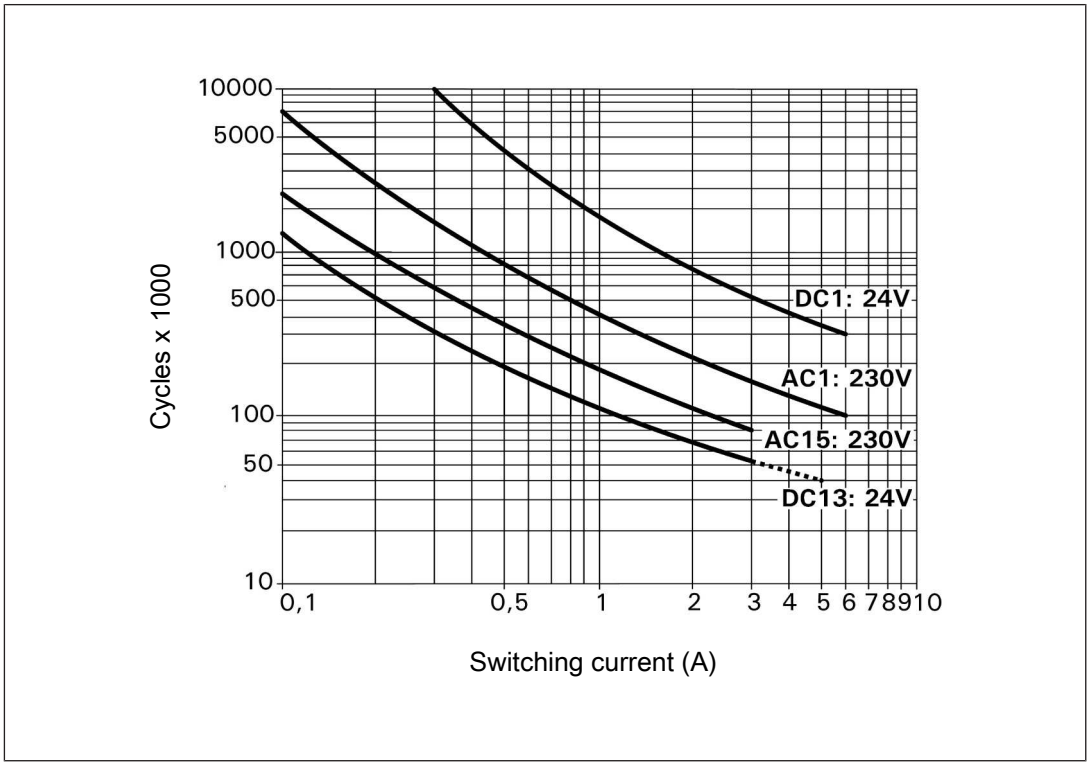


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s5

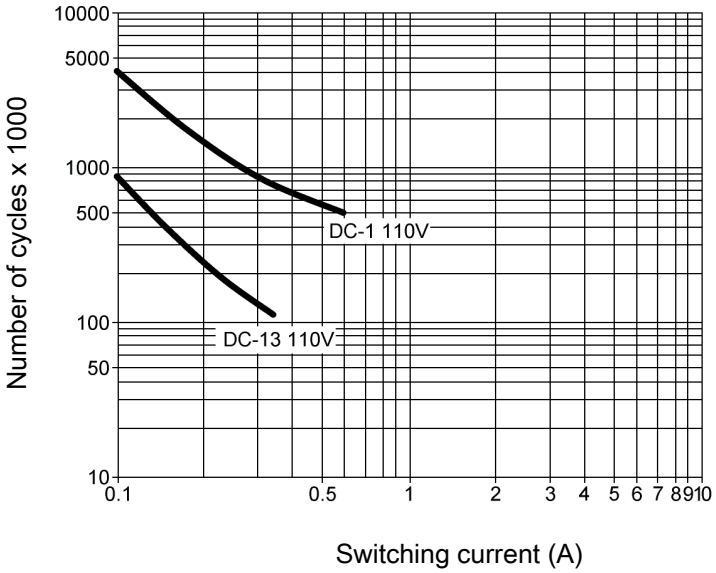


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [📖 644]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order No.
PNOZ s5	24 VDC	Screw terminals	750 105
PNOZ s5 C	24 VDC	Spring-loaded terminals	751 105
PNOZ s5 C (coated version)	24 VDC	Spring-loaded terminals	751 185
PNOZ s5	48 - 240 VAC/DC	Screw terminals	750 135
PNOZ s5 C	48 - 240 VAC/DC	Spring-loaded terminals	751 135

Safety relays PNOZsigma
PNOZ s6

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - 2 control elements (pushbuttons)
- A connector can be used to connect 1 PNOZsigma contact expansion module
- LED for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Feedback loop
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s6

Block diagram/terminal configuration

Unit types with UB 24 VDC

- U_B: 24 VDC; Order no. 750106, 751106

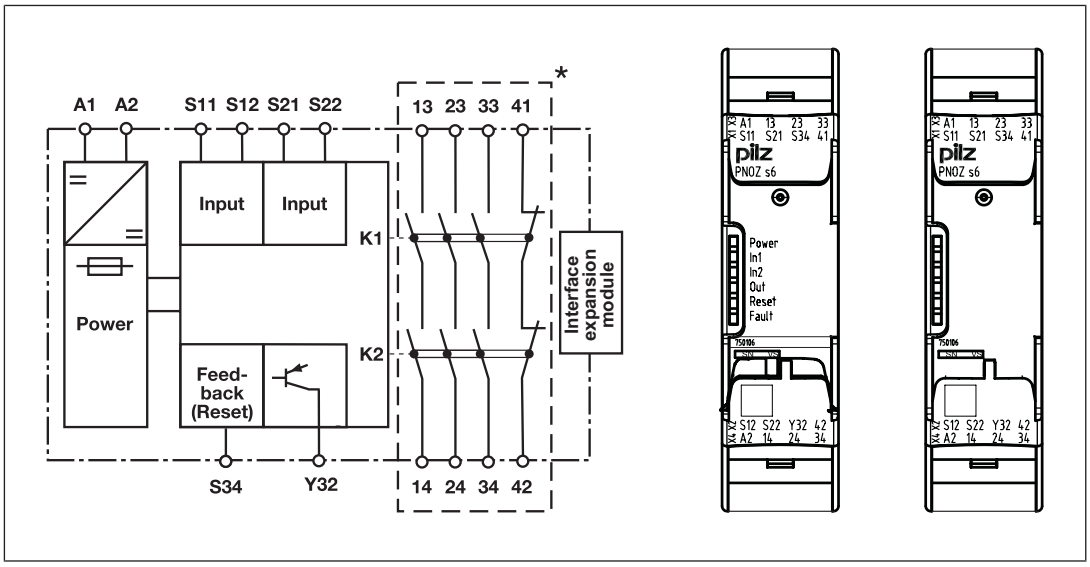


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZsigma
PNOZ s6

Unit types with UB 48 - 240 VAC/DC

- U_B: 48 - 240 VAC/DC; Order no. 750136, 751136

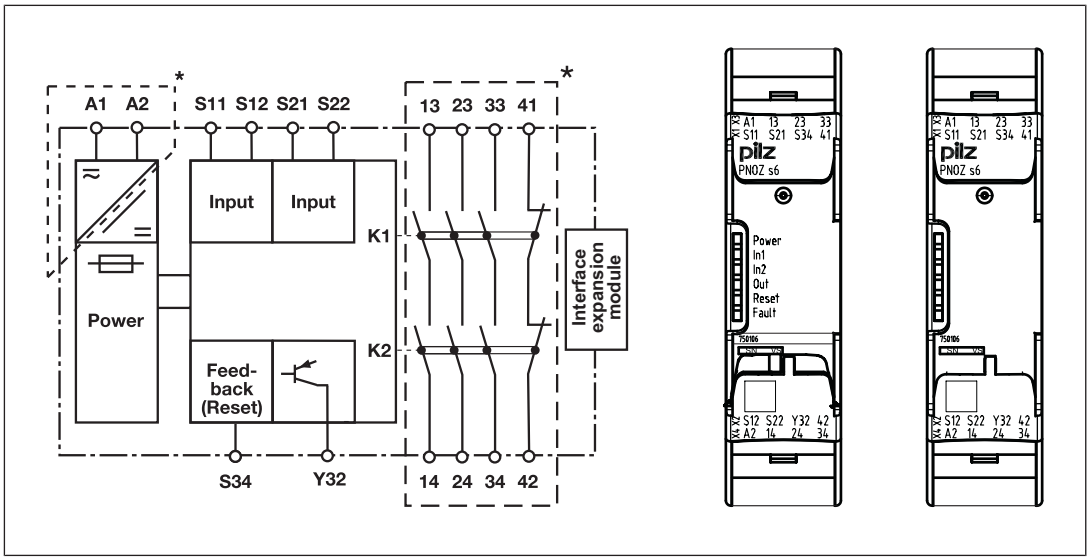


Fig.: Centre: Front view with cover, right: Front view without cover

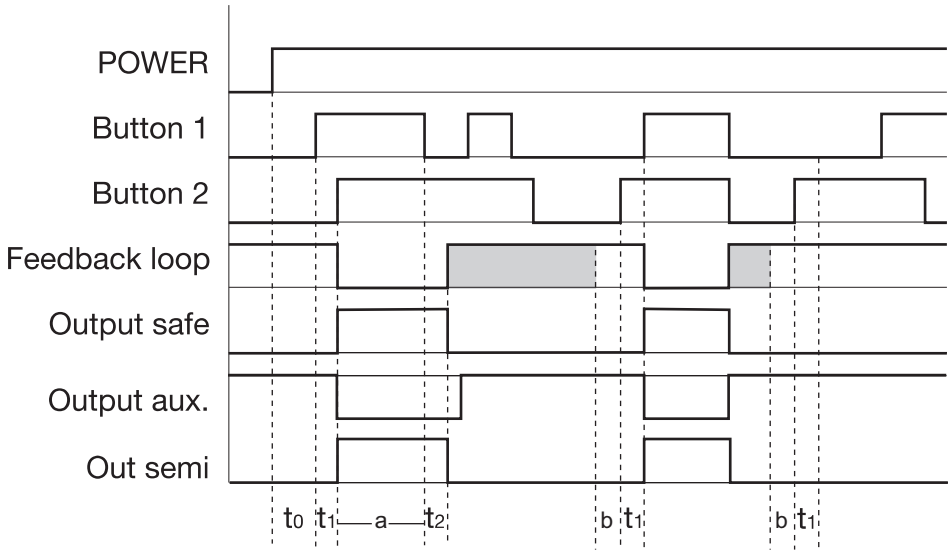
*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function description

- The two-hand control relay must be activated by simultaneously pressing two buttons within 0,5 s. If one or both of the buttons are released, the unit interrupts the control command for the hazardous movement.
- Reactivation: The output relays will not re-energise until both operator elements have been released and then re-operated simultaneously.

Safety relays PNOZsigma
PNOZ s6

Timing diagram



Legend

- POWER: Supply voltage
- Button 1/Button 2: Input circuits
- Feedback loop: Feedback loop
- Output safe: Safety outputs
- Output aux: Auxiliary contacts
- Out semi: Semiconductor output switch status
- t_0: Recovery time after power on
- t_1: Simultaneity, channel 1 and 2
- t_2: Delay-on de-energisation
- a: Operating cycle ended through button 1 or 2
- b: S34-S12 must be closed before before the button is operated

Shaded area: Status irrelevant

Safety relays PNOZsigma
PNOZ s6

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 667]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 and semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 667]).
- Calculation of the max. cable length l_{max} in the input circuit:

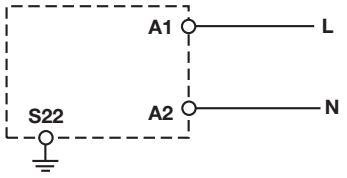
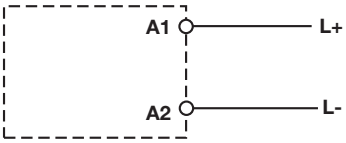
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

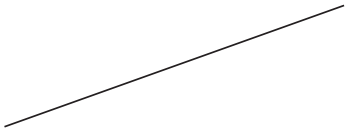
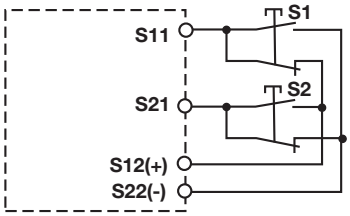
R_{lmax} = max. overall cable resistance (see Technical details [📖 667])
R_l / km = cable resistance/km

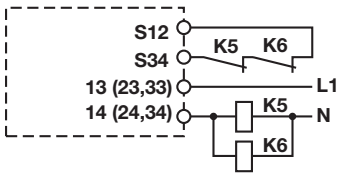
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- With U_B 48 – 240 VAC/DC: Connect S22 to functional earth.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

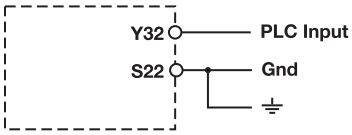
Safety relays PNOZsigma
PNOZ s6

Preparing for operation

Supply voltage	Unit types with U_B 48-240 VAC/DC	Unit types with U_B 240 VDC
		

Input circuit	Single-channel	Dual-channel
Two-hand button **with** detection of shorts across contacts		

Feedback loop	with feedback loop monitoring	without feedback loop monitoring
Link or contacts from external contactors		

Semiconductor output


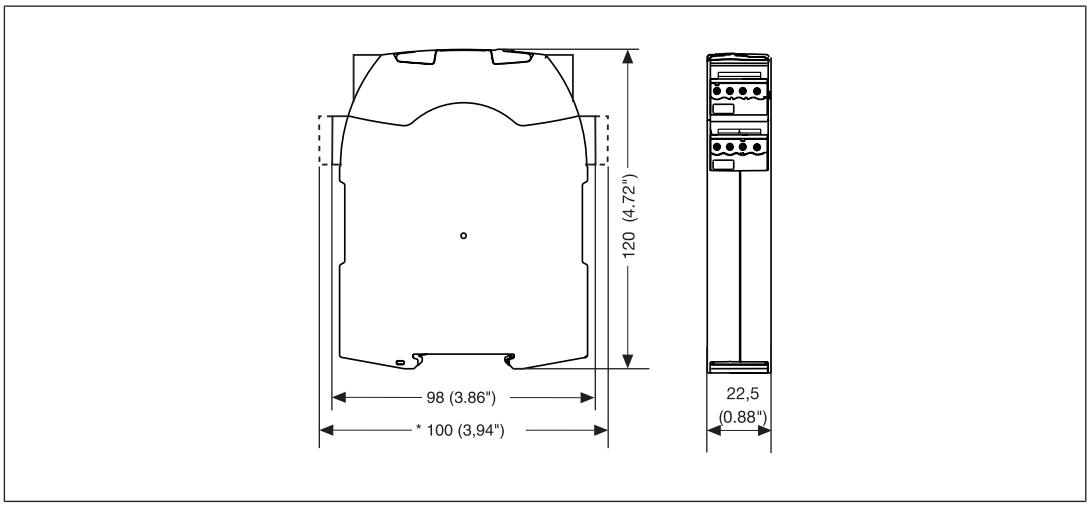
Legend

- S1/S2: Two-hand pushbuttons

Safety relays PNOZsigma
PNOZ s6

Dimensions in mm

*with spring-loaded terminals



Technical details

Order no. 750106 – 750136

See below for more order numbers

General	750106	750136
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**750106**	**750136**
Supply voltage		
Voltage	**24 V**	**48 - 240 V**
Kind	**DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	**7 VA**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Frequency range AC	–	**50 - 60 Hz**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Current at		
Normally open contact	**20 mA**	**20 mA**
N/C	**10 mA**	**10 mA**
Max. overall cable resistance Rl-max per input circuit	**30 Ohm**	**30 Ohm**

Safety relays PNOZsigma
PNOZ s6

Electrical data	750106	750136
External unit fuse protection F1 min.	1 A	1 A
External unit fuse protection F1 max.	Max. conductor cross section	Max. conductor cross section
Two-hand control relay type		
In accordance with the standard	EN 574	EN 574
Type	III C	III C
Inputs	**750106**	**750136**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Feedback loop DC	15 mA	15 mA
Semiconductor outputs	**750106**	**750136**
Number	1	1
Voltage	24 V	24 V
Current	20 mA	20 mA
Relay outputs	**750106**	**750136**
Number of output contacts		
Safety contacts (N/O), instantaneous	3	3
Auxiliary contacts (N/C)	1	1
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts		
AC1 at	240 V	240 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	150 W	150 W

Safety relays PNOZsigma
PNOZ s6

Relay outputs	750106	750136
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**10 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**

Safety relays PNOZsigma
PNOZ s6

Relay outputs	750106	750136
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750106**	**750136**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	–	**6 A**
Conv. therm. current with 2 contacts	–	**6 A**
Conv. therm. current with 3 contacts	–	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**4,5 A**
Times	**750106**	**750136**
Delay-on de-energisation (response time in accordance with EN 574)		
Normally open contact	**30 ms**	**30 ms**
N/C	**40 ms**	**40 ms**
Recovery time	**250 ms**	**250 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**0,5 s**	**0,5 s**
Environmental data	**750106**	**750136**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**

Safety relays PNOZsigma
PNOZ s6

Environmental data	750106	750136
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750106**	**750136**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**

Safety relays PNOZsigma
PNOZ s6

Mechanical data	750106	750136
Dimensions		
Height	**98 mm**	**98 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**185 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 751106 – 751136

General	751106	751136
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**751106**	**751136**
Supply voltage		
Voltage	**24 V**	**48 - 240 V**
Kind	**DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	**7 VA**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Frequency range AC	–	**50 - 60 Hz**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Current at		
Normally open contact	**20 mA**	**20 mA**
N/C	**10 mA**	**10 mA**
Max. overall cable resistance Rl-max per input circuit	**30 Ohm**	**30 Ohm**
External unit fuse protection F1 min.	**1 A**	**1 A**
External unit fuse protection F1 max.	**Max. conductor cross section**	**Max. conductor cross section**
Two-hand control relay type		
In accordance with the standard	**EN 574**	**EN 574**
Type	**III C**	**III C**
Inputs	**751106**	**751136**
Number	**2**	**2**

Safety relays PNOZsigma
PNOZ s6

Inputs	751106	751136
Voltage at		
Input circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**
Current at		
Feedback loop DC	**15 mA**	**15 mA**
Semiconductor outputs	**751106**	**751136**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
Relay outputs	**751106**	**751136**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**

Safety relays PNOZsigma
PNOZ s6

Relay outputs	751106	751136
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**10 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZsigma
PNOZ s6

Conventional thermal current while loading several contacts	751106	751136
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	–	**6 A**
Conv. therm. current with 2 contacts	–	**6 A**
Conv. therm. current with 3 contacts	–	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**4,5 A**
Times	**751106**	**751136**
Delay-on de-energisation (response time in accordance with EN 574)		
Normally open contact	**30 ms**	**30 ms**
N/C	**40 ms**	**40 ms**
Recovery time	**250 ms**	**250 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**0,5 s**	**0,5 s**
Environmental data	**751106**	**751136**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**

Safety relays PNOZsigma
PNOZ s6

Environmental data	751106	751136
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**751106**	**751136**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**9 mm**	**9 mm**
Dimensions		
Height	**100 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**185 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s6

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Two-hand function	**PL e**	**Cat. 4**	**SIL CL 3**	**2,62E-09**	**SIL 3**	**3,32E-05**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s6

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.

Unit types with U_B 240 VDC

- U_B: 24 VDC; Order no. 750106, 751106

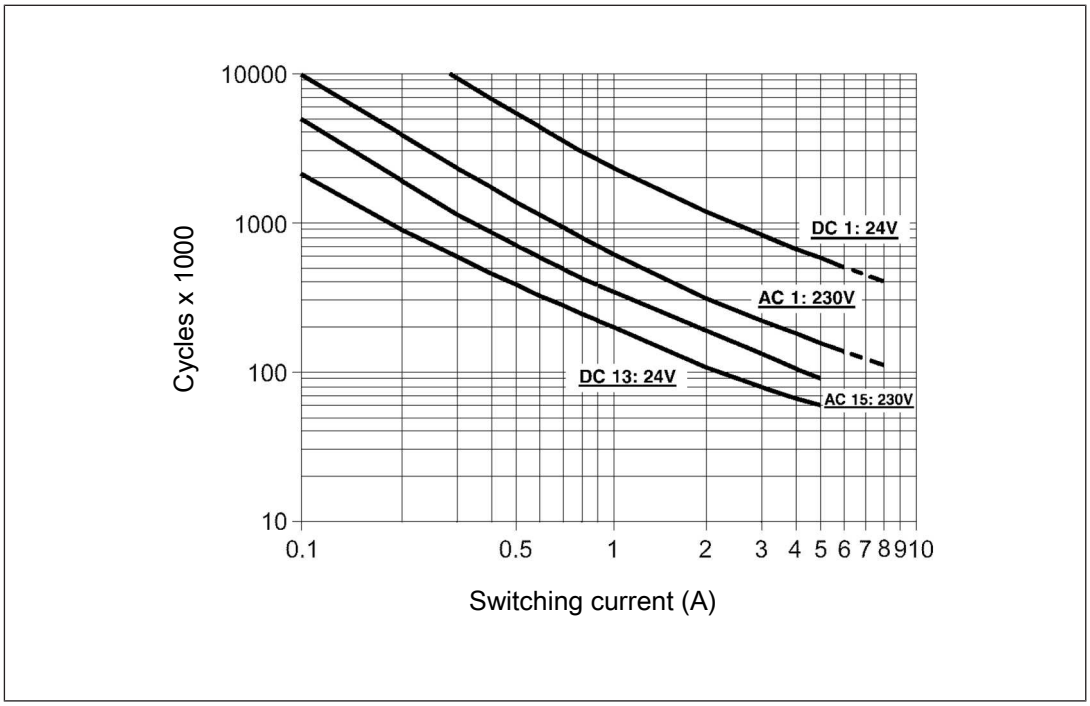


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma
PNOZ s6

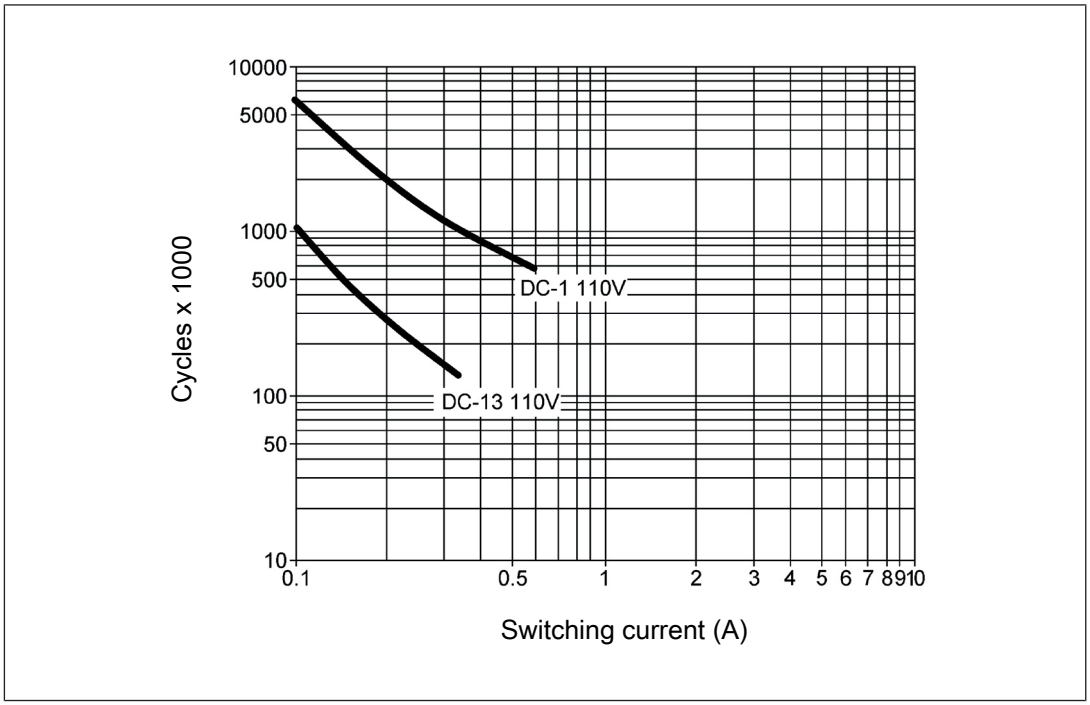


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 667]) 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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZsigma
PNOZ s6

Unit types with U_B 48 – 240 VAC/DC

- U_B: 48 – 240 VAC/DC; Order no. 750136, 751136

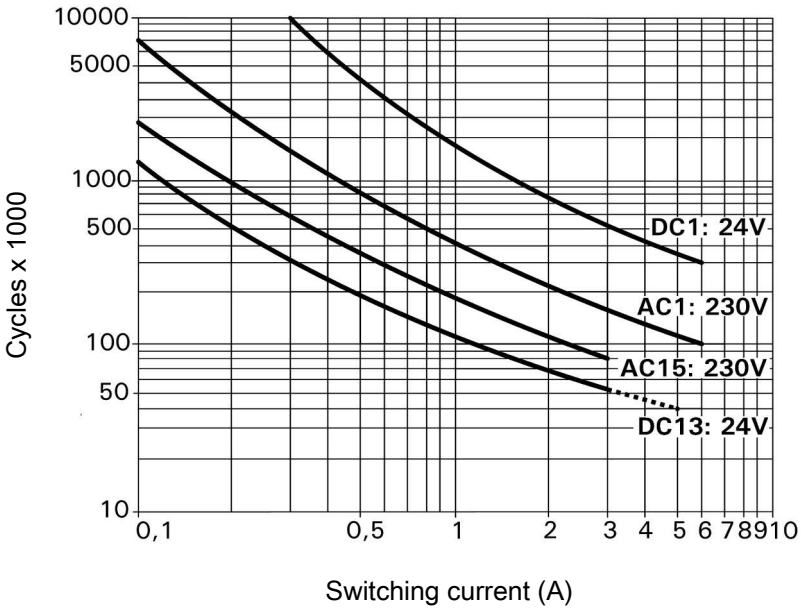


Fig.: Service life graphs at 24 VDC and 230 VAC

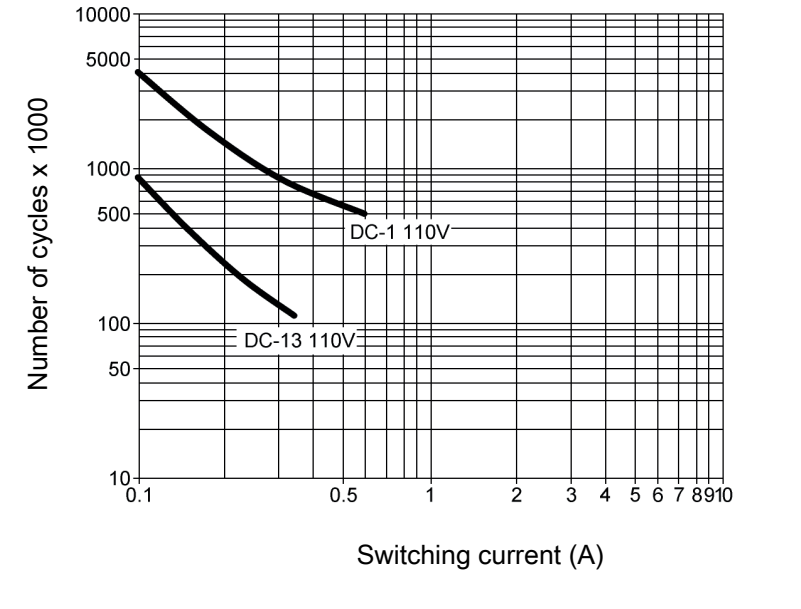


Fig.: Service life graphs at 110 VDC

Safety relays PNOZsigma
PNOZ s6

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [667]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order No.
PNOZ s6	24 VDC	Screw terminals	750 106
PNOZ s6 C	24 VDC	Spring-loaded terminals	751 106
PNOZ s6	48 - 240 VAC/DC	Screw terminals	750 136
PNOZ s6 C	48 - 240 VAC/DC	Spring-loaded terminals	751 136

Safety relays PNOZsigma
PNOZ s6.1

Unit features

- Positive-guided relay outputs:
  - 3 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- 1 semiconductor output
- Connection options for:
  - 2 control elements (pushbuttons)
  - Emergency stop pushbutton
  - Safety gate limit switches
- A connector can be used to connect 1 PNOZsigma contact expansion module
- LED for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Feedback loop
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s6.1

Block diagram/terminal configuration

Unit types with UB 24 VDC

- U_B: 24 VDC; Order no. 750126, 751126

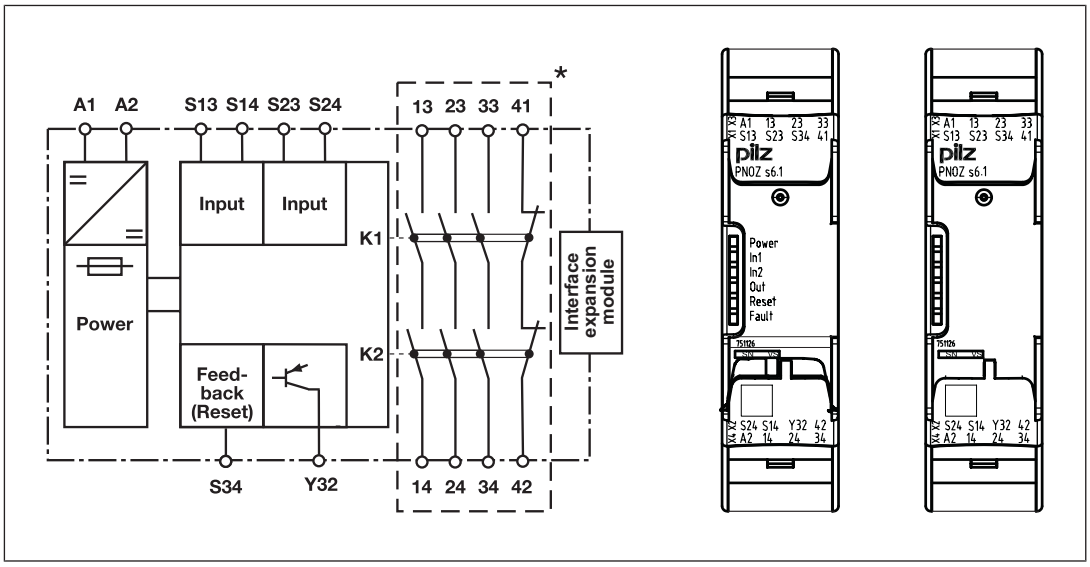


Fig.: Centre: Front view with cover, right: Front view without cover

*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Safety relays PNOZsigma
PNOZ s6.1

Unit types with UB 48 - 240 VAC/DC

- U_B: 48 - 240 VAC/DC; Order no. 750156, 751156

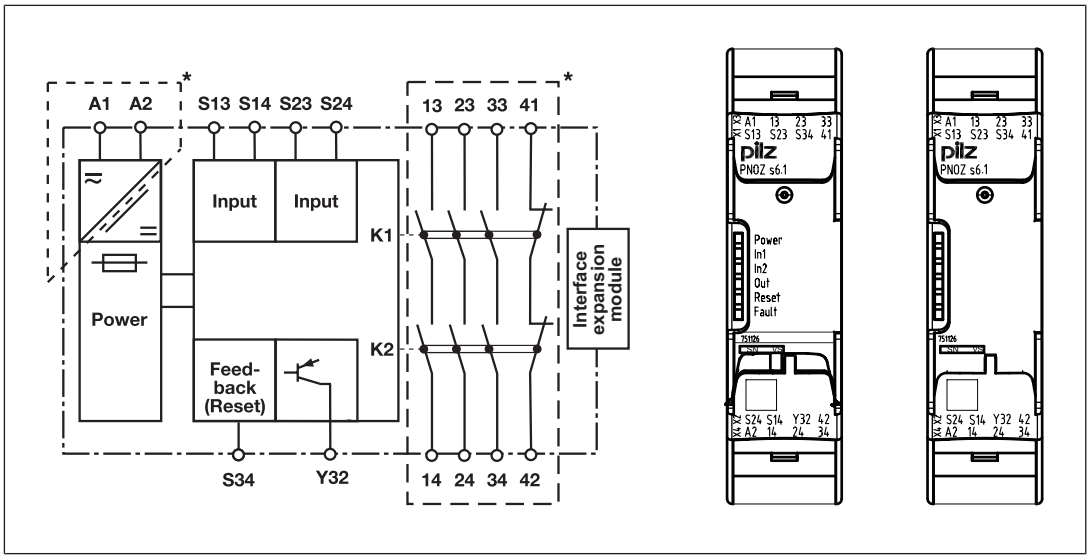


Fig.: Centre: Front view with cover, right: Front view without cover

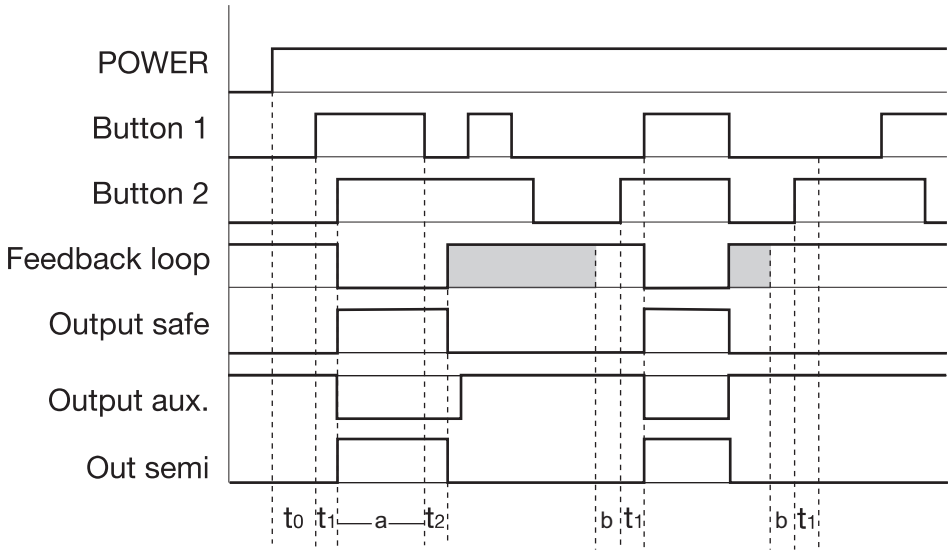
*Insulation between the non-marked area and the relay contacts: Basic insulation (overvoltage category III), Protective separation (overvoltage category II)

Function description

- The safety relay must be activated by simultaneously pressing two control elements (pushbuttons) within 0,5 s . If one or both pushbuttons are released or the contacts open, the unit interrupts the control command for the hazardous movement.
- Reactivation: The output relays will not re-energise until both control elements have been released and re-operated simultaneously or the contacts have opened and then closed.

Safety relays PNOZsigma
PNOZ s6.1

Timing diagram



Legend

- POWER: Supply voltage
- Button 1/Button 2: Input circuits
- Feedback loop: Feedback loop
- Output safe: Safety outputs
- Output aux: Auxiliary contacts
- Out semi: Semiconductor output switch status
- t_0: Recovery time after power on
- t_1: Simultaneity, channel 1 and 2
- t_2: Delay-on de-energisation
- a: Operating cycle ended through button 1 or 2
- b: S34-S12 must be closed before before the button is operated

Shaded area: Status irrelevant

Safety relays PNOZsigma
PNOZ s6.1

Installation

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expansion module.
- Connect the base unit and the contact expansion module to the supplied connector before mounting the units to the DIN rail.

Installation in control cabinet

- 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the device upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 688]" must be followed.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 and semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 688]).
- Calculation of the max. cable length l_{max} in the input circuit:

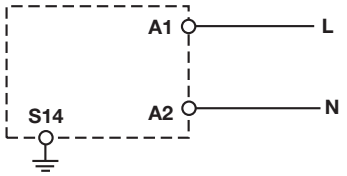
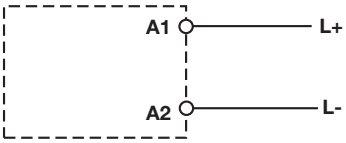
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

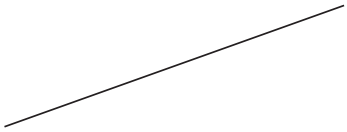
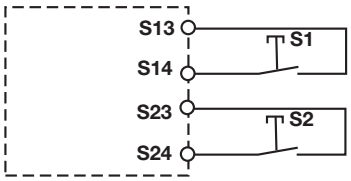
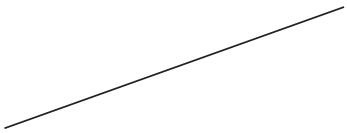
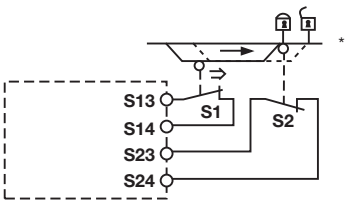
R_{lmax} = max. overall cable resistance (see Technical details [📖 688])
R_l / km = cable resistance/km

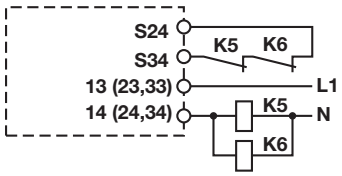
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- With U_B 48 – 240 VAC/DC: Connect S14 to functional earth.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- On 24 VDC devices:
  The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

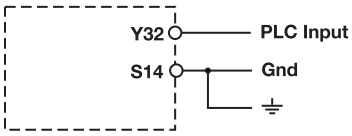
Safety relays PNOZsigma
PNOZ s6.1

Preparing for operation

Supply voltage	Unit types with U_B 48-240 VAC/DC	Unit types with U_B 240 VDC
		

Input circuit	Single-channel	Dual-channel
Two-hand button **with** detection of shorts across contacts		
Simultaneity monitoring in safety gate applications with automatic start after the safety gate is closed		

Feedback loop	with feedback loop monitoring	without feedback loop monitoring
Link or contacts from external contactors		

Semiconductor output


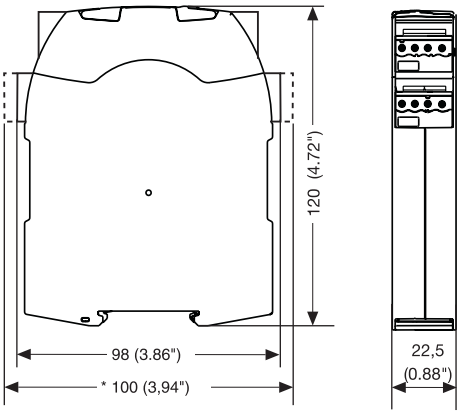
Legend

- S1/S2: Two-hand pushbuttons

Safety relays PNOZsigma
PNOZ s6.1

Dimensions in mm

*with spring-loaded terminals



Technical details

Order no. 750123 – 750156

See below for more order numbers

General	750126	750156
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**750126**	**750156**
Supply voltage		
Voltage	**24 V**	**48 - 240 V**
Kind	**DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	**7 VA**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Frequency range AC	–	**50 - 60 Hz**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Current at		
Normally open contact	**20 mA**	**20 mA**
Max. overall cable resistance Rl-max per input circuit	**30 Ohm**	**30 Ohm**
External unit fuse protection F1 min.	**1 A**	**1 A**

Safety relays PNOZsigma
PNOZ s6.1

Electrical data	750126	750156
External unit fuse protection F1 max.	Max. conductor cross section	Max. conductor cross section
Two-hand control relay type		
In accordance with the standard	EN 574	EN 574
Type	III A	III A
Inputs	**750126**	**750156**
Number	2	2
Voltage at		
Input circuit DC	24 V	24 V
Feedback loop DC	24 V	24 V
Current at		
Feedback loop DC	15 mA	15 mA
Semiconductor outputs	**750126**	**750156**
Number	1	1
Voltage	24 V	24 V
Current	20 mA	20 mA
Relay outputs	**750126**	**750156**
Number of output contacts		
Safety contacts (N/O), instantaneous	3	3
Auxiliary contacts (N/C)	1	1
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts		
AC1 at	240 V	240 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	150 W	150 W

Safety relays PNOZsigma
PNOZ s6.1

Relay outputs	750126	750156
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**10 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**

Safety relays PNOZsigma
PNOZ s6.1

Relay outputs	750126	750156
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750126**	**750156**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	–	**6 A**
Conv. therm. current with 2 contacts	–	**6 A**
Conv. therm. current with 3 contacts	–	**4,5 A**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**4,5 A**
Times	**750126**	**750156**
Delay-on de-energisation (response time in accordance with EN 574)		
Normally open contact	**40 ms**	**40 ms**
N/C	**50 ms**	**50 ms**
Recovery time	**250 ms**	**250 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**0,5 s**	**0,5 s**
Environmental data	**750126**	**750156**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**

Safety relays PNOZsigma
PNOZ s6.1

Environmental data	750126	750156
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750126**	**750156**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Screw terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	**0,25 - 2,5 mm², 24 - 12 AWG**
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	**0,25 - 1 mm², 24 - 16 AWG**
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	**0,2 - 1,5 mm², 24 - 16 AWG**
Torque setting with screw terminals	**0,5 Nm**	**0,5 Nm**

Safety relays PNOZsigma
PNOZ s6.1

Mechanical data	750126	750156
Dimensions		
Height	**98 mm**	**98 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**185 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Order no. 751126 – 751156

General	751126	751156
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**751126**	**751156**
Supply voltage		
Voltage	**24 V**	**48 - 240 V**
Kind	**DC**	**AC/DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (AC)	–	**7 VA**
Output of external power supply (DC)	**3,5 W**	**3,5 W**
Frequency range AC	–	**50 - 60 Hz**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Current at		
Normally open contact	**20 mA**	**20 mA**
Max. overall cable resistance Rl-max per input circuit	**30 Ohm**	**30 Ohm**
External unit fuse protection F1 min.	**1 A**	**1 A**
External unit fuse protection F1 max.	**Max. conductor cross section**	**Max. conductor cross section**
Two-hand control relay type		
In accordance with the standard	**EN 574**	**EN 574**
Type	**III A**	**III A**
Inputs	**751126**	**751156**
Number	**2**	**2**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Feedback loop DC	**24 V**	**24 V**

Safety relays PNOZsigma
PNOZ s6.1

Inputs	751126	751156
Current at		
Feedback loop DC	**15 mA**	**15 mA**
Semiconductor outputs	**751126**	**751156**
Number	**1**	**1**
Voltage	**24 V**	**24 V**
Current	**20 mA**	**20 mA**
Relay outputs	**751126**	**751156**
Number of output contacts		
Safety contacts (N/O), instantaneous	**3**	**3**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**

Safety relays PNOZsigma
PNOZ s6.1

Relay outputs	751126	751156
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**10 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**66 A²s**
Blow-out fuse, quick	**10 A**	**6 A**
Blow-out fuse, slow	**6 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**751126**	**751156**
Ith per contact at UB AC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	–	**6 A**
Conv. therm. current with 2 contacts	–	**6 A**
Conv. therm. current with 3 contacts	–	**4,5 A**

Safety relays PNOZsigma
PNOZ s6.1

Conventional thermal current while loading several contacts	751126	751156
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**4,5 A**
Times	**751126**	**751156**
Delay-on de-energisation (response time in accordance with EN 574)		
Normally open contact	**40 ms**	**40 ms**
N/C	**50 ms**	**50 ms**
Recovery time	**250 ms**	**250 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Simultaneity, channel 1 and 2 max.	**0,5 s**	**0,5 s**
Environmental data	**751126**	**751156**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**

Safety relays PNOZsigma
PNOZ s6.1

Environmental data	751126	751156
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**751126**	**751156**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	**2**	**2**
Stripping length with spring-loaded terminals	**9 mm**	**9 mm**
Dimensions		
Height	**100 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**185 g**	**205 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s6.1

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
E-STOP/ safety gate function	**PL e**	**Cat. 4**	**SIL CL 3**	**2,62E-09**	**SIL 3**	**3,32E-05**	**20**
Two-hand function	**PL c**	**Cat. 1**	**SIL CL 1**	**5,99E-08**	**SIL 1**	**5,10E-03**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s6.1

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.

Unit types with U_B 240 VDC

- U_B: 24 VDC; Order no. 750126, 751126

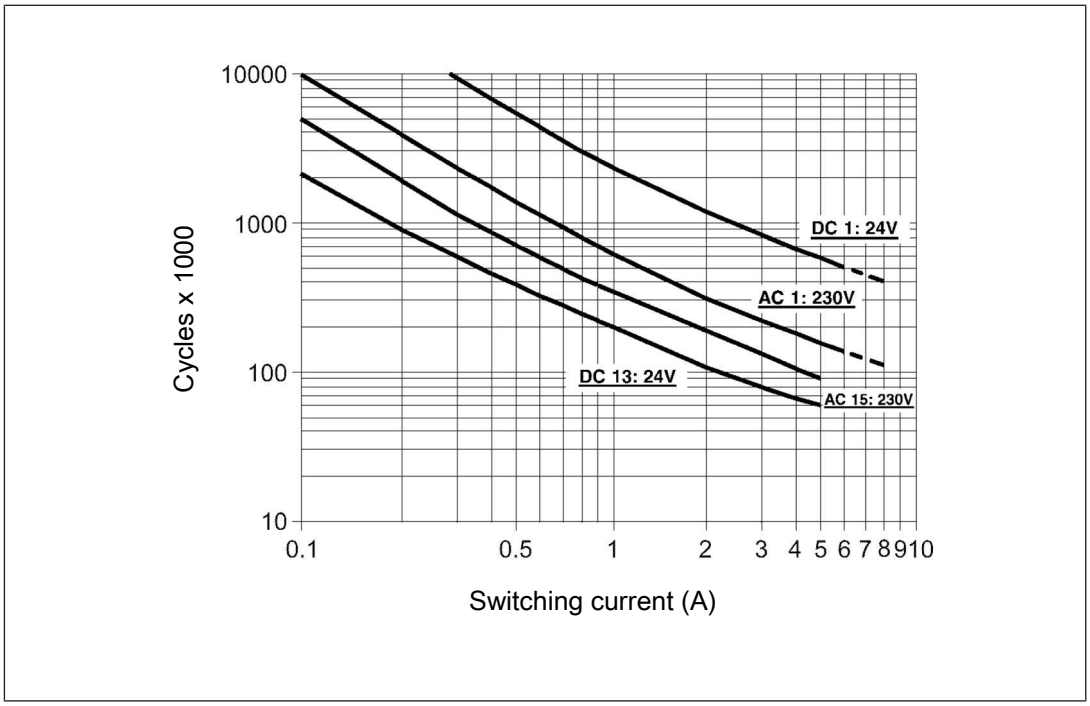


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma
PNOZ s6.1

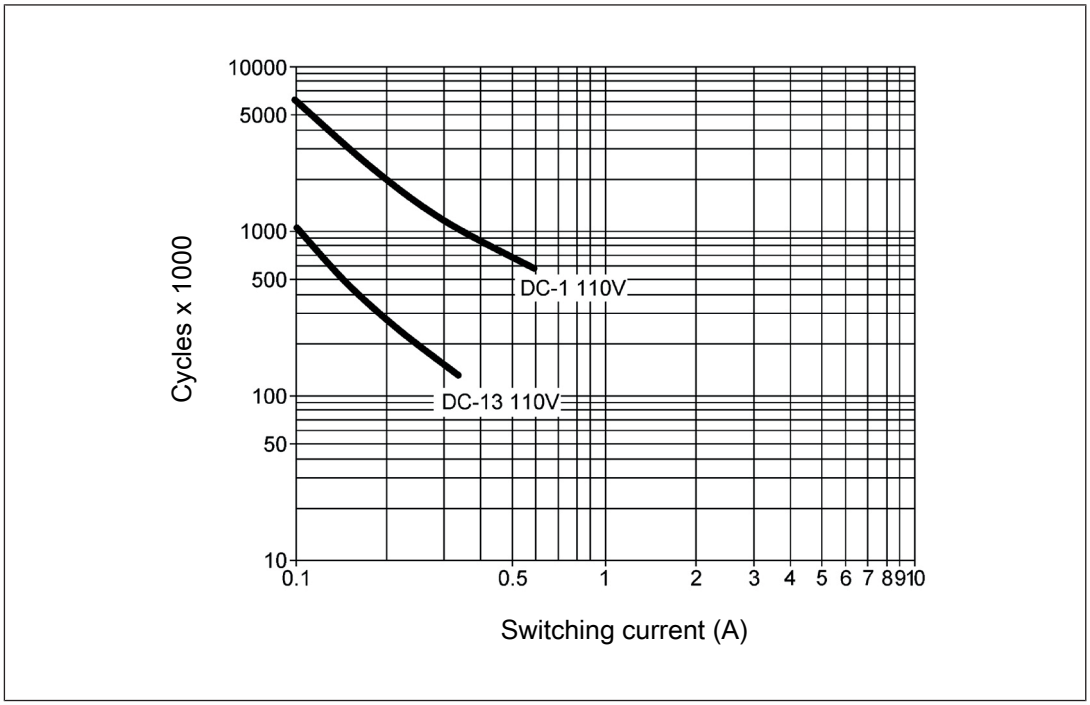


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 688]) 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 DC contactors, use flywheel diodes for spark suppression.

Safety relays PNOZsigma
PNOZ s6.1

Unit types with U_B 48 – 240 VAC/DC

- U_B: 48 – 240 VAC/DC; Order no. 750156, 751156

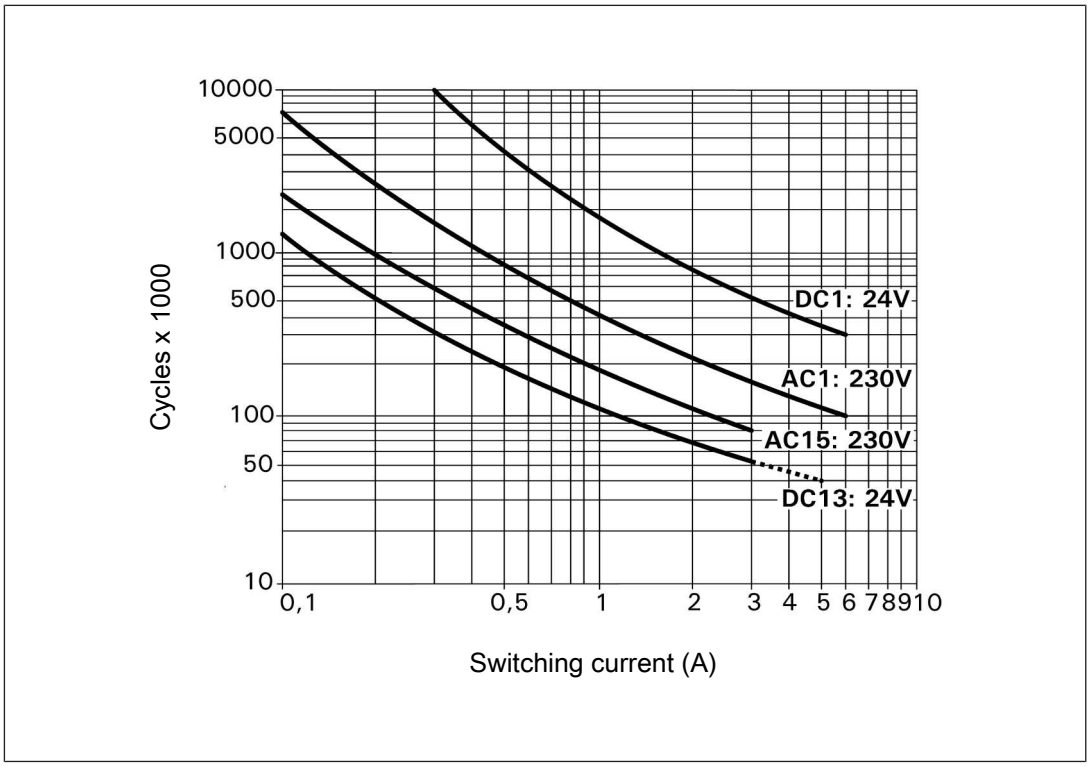


Fig.: Service life graphs at 24 VDC and 230 VAC

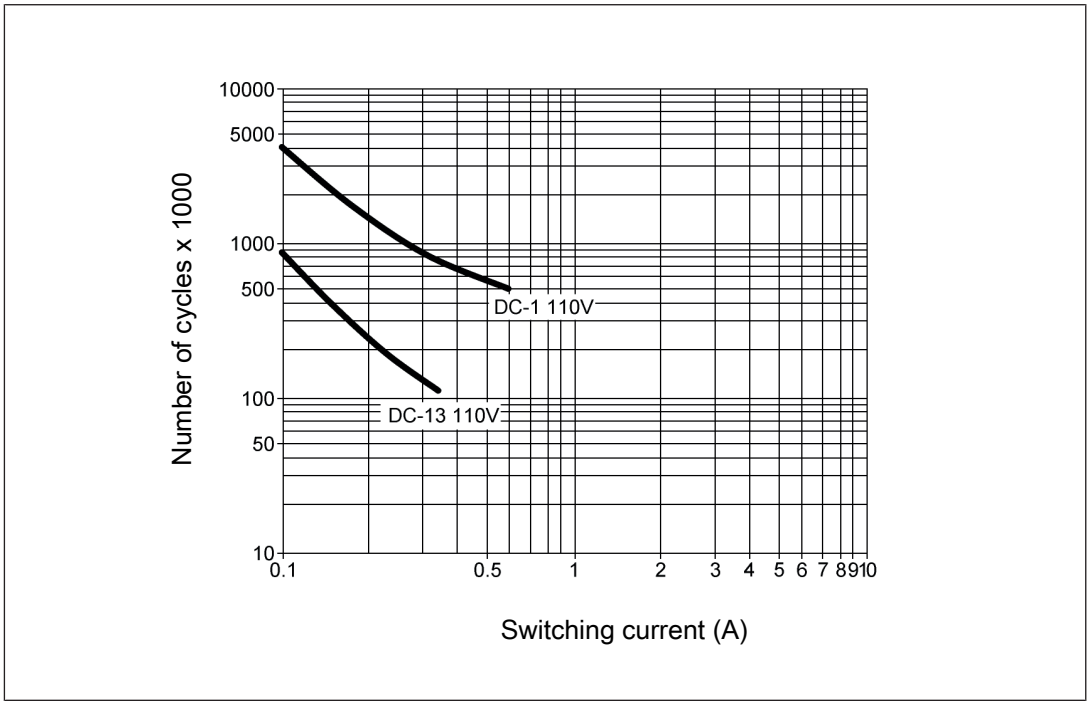


Fig.: Service life graphs at 110 VDC

Safety relays PNOZsigma
PNOZ s6.1

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [688]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order No.
PNOZ s6.1	24 VDC	Screw terminals	750 126
PNOZ s6.1 C	24 VDC	Spring-loaded terminals	751 126
PNOZ s6.1	48 - 240 VAC/DC	Screw terminals	750 156
PNOZ s6.1 C	48 - 240 VAC/DC	Spring-loaded terminals	751 156

Safety relays PNOZsigma
PNOZ s7

Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- LED for:
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s7

Block diagram/terminal configuration

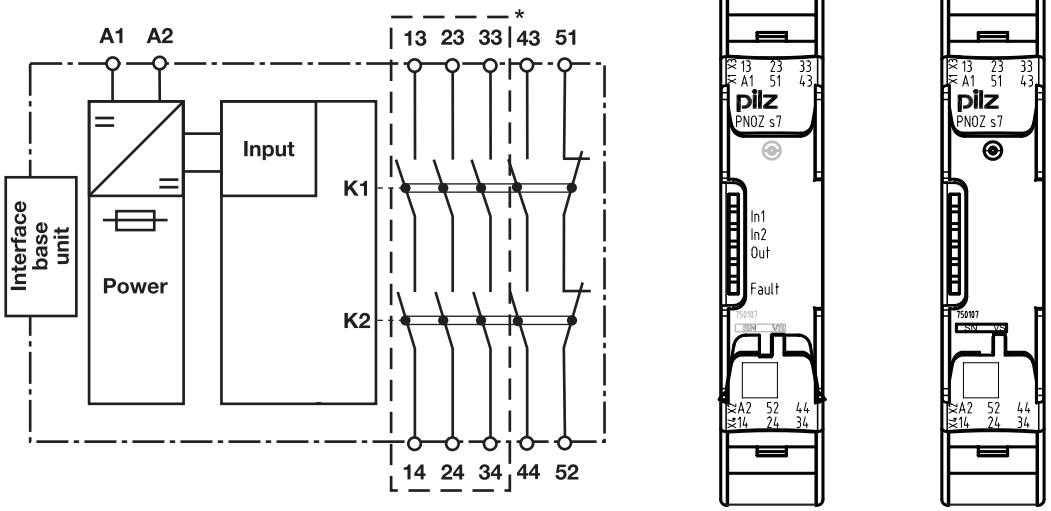


Fig.: Centre: Front view with cover, right: Front view without cover

*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

with PNOZsigma base unit:

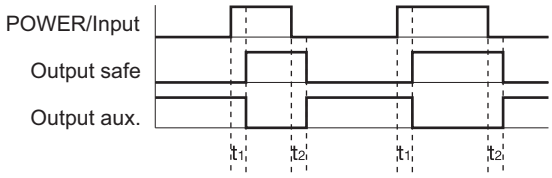
- Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

- Single-channel operation: one input circuit affects the output relays

Safety relays PNOZsigma
PNOZ s7

Timing diagram



Legend

- POWER/Input: Supply voltage/input circuit
- Output safe: Safety contacts
- Output aux.: Auxiliary contacts
- t_1: Switch-on delay
- t_2: Delay-on de-energisation

Installation

Install contact expansion module without base unit:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expander module
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

Control cabinet 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the unit upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s7

Wiring

Please note:

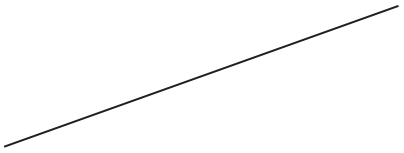
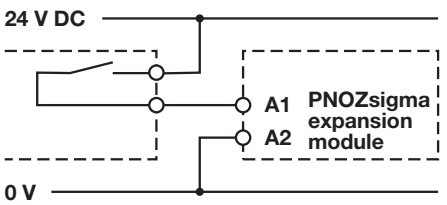
- Information given in the "Technical details [📖 708]" must be followed.
- Outputs 13-14, 23-24, 33-34, 43-44 are safety contacts; outputs 51 -52 are auxiliary contacts (e.g. for display).
- Auxiliary contact 51-52 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 708]).
- Calculation of the max. cable length l_{max} in the input circuit:

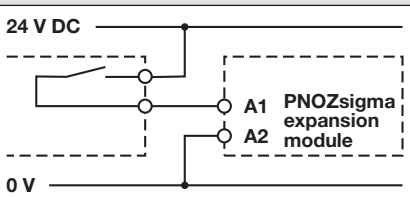
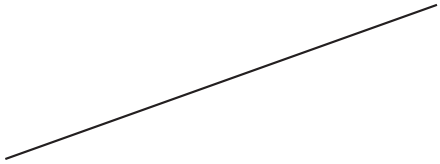
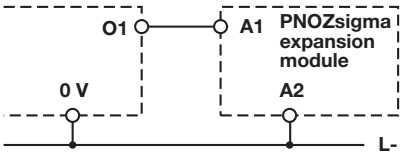
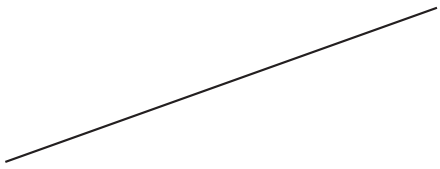
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

R_{lmax} = max. overall cable resistance (see Technical details [📖 708])
R_l / km = cable resistance/km

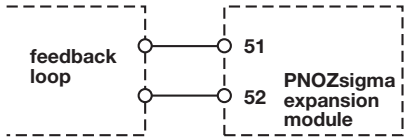
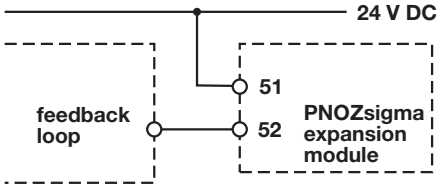
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

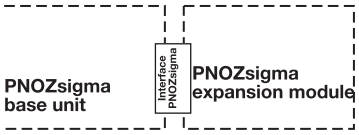
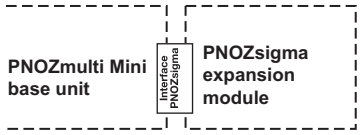
Preparing for operation

Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

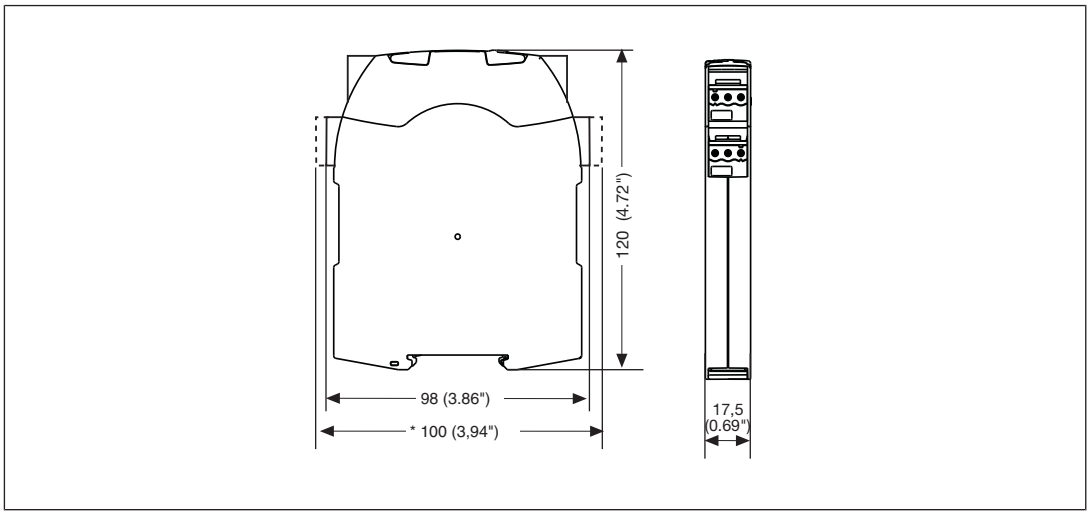
Safety relays PNOZsigma
PNOZ s7

Feedback loop	Base unit: Safety relay PNOZ X	Base unit: Safety relay PNOZelog
The inputs that evaluate the feedback loop will depend on the base unit and application		

Connection to PNOZsigma base unit/PNOZmulti Mini base unit	Base unit: Safety relay PNOZsigma	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s7

Technical details

General	750107	751107	751187
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750107**	**751107**	**751187**
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	2 W	2 W	2 W
Residual ripple DC	20 %	20 %	20 %
Duty cycle	100 %	100 %	100 %
Inputs	**750107**	**751107**	**751187**
Number	1	1	1
Voltage at			
Input circuit DC	24 V	24 V	24 V
Current at			
Input circuit DC	70 mA	70 mA	70 mA
Max. inrush current impulse			
Current pulse, input circuit	2,7 A	2,7 A	2,7 A
Pulse duration, input circuit	0,1 ms	0,1 ms	0,1 ms
Max. overall cable resistance RImax			
Single-channel at UB DC	30 Ohm	30 Ohm	30 Ohm
Relay outputs	**750107**	**751107**	**751187**
Number of output contacts			
Safety contacts (N/O), instantaneous	4	4	4
Auxiliary contacts (N/C)	1	1	1
Max. short circuit current IK	1 kA	1 kA	1 kA
Utilisation category			
In accordance with the standard	EN 60947-4-1	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZsigma
PNOZ s7

Relay outputs	750107	751107	751187
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**	**2 A**
Max. power	**500 VA**	**500 VA**	**500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**	**2 A**
Max. power	**50 W**	**50 W**	**50 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**5 A**	**5 A**	**5 A**
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**2 A**	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**2 A**	**2 A**	**2 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**

Safety relays PNOZsigma
PNOZ s7

Relay outputs	750107	751107	751187
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**160 A²s**	**160 A²s**	**160 A²s**
Blow-out fuse, quick	**4 A**	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**	**4 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**2 A**	**2 A**	**2 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750107**	**751107**	**751187**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V			
Conv. therm. current with 1 contact	**6 A**	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5,5 A**	**5,5 A**	**5,5 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**4 A**	**4 A**	**4 A**
Times	**750107**	**751107**	**751187**
Switch-on delay			
With automatic start after power on typ.	**30 ms**	**30 ms**	**30 ms**
With automatic start after power on max.	**50 ms**	**50 ms**	**50 ms**

Safety relays PNOZsigma
PNOZ s7

Times	750107	751107	751187
Delay-on de-energisation			
With E-STOP typ.	**18 ms**	**18 ms**	**18 ms**
With E-STOP max.	**30 ms**	**30 ms**	**30 ms**
With power failure typ.	**18 ms**	**18 ms**	**18 ms**
With power failure max.	**30 ms**	**30 ms**	**30 ms**
Environmental data	**750107**	**751107**	**751187**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**	**III**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**	**6 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP20**	**IP20**	**IP20**
Mechanical data	**750107**	**751107**	**751187**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZsigma
PNOZ s7

Mechanical data	750107	751107	751187
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Top	**PC**	**PC**	**PC**
Connection type	**Screw terminal**	**Cage clamp terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,5 Nm**	–	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**	**2**
Stripping length with spring-loaded terminals	–	**9 mm**	**9 mm**
Dimensions			
Height	**98 mm**	**100 mm**	**100 mm**
Width	**17,5 mm**	**17,5 mm**	**17,5 mm**
Depth	**120 mm**	**120 mm**	**120 mm**
Weight	**170 g**	**170 g**	**170 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s7

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s7

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.

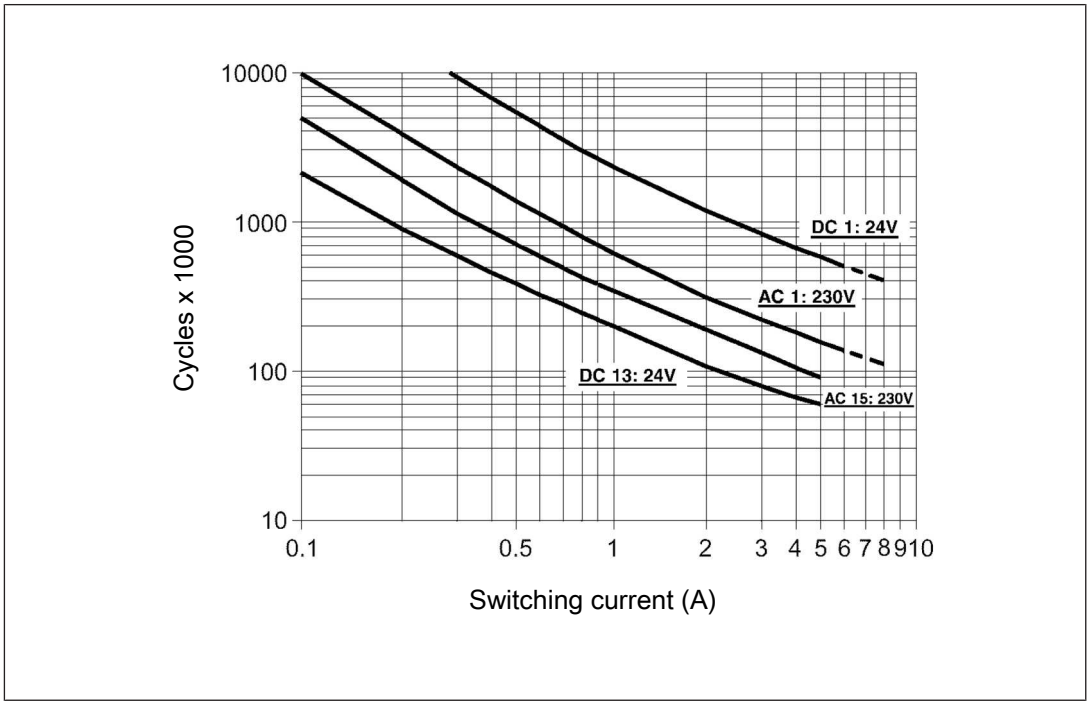


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s7

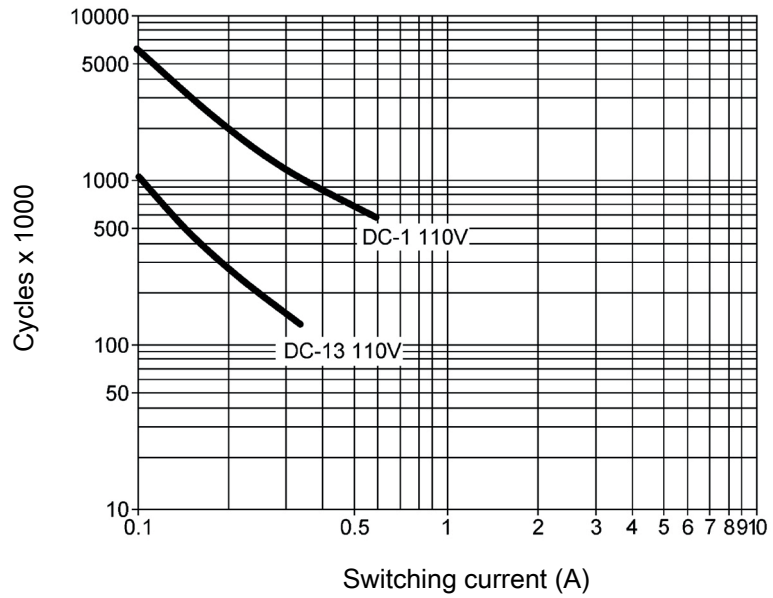


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

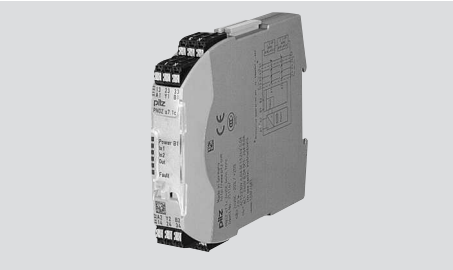
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 708]) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Terminals	Order No.
PNOZ s7	24 VDC	Screw terminals	750 107
PNOZ s7 C	24 VDC	Spring-loaded terminals	751 107
PNOZ s7 C (coated version)	24 VDC	Spring-loaded terminals	751 187

Safety relays PNOZsigma
PNOZ s7.1



Unit features

- Relay outputs:
  - 3 safety contacts (N/O), instantaneous
- Supply voltage for expansion modules
- LED for:
  - Supply voltage at B1 and B2
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s7.1

Block diagram/terminal configuration

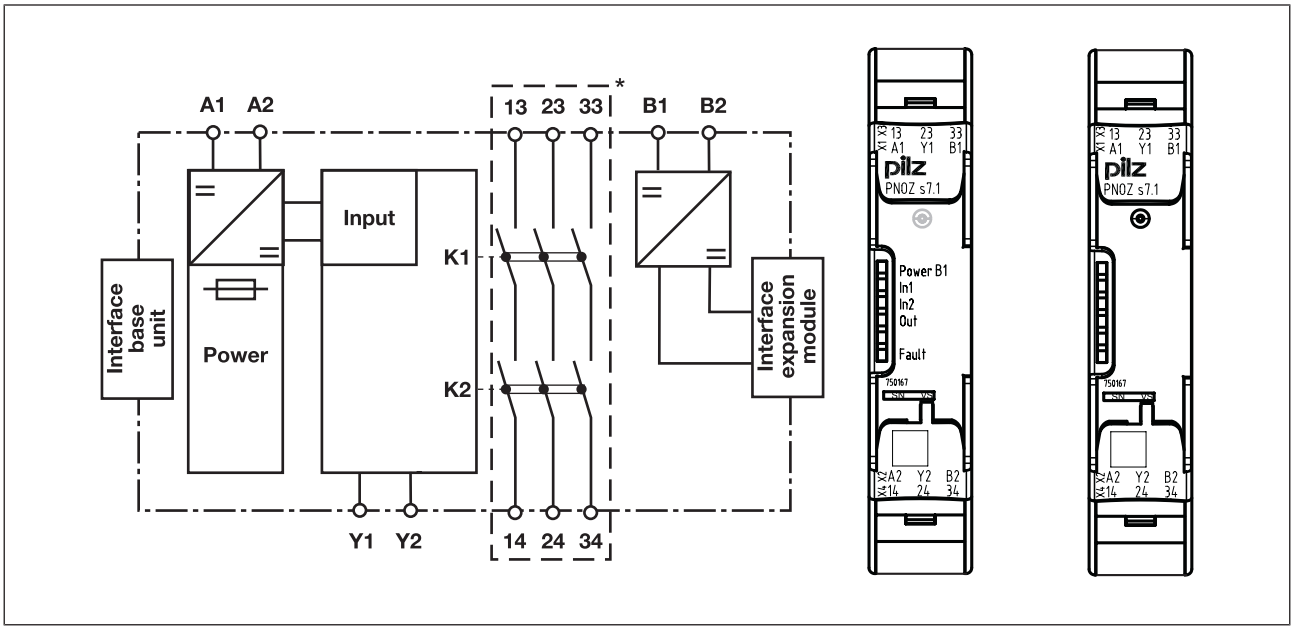


Fig.: Centre: Front view with cover, right: Front view without cover

*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

with PNOZsigma base unit:

- Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

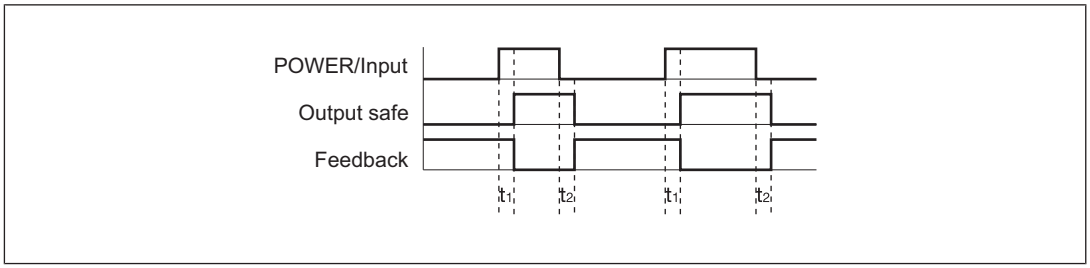
- Single-channel operation: one input circuit affects the output relays
- Connection for base unit

with PNOZsigma s7.2 expansion modules:

- Dual-channel operation and supply voltage via PNOZsigma connector

Safety relays PNOZsigma
PNOZ s7.1

Timing diagram



Legend

- POWER/Input: Supply voltage/Input
- Output safe: Safety contacts
- Feedback: Feedback loop
- t_1: Switch-on delay
- t_2: Delay-on de-energisation

Installation

Install contact expansion module without base unit:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and contact expansion module PNOZ s7.1:

- Remove the plug terminator at the side of the base unit and at the left of the contact expansion module
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

Connect contact expansion module PNOZ s7.1 to PNOZsigma contact expansion modules

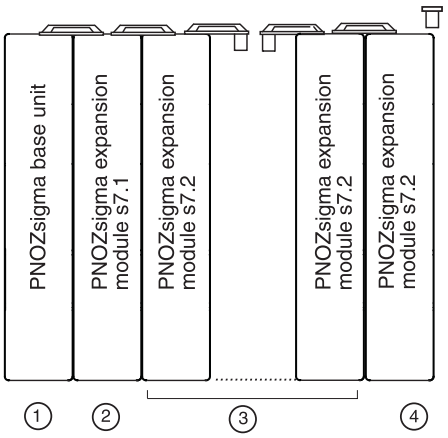
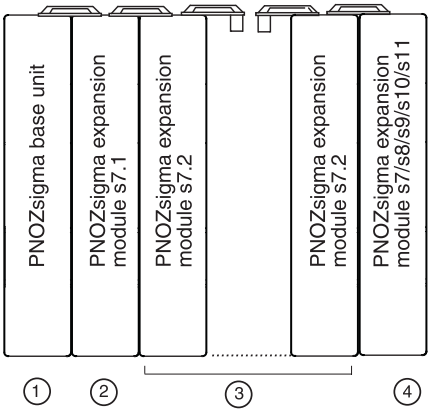
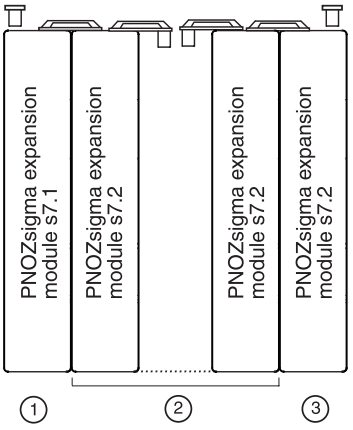
- Connect the contact expansion modules using the connector supplied.

Control cabinet installation

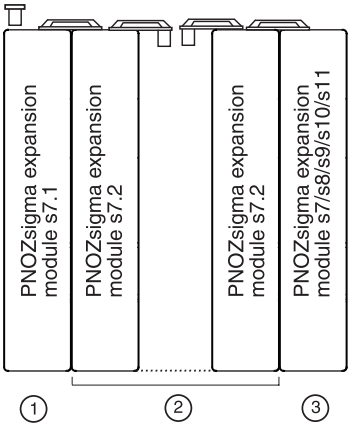
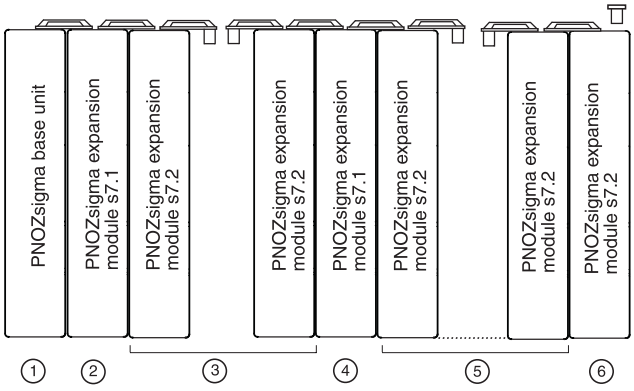
- The safety relay should be installed in a control cabinet with a protection type of at least IP54.
- Use the notch on the rear of the unit to attach it to a DIN rail (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).

Push the unit upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s7.1

Expansion options	Please note the max. power consumption of the contact expansion modules (see technical data PNOZ s7.1).
①: Base unit ②: Contact expansion module PNOZ s7.1 ③: Contact expansion module PNOZ s7.2 ④: Contact expansion module PNOZ s7.2 with terminator	
①: Base unit ②: Contact expansion module PNOZ s7.1 ③: Contact expansion module PNOZ s7.2 ④: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator	
①: Contact expansion module PNOZ s7.1 with terminator ②: Contact expansion module PNOZ s7.2 ③: Contact expansion module PNOZ s7.2 with terminator	

Safety relays PNOZsigma
PNOZ s7.1

Expansion options	Please note the max. power consumption of the contact expansion modules (see technical data PNOZ s7.1).
①: Contact expansion module PNOZ s7.1 with terminator ②: Contact expansion module PNOZ s7.2 ③: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator	
①: Base unit ②: Contact expansion module PNOZ s7.1 ③: Contact expansion module PNOZ s7.2 ④: Contact expansion module PNOZ s7.1 ⑤: Contact expansion module PNOZ s7.2 ⑥: Contact expansion module PNOZ s7.2 with terminator	

Wiring

Please note:

- Information given in the "Technical details [📖 723]" must be followed.
- The output contacts 13-14, 23-24, 33-34 are safety contacts.
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 723]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

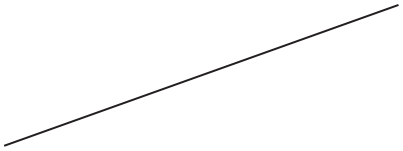
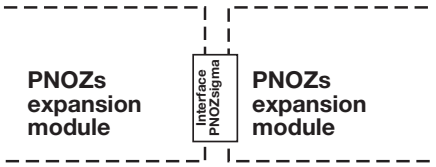
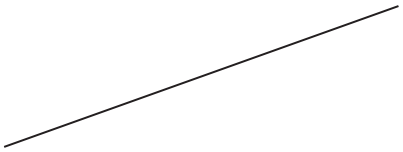
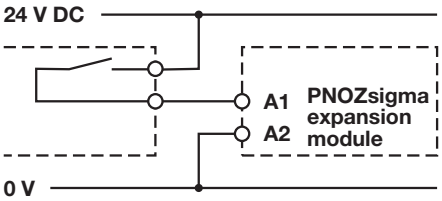
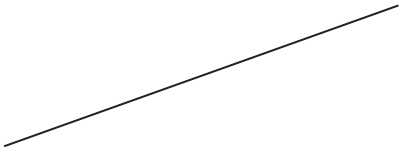
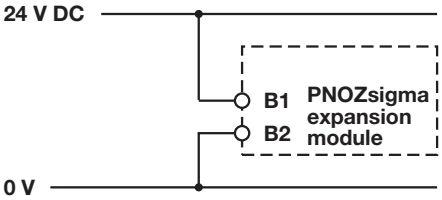
R_{lmax} = max. overall cable resistance (see Technical details [📖 723])
R_l / km = cable resistance/km

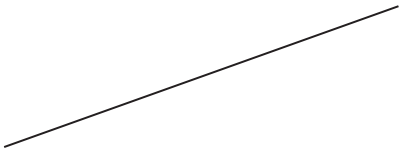
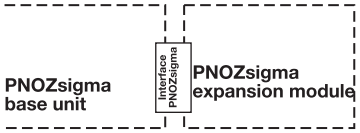
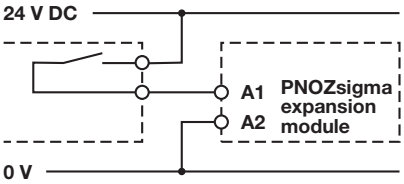
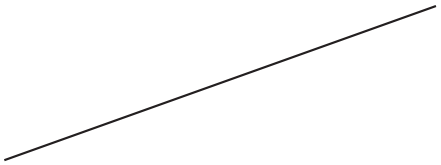
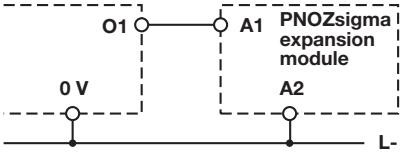
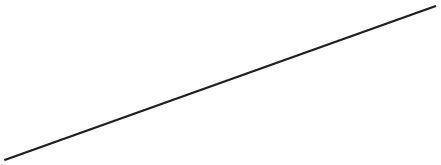
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

Safety relays PNOZsigma
PNOZ s7.1

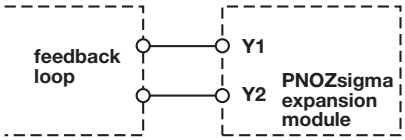
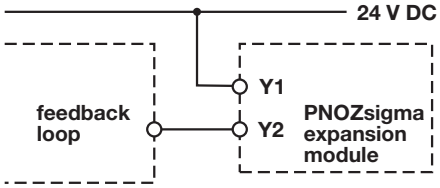
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

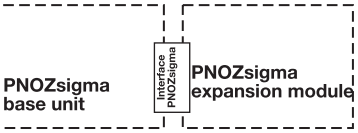
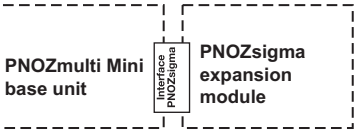
Preparing for operation

Supply voltage	AC	DC
Base unit: Safety relay PNOZsigma		
Base unit: Safety relay PNOZ X		
Supply voltage for expansion modules PNOZsigma		

Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZsigma		
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog driven via semiconductor outputs (24 VDC)		

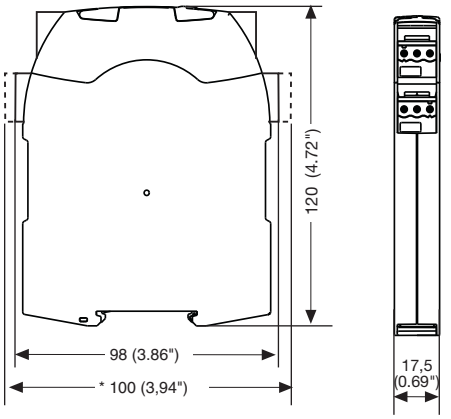
Safety relays PNOZsigma
PNOZ s7.1

Start circuit/feedback loop	Base unit: Safety relay PNOZ X	Base unit: Safety relay PNOZelog
The inputs that evaluate the feedback loop will depend on the base unit and application		

Connection to PNOZsigma base unit/PNOZmulti Mini base unit	Base unit: Safety relay PNOZsigma	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s7.1

Technical details

General	750167	751167
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**750167**	**751167**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	2 W	2 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Max. power of all expansion modules	20 W	20 W
Inputs	**750167**	**751167**
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	70 mA	70 mA
Max. inrush current impulse		
Current pulse, input circuit	2 A	2 A
Pulse duration, input circuit	0,1 ms	0,1 ms
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Relay outputs	**750167**	**751167**
Number of output contacts		
Safety contacts (N/O), instantaneous	3	3
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZsigma
PNOZ s7.1

Relay outputs	750167	751167
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZsigma
PNOZ s7.1

Conventional thermal current while loading several contacts	750167	751167
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5,5 A**	**5,5 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Times	**750167**	**751167**
Switch-on delay		
With automatic start after power on typ.	**30 ms**	**30 ms**
With automatic start after power on max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**18 ms**	**18 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**18 ms**	**18 ms**
With power failure max.	**30 ms**	**30 ms**
Supply interruption before de-energisation	**5 ms**	**5 ms**
Environmental data	**750167**	**751167**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**

Safety relays PNOZsigma
PNOZ s7.1

Environmental data	750167	751167
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750167**	**751167**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**17,5 mm**	**17,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**170 g**	**170 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s7.1

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s7.1

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.

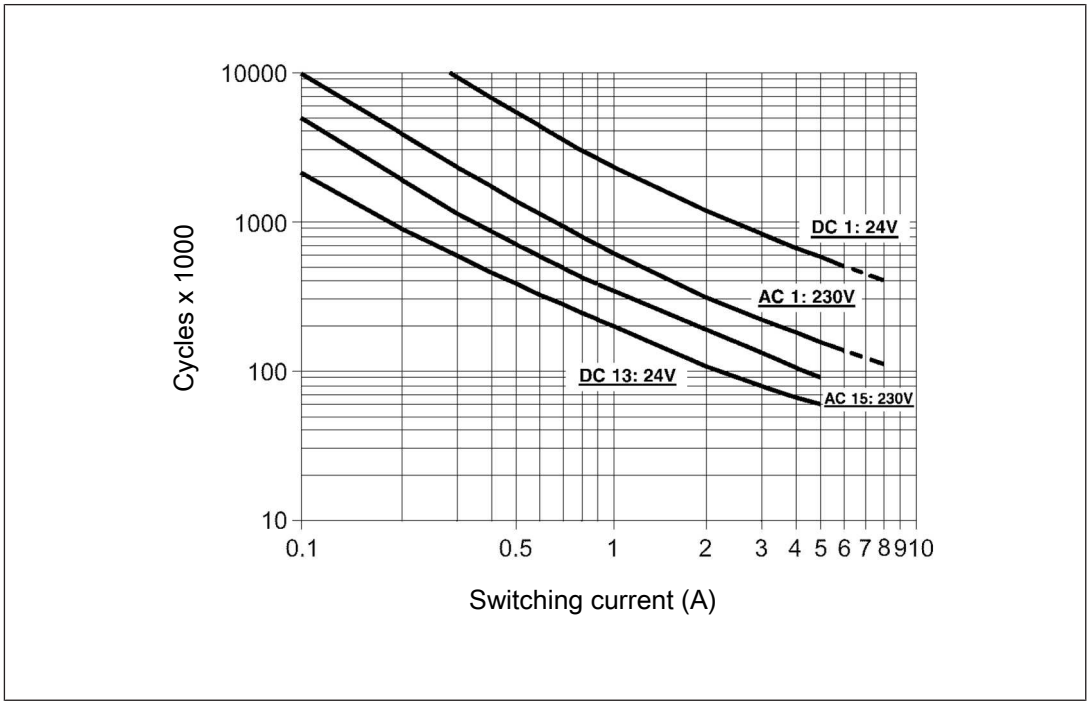


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s7.1

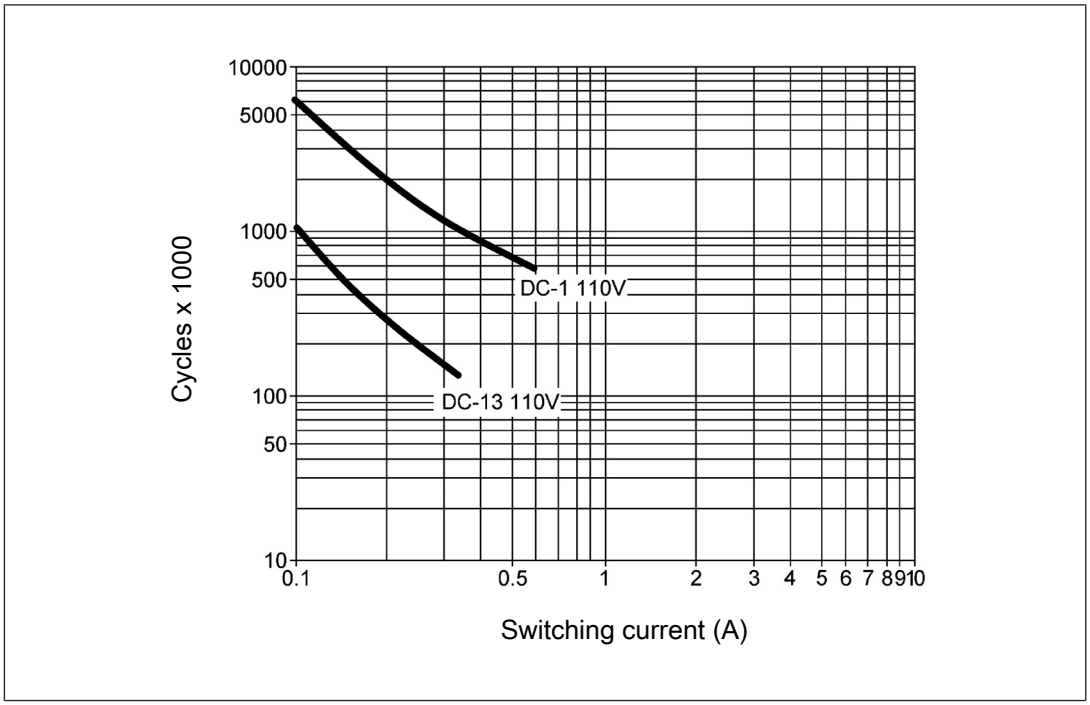


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

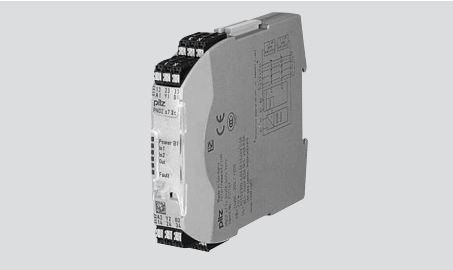
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 723]) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order No.
PNOZ s7.1	24 VDC	Screw terminals	750 167
PNOZ s7.1 C	24 VDC	Spring-loaded terminals	751 167

Safety relays PNOZsigma
PNOZ s7.2



Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- Connection option for expansion modules
- LED for:
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s7.2

Block diagram/terminal configuration

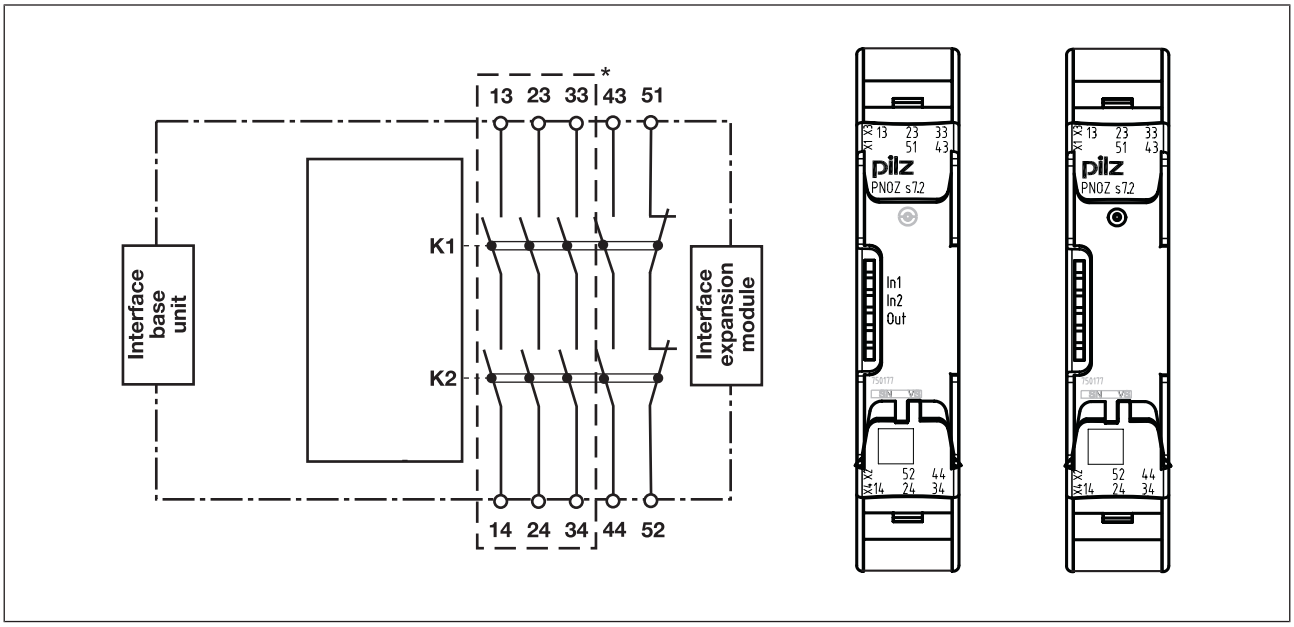


Fig.: Centre: Front view with cover, right: Front view without cover

*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

with PNOZsigma s7.1:

- Dual-channel operation and supply voltage via PNOZsigma connector

with PNOZsigma expander modules:

- Dual-channel operation and supply voltage via PNOZsigma connector

Installation

Connect contact expansion module PNOZ s7.2 to PNOZsigma contact expansion modules

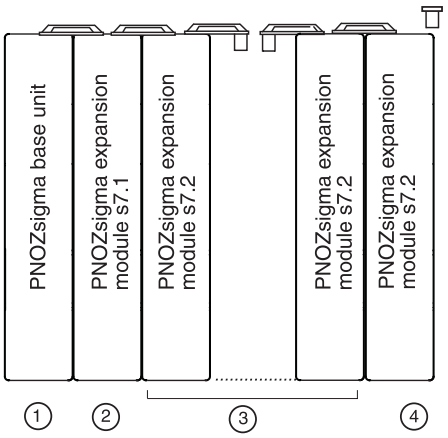
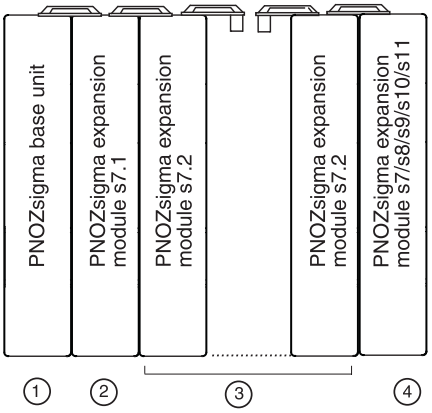
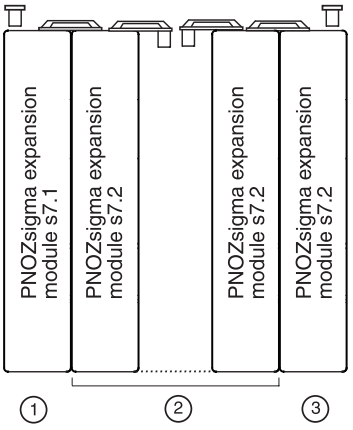
- Connect the contact expansion modules using the connector supplied.

Control cabinet installation

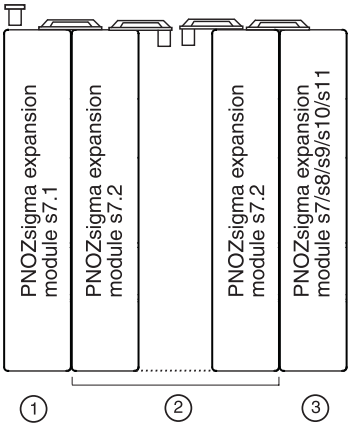
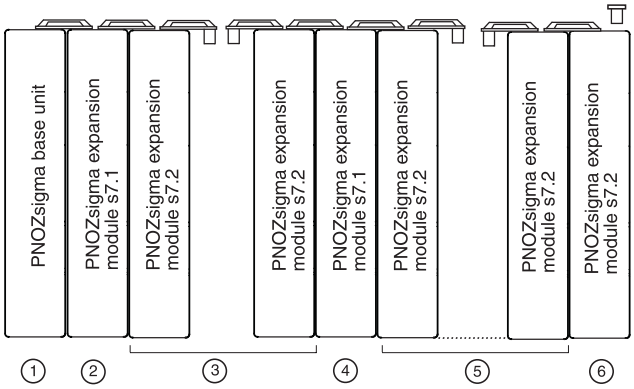
- The safety relay should be installed in a control cabinet with a protection type of at least IP54.
- Use the notch on the rear of the unit to attach it to a DIN rail.
- Ensure the unit is mounted securely on a vertical DIN rail (35 mm) by using a fixing element (e.g. retaining bracket or an end angle).

Push the unit upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s7.2

Expansion options	Please note the max. power consumption of the contact expansion modules (see technical data PNOZ s7.1).
①: Base unit ②: Contact expansion module PNOZ s7.1 ③: Contact expansion module PNOZ s7.2 ④: Contact expansion module PNOZ s7.2 with terminator	
①: Base unit ②: Contact expansion module PNOZ s7.1 ③: Contact expansion module PNOZ s7.2 ④: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator	
①: Contact expansion module PNOZ s7.1 with terminator ②: Contact expansion module PNOZ s7.2 ③: Contact expansion module PNOZ s7.2 with terminator	

Safety relays PNOZsigma
PNOZ s7.2

Expansion options	Please note the max. power consumption of the contact expansion modules (see technical data PNOZ s7.1).
①: Contact expansion module PNOZ s7.1 with terminator ②: Contact expansion module PNOZ s7.2 ③: Expansion module PNOZ s7, s8, s9, s10, s11 as a terminator	
①: Base unit ②: Contact expansion module PNOZ s7.1 ③: Contact expansion module PNOZ s7.2 ④: Contact expansion module PNOZ s7.1 ⑤: Contact expansion module PNOZ s7.2 ⑥: Contact expansion module PNOZ s7.2 with terminator	

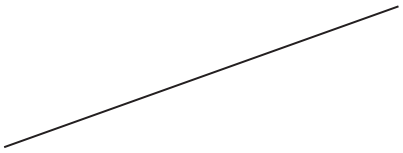
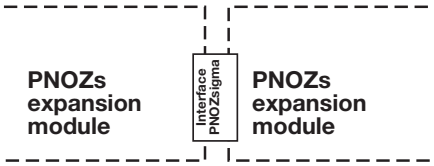
Wiring

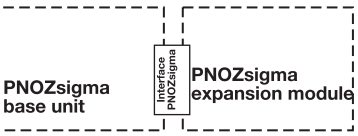
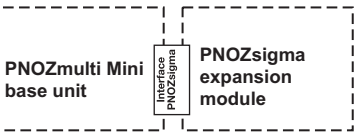
Please note:

- Information given in the "Technical details [📖 735]" must be followed.
- Outputs 13-14, 23-24, 33-34, 43-44 are safety contacts; outputs 51 -52 are auxiliary contacts (e.g. for display).
- Auxiliary contact 51-52 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 735]).
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

Safety relays PNOZsigma
PNOZ s7.2

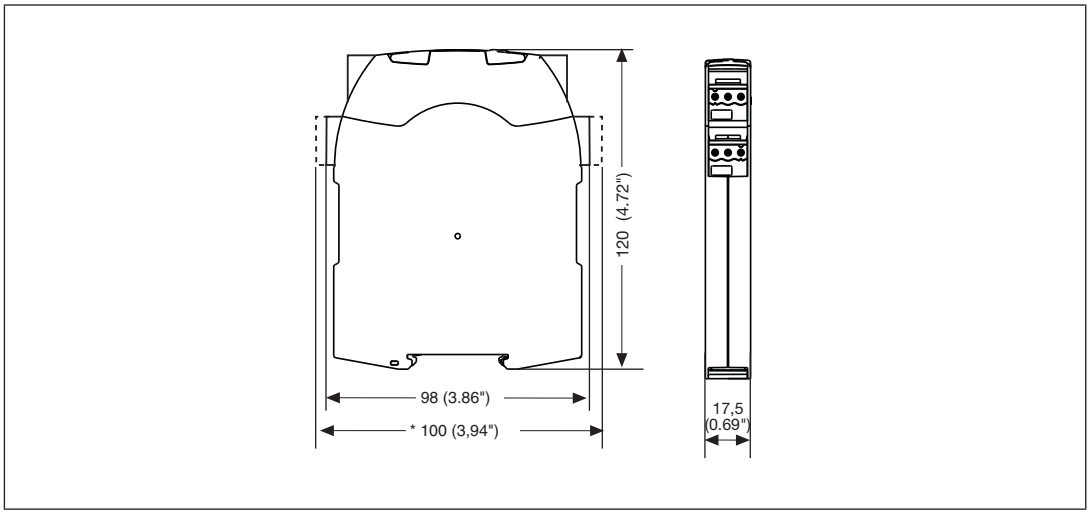
Preparing for operation

Supply voltage/input circuit/ feedback loop	AC	DC
Contact expansion module PNOZ s7.2		

Connection to PNOZsigma base unit/PNOZmulti Mini base unit	Base unit: Safety relay PNOZ-sigma	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s7.2

Technical details

General	750177	751177
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**750177**	**751177**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Power consumption	2 W	2 W
Duty cycle	100 %	100 %
Inputs	**750177**	**751177**
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Relay outputs	**750177**	**751177**
Number of output contacts		
Safety contacts (N/O), instantaneous	4	4
Auxiliary contacts (N/C)	1	1
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts		
AC1 at	240 V	240 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	150 W	150 W

Safety relays PNOZsigma
PNOZ s7.2

Relay outputs	750177	751177
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**500 VA**	**500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**50 W**	**50 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**

Safety relays PNOZsigma
PNOZ s7.2

Relay outputs	750177	751177
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**160 A²s**
Blow-out fuse, quick	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**2 A**	**2 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750177**	**751177**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5,5 A**	**5,5 A**
Conv. therm. current with 3 contacts	**4,5 A**	**4,5 A**
Conv. therm. current with 4 contacts	**4 A**	**4 A**
Times	**750177**	**751177**
Switch-on delay		
With automatic start after power on typ.	**30 ms**	**30 ms**
With automatic start after power on max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**18 ms**	**18 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**18 ms**	**18 ms**
With power failure max.	**30 ms**	**30 ms**
Environmental data	**750177**	**751177**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**

Safety relays PNOZsigma
PNOZ s7.2

Environmental data	750177	751177
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750177**	**751177**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**

Safety relays PNOZsigma
PNOZ s7.2

Mechanical data	750177	751177
Dimensions		
Height	**98 mm**	**100 mm**
Width	**17,5 mm**	**17,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**170 g**	**170 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s7.2

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.

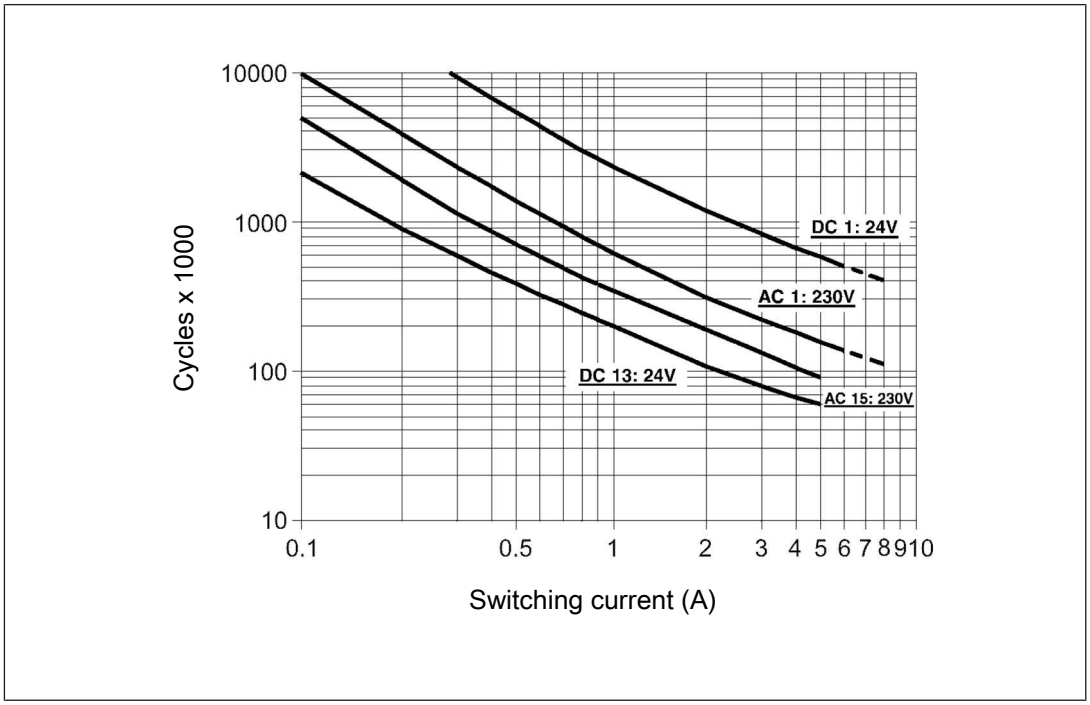


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s7.2

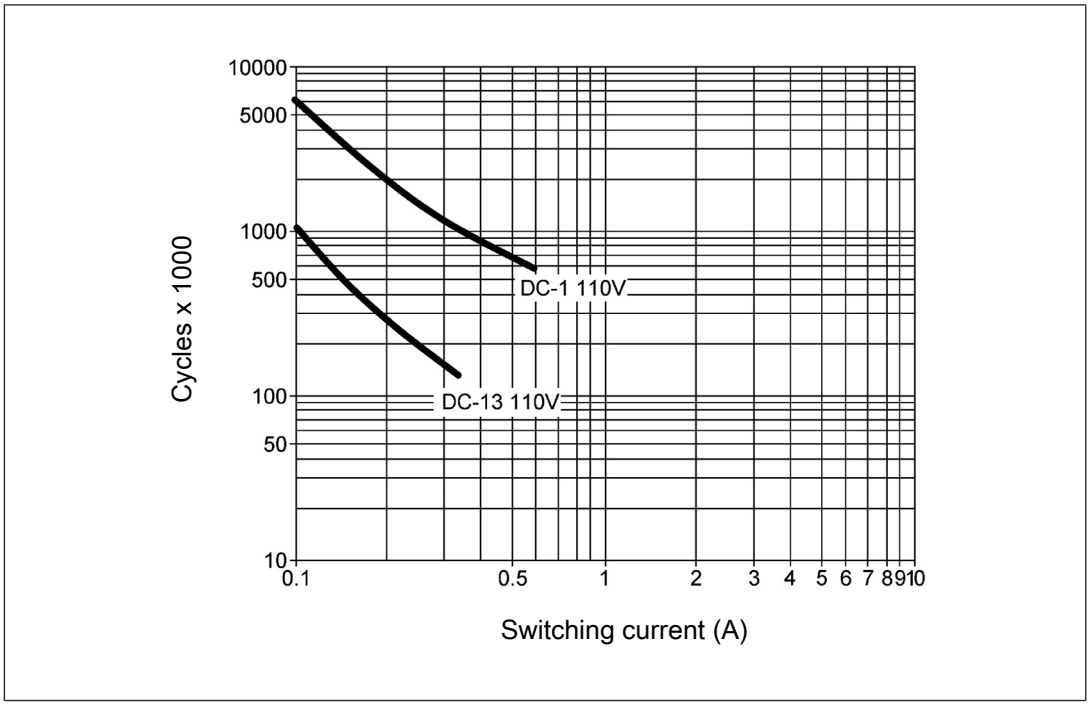


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

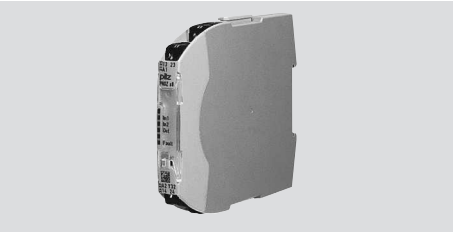
Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 735]) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order No.
PNOZ s7.2	24 VDC	Screw terminals	750 177
PNOZ s7.2 C	24 VDC	Spring-loaded terminals	751 177

Safety relays PNOZsigma
PNOZ s8



Unit features

- Relay outputs:
  - 2 safety contacts (N/O), instantaneous
- 1 semiconductor output
- LED for:
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s8

Block diagram/terminal configuration

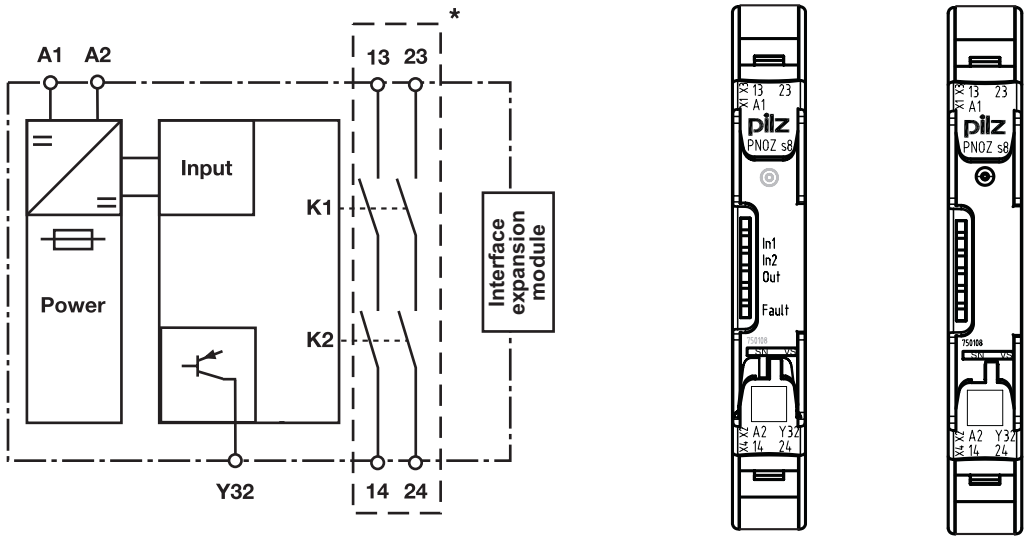


Fig.: Centre: Front view with cover, right: Front view without cover

*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

with PNOZsigma base unit:

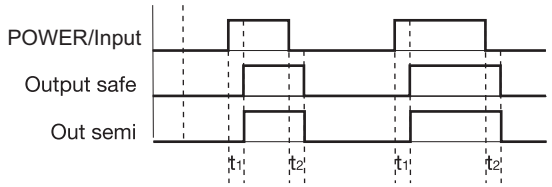
- Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

- Single-channel operation: one input circuit affects the output relays

Safety relays PNOZsigma
PNOZ s8

Timing diagram



Legend

- POWER/Input: Supply voltage/input
- Output safe: Safety contacts
- Out semi: Semiconductor output
- t_1: Switch-on delay
- t_2: Delay-on de-energisation

Installation

Install contact expansion module without base unit:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expander module
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

Control cabinet 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the unit upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s8

Wiring

Please note:

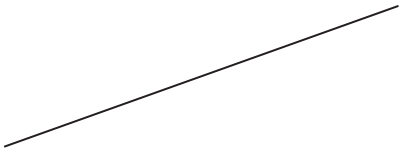
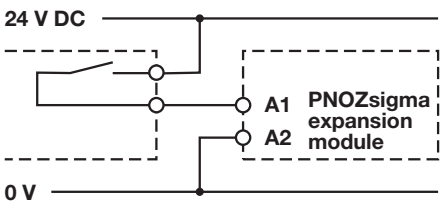
- Information given in the "Technical details [📖 747]" must be followed.
- Outputs 13-14 and 23-24 are safety contacts, the semiconductor output Y32 is an auxiliary output (e.g. for display).
- Semiconductor output Y32 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 747]).
- Calculation of the max. cable length l_{max} in the input circuit:

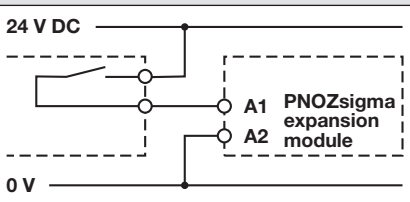
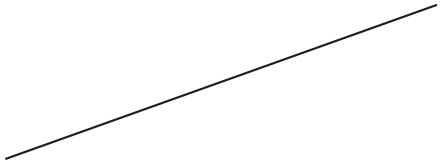
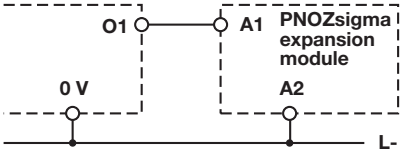
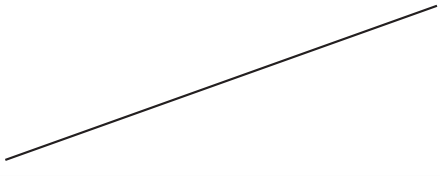
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

R_{lmax} = max. overall cable resistance (see Technical details [📖 747])
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.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Preparing for operation

Supply voltage	AC	DC
		

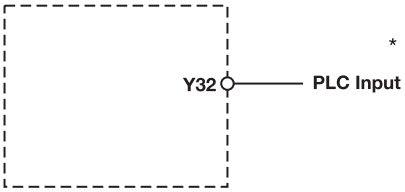
Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

Safety relays PNOZsigma
PNOZ s8

Feedback loop

- **with PNOZsigma base unit:**
  The feedback loop is connected and evaluated via the connector.
- **without PNOZsigma base unit:**
  Feedback loop does not need to be monitored because the contact expansion block monitors its own output contacts.

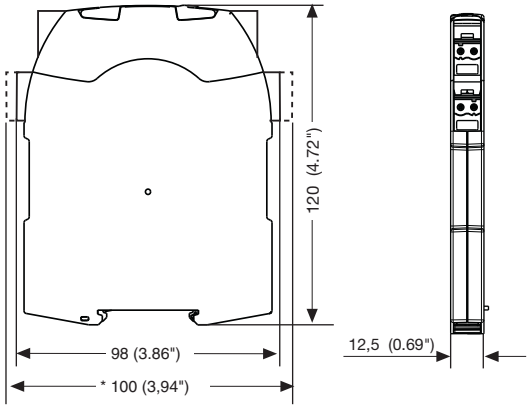
Semiconductor output



*Connect together the 0V connections on all the external power supplies

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s8

Technical details

General	750108	751108
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750108**	**751108**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	2 W	2 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Inputs	**750108**	**751108**
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	65 mA	65 mA
Max. inrush current impulse		
Current pulse, input circuit	0,6 A	0,6 A
Pulse duration, input circuit	15 ms	15 ms
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Semiconductor outputs	**750108**	**751108**
Number	1	1
Voltage	24 V	24 V
Current	20 mA	20 mA
Relay outputs	**750108**	**751108**
Number of output contacts		
Safety contacts (N/O), instant-aneous	2	2
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZsigma
PNOZ s8

Relay outputs	750108	751108
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,02 A**	**0,02 A**
Max. current	**3 A**	**3 A**
Max. power	**720 VA**	**720 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,02 A**	**0,02 A**
Max. current	**3 A**	**3 A**
Max. power	**72 W**	**72 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**1,5 A**	**1,5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**1,5 A**	**1,5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**3 A**	**3 A**
Voltage	**24 V DC G. P.**	**24 V DC G. P.**
With current	**3 A**	**3 A**
Pilot Duty	**B300, R300**	**B300, R300**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Blow-out fuse, quick	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**
Circuit breaker 24V AC/DC, characteristic B/C	**2 A**	**2 A**
Conventional thermal current	**3 A**	**3 A**
Contact material	**AgSnO2**	**AgSnO2**
Times	**750108**	**751108**
Switch-on delay		
With automatic start after power on typ.	**100 ms**	**100 ms**
With automatic start after power on max.	**150 ms**	**150 ms**

Safety relays PNOZsigma
PNOZ s8

Times	750108	751108
Delay-on de-energisation		
With E-STOP typ.	**30 ms**	**30 ms**
With E-STOP max.	**40 ms**	**40 ms**
With power failure typ.	**30 ms**	**30 ms**
With power failure max.	**40 ms**	**40 ms**
Environmental data	**750108**	**751108**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III / II**	**III / II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4 kV**	**4 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750108**	**751108**
Mounting position	**Any**	**Any**
Mechanical life	**5,000,000 cycles**	**5,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZsigma
PNOZ s8

Mechanical data	750108	751108
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**12,5 mm**	**12,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**105 g**	**105 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL c**	**Cat. 3**	**SIL CL 2**	**2,00E-07**	**SIL 2**	**6,35E-03**	**20**

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

Safety relays PNOZsigma
PNOZ s8

Supplementary data

The PFH value depends on the switching frequency and the load on the relay output.
If the values in the service life table 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.

Service life table

The service life table indicates 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.

Load type	Switching current	Number of cycles
DC1	3 A	200,000
DC13	1.5 A	75,000
AC1	3 A	50,000
AC15	1.5 A	50,000

Order reference

Product type	Features	Connection type	Order No.
PNOZ s8	24 VDC	Screw terminals	750 108
PNOZ s8 C	24 VDC	Spring-loaded terminals	751 108

Safety relays PNOZsigma
PNOZ s9

Unit features

- Positive-guided relay outputs, either instantaneous, delay-on de-energisation (also retriggerable), pulsing or delay-on energisation:
  - 3 safety contacts
  - 1 auxiliary contact
- Switch-on time, pulse time or delay-on de-energisation selectable with rotary switches
- LED indicator for:
  - Supply voltage
  - Input status, channel 1
  - Input status, channel 2
  - Switch status channel 1/2
  - Start circuit
  - Error
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Safety relays PNOZsigma
PNOZ s9

Block diagram/terminal configuration

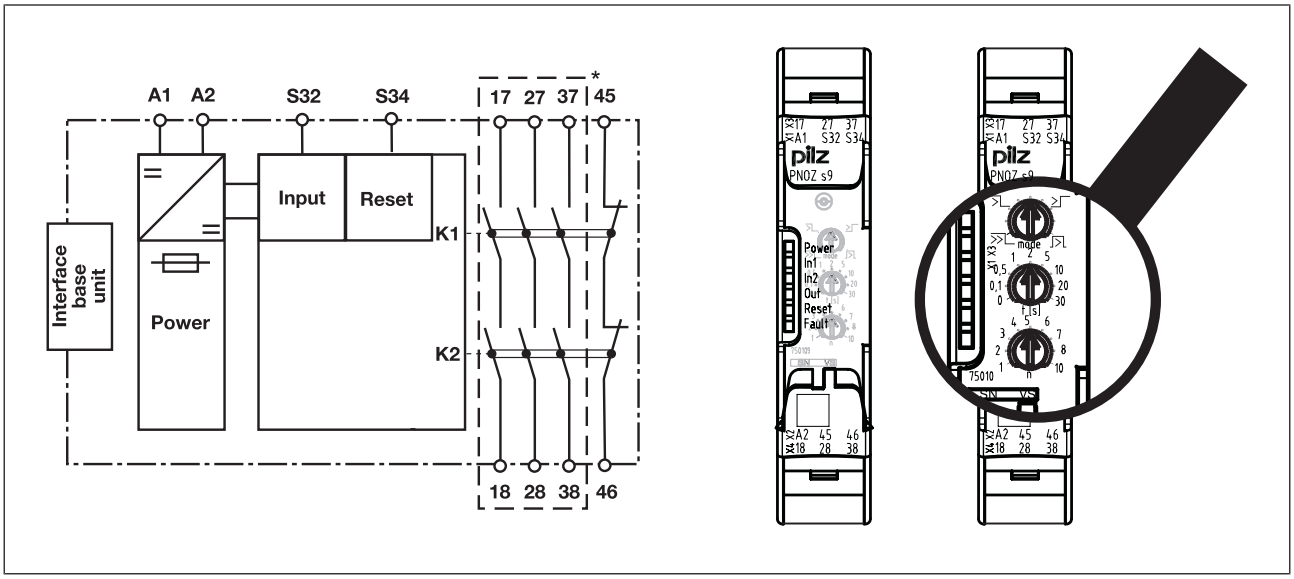


Fig.: Centre: Front view with cover, right: Front view without cover

*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Function description

- Delay-on de-energisation, not retriggerable
  If the supply voltage at the input circuit is interrupted, the safety contacts will open once the set release time has elapsed, even if the safety function is cancelled during the delay time. The unit cannot be reactivated until the delay time has elapsed.
- Delay-on de-energisation, retriggerable
  (only possible as a standalone application or with the PNOZsigma base unit!)
  If the supply voltage at the input circuit is interrupted, the safety contacts will open once the set release time has elapsed.
  If the safety function is cancelled during the delay time (e.g. safety gate closed), the unit will remain active.
- Pulse on switching on
  The safety contacts close when supply voltage is applied, the feedback loop is closed and finally the input circuit is closed. The safety contacts are reopened once the pulse time has elapsed.
  If the input circuit is opened for more than 10 ms during the pulse time, the safety contacts will open immediately and the auxiliary contact will be closed.

Safety relays PNOZsigma
PNOZ s9

- ≥⌐ Delay-on energisation
  The set delay time is started when supply voltage is applied, the feedback loop is closed and finally the input circuit is closed.
  If the input circuit and feedback loop are closed once the delay time has elapsed, the safety contacts will close and the auxiliary contact will be opened.
  If the input circuit is opened for more than 10 ms, the safety contacts will open immediately and the auxiliary contact will be closed.

with PNOZsigma base unit:

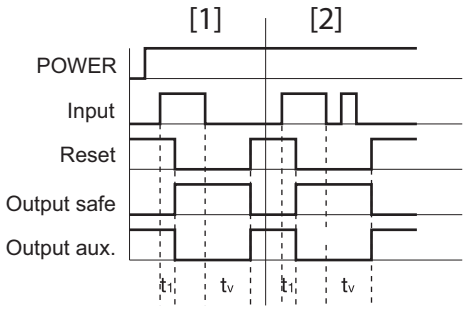
- Dual-channel operation via PNOZsigma connector

with other base units or without base unit:

- Single-channel operation: one input circuit affects the output relays

Timing diagrams

Delay-on de-energisation, not retriggerable

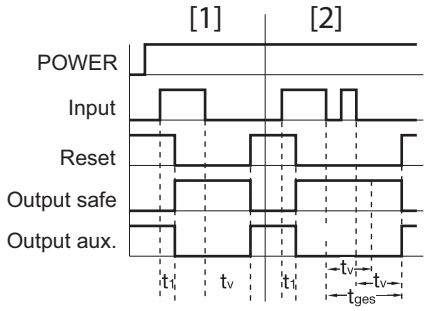


Legend

- POWER: Supply voltage
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Reset: Feedback loop input
- t_1: Switch-on delay
- t_v: Delay time
- [1]: Delay-on de-energisation with the time t_v
- [2]: No retriggering in the time t_v

Safety relays PNOZsigma
PNOZ s9

Delay-on de-energisation, retriggerable

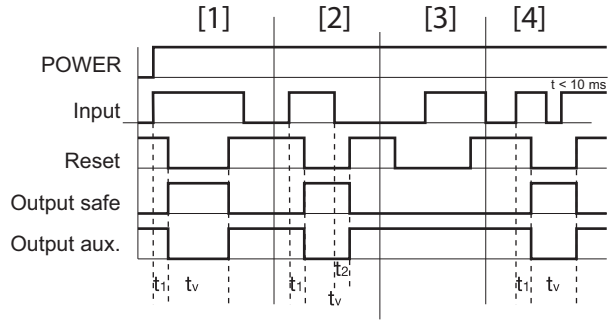


Legend

- POWER: Supply voltage
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Reset: Feedback loop input
- t_1: Switch-on delay
- t_v: Delay time
- t_{ges}: Overall delay time
- [1]: Delay-on de-energisation with the time t_v
- [2]: Retriggering in the time t_v for overall delay-on de-energisation t_{ges}

Safety relays PNOZsigma
PNOZ s9

Pulse on switching on

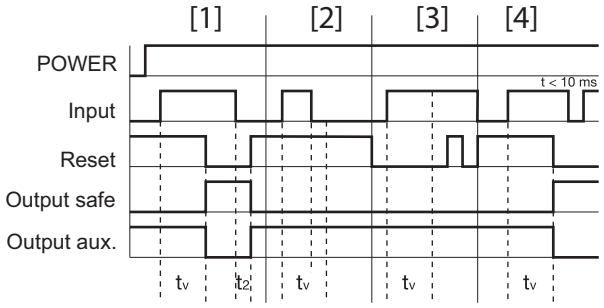


Legend

- POWER: Supply voltage
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Reset: Feedback loop input
- t_1: Switch-on delay
- t_2: Delay-on de-energisation
- t_v: Delay time (pulse time)
- [1]: Normal operating cycle
- [2]: Fault: Input circuit opened too early
- [3]: Fault: Feedback loop closed too late
- [4]: Normal operating cycle with supply interruption < 10 ms

Safety relays PNOZsigma
PNOZ s9

Delay-on energisation



Legend

- POWER: Supply voltage
- Input: Input circuit
- Output safe: Safety contacts
- Output aux: Auxiliary contact
- Reset: Feedback loop input
- t_2: Delay-on de-energisation
- tv: Delay time
- [1]: Normal operating cycle
- [2]: Fault: Input circuit opened too early, before t_v expired
- [3]: Fault: Feedback loop closed too late after t_v elapsed
- [4]: Normal operating cycle with supply interruption < 10 ms

Installation

Install contact expansion module without base unit:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expander module
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

Control cabinet 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).

- Push the unit upwards or downwards before lifting it from the DIN rail.

Wiring

Please note:

- Information given in the "Technical details [📖 761]" must be followed.
- Outputs 17-18, 27-28, 37-38 are safety contacts; output 45-46 is an auxiliary contact (e.g. for display).
- Auxiliary contact 45-46 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 761]).
- Calculation of the max. cable length l_{max} in the input circuit:

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

R_{lmax} = max. overall cable resistance (see Technical details [📖 761])
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.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Preparing for operation

Operating modes and delay time

The operating mode and delay time are set via the rotary switches on the unit. You can do this by opening the cover on the front of the unit.

Set operating modes

- Switch off supply voltage.
- Select operating mode via the operating mode selector switch "mode".
- If the operating mode selector switch "mode" is in its start position (vertical position), an error message will appear.

operating mode selector switch "mode"	delay-on de-energisation, not retriggerable	delay-on de-energisation, retriggerable	delay-on energisation	pulse on switching on

Safety relays PNOZsigma
PNOZ s9

Set delay time

Time selector switch "t[s]"

Factor selector switch "n"

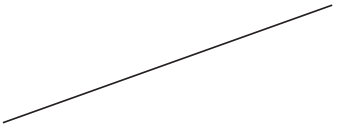
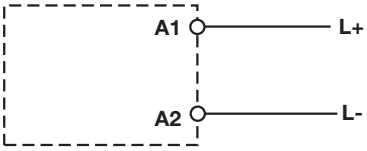
n x t[s] = Delay time

Example:

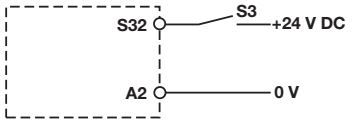
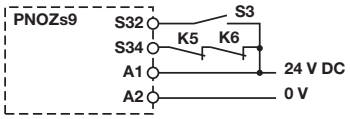
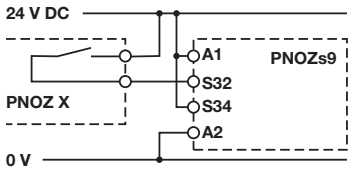
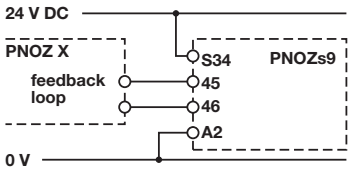
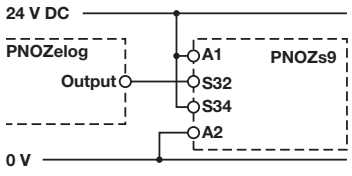
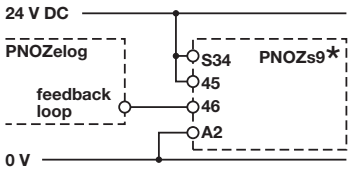
t = 4 s, n = 5
Delay time = 5 x 4 = 20 s

Connection

- Supply voltage

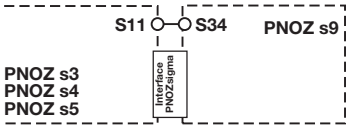
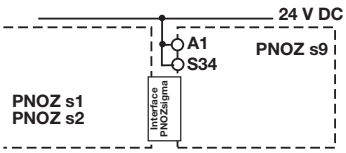
Supply voltage	AC	DC
		

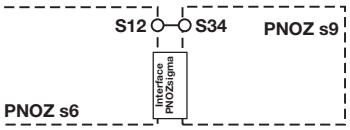
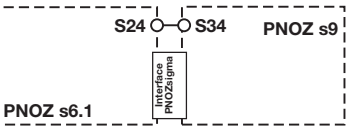
- 1-channel input circuit/feedback loop

Input circuit	Input circuit	Feedback loop
Without base unit (stand-alone)		
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog; driven via semiconductor outputs (24 VDC)		

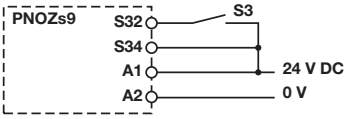
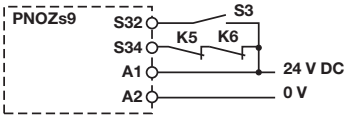
Safety relays PNOZsigma
PNOZ s9

- 2-channel input circuit

	Base unit: Safety relays PNOZ s3, PNOZ s4, PNOZ s5	Base unit: Safety relays PNOZ s1, PNOZ s2
The input circuit is connected and evaluated via the connector.		

	Base unit: Two-hand control device PNOZ s6	Base unit: Two-hand control device PNOZ s6.1
The input circuit is connected and evaluated via the connector.		

- Application

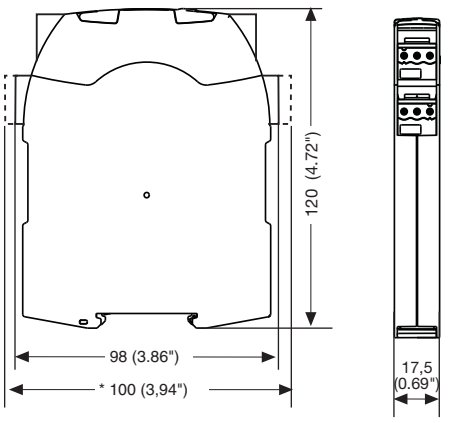
	Without feedback loop	With feedback loop
Without base unit		

Legend

- S3: Start button

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s9

Technical details

General	750109	751109	751189
Approvals	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**750109**	**751109**	**751189**
Supply voltage			
Voltage	24 V	24 V	24 V
Kind	DC	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	2 W	2 W	2 W
Residual ripple DC	20 %	20 %	20 %
Duty cycle	100 %	100 %	100 %
Max. inrush current impulse			
Current pulse, A1	0,7 A	0,7 A	0,7 A
Pulse duration, A1	10 ms	10 ms	10 ms
Max. overall cable resistance RImax			
Feedback loop	30 Ohm	30 Ohm	30 Ohm
A1/A2	20 Ohm	20 Ohm	20 Ohm
Inputs	**750109**	**751109**	**751189**
Voltage at			
Feedback loop DC	24 V	24 V	24 V
Current at			
Input circuit DC	15 mA	15 mA	15 mA
Feedback loop DC	15 mA	15 mA	15 mA
Max. inrush current impulse			
Current pulse, input circuit	0,1 A	0,1 A	0,1 A
Pulse duration, input circuit	20 µs	20 µs	20 µs
Current pulse, feedback loop	0,1 A	0,1 A	0,1 A
Pulse duration, feedback loop	20 µs	20 µs	20 µs
Max. overall cable resistance RImax			
Single-channel at UB DC	30 Ohm	30 Ohm	30 Ohm

Safety relays PNOZsigma
PNOZ s9

Relay outputs	750109	751109	751189
Number of output contacts			
Safety contacts (N/O), delayed	**3**	**3**	**3**
Auxiliary contacts (N/C), delayed	**1**	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**	**1 kA**
Utilisation category			
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category of auxiliary contacts			
AC1 at	**240 V**	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**	**6 A**
Max. power	**150 W**	**150 W**	**150 W**
Utilisation category			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**5 A**	**5 A**	**5 A**

Safety relays PNOZsigma
PNOZ s9

Relay outputs	750109	751109	751189
Utilisation category of auxiliary contacts			
AC15 at	**230 V**	**230 V**	**230 V**
Max. current	**5 A**	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**	**24 V**
Max. current	**5 A**	**5 A**	**5 A**
Utilisation category in accordance with UL			
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**	**6 A**
External contact fuse protection, safety contacts			
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts			
Max. melting integral	**160 A²s**	**160 A²s**	**160 A²s**
Blow-out fuse, quick	**10 A**	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**	**6 A**
Blow-out fuse, gG	**6 A**	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**	**6 A**
Conventional thermal current	**6 A**	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Times	**750109**	**751109**	**751189**
Switch-on delay			
With manual start typ.	**60 ms**	**60 ms**	**60 ms**
With manual start max.	**80 ms**	**80 ms**	**80 ms**
Delay-on de-energisation			
With E-STOP typ.	**40 ms**	**40 ms**	**40 ms**
With E-STOP max.	**50 ms**	**50 ms**	**50 ms**

Safety relays PNOZsigma
PNOZ s9

Times	750109	751109	751189
Recovery time at max. switching frequency 1/s			
After power failure	**800 ms**	**800 ms**	**800 ms**
Delay time tv	**0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s**	**0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s**	**0,04 s, 0,1 s, 0,2 s, 0,3 s, 0,4 s, 0,5 s, 0,6 s, 0,7 s, 0,8 s, 1 s, 1,5 s, 2 s, 2,5 s, 3 s, 3,5 s, 4 s, 5 s, 6 s, 7 s, 8 s, 10 s, 12 s, 14 s, 15 s, 16 s, 20 s, 25 s, 30 s, 35 s, 40 s, 50 s, 60 s, 70 s, 80 s, 90 s, 100 s, 120 s, 140 s, 150 s, 160 s, 180 s, 200 s, 210 s, 240 s, 300 s**
Time accuracy	**+/-1 % + +/-20 ms**	**+/-1 % + +/-20 ms**	**+/-1 % + +/-20 ms**
Repetition accuracy	**+/-1 % + +/-20 ms**	**+/-1 % + +/-20 ms**	**+/-1 % + +/-20 ms**
Repetition accuracy in the event of an error	**+/-15 % + +/-20 ms**	**+/-15 % + +/-20 ms**	**+/-15 % + +/-20 ms**
Min. delay time (operating mode delay-on energisation)	**tv - 15 % - 20 ms**	**tv - 15 % - 20 ms**	**tv - 15 % - 20 ms**
Max. delay time	**tv + 15 % + 20 ms**	**tv + 15 % + 20 ms**	**tv + 15 % + 20 ms**
Supply interruption before de-energisation in the input circuit	**10 ms**	**10 ms**	**10 ms**
Supply interruption before de-energisation	**10 ms**	**10 ms**	**10 ms**
Environmental data	**750109**	**751109**	**751189**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature			
Temperature range	**-15 - 55 °C**	**-15 - 55 °C**	**-15 - 55 °C**
Storage temperature			
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability			
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration			
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**	**0,35 mm**

Safety relays PNOZsigma
PNOZ s9

Environmental data	750109	751109	751189
Airgap creepage			
In accordance with the standard	**EN 60947-1**	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**	**III**
Pollution degree	**2**	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**	**6 kV**
Protection type			
Mounting area (e.g. control cabinet)	**IP54**	**IP54**	**IP54**
Housing	**IP40**	**IP40**	**IP40**
Terminals	**IP 20**	**IP 20**	**IP 20**
Mechanical data	**750109**	**751109**	**751189**
Mounting position	**Any**	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**	**10,000,000 cycles**
Material			
Bottom	**PC**	**PC**	**PC**
Front	**PC**	**PC**	**PC**
Top	**PC**	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**	**plug-in**
Conductor cross section with screw terminals			
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–	–
Torque setting with screw terminals	**0,5 Nm**	–	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**	**2**

Safety relays PNOZsigma
PNOZ s9

Mechanical data	750109	751109	751189
Stripping length with spring-loaded terminals	–	**9 mm**	**9 mm**
Dimensions			
Height	**98 mm**	**100 mm**	**100 mm**
Width	**17,5 mm**	**17,5 mm**	**17,5 mm**
Depth	**120 mm**	**120 mm**	**120 mm**
Weight	**175 g**	**175 g**	**175 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, delayed	**PL e**	**Cat. 4**	**SIL CL 3**	**2,34E-09**	**SIL 3**	**2,75E-05**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s9

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.

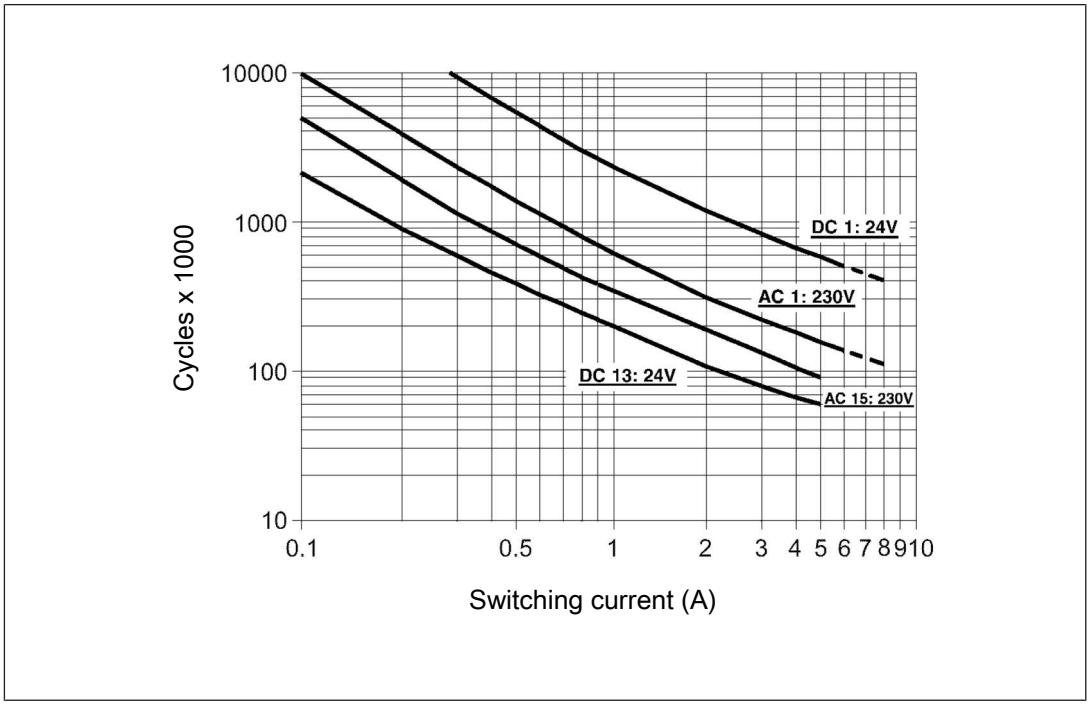


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s9

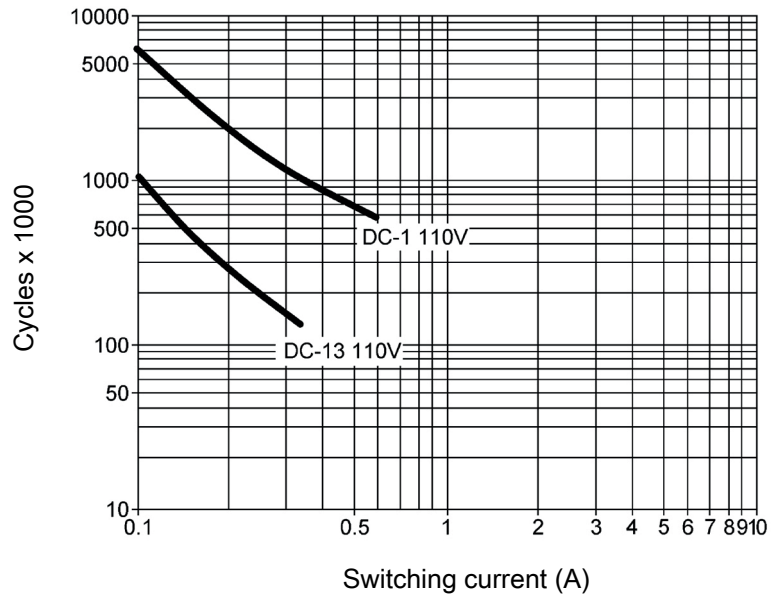


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 761]) 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

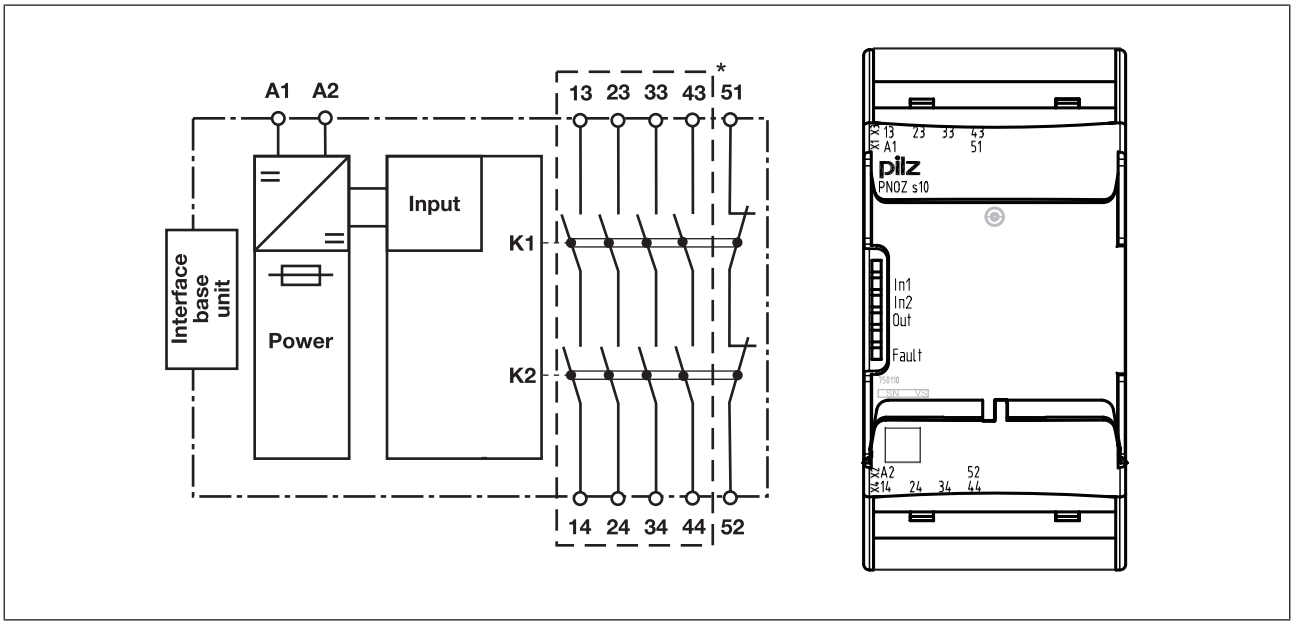
Product type	Features	Connection type	Order No.
PNOZ s9	24 VDC	Screw terminals	750 109
PNOZ s9 C	24 VDC	Spring-loaded terminals	751 109
PNOZ s9 C (coated version)	24 VDC	Spring-loaded terminals	751 189
PNOZ s9 C	24 VDC; 10 pieces	Spring-loaded terminals	751 909

Safety relays PNOZsigma
PNOZ s10

Unit features

- Positive-guided relay outputs:
  - 4 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- LED for:
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration



*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Safety relays PNOZsigma
PNOZ s10

Function description

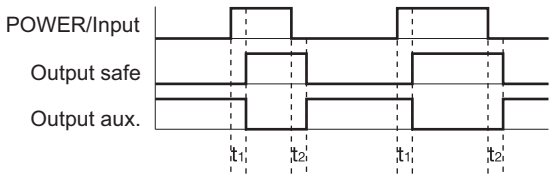
with PNOZsigma base unit:

- Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

- Single-channel operation: one input circuit affects the output relays

Timing diagram



Legend

- POWER/Input: Supply voltage/input circuit
- Output safe: Safety contacts
- Output aux.: Auxiliary contacts
- t_1: Switch-on delay
- t_2: Delay-on de-energisation

Installation

Install contact expansion module without base unit:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expander module
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

Control cabinet 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the unit upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s10

Wiring

Please note:

- Information given in the "Technical details [📖 773]" must be followed.
- Outputs 13-14, 23-24, 33-34, 43-44 are safety contacts; outputs 51 -52 are auxiliary contacts (e.g. for display).
- Auxiliary contact 51-52 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 773]).
- Calculation of the max. cable length l_{max} in the input circuit:

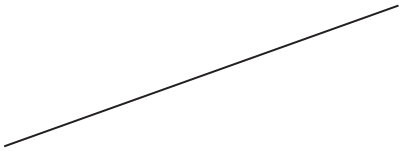
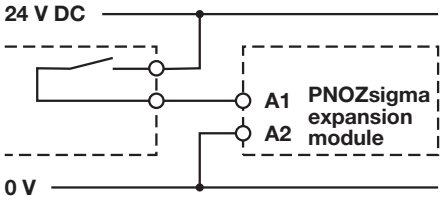
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

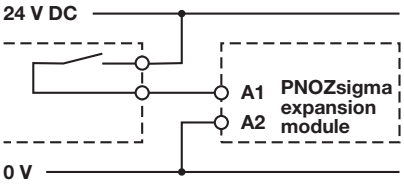
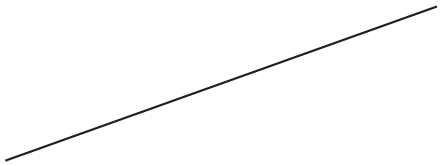
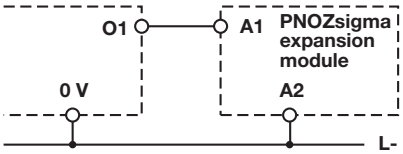
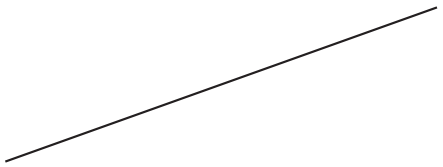
R_{lmax} = max. overall cable resistance (see Technical details [📖 773])
R_l / km = cable resistance/km

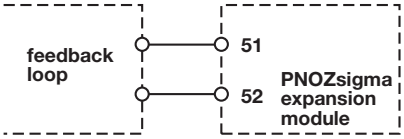
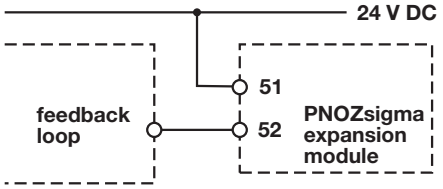
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Do not connect undesignated terminals.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.

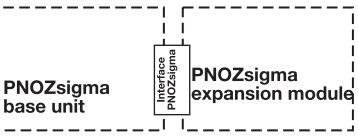
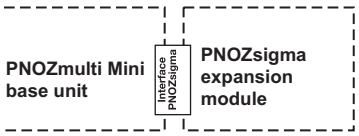
Safety relays PNOZsigma
PNOZ s10

Preparing for operation

Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

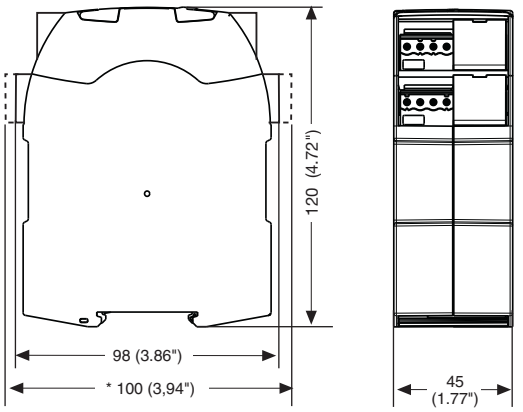
Feedback loop	Base unit: Safety relay PNOZ X	Base unit: Safety relay PNOZelog
The inputs that evaluate the feedback loop will depend on the base unit and application		

Connection to PNOZsigma base unit/PNOZmulti Mini base unit	Base unit: Safety relay PNOZ-sigma	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

Safety relays PNOZsigma
PNOZ s10

Dimensions in mm

*with spring-loaded terminals



Technical details

General	750110	751110
Approvals	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed**
Electrical data	**750110**	**751110**
Supply voltage		
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-20 %/+20 %**	**-20 %/+20 %**
Output of external power supply (DC)	**3 W**	**3 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
Inputs	**750110**	**751110**
Number	**1**	**1**
Voltage at		
Input circuit DC	**24 V**	**24 V**
Current at		
Input circuit DC	**95 mA**	**95 mA**
Max. inrush current impulse		
Current pulse, input circuit	**2 A**	**2 A**
Pulse duration, input circuit	**0,1 ms**	**0,1 ms**

Safety relays PNOZsigma
PNOZ s10

Inputs	750110	751110
Max. overall cable resistance Rl-max		
Single-channel at UB DC	**30 Ohm**	**30 Ohm**
Relay outputs	**750110**	**751110**
Number of output contacts		
Safety contacts (N/O), instantaneous	**4**	**4**
Auxiliary contacts (N/C)	**1**	**1**
Max. short circuit current IK	**1 kA**	**1 kA**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**12 A**	**12 A**
Max. power	**3000 VA**	**3000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**12 A**	**12 A**
Max. power	**300 W**	**300 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**500 VA**	**500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**2 A**	**2 A**
Max. power	**50 W**	**50 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**6 A**	**6 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**7,5 A**	**7,5 A**

Safety relays PNOZsigma
PNOZ s10

Relay outputs	750110	751110
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**2 A**	**2 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**2 A**	**2 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G. P.**	**240 V AC G. P.**
With current	**12 A**	**12 A**
Voltage	**24 V DC Resistive**	**24 V DC Resistive**
With current	**12 A**	**12 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**640 A²s**	**640 A²s**
Blow-out fuse, quick	**16 A**	**16 A**
Blow-out fuse, slow	**10 A**	**10 A**
Blow-out fuse, gG	**16 A**	**16 A**
Circuit breaker 24V AC/DC, characteristic B/C	**10 A**	**10 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**240 A²s**	**240 A²s**
Blow-out fuse, quick	**4 A**	**4 A**
Blow-out fuse, slow	**2 A**	**2 A**
Blow-out fuse, gG	**4 A**	**4 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**2 A**	**2 A**
Contact material	**AgSnO2 + 0,2 µm Au**	**AgSnO2 + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750110**	**751110**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**12 A**	**12 A**
Conv. therm. current with 2 contacts	**11 A**	**11 A**
Conv. therm. current with 3 contacts	**9 A**	**9 A**
Conv. therm. current with 4 contacts	**8 A**	**8 A**

Safety relays PNOZsigma
PNOZ s10

Times	750110	751110
Switch-on delay		
With automatic start after power on typ.	**30 ms**	**30 ms**
With automatic start after power on max.	**50 ms**	**50 ms**
Delay-on de-energisation		
With E-STOP typ.	**20 ms**	**20 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**20 ms**	**20 ms**
With power failure max.	**30 ms**	**30 ms**
Environmental data	**750110**	**751110**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750110**	**751110**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**

Safety relays PNOZsigma
PNOZ s10

Mechanical data	750110	751110
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**45 mm**	**45 mm**
Depth	**120 mm**	**120 mm**
Weight	**295 g**	**295 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety relays PNOZsigma
PNOZ s10

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Supplementary data

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.

Safety relays PNOZsigma
PNOZ s10

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.

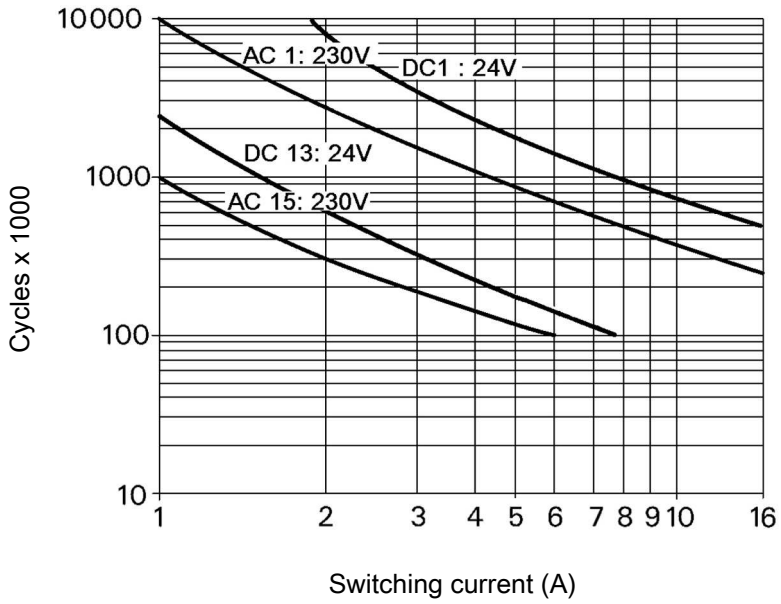


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s10

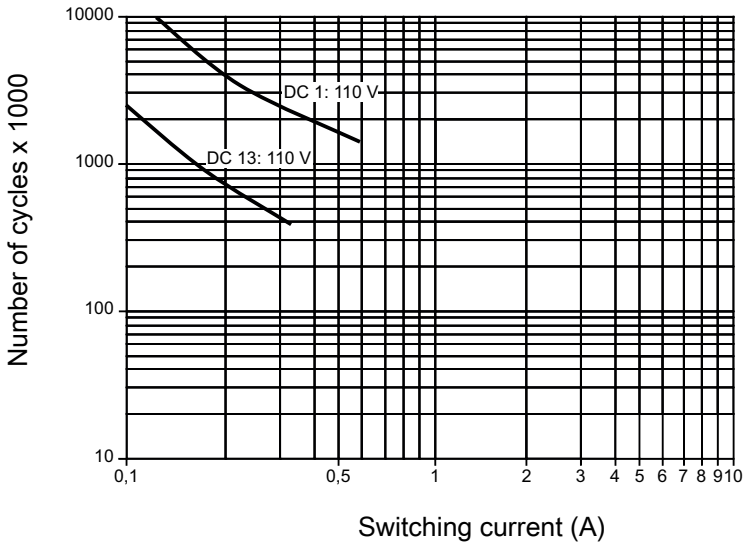


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 2 A
- Utilisation category: AC15
- Contact service life: 300 000 cycles

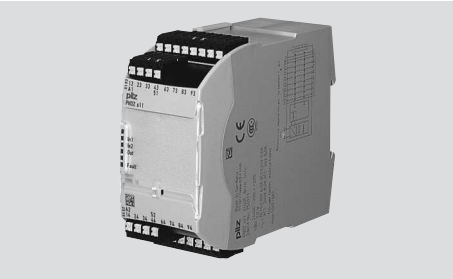
Provided the application to be implemented requires fewer than 300 000 cycles, the PFH value (see Technical details) can be used in the calculation.

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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Connection type	Order No.
PNOZ s10	24 VDC	Screw terminals	750 110
PNOZ s10 C	24 VDC	Spring-loaded terminals	751 110

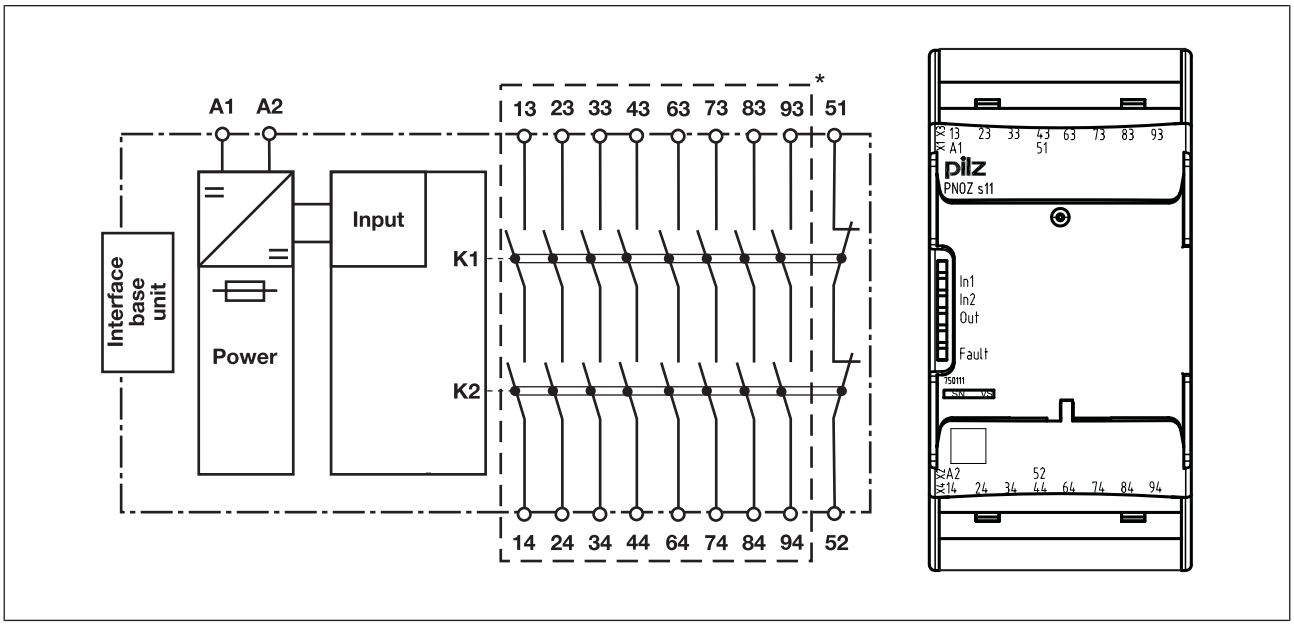
Safety relays PNOZsigma
PNOZ s11



Unit features

- Positive-guided relay outputs:
  - 8 safety contacts (N/O), instantaneous
  - 1 auxiliary contact (N/C), instantaneous
- LED for:
  - Input status, channel 1
  - Input status, channel 2
  - Switch status of the safety contacts
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration



*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Safety relays PNOZsigma
PNOZ s11

Function description

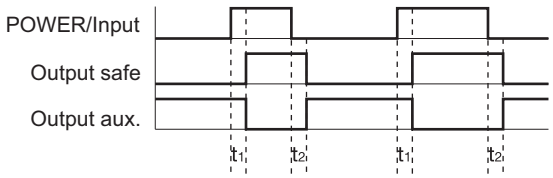
with PNOZsigma base unit:

- Dual-channel operation via PNOZsigma connector

without PNOZsigma base unit:

- Single-channel operation: one input circuit affects the output relays

Timing diagram



Legend

- POWER/Input: Supply voltage/input circuit
- Output safe: Safety contacts
- Output aux.: Auxiliary contacts
- t_1: Switch-on delay
- t_2: Delay-on de-energisation

Installation

Install contact expansion module without base unit:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

- Remove the plug terminator at the side of the base unit and at the contact expander module
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

Control cabinet 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 (35 mm).
- When installed vertically: Secure the unit by using a fixing element (e.g. retaining bracket or end angle).
- Push the unit upwards or downwards before lifting it from the DIN rail.

Safety relays PNOZsigma
PNOZ s11

Wiring

Please note:

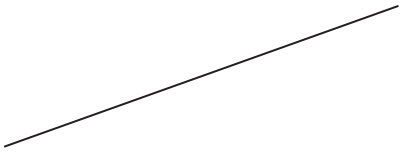
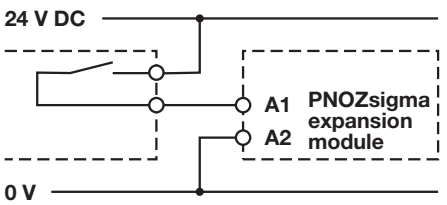
- Information given in the "Technical details [785]" must be followed.
- Outputs 13-14, 23-24, 33-34, 43-44, 63-64, 73-74, 83-84, 93-94 are safety contacts; output 51-52 is an auxiliary contact (e.g. for display).
- Auxiliary contact 51-52 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [785]).
- Calculation of the max. cable length l_{max} in the input circuit:

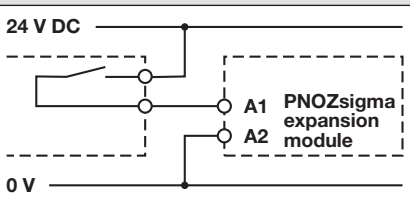
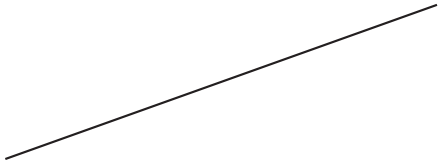
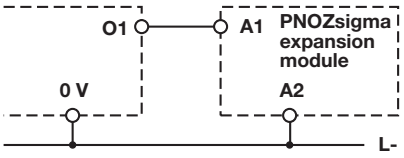
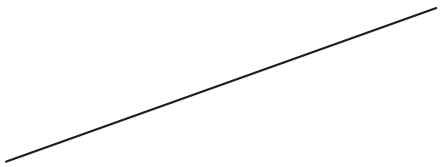
$$l_{max} = \frac{R_{lmax}}{R_l / km}$$

R_{lmax} = max. overall cable resistance (see Technical details [785])
R_l / km = cable resistance/km

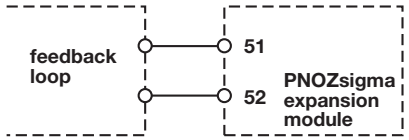
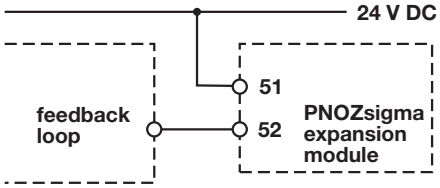
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

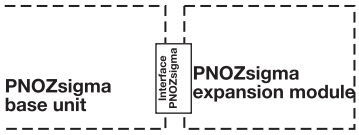
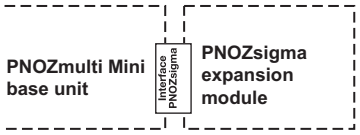
Preparing for operation

Supply voltage	AC	DC
		

Input circuit	Single-channel	Dual-channel
Base unit: Safety relay PNOZ X		
Base unit: Safety relay PNOZelog Driven via semiconductor outputs (24 VDC)		

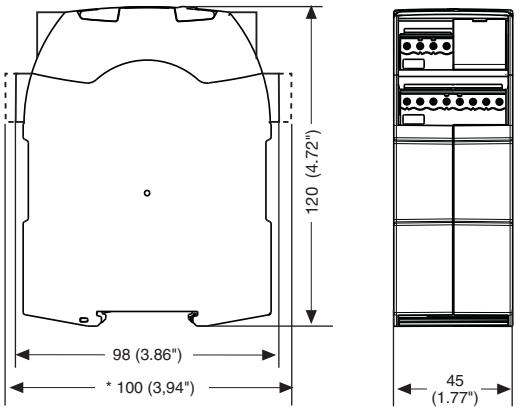
Safety relays PNOZsigma
PNOZ s11

Feedback loop	Base unit: Safety relay PNOZ X	Base unit: Safety relay PNOZelog
The inputs that evaluate the feedback loop will depend on the base unit and application		

Connection to PNOZsigma base unit/PNOZmulti Mini base unit	Base unit: Safety relay PNOZsigma	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s11

Technical details

General	750111	751111
Approvals	CCC, CE, EAC (Eurasian), TÜV, cULus Listed	CCC, CE, EAC (Eurasian), TÜV, cULus Listed
Electrical data	**750111**	**751111**
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Voltage tolerance	-20 %/+20 %	-20 %/+20 %
Output of external power supply (DC)	3 W	3 W
Residual ripple DC	20 %	20 %
Duty cycle	100 %	100 %
Inputs	**750111**	**751111**
Number	1	1
Voltage at		
Input circuit DC	24 V	24 V
Current at		
Input circuit DC	95 mA	95 mA
Max. inrush current impulse		
Current pulse, input circuit	2 A	2 A
Pulse duration, input circuit	0,1 ms	0,1 ms
Max. overall cable resistance Rl-max		
Single-channel at UB DC	30 Ohm	30 Ohm
Relay outputs	**750111**	**751111**
Number of output contacts		
Safety contacts (N/O), instantaneous	8	8
Auxiliary contacts (N/C)	1	1
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1

Safety relays PNOZsigma
PNOZ s11

Relay outputs	750111	751111
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**1500 VA**	**1500 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**6 A**	**6 A**
Max. power	**150 W**	**150 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**5 A**	**5 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**5 A**	**5 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**

Safety relays PNOZsigma
PNOZ s11

Relay outputs	750111	751111
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**260 A²s**	**260 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**10 A**	**10 A**
Circuit breaker 24V AC/DC, characteristic B/C	**6 A**	**6 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**160 A²s**	**160 A²s**
Blow-out fuse, quick	**10 A**	**10 A**
Blow-out fuse, slow	**6 A**	**6 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**6 A**	**6 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**
Conventional thermal current while loading several contacts	**750111**	**751111**
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**6 A**	**6 A**
Conv. therm. current with 3 contacts	**6 A**	**6 A**
Conv. therm. current with 4 contacts	**6 A**	**6 A**
Conv. therm. current with 5 contacts	**6 A**	**6 A**
Conv. therm. current with 6 contacts	**5,7 A**	**5,7 A**
Conv. therm. current with 7 contacts	**5,3 A**	**5,3 A**
Conv. therm. current with 8 contacts	**5 A**	**5 A**
Times	**750111**	**751111**
Switch-on delay		
With automatic start after power on typ.	**30 ms**	**30 ms**
With automatic start after power on max.	**50 ms**	**50 ms**

Safety relays PNOZsigma
PNOZ s11

Times	750111	751111
Delay-on de-energisation		
With E-STOP typ.	**18 ms**	**18 ms**
With E-STOP max.	**30 ms**	**30 ms**
With power failure typ.	**18 ms**	**18 ms**
With power failure max.	**30 ms**	**30 ms**
Environmental data	**750111**	**751111**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750111**	**751111**
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Cage clamp terminal**
Mounting type	**plug-in**	**plug-in**

Safety relays PNOZsigma
PNOZ s11

Mechanical data	750111	751111
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**45 mm**	**45 mm**
Depth	**120 mm**	**120 mm**
Weight	**335 g**	**335 g**

Where standards are undated, the 2014-07 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

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

Safety relays PNOZsigma
PNOZ s11

Supplementary data

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.

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.

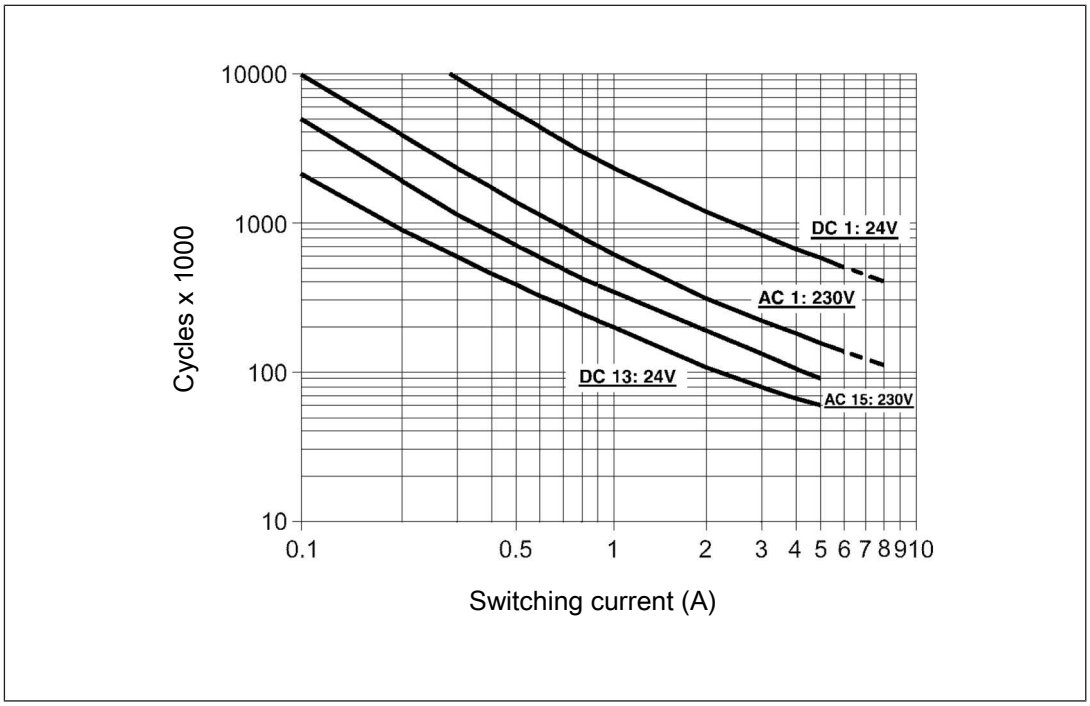


Fig.: Service life graphs at 24 V DC and 230 V AC

Safety relays PNOZsigma
PNOZ s11

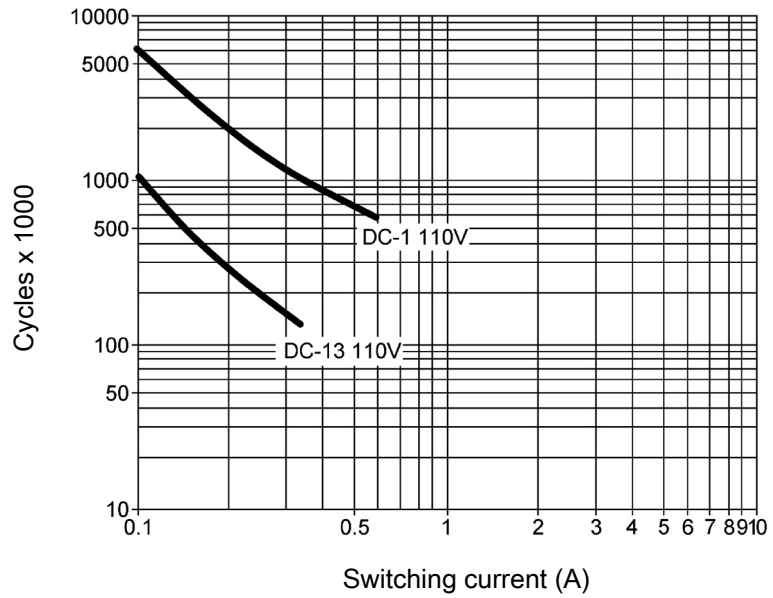


Fig.: Service life graphs at 110 V DC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 2 000 000 cycles

Provided the application to be implemented requires fewer than 2 000 000 cycles, the PFH value (see Technical details [📖 785]) 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 DC contactors, use flywheel diodes for spark suppression.

Order reference

Product type	Features	Terminals	Order No.
PNOZ s11	24 VDC	Screw terminals	750 111
PNOZ s11 C	24 VDC	Spring-loaded terminals	751 111

Safety relays PNOZsigma
PNOZ s20

Unit features

- Semiconductor outputs:
  - 2 safety outputs instantaneous
  - 1 auxiliary output instantaneous
- Connection option for expansion modules
- LED display for:
  - Supply voltage
  - Switch state of safety outputs
  - Input state channel 1/2
  - Fault
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration

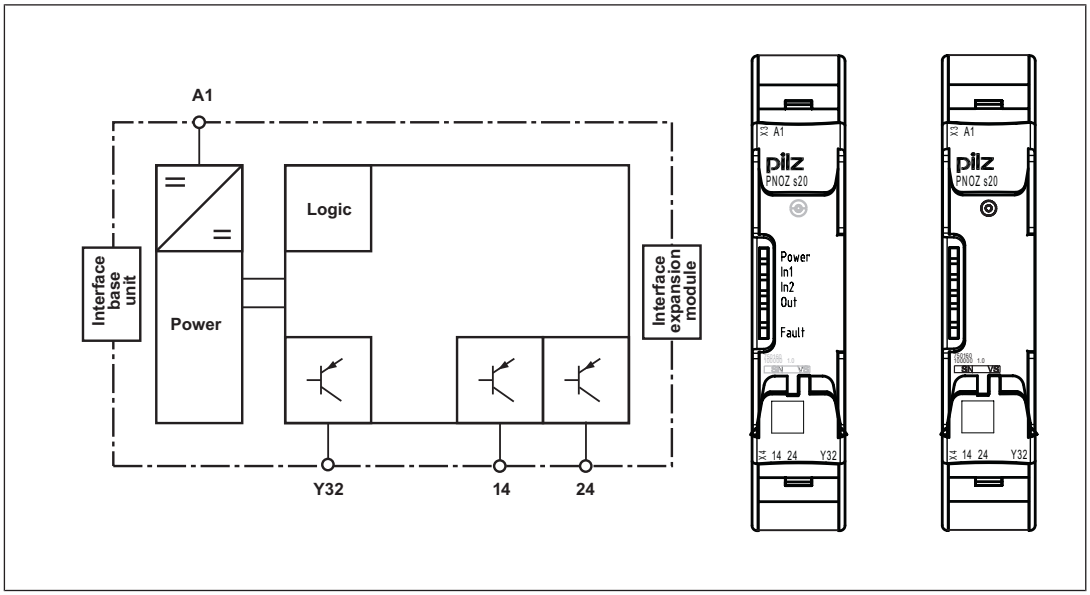


Fig.: Centre: Front view with cover, right: Front view without cover

Safety relays PNOZsigma
PNOZ s20

Function description

The contact expansion module PNOZ s20 also provides safety outputs. It is driven by a base unit PNOZsigma.

Several PNOZ s20 units can be connected to the base unit (see Installation [793]).

Functional procedure after supply voltage has been applied and the base unit's safety contacts are closed:

- There is a high signal at safety outputs 14 and 24 and auxiliary output Y32.
- LEDs "IN1", "IN2" and "Out" are lit.

Functional procedure if one or both of the base unit's safety contacts open:

- There is a low signal at safety outputs 14 and 24 and auxiliary output Y32.
- LEDs "IN1", "IN2" and "Out" go out.

The safety outputs will not switch back to a high signal until all the base unit's safety contacts are open and then closed again.

Safety outputs are checked via regular off tests.

- Max. duration of off time during self test, see Technical details
- Safety outputs are switched off for the duration of the off time during the self test.

The auxiliary output Y32 displays the state of the safety outputs.

Installation

Control cabinet 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).

Push the unit upwards or downwards before lifting it from the DIN rail.

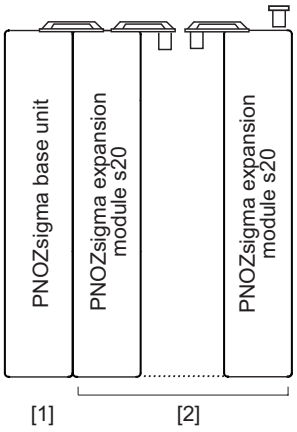
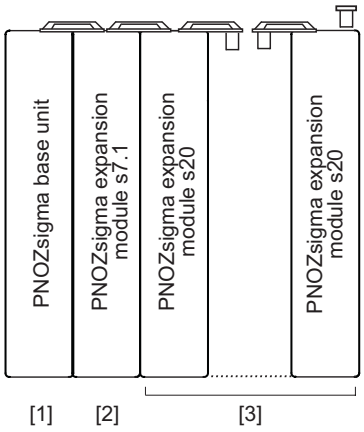
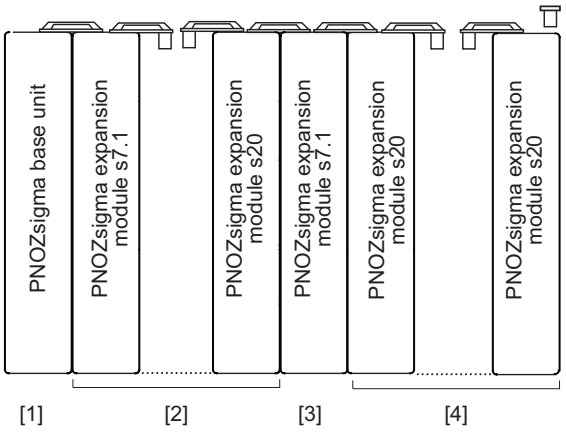
Connect the base unit and contact expansion module PNOZ s20

- Remove the plug terminator at the side of the base unit and at the left of the contact expansion module.
- Connect the base unit and the contact expansion module using the connector supplied, before mounting the units to the DIN rail.

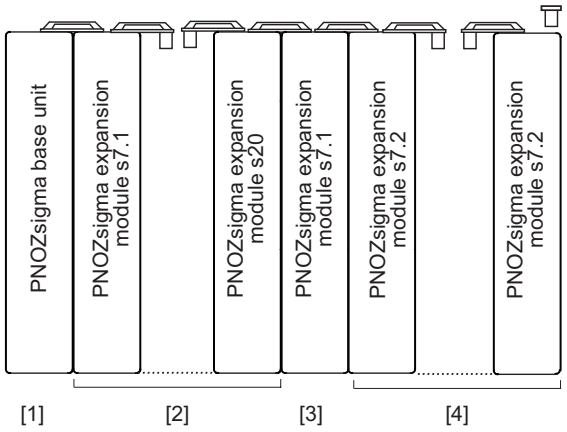
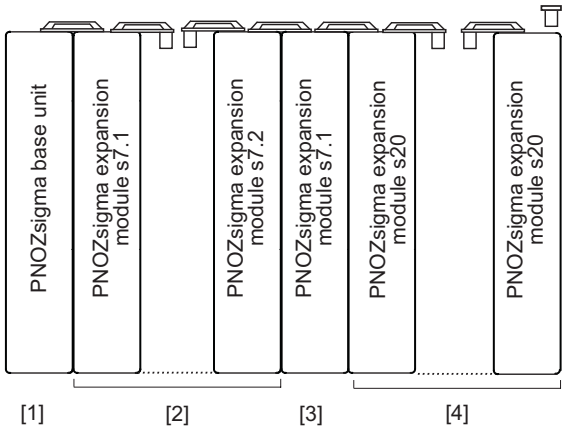
Connect the contact expansion module PNOZ s20 to the contact expansion modules PNOZsigma

- Connect the contact expansion modules using the connectors supplied.
- Fit the terminator to the module on the right.
- Expansion options are described in the following table.

Safety relays PNOZsigma
PNOZ s20

Expansion options	Consider the max. power consumption of all the units used in the application
[1]: Base unit PNOZ s3/s4/s4.1/s5/s6/s6.1 [2]: Up to 5 contact expansion modules PNOZ s20 (final block with terminator)	
[1]: Base unit PNOZsigma [2]: Contact expansion module PNOZ s7.1 [3]*: Up to 10 contact expansion modules PNOZ s20 (final block with terminator)	
[1]: Base unit PNOZsigma [2]: One contact expansion module PNOZ s7.1 and up to 9 contact expansion modules PNOZ s20 [3]: Contact expansion module PNOZ s7.1 [4]*: Up to 10 contact expansion modules PNOZ s20 (final block with terminator)	

Safety relays PNOZsigma
PNOZ s20

Expansion options	Consider the max. power consumption of all the units used in the application
[1]: Base unit PNOZsigma [2]: One contact expansion module PNOZ s7.1 and up to 9 contact expansion modules PNOZ s20 [3]: Contact expansion module PNOZ s7.1 [4]:* Up to 10 contact expansion modules PNOZ s7.2 (final block with terminator)	
[1]: Base unit PNOZsigma [2]: One contact expansion module PNOZ s7.1 and up to 9 contact expansion modules PNOZ s7.2 [3]: Contact expansion module PNOZ s7.1 [4]*: Up to 10 contact expansion modules PNOZ s20 (final block with terminator)	

*) Alternatively, one of the following units can be used as the final expansion block:

- PNOZ s7
- PNOZ s8
- PNOZ s9
- PNOZ s10
- PNOZ s11

These units sometimes require more power than the units combined in the table. If the maximum power consumption of all expansion modules is exceeded (see the technical details of the respective devices), you will need to reduce the number of connected PNOZ s20 or PNOZ s7.2 units.

Example:

Use of PNOZ s10 with a power consumption of 3 W

The max. number of expansion modules PNOZ s20 or PNOZ s7.2 is reduced by 2:

- 1 unit, in order to comply with the max. power consumption and
- 1 unit, which is replaced by PNOZ s10

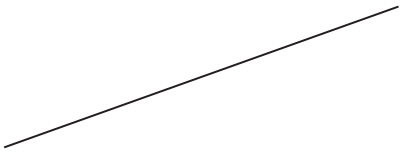
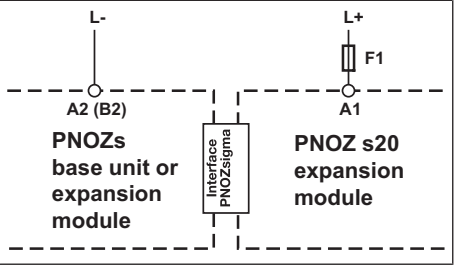
Safety relays PNOZsigma
PNOZ s20

Wiring

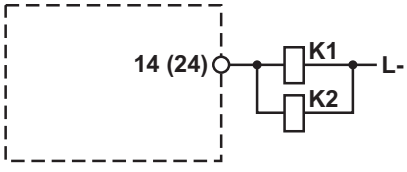
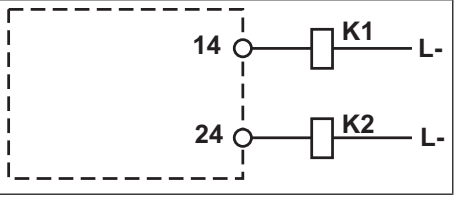
Please note:

- Information given in the "Technical details [797]" must be followed.
- Outputs 14-24 are safety outputs; semiconductor output Y32 is an auxiliary output (e.g. for display).
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Preparing for operation

Supply voltage/input circuit/ feedback loop	AC	DC
Contact expansion module PNOZ s20		

Connect the N/C contacts from external contactors to the feedback loop on the base unit.

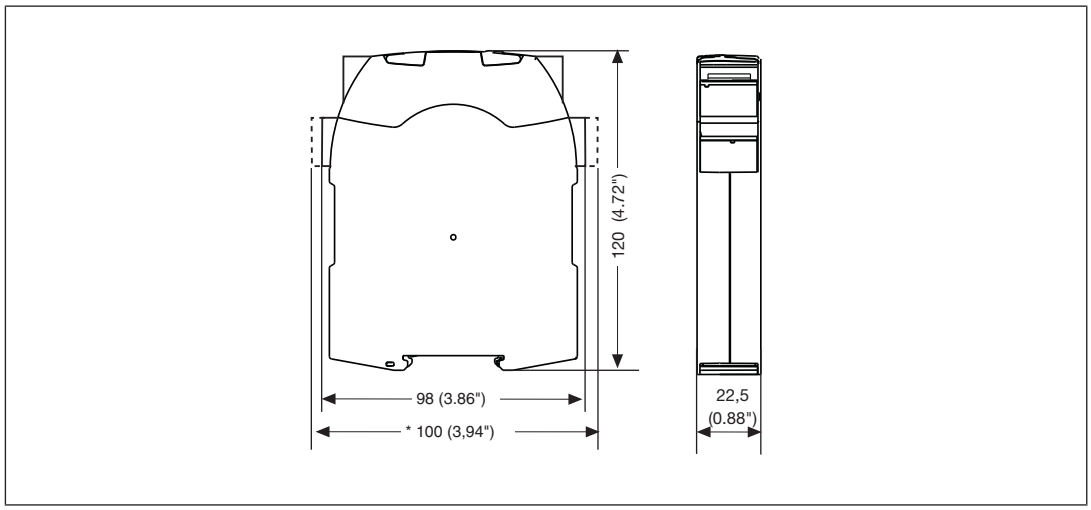
Safety output	Single-channel operation	Dual-channel operation
		

With dual-channel operation, always use both safety outputs for a safety function.

Safety relays PNOZsigma
PNOZ s20

Dimensions in mm

* with spring-loaded terminals



Technical details

General	750160	751160
Approvals	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**	**CCC, CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	**750160**	**751160**
Supply voltage		
for	**Module supply**	**Module supply**
Voltage	**24 V**	**24 V**
Kind	**DC**	**DC**
Voltage tolerance	**-15 %/+10 %**	**-15 %/+10 %**
Output of external power supply (DC)	**95 W**	**95 W**
Output of external power supply (DC) at no load	**1,6 W**	**1,6 W**
Residual ripple DC	**20 %**	**20 %**
Duty cycle	**100 %**	**100 %**
External unit fuse protection F1 max.	**4 A, circuit breaker 24 VAC/DC, characteristic B**	**4 A, circuit breaker 24 VAC/DC, characteristic B**
Semiconductor outputs	**750160**	**751160**
Overall performance ext. loading, semiconductor	**93 W**	**93 W**
Number of safety outputs		
Instantaneous	**2**	**2**
Number of auxiliary outputs	**1**	**1**
Residual current at "0" signal	**2 mA**	**2 mA**

Safety relays PNOZsigma
PNOZ s20

Semiconductor outputs	750160	751160
Max. internal voltage drop	**120 mV**	**120 mV**
Max. duration of off time during self test	**600 µs**	**600 µs**
Switching capability, 2 safety outputs under load		
Current	**1,5 A**	**1,5 A**
Power	**40 W**	**40 W**
Switching capability, 1 safety output under load		
Current	**2 A**	**2 A**
Power	**50 W**	**50 W**
Switching capability auxiliary outputs		
Current	**0,5 A**	**0,5 A**
Power	**13 W**	**13 W**
Max. line capacitance at the outputs without load	**2 nF**	**2 nF**
Times	**750160**	**751160**
Switch-on delay		
Max. switch-on delay after power on	**4 s**	**4 s**
With automatic start typ.	**60 ms**	**60 ms**
With automatic start max.	**210 ms**	**210 ms**
Recovery time at max. switching frequency 1/s		
After E-STOP	**50 ms**	**50 ms**
After power failure	**50 ms**	**50 ms**
Response time tr semiconductor outputs		
typ.	**25 ms**	**25 ms**
max.	**35 ms**	**35 ms**
Environmental data	**750160**	**751160**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**

Safety relays PNOZsigma
PNOZ s20

Environmental data	750160	751160
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**30 V**	**30 V**
Rated impulse withstand voltage	**0,8 kV**	**0,8 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**
Mechanical data	**750160**	**751160**
Mounting position	**Any**	**Any**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**

Safety relays PNOZsigma
PNOZ s20

Mechanical data	750160	751160
Dimensions		
Height	**98 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**120 g**	**120 g**

Where standards are undated, the 2014-06 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
1-channel	**PL d**	**Cat. 2**	**SIL CL 2**	**1,32E-08**	**SIL 2**	**1,17E-03**	**20**
2-channel	**PL e**	**Cat. 4**	**SIL CL 3**	**2,03E-09**	**SIL 3**	**1,85E-04**	**20**

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

Order reference

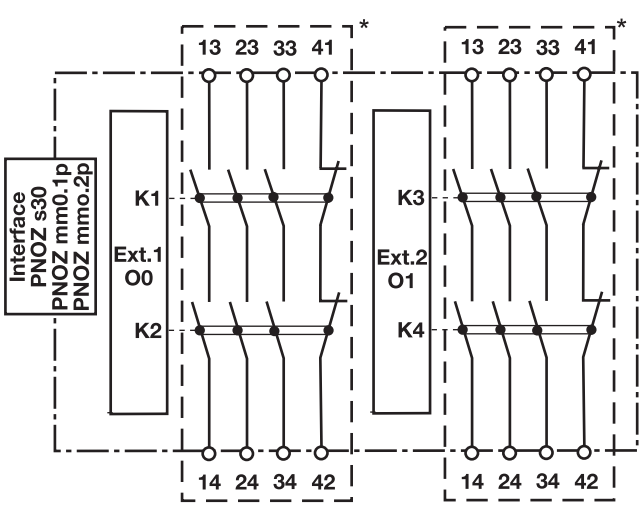
Product type	Features	Connection type	Order no.
PNOZ s20	24 VDC	Screw terminals	750 160
PNOZ s20 C	24 VDC	Spring-loaded terminals	751 160

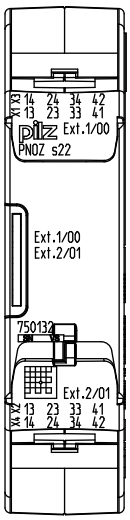
Safety relays PNOZsigma
PNOZ s22

Unit features

- Positive-guided relay outputs:
  - 6 safety contacts (N/O), instantaneous
  - 2 auxiliary contacts (N/C), instantaneous
- 3 safety contacts and 1 auxiliary contact each; these can be controlled separately
- LED indicator for:
  - Input state of channel Ext.1/O0
  - Input state of channel Ext.2/O1
- Plug-in connection terminals (either spring-loaded terminal or screw terminal)
- See order reference for unit types

Block diagram/terminal configuration





*Safe separation from non-marked area in accordance with EN 60947-1, 6 kV, basic insulation between all safety contacts.

Safety relays PNOZsigma
PNOZ s22

Function description

- Dual-channel operation and supply voltage via PNOZsigma connector
- 3 safety contacts and 1 auxiliary contact each; these can be controlled separately

Installation

Connect the contact expansion block to the PNOZ s30 or base unit PNOZ mm0.1p/ PNOZ mm0.2p

- Connect the contact expansion block using the connector supplied.

Control cabinet 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).

Push the unit upwards or downwards before lifting it from the DIN rail.

Wiring

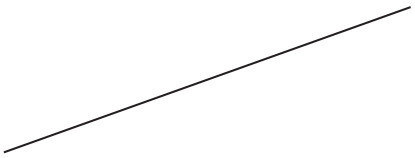
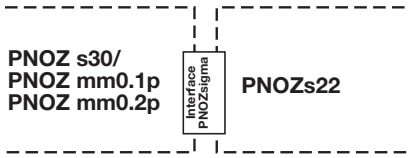
Please note:

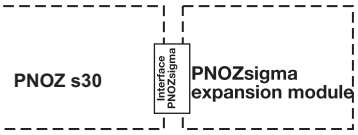
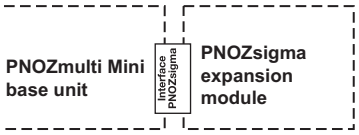
- Information given in the "Technical details [📖 804]" must be followed.
- The wiring guidelines in the base units' operating instructions must be taken into account.
- Outputs 13-14, 23-24, 33-34 are safety contacts; output 41-42 is an auxiliary contact (e.g. for display).
- Auxiliary contact 41-42 should **not** be used for safety circuits!
- To prevent contact welding, a fuse should be connected before the output contacts (see Technical details [📖 804]).
- Use copper wire that can withstand 60/75 °C.
- Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.
- Ensure the wiring and EMC requirements of IEC 60204-1 are met.
- The power supply must comply with the regulations for extra low voltages with protective electrical separation (SELV, PELV) in accordance with VDE 0100, Part 410.

Safety relays PNOZsigma
PNOZ s22

Preparing for operation

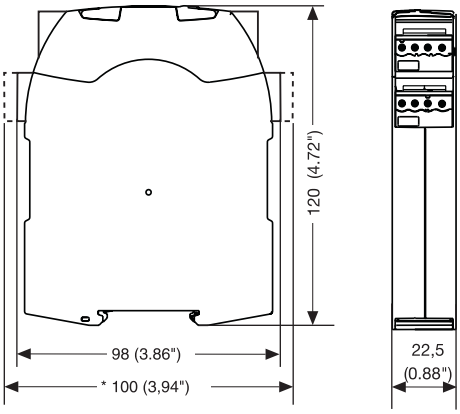
Connection

	AC	DC
Supply voltage/input circuit/feed-back loop		

Connection to speed monitor PNOZ s30/PNOZmulti Mini base unit	Base unit: Speed monitor PNOZ s30	Base unit: Small control system PNOZmulti Mini
The feedback loop is connected and evaluated via the connector		

Dimensions in mm

*with spring-loaded terminals



Safety relays PNOZsigma
PNOZ s22

Technical details

General	750132	751132
Approvals	CCC, EAC (Eurasian), TÜV, cU-Lus Listed	CCC, EAC (Eurasian), TÜV, cU-Lus Listed
Electrical data	**750132**	**751132**
Supply voltage		
Voltage tolerance	-15 %/+20 %	-15 %/+20 %
Supply voltage		
Voltage	24 V	24 V
Kind	DC	DC
Power consumption	1,5 W	1,5 W
Duty cycle	100 %	100 %
Relay outputs	**750132**	**751132**
Number of output contacts		
Safety contacts (N/O), instantaneous	6	6
Auxiliary contacts (N/C)	2	2
Max. short circuit current IK	1 kA	1 kA
Utilisation category		
In accordance with the standard	EN 60947-4-1	EN 60947-4-1
Utilisation category of safety contacts		
AC1 at	240 V	240 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	150 W	150 W
Utilisation category of auxiliary contacts		
AC1 at	240 V	240 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	1500 VA	1500 VA
DC1 at	24 V	24 V
Min. current	0,01 A	0,01 A
Max. current	6 A	6 A
Max. power	150 W	150 W

Safety relays PNOZsigma
PNOZ s22

Relay outputs	750132	751132
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3 A**	**3 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**4 A**	**4 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4 A**	**4 A**
Utilisation category in accordance with UL		
Voltage	**240 V AC G.U. (same polarity)**	**240 V AC G.U. (same polarity)**
With current	**6 A**	**6 A**
Voltage	**24 V DC G. U.**	**24 V DC G. U.**
With current	**6 A**	**6 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Max. melting integral	**66 A²s**	**66 A²s**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Blow-out fuse, gG	**6 A**	**6 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZsigma
PNOZ s22

Conventional thermal current while loading several contacts	750132	751132
Ith per contact at UB DC; AC1: 240 V, DC1: 24 V		
Conv. therm. current with 1 contact	**6 A**	**6 A**
Conv. therm. current with 2 contacts	**5 A**	**5 A**
Conv. therm. current with 3 contacts	**4 A**	**4 A**
Times	**750132**	**751132**
Switch-on delay		
With automatic start typ.	**11 ms**	**11 ms**
With automatic start max.	**20 ms**	**20 ms**
Delay-on de-energisation		
With E-STOP typ.	**12 ms**	**12 ms**
With E-STOP max.	**20 ms**	**20 ms**
Environmental data	**750132**	**751132**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-10 - 55 °C**	**-10 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**
Climatic suitability		
Humidity	**93 % r. h. at 40 °C**	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**	**Not permitted**
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-4, EN 61326-3-1**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10 - 55 Hz**	**10 - 55 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**III**	**III**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**6 kV**	**6 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP40**	**IP40**
Terminals	**IP20**	**IP20**

Safety relays PNOZsigma
PNOZ s22

Mechanical data	750132	751132
Mounting position	**Any**	**Any**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,5 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,2 - 1,5 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,5 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98 mm**	**100 mm**
Width	**22,5 mm**	**22,5 mm**
Depth	**120 mm**	**120 mm**
Weight	**265 g**	**265 g**

Where standards are undated, the 2014-07 latest editions shall apply.

The values for conventional thermal current stated in the technical details apply when the contacts from Ext.1/O0 **and** Ext.2/O1 are under load simultaneously.

Conventional thermal current when either the contacts from Ext.1/O0 **or** the contacts from Ext.2/O1 are under load:

Number of contacts in total	I_{th} [A] per contact
1	6 A
2	6 A
3	5 A

Safety relays PNOZsigma
PNOZ s22

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Safety contacts, instantaneous	**PL e**	**Cat. 4**	**SIL CL 3**	**2,31E-09**	**SIL 3**	**2,03E-06**	**20**

Supplementary data

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.

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.

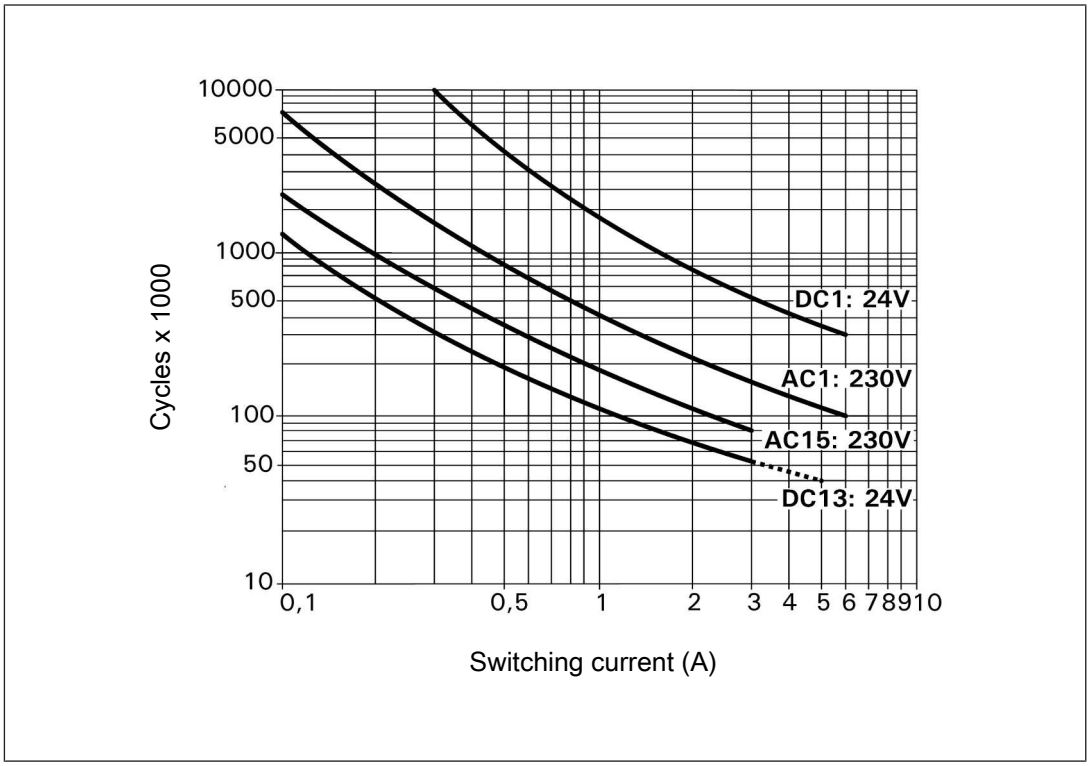


Fig.: Service life graphs at 24 VDC and 230 VAC

Safety relays PNOZsigma
PNOZ s22

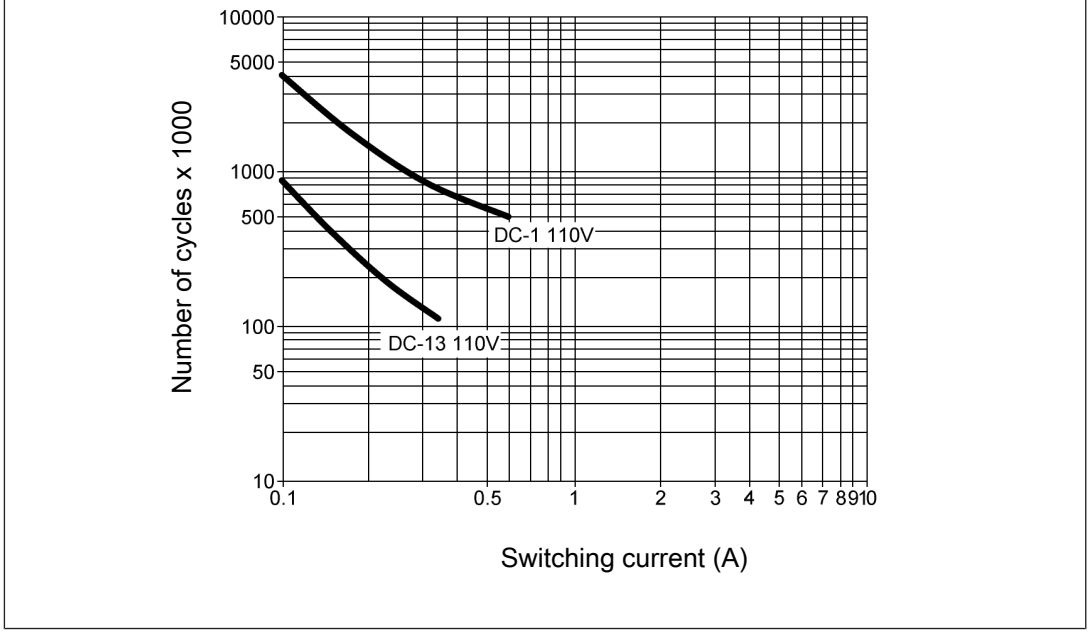


Fig.: Service life graphs at 110 VDC

Example

- Inductive load: 0.2 A
- Utilisation category: AC15
- Contact service life: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [804]) can be used in the calculation.

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

Order reference

Product type	Features	Connection type	Order No.
PNOZ s22	24 VDC	Screw terminals	750 132
PNOZ s22 C	24 VDC	Spring-loaded terminals	751 132

Safety relays PNOZsigma
PNOZ s30

Overview

Unit structure

Range

Scope of supply:

- Speed monitor PNOZ s30
- Terminator
- Connection terminals
- Chip card
- Chip card holder
- Documentation on data medium

Unit features

Using the product PNOZ s30:

Speed monitor for safe monitoring of standstill, speed, speed range, position and direction.

The product has the following features:

- Measured value recorded by
  - Incremental encoder
  - Proximity switch
- Measured variables
  - Standstill
  - Speed
  - Speed range
  - Position
  - Direction
  - Analogue voltage (track S)

Safety relays PNOZsigma
PNOZ s30

- Positive-guided relay outputs
  - 2 safety contacts (NO)
  - 2 auxiliary contacts (NC)
- Semiconductor outputs
  - 4 auxiliary outputs
- Expansion interface for 2 more safe relay outputs that be controlled separately
- Can be configured via the display on the speed monitor
- Configuration is stored on a chip card
- Display
  - Current frequencies
  - Current position
  - Warning and error messages
- Status and fault LEDs
- Rotary encoder connection technology:
  RJ45 socket

Safety relays PNOZsigma
PNOZ s30

Front/side view

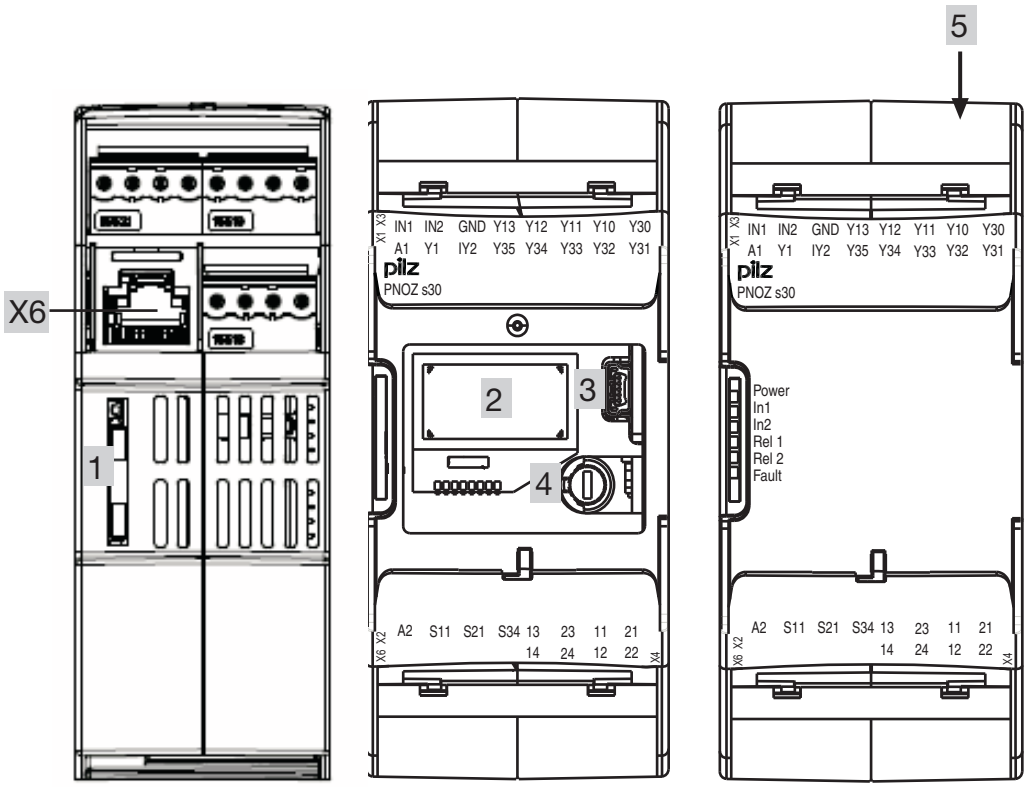


Fig.: Left: Side view, centre: Front view without cover, right: Front view with cover

Legend:

- A1, A2:
  Supply connections
- In1, In2, GND:
  Proximity switch 1 - In1 (track A) and 2 - In2 (track B) and GND
- Y10 ... Y13:
  Select inputs (SEL1, SEL2, SEL4, SEL8)
- 13-14 and 23-24:
  Relay outputs (safety contacts)
- 11-12 and 21-22:
  Relay outputs (auxiliary contacts)
- Y32 ... Y35: Semiconductor outputs (auxiliary outputs)
- S11: +24 V / 30 mA (supply for S34, Y1 and Y2)
- S21: 0 V (GND for S11, S34, Y1 and Y2)
- S34: Start input

Safety relays PNOZsigma
PNOZ s30

- Y30: 0 V ext (GND for select input and semiconductor outputs)
- Y31: 24 V ext (supply for semiconductor outputs)
- Y1, Y2:
  Y1: Feedback input for Rel. 1
  Y2: Feedback input for Rel. 2
- X6: RJ45 socket for connecting the encoder
  (tracks A, /A, B, /B, Z, /Z, S and GND). Proximity switches can be connected via RJ45 socket or connection terminals.
- 1: Chip card
- 2: Display format
- 3: USB connection (service only)
- 4: Rotary knob
- 5: Expansion interface for 2 more external relay outputs
- LEDs:
  - Power
  - In1
  - In2
  - Rel 1
  - Rel 2
  - Fault

Function description

Introduction

Proximity switches or rotary encoders record measured values, which are evaluated in the speed monitor PNOZ s30. There are 9 monitoring functions (F1 ... F9), which are performed simultaneously.

Up to 16 different parameter sets (P0 ... P15) for the monitoring functions can be selected via the select inputs.

Configuration of the monitoring functions is menu-driven, using a rotary knob. The outputs switch depending on the configuration.

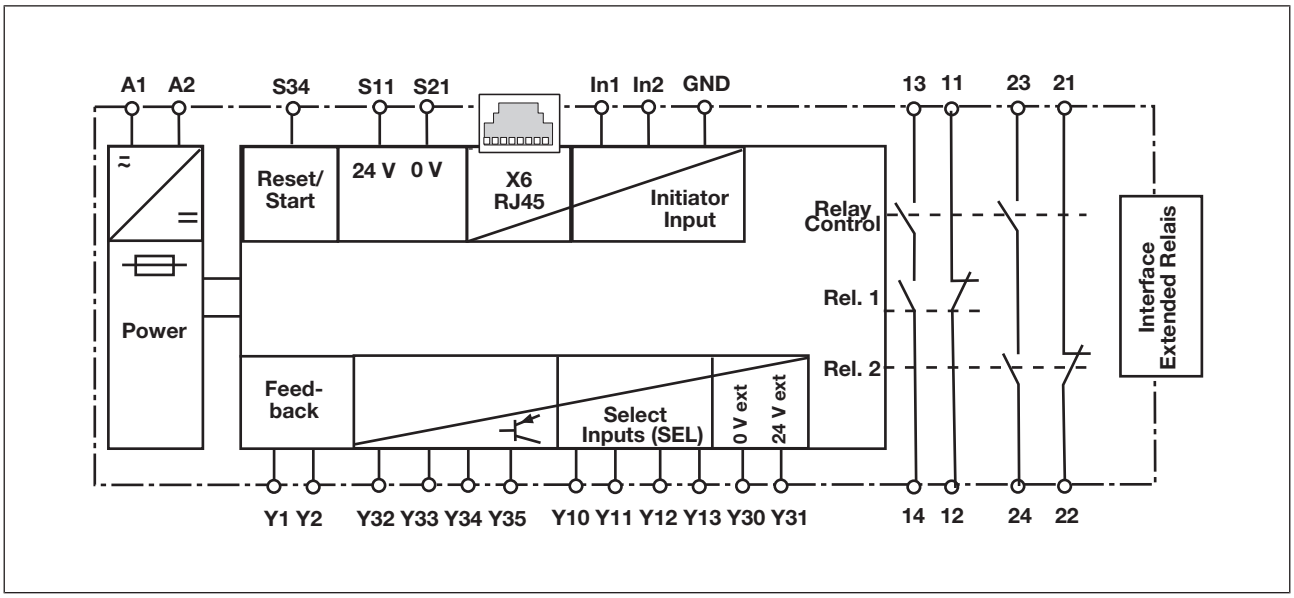
An interface is available to connect a contact expansion module PNOZsigma, enabling the number of outputs to be expanded.

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.

Safety relays PNOZsigma
PNOZ s30

Block diagram



Functions

The following monitoring functions can be configured:

Standstill

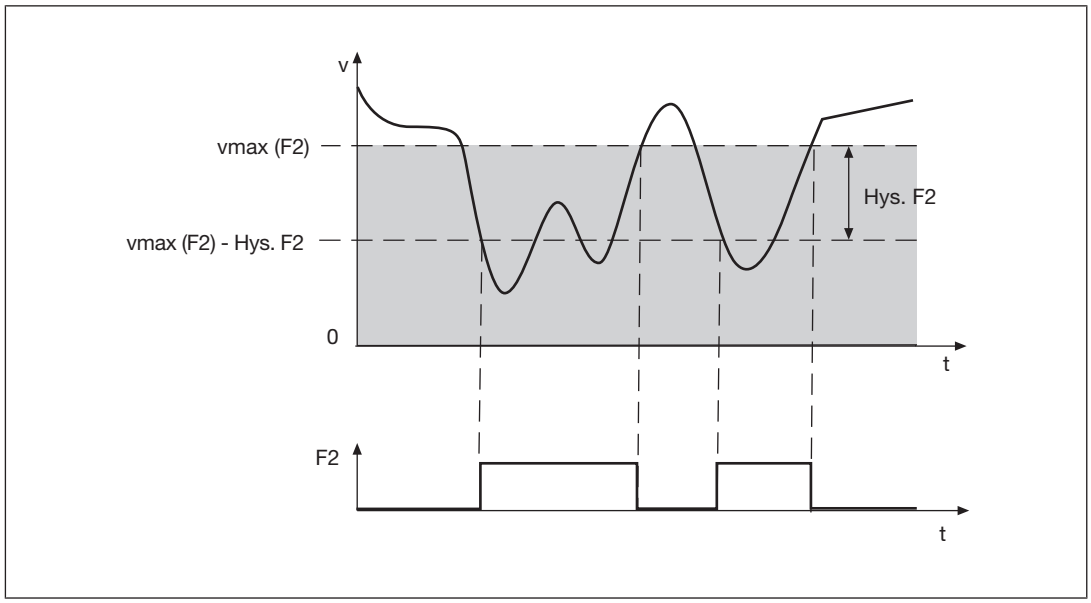
With standstill monitoring, the output is switched on when the value falls below the stated standstill value; if the standstill value is exceeded, the output switches off.

Speed

With speed monitoring, the output switches off when the configured value is exceeded.

Safety relays PNOZsigma
PNOZ s30

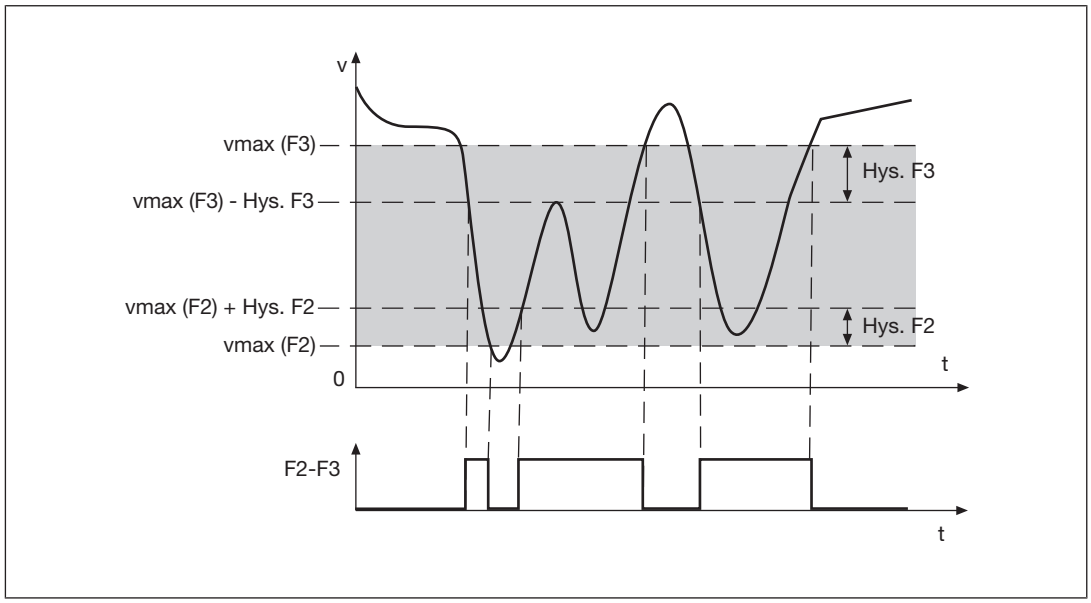
Timing diagram for standstill/speed monitoring:



Speed range

With range monitoring, the output switches off if the rotational speed (velocity, frequency) is outside the configured range.

Timing diagram for speed range monitoring:



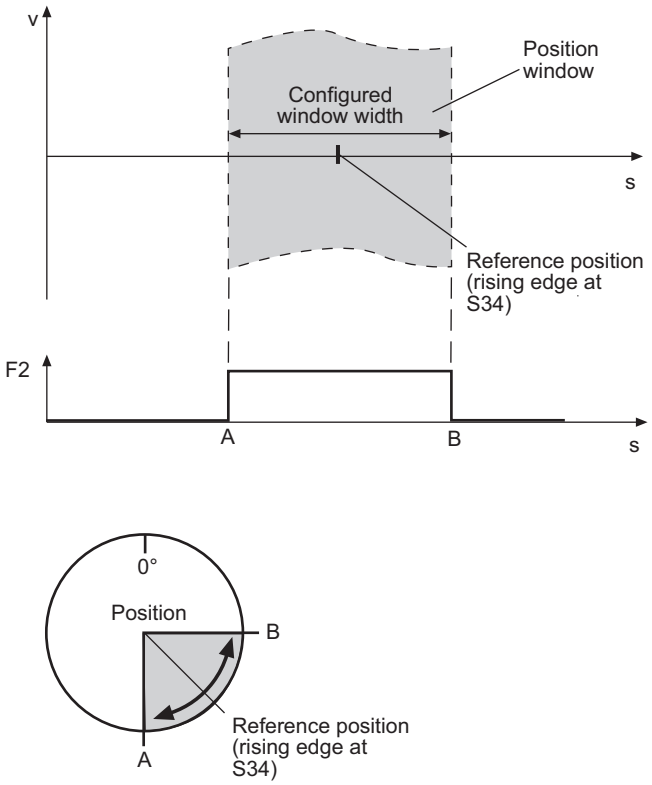
Safety relays PNOZsigma
PNOZ s30

Position

Position monitoring is activated via a rising edge at the start input. The current position is adopted as a reference position in the middle of the position window (configured window width) and the assigned output is switched on.

The output will stay switched on provided the current position is within the position window.

Timing diagram for position monitoring:



If the position moves outside the configured range, position monitoring is reset and the assigned outputs are switched off. Position monitoring can be restarted via a rising edge at the start input

A max. of 4 positions can be configured to be monitored simultaneously.

Please note:

- Active position monitoring is not started again by another rising edge at the start input.
- Active position monitoring continues unchanged even if a different parameter set is selected, which also uses position monitoring. This also applies if position monitoring is used in a different switch function.
- Active position monitoring is reset if another parameter set is selected, which does not use position monitoring.
- Position monitoring cannot be used if proximity switches are employed.

Direction

If the direction is to be detected safely, this function must be linked to a safety contact.

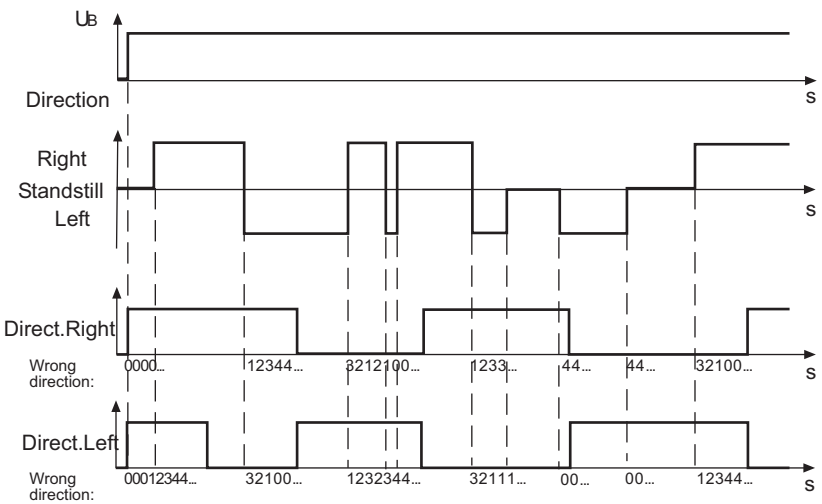
- If "Direct. Right" is configured, the safety output is switched on during normal operation in clockwise rotation.
- If "Direct. Left" is configured, the safety output is switched on during normal operation in anti-clockwise rotation.

For both directions, a tolerance can be entered for the wrong direction. In other words, the drive can run in the wrong direction up to the set tolerance value, without the assigned output switching off.
If an output has been switched off, it cannot switch back on again until the drive has been run in the right direction up to the tolerance value.

Please note:

- Direction monitoring is always active, irrespective of whether it is used in the selected parameter set.
- Direct.Right and Direct.Left are active when the PNOZ s30 is started up.
- Direction cannot be detected if proximity switches are used.

Timing diagram for direction monitoring:



Configuration in the example:

- Wrong direction in anti-clockwise rotation
  Max. right: 3 pulses
- Wrong direction in clockwise rotation
  Max. left: 3 pulses

Monitoring for broken shearpins

An additional proximity switch or an HTL signal from an additional rotary encoder can be connected to track Z to monitor for broken shearpins. These must both be configured as Z-frequency monitoring.

Please note:
Monitoring for broken shearpins does not become active until

- The minimum speed has been exceeded and
- The tolerance for detecting feasibility errors has elapsed.

The minimum speed and tolerance depend on the ratio of the frequency at tracks AB "f_{AB}" to the frequency at track Z "f_Z" in your configuration (***fAB/fZ Verh.*** setting in the menu).

Minimum speed:

- when ***fAB/fZ Verh.*** ≥ 1.0
  f_Z = 70 mHz or f_{AB} = (f_{AB}/f_Z) *x* 70 mHz
- when f_{AB}/f_Z ***Verh.*** < 1.0
  f_{AB} = 70 mHz or f_Z= 70 mHz/(f_{AB}/f_z)

Tolerance for detecting feasibility errors:

- when ***fAB/fZ Verh.*** ≥ 1.0
  7.5 Z-pulses or 7.5x *(f_{AB}/f_Z)* AB-pulses
- when ***fAB/fZ Verh.*** < 1.0
  4.5 AB-pulses or *4.5/(f_{AB}/f_Z)* Z-pulses

Hysteresis

For each switch function F1 ... F9 (with the exception of direction and position), a hysteresis can be configured. This prevents the outputs on the speed monitor from bouncing if there are fluctuations around the response value. The hysteresis becomes effective when the output is switched on:
Switch-on value = switching threshold – hysteresis
For the lower range limit:
Switch-on value = switching threshold + hysteresis

Start types

You can choose between the following start modes:

- **Automatic start**

  If an automatic start is configured, the output switches on automatically if the speed does not reach the limit value, for example.
- **Monitored start with rising edge**

  If a monitored start with rising edge is configured, the output switches on if the speed does not reach the limit value and then a rising edge was detected at S34.

- **Monitored start with falling edge**

  If a monitored start with falling edge is configured, the output switches on if the speed does not reach the limit value and then a falling edge was detected at S34.

Switch delay

A delay time can be set for each output (see technical details). The outputs will not switch until the set time has elapsed. It is possible to configure whether the delay time is to be activated when switching on, switching off, or switching on and off.

Feedback loops

Feedback loops are used to monitor external contactors or relays. The corresponding feedback loop must be closed before starting.

Start-up delay

A start-up delay time can be configured, which prevents the evaluation of the encoder signals for the configured time period after the supply voltage is switched on.

Switching direction on semiconductor outputs

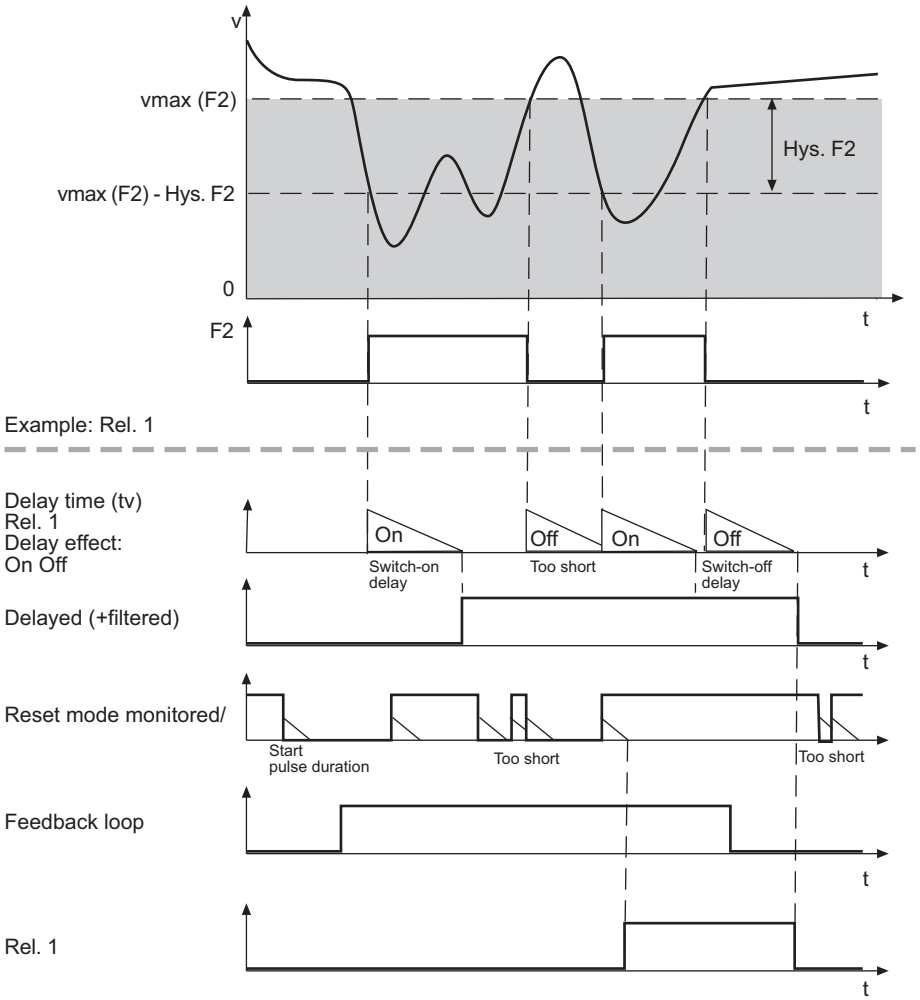
The semiconductor outputs can be operated in normally de-energised or normally energised mode.

Units

The values to be configured can be entered in various units. Depending on the axis type (linear or rotational axis), various units can be selected for speed and distance (see chapter entitled "Menu overview").

Safety relays PNOZsigma
PNOZ s30

Timing diagram for speed monitoring



Configuration in the example:

- Switch function: F2
- Assigned output: Rel. 1
- Delay effect on outputs: On + Off
- Start type: Monitored /

Speed configuration

The speed monitor is configured using the rotary knob on the device.

Up to 16 parameter sets (P0 ... P15), each with a max. of 9 switch functions (F1 ... F9) can be configured to monitor various operating modes, for example.
One of the 16 parameter sets is selected via 4 select inputs SEL1 (Y10), SEL2 (Y11), SEL4 (Y12), SEL8 (Y13).

The switch functions are monitored simultaneously.
Each of a switch function's 16 parameters can be configured as

- Standstill limit
- Speed limit
- Upper or lower limit of speed range
- Right-hand direction monitoring
- Left-hand direction monitoring
- Position monitoring 1 to 4 with width of position window 1 to 4

Exactly one switch function can be assigned to each output. The same switch function can be assigned to several outputs. With range monitoring, a range is assigned to an output (F2-F3, F4-F5, F6-F7 or F8-F9).
A switch delay and start mode can be configured for each output.

If only one parameter set is used, configure the mode "Select inputs: None". The select inputs will then be ignored.

Example configuration:

2 parameter sets for 2 operating modes are configured:

- Set-up: P1
- Automatic mode: P2

The parameter set P1 is used to monitor a reduced speed.

The parameter set P2, "Automatic mode", is selected for speed monitoring (selection via the select inputs, see next chapter "Select inputs").

The following switch functions are configured for the parameter set P1:

- F1: Standstill 2 Hz
- F2: Overspeed: 50 Hz
- F3: Warning threshold: 50 Hz

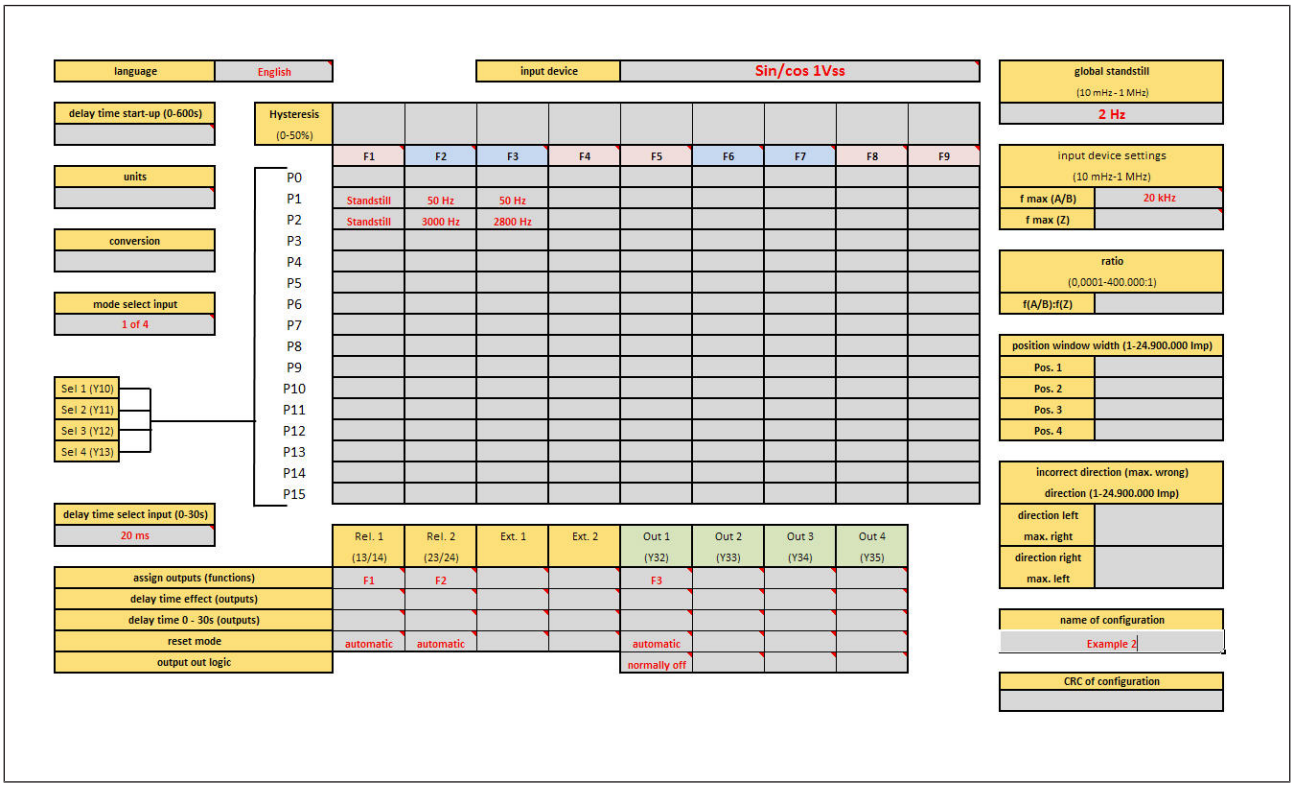
The following switch functions are configured for the parameter set P2:

- F1: Standstill 2 Hz
- F2: Overspeed: 3000 Hz
- F3: Warning threshold: 2800 Hz

Safety relays PNOZsigma
PNOZ s30

The following outputs are assigned to the switch functions:

- F1: Relay output Rel. 1
- F2: Relay output Rel. 2
- F3: Semiconductor output Out 1



For documentation and a better overview of the device settings, we recommend that you fill in this configuration overview before setting the device parameters.

Select Inputs

The parameter sets are selected via the 4 select inputs SEL1 (Y10), SEL2 (Y11), SEL4 (Y12), SEL8 (Y13). Only one of the configured parameter sets can be selected.

One of the following modes can be selected in the "Select inputs mode" menu, depending on the application:

"None" mode

For applications up to PL e of EN ISO 13849-1 and SIL CL 3 of EN IEC 62061.

The select inputs are ignored. Only the parameter set P0 is configured and used. The lowest frequency (10 mHz) is automatically set for all other parameter sets.

"1 from 4" mode

For applications up to PL e of EN ISO 13849-1 and SIL CL 3 of EN IEC 62061.

A maximum of 4 parameter sets can be configured and used: P1, P2, P4 and P8.

Parameter set	Signal states of the select inputs			
	SEL 8 (Y13)	SEL 4 (Y12)	SEL 2 (Y11)	SEL 1 (Y10)
P1	0	0	0	1
P2	0	0	1	0
P4	0	1	0	0
P8	1	0	0	0

When using these 4 parameter sets, the following safety features are met:

If there is an error when activating the select inputs, such as

- Short circuits and shorts between contacts
- Open circuit
- Input drift

a parameter set other than P1, P2, P4 or P8 is selected.

The lowest frequency (10 mHz) is automatically set for the other parameter sets (P0, P3, P5 ... P7, P9 ... P15). If one of these parameter sets is selected, an error message appears and all outputs switch off.

"All 16" mode

In this mode, the number of parameter sets can be increased to max. 16. This mode can only be used for applications up to max. PL d of EN ISO 13849-1 and up to SIL CL 2 of EN IEC 62061.

Parameter set	Signal states of the select inputs			
	SEL 8 (Y13)	SEL 4 (Y12)	SEL 2 (Y11)	SEL 1 (Y10)
P0	0	0	0	0
P1	0	0	0	1
P2	0	0	1	0
P3	0	0	1	1
P4	0	1	0	0
P5	0	1	0	1
P6	0	1	1	0

Safety relays PNOZsigma
PNOZ s30

Parameter set	Signal states of the select inputs			
P7	0	1	1	1
P8	1	0	0	0
P9	1	0	0	1
P10	1	0	1	0
P11	1	0	1	1
P12	1	1	0	0
P13	1	1	0	1
P14	1	1	1	0
P15	1	1	1	1

When using the expanded parameter sets, please note:
If an open circuit occurs when the select inputs are activated, the system will switch to a parameter set with a lower number (e.g. P7 -> P3 if an open circuit occurs at SEL4).
The limit values for the switch functions should therefore be entered in ascending order. (Parameter set P0 -> lowest values, parameter set P15 -> highest values).

Delay on the select inputs
A reaction time can be entered for the select inputs. That way it is possible to filter out invalid signals (e.g. contact bounce or an intermediate state) that occur when switching.

Switch functions

The following switch functions can be configured:

- **Standstill**

  The standstill frequency is configured centrally. The standstill frequency should be the lowest frequency in the configuration.

  All switch function parameters are pre-configured to the lowest frequency ex works.

- **Speed**

  Limit values can be configured to monitor for overspeed.

  Limit values should be entered in ascending order (Parameter set P0 -> lowest values, parameter set P15 -> highest values)

- **Speed range**

  Up to 4 speed ranges can be monitored simultaneously.

  Configure two switch functions to monitor a range:

  – F2 and F3,
  – F4 and F5,
  – F6 and F7 or
  – F8 and F9.

The switch function with the lower number (e.g. F2) operates as the lower range limit; the switch function with the higher number (e.g. F3) operates as the upper range limit.

Both switch functions can be assigned to one or more outputs.

- **Position**

  Up to 4 different position windows can be monitored: Position 1 ... Position 4.

  Each position to be monitored can be entered as often as necessary in parameter sets P0 to P15 and switch functions F1 to F9.

- **Direction**

  The monitoring functions "Direct. Left" and "Direct. Right" can be configured as a switch function as often as necessary.

  For both directions, a tolerance can be entered for the wrong direction.

Basic configuration

Two basic configurations are available for standard applications, for simple configuration within the display menu. A basic configuration contains limited menu functions adapted for standard applications, with partly pre-defined parameters.

The following basic configurations are available:

Basic configuration 1: Ini pnp pnp (proximity switch)

Pre-defined settings and configuration options:

- **Encoder type**

  2 pnp type proximity switches

- **Switch functions**
  - **Standstill (F1)**
    - Standstill frequency configurable in Hz
  - **Speed (F2)**
    - Max. frequency (v max) configurable in Hz
- **Parameter set/select input**

  P0, select inputs are ignored ("None" mode")

- **Hysteresis**

  Standstill and speed, 2 % each

- **Output assignment**
  - Standstill: Relay output Rel. 1 and semiconductor output Out 1
  - Speed: Relay output Rel. 2 and semiconductor output Out 2
- **Reset mode**
  - Rel. 1, Rel. 2 Out 1, Out 2: Automatic reset
- **Switch delay**

  None

Safety relays PNOZsigma
PNOZ s30

- **Max. encoder frequency**

  3.5 kHz

Basic configuration 2: Rotary encoder

- **Encoder type**

  Rotary encoders

  – Rotary encoder type configurable

- **Switch functions**

  – **Standstill (F1)**

  – Standstill frequency configurable in Hz

  – **Speed (F2)**

  – Max. frequency (v max) configurable in Hz

  – **Direction (F3)**

  Direction left
  Tolerance for wrong direction = 10 Imp

  – **Direction (F4)**

  Direction right
  Tolerance for wrong direction = 10 Imp

- **Parameter set/select input**

  P0, select inputs are ignored ("None" mode")

- **Hysteresis**

  Standstill and speed, 2 % each

- **Output assignment**

  – Standstill: Relay output Rel. 1 and semiconductor output Out 1

  – Speed: Relay output Rel. 2 and semiconductor output Out 2

  – Direction left: External output Ext. 1 and semiconductor output Out 3

  – Direction right: External output Ext. 2 and semiconductor output Out 4

- **Reset mode**

  – All outputs: Automatic reset

- **Switch delay**

  None

- **Max. encoder frequency**

  1 MHz

Chip card

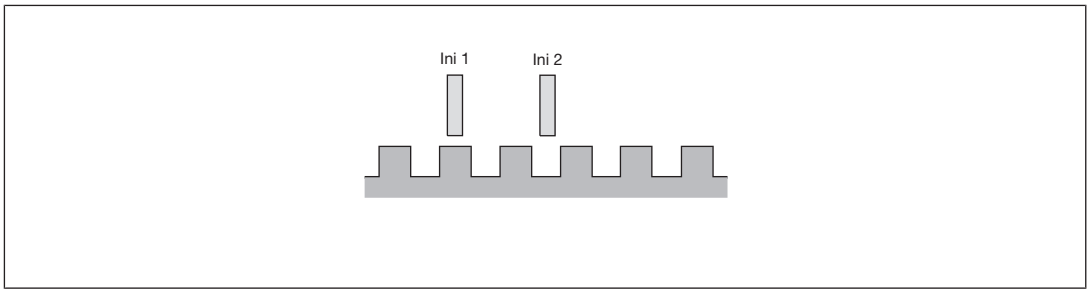
The set parameters, the name of the configuration, the check sum and the passwords are stored on the chip card (see section entitled "Using the chip card").

Input device types

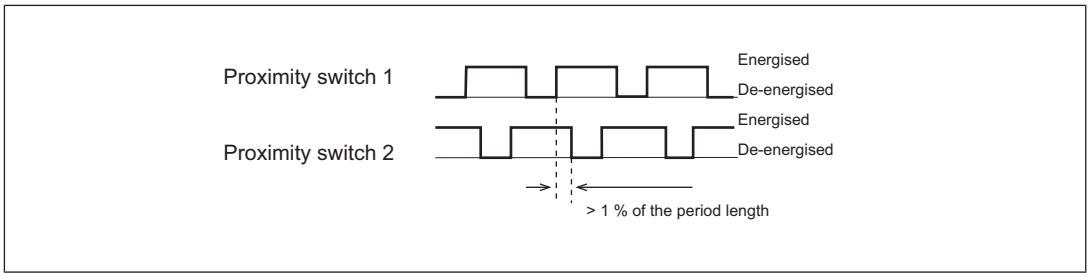
Proximity switch

- The following proximity switches can be used:
  - pnp
  - npn
- The proximity switches must be fitted so that at least one is always activated. In other words, the proximity switches must be fitted so that the recorded signals always overlap.
- The cable used to connect the proximity switches must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").
- The supply voltage of the proximity switches should be monitored via track S.

Proximity switch assembly:



Example pnp – pnp:



- Please note the values stated in the technical details
- The maximum frequency of the used encoders must be entered for a complete configuration ("Encoder" Menu -> "Track AB" -> "Track AB fmax" / "Track Z" -> "Track Z fmax").

Safety relays PNOZsigma
PNOZ s30

Rotary encoders

- The following rotary encoders can be used:
  - TTL, HTL (single-ended or differential signals)
  - sin/cos 1 Vss
  - Hiperface
- The rotary encoders can be connected with or without Z index (0 index)
- The cable used to connect the rotary encoders must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").
- A proximity switch can also be connected to track Z for monitoring broken shearpins
- Track S can be used:
  - To connect an encoder's error output
  - To monitor voltages between 0 V and 30 V for a permitted upper and lower limit. For example, the encoder's supply voltage can be monitored.
- The following must be entered for a complete configuration:
  - The maximum frequency of the used encoders ("Encoder Settings" menu -> "Track AB" -> "Track AB fmax" / "Track Z" -> "Track Z fmax").
  - The ratio fAB/fZ ("Encoder Settings" menu -> "Track Z" -> fAB/fZ Verh.)

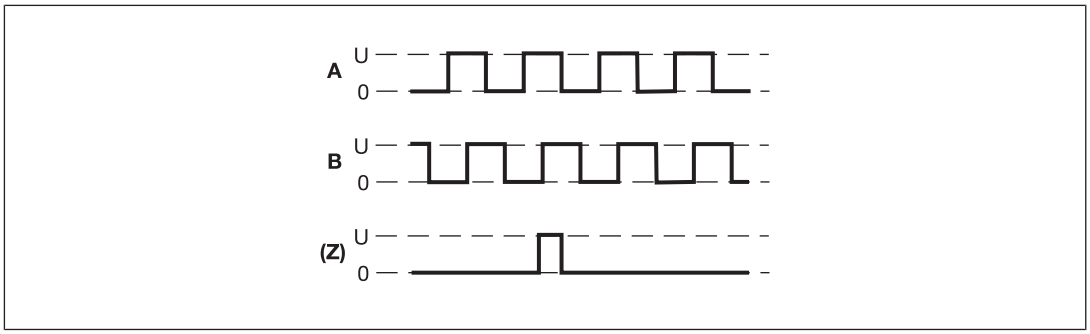
Please note the values stated in the technical details

Safety relays PNOZsigma
PNOZ s30

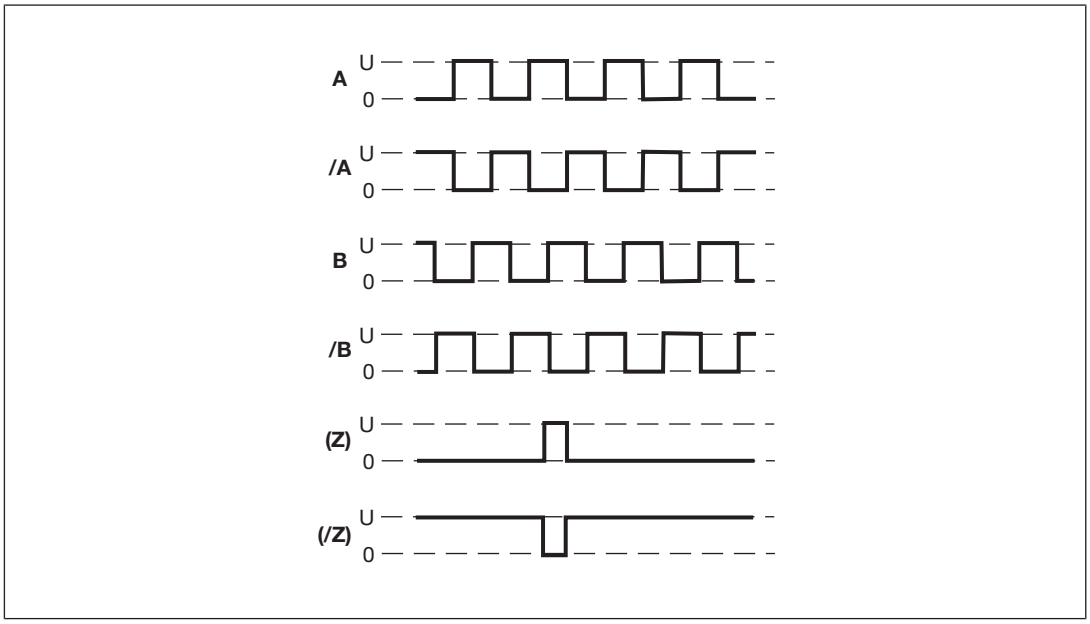
Output signals

Output signals TTL, HTL

- Single ended



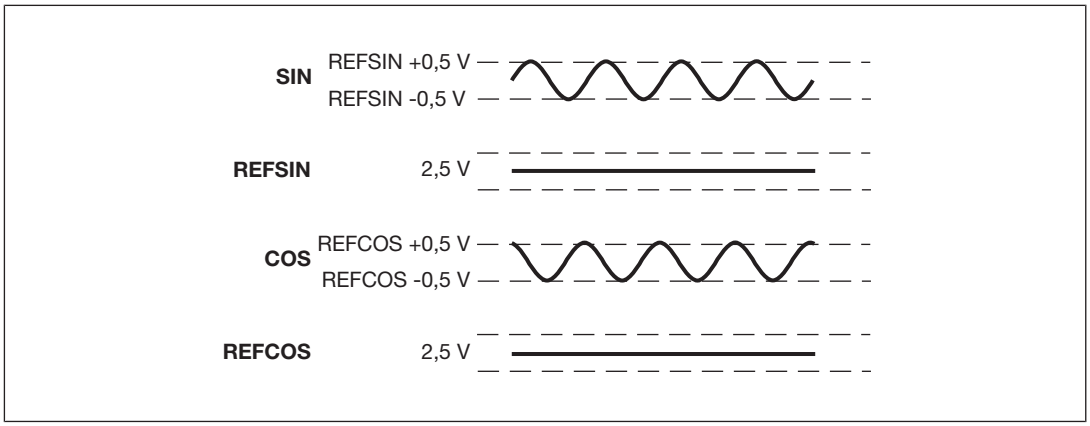
- Differential



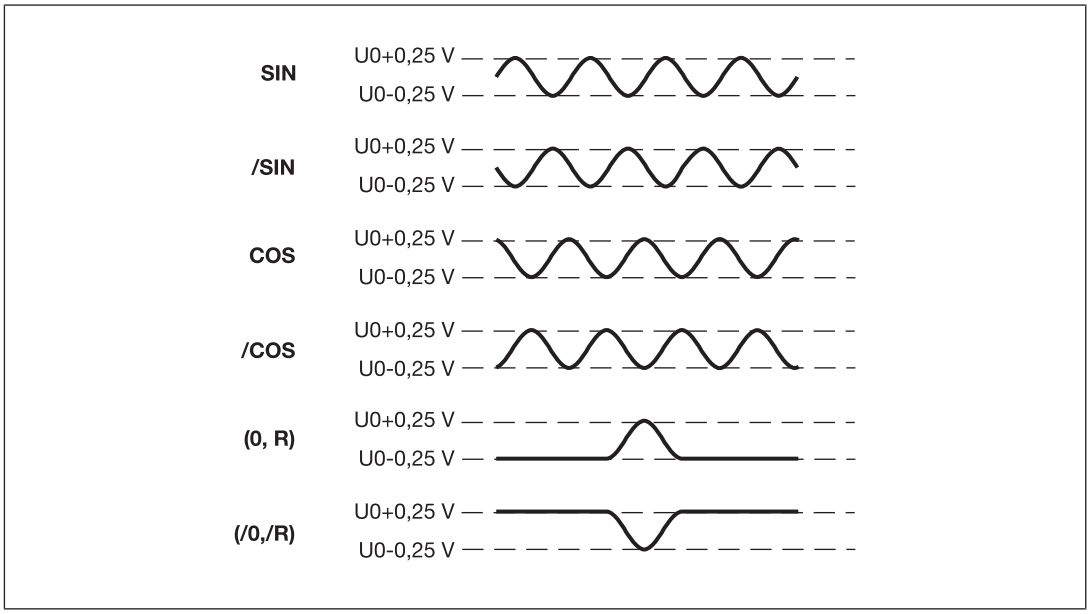
Safety relays PNOZsigma
PNOZ s30

Output signals Sin/Cos (1 Vss)

- Single ended with reference track (e.g. Hiperface ®)



- Differential with/without Z index (e.g. Heidenhain 1 Vss)



Adapter for incremental encoders

The adapter records the data between the encoder and the drive and makes it available to the PNOZ s30 via the RJ45 socket.

Pilz supplies complete adapters as well as ready-made cable with RJ45 connector, which can be used when making your own adapter. The range of products in this area is constantly being expanded. Please contact us about the range of adapters that is currently available.

Safety relays PNOZsigma
PNOZ s30

Installation

General installation guidelines

Install base unit without contact expansion module:

- Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expansion module:

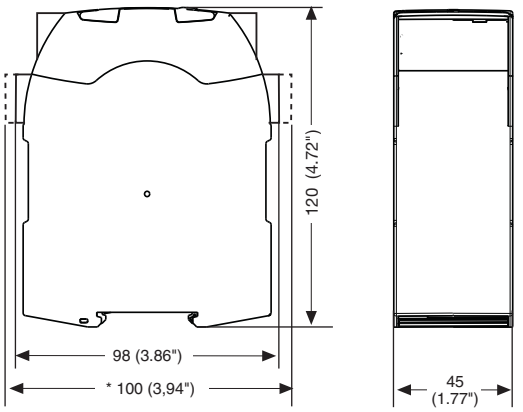
- Remove the plug terminator at the side of the base unit and at the contact expander module.
- Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

Control cabinet installation

- The unit should be installed in a control cabinet with a protection type of at least IP54.
- It is preferable to install the device on a horizontal DIN rail in order to ensure the best possible convection.
- Use the notch on the rear of the unit to attach it to the DIN rail.
- Push the device upwards or downwards before lifting it from the DIN rail.

Dimensions

*with spring-loaded terminals



Commissioning

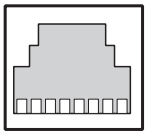
Wiring

General wiring guidelines

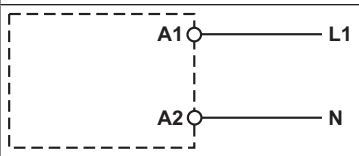
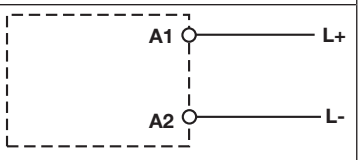
Note:

- Information given in the "Technical details" must be followed.
- Use copper wire that can withstand 75 °C.
- The cable used to connect the encoders and proximity switches must be shielded (see connection diagrams in the chapter entitled "EMC-compliant wiring").
- The shield may only be connected to earth at a single point.
- Earth loops should be avoided.
- If possible, the connections for the various earth potentials (GND, S21, Y30, A2) should not be connected on the PNOZ s30 but should be connected directly to the GNDs on the connected units, otherwise noise susceptibility may be increased significantly (conductor loops are not permitted).

Pin assignment of RJ45 socket

RJ45 socket 8-pin	PIN	Track
	1	S
	2	GND
	3	Z
	4	A
	5	/A
	6	/Z
	7	B
	8	/B

Supply voltage

Supply voltage	AC	DC
		

Safety relays PNOZsigma
PNOZ s30

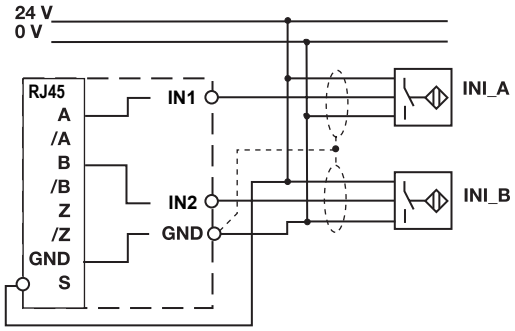
Connection of proximity switches

The following proximity switch combinations can be connected:

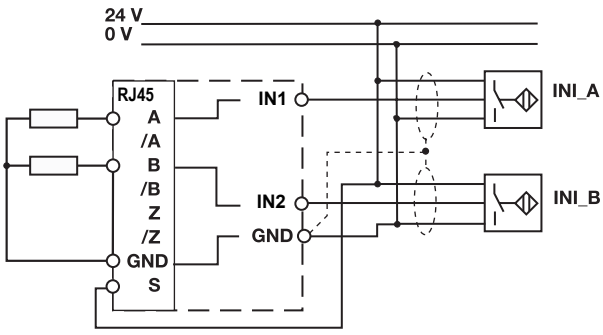
- A: pnp, B: pnp
- A: npn, B: npn
- A: pnp, B: npn
- A: npn, B: pnp

When connecting proximity switches please note:

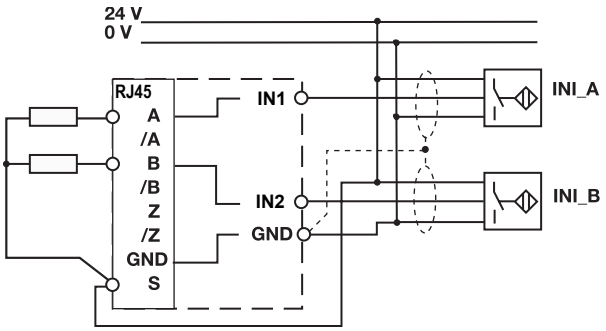
- Proximity switches can either be connected to terminals In1, In2 and GND or to tracks A and B plus GND on the RJ45 socket.
- Track S should be used to monitor the supply voltage (see drawing). A permitted voltage range can be entered in the menu.
- Connect the proximity switch to 24 VDC of the power supply.
- When connecting the proximity switches, please refer to the chapter entitled "EMC-compliant wiring"
- Invalid signals may occur with cable lengths >50 m. In this case we recommend that you connect a resistor between the signal lines, as shown in the diagrams.



pnp proximity switch with resistor R = 10 kOhm



npn proximity switch with resistor R = 47 kOhm



Connection of a rotary encoder

Proceed as follows when connecting the encoder:

- The encoder can be connected via an adapter (e.g. PNOZ msi6p) or directly to the PNOZ s30.
- Use only shielded cables for all connections. Please refer to the chapter entitled "EMC-compliant wiring".
- Always connect GND on the encoder to GND on the RJ45 connector.

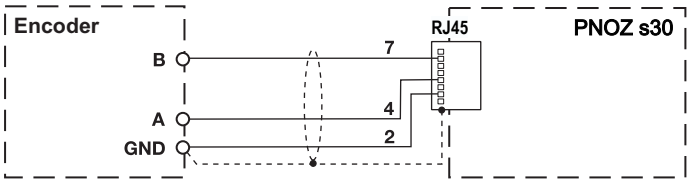
Connect rotary encoder to speed monitor

Encoder types:

- TTL single ended
- HTL single ended

Please note:

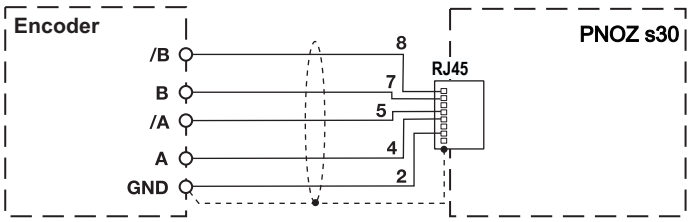
- Tracks/A, /B, Z and /Z must remain free



Safety relays PNOZsigma
PNOZ s30

Encoder types:

- TTL Differential
- HTL differential
- sin/cos 1 Vss
- Hiperface



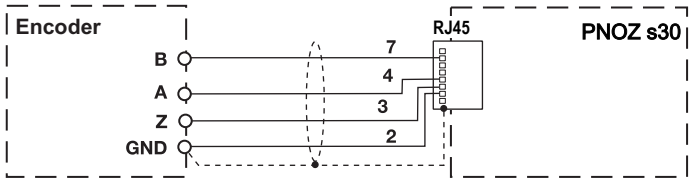
Connect rotary encoder with Z index to speed monitor

Encoder types:

- TTL single ended Z Index
- HTL single ended Z Index

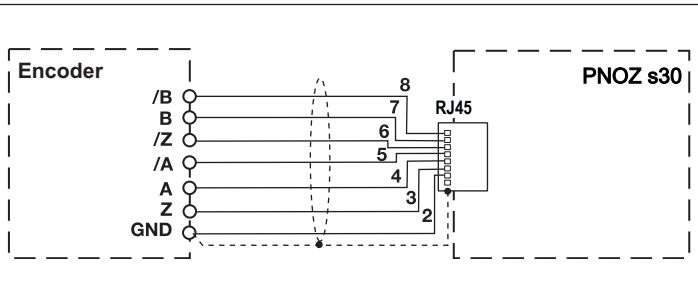
Please note:

- Tracks /A, /B and /Z must remain free



Encoder types:

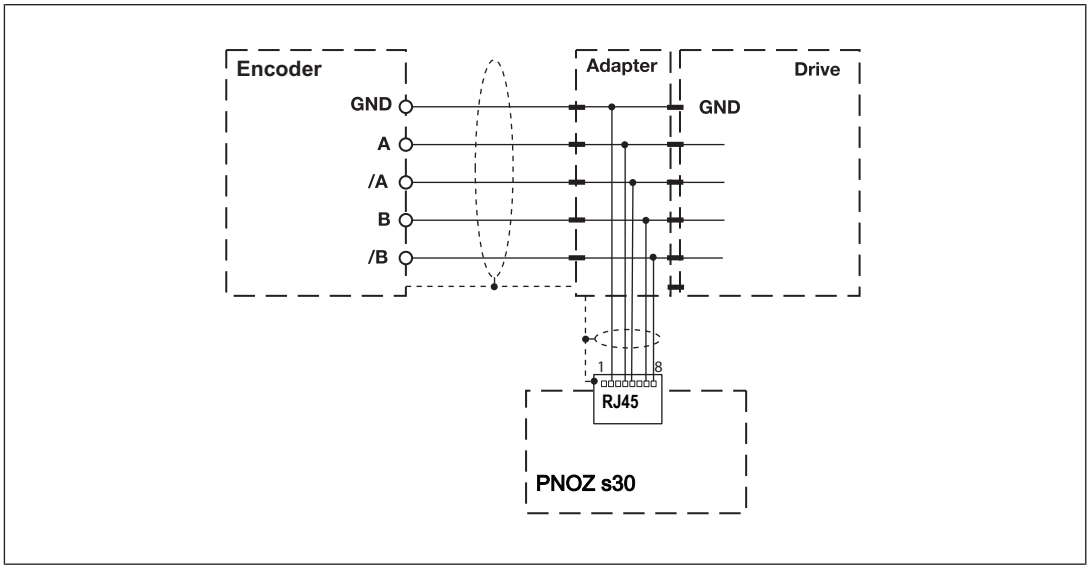
- TTL differential + Z Index
- HTL differential + Z Index
- sin/cos 1 Vss Z Index



Safety relays PNOZsigma
PNOZ s30

Connect rotary encoder to the speed monitor via an adapter

The adapter (see Accessories) is connected between the encoder and the drive. The output on the adapter is connected to the RJ45 socket on the PNOZ s30.



Connection of proximity switch and rotary encoder

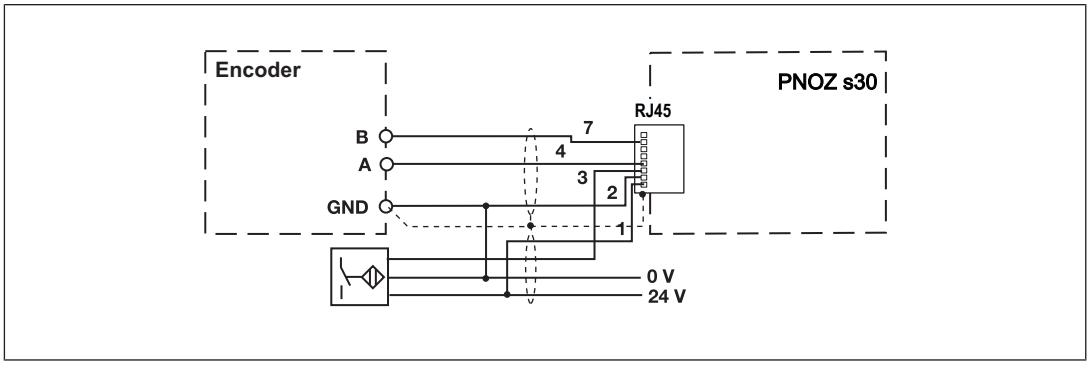
When connecting the encoders and proximity switches, please refer to the chapter entitled "EMC-compliant wiring".

Sensor types:

- Configuration: HTL single Z Freq. Ini pnp
  - HTL single ended (A,B) + Ini pnp (Z)
  - HTL single ended (A,B) + HTL differential (A as Z)
  - HTL single ended (A,B) + HTL single ended (A as Z)
- Configuration: TTL single Z Freq. Ini pnp
  - TTL single ended (A,B) + Ini pnp (Z)
  - TTL single ended (A,B) + HTL differential (A as Z)
  - TTL single ended (A,B) + HTL single ended (A as Z)

Safety relays PNOZsigma
PNOZ s30

Please note:
Tracks /A, /B and /Z must remain free.

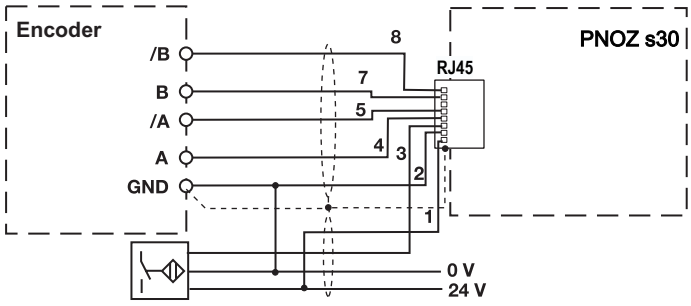


Sensor types:

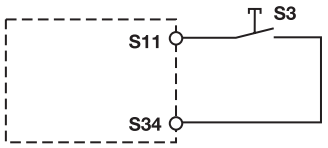
- Configuration: TTL differential Z Freq. Ini pnp
  - TTL differential (A,/A,B,/B) + Ini pnp (Z)
  - TTL differential (A,/A,B,/B) + HTL differential (A as Z)
  - TTL differential (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: HTL differential Z Freq. Ini pnp
  - HTL differential (A,/A,B,/B) + Ini pnp (Z)
  - HTL differential (A,/A,B,/B) + HTL differential (A as Z)
  - HTL differential (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: sin/cos 1 Vss Z Freq. Ini pnp
  - sin/cos 1 Vss (A,/A,B,/B) + Ini pnp (Z)
  - sin/cos 1 Vss (A,/A,B,/B) + HTL differential (A as Z)
  - sin/cos 1 Vss (A,/A,B,/B) + HTL single ended (A as Z)
- Configuration: Hiperface Z Freq. Ini pnp
  - Hiperface (A,/A,B,/B) + Ini pnp (Z)
  - Hiperface (A,/A,B,/B) + HTL differential (A as Z)
  - Hiperface (A,/A,B,/B) + HTL single ended (A as Z)

Safety relays PNOZsigma
PNOZ s30

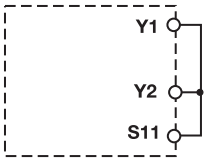
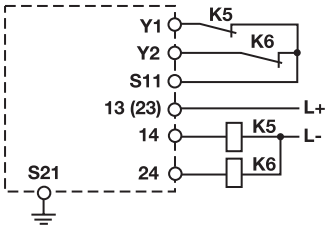
Please note:
Track /Z must remain free!!



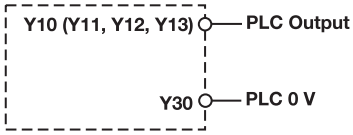
Reset circuit

Automatic start	Monitored start
automatic start must only be configured No wiring necessary!	

Feedback circuit

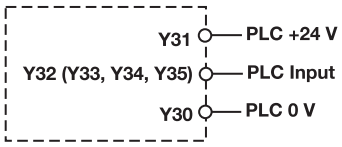
No feedback loop monitoring	Contacts from external contactors
	

Select inputs



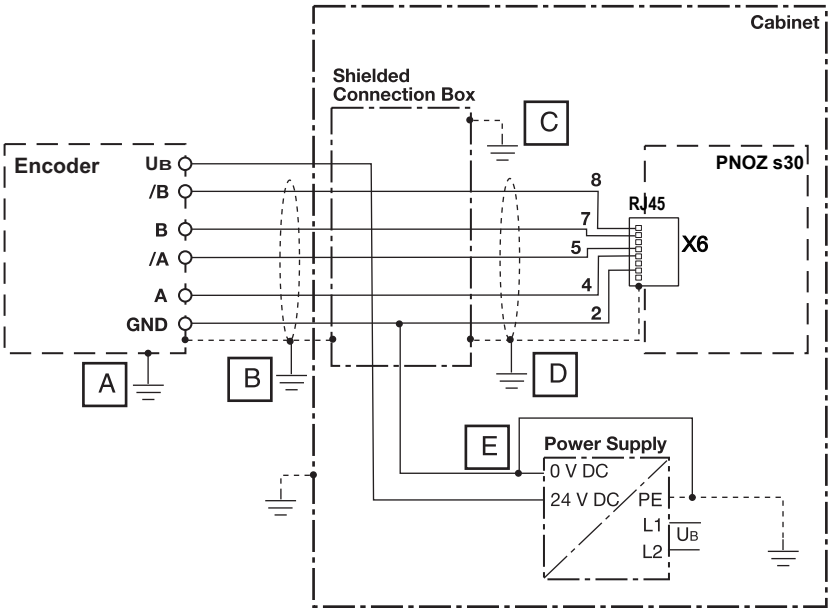
Safety relays PNOZsigma
PNOZ s30

Semiconductor outputs



EMC-compliant wiring

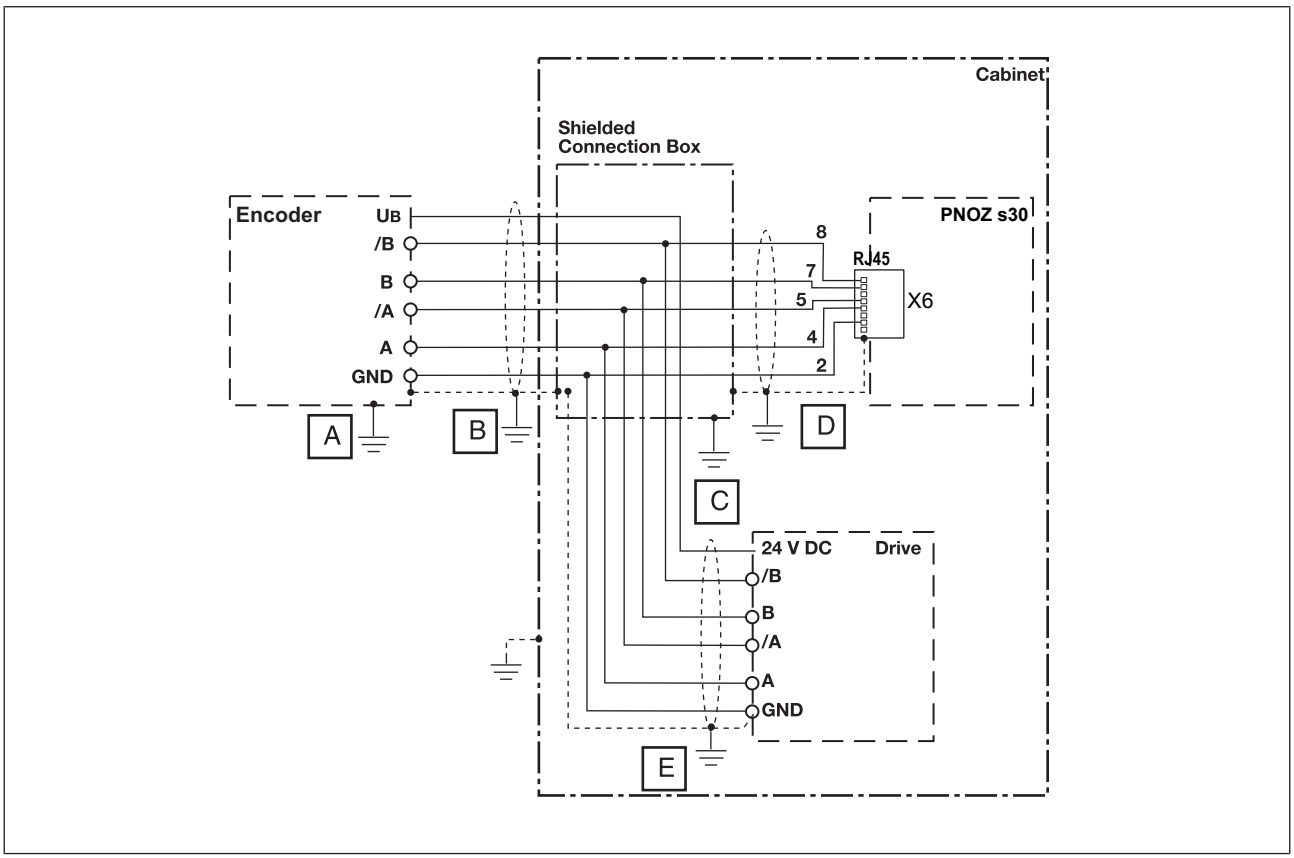
EMC-compliant wiring for connecting an encoder



To avoid EMC interference we recommend that the shield on the sensor cables or the housing of the shielded junction box is only connected to earth at a single point:
A **or** B **or** C **or** D **or** E
Conductor loops outside the shield must be avoided.
If a shielded junction box is not used, the shield must run continuously from the sensor to the evaluation device.

Safety relays PNOZsigma
PNOZ s30

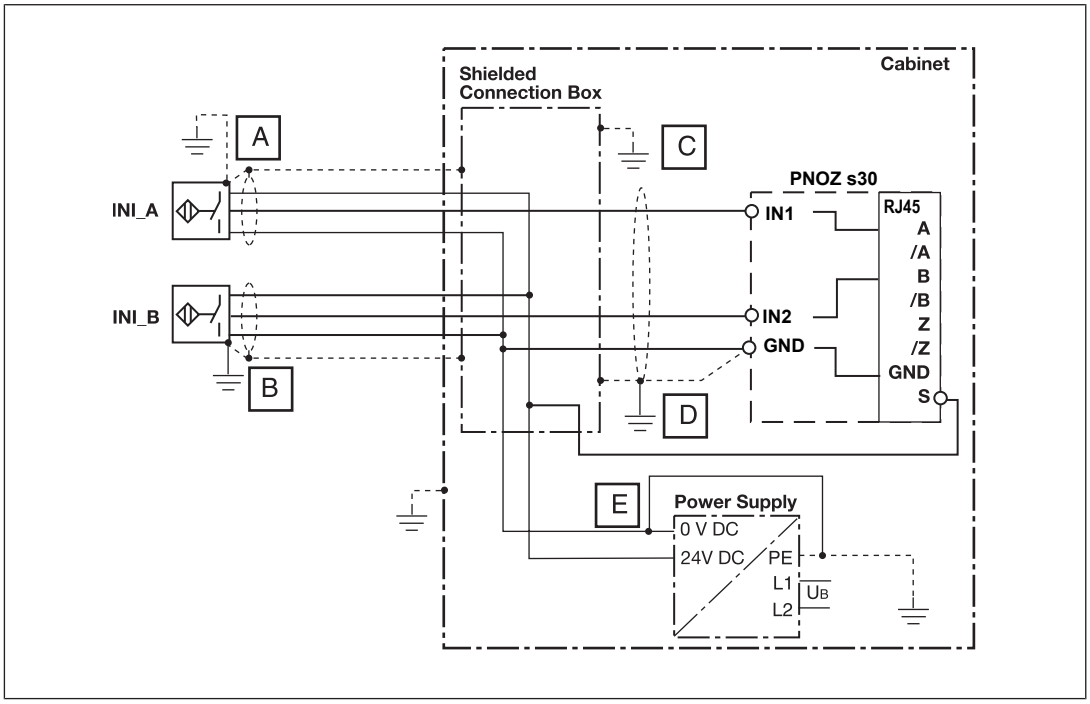
EMC-compliant wiring for connecting an encoder with drive



To avoid EMC interference we recommend that the shield on the sensor cables or the housing of the shielded junction box is only connected to earth at a single point:
A **or** B **or** C **or** D **or** E
Conductor loops outside the shield must be avoided.
If a shielded junction box is not used, the shield must run continuously from the sensor to the evaluation device.

Safety relays PNOZsigma
PNOZ s30

EMC-compliant wiring for connecting 2 proximity switches



To avoid EMC interference we recommend that the shield on the sensor cables or the housing of the shielded junction box is only connected to earth at a single point:
A **or** B **or** C **or** D **or** E
Conductor loops outside the shield must be avoided.
If a shielded junction box is not used, the shield must run continuously from the sensor to the evaluation device.

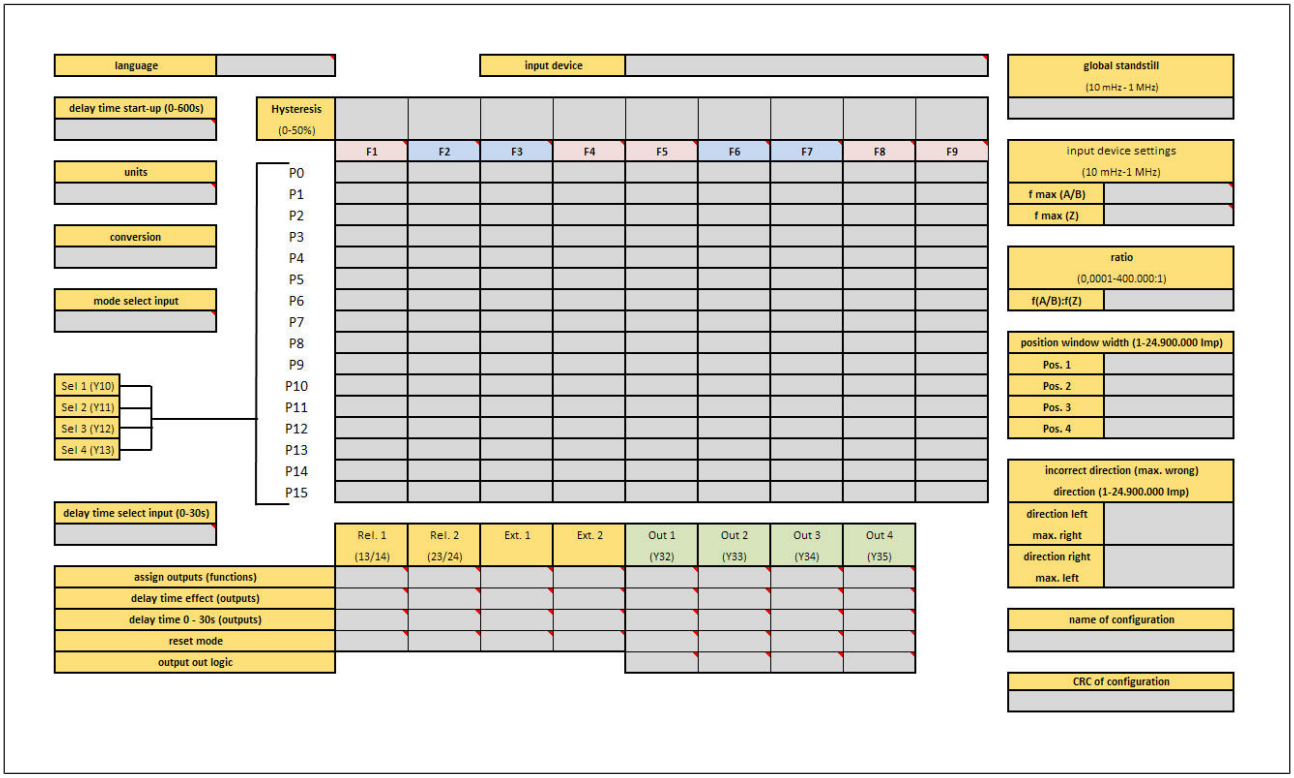
Safety relays PNOZsigma
PNOZ s30

Display menu - Configuration

The menu settings are made on the unit's display via a rotary knob. You have the option to make the settings on the knob by hand or with a screwdriver. If you make the settings with a screwdriver, the knob can remain within the unit.

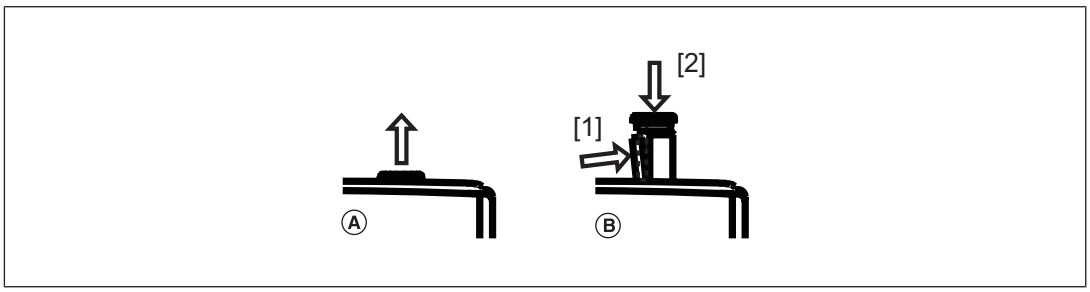
Create configuration overview

For a better overview, before entering the configuration values we recommend that they are entered in the form *PNOZ_s30_Config_Overview*:



Safety relays PNOZsigma
PNOZ s30

Operate rotary knob



Pull out knob (A):

- until it locks into position
- Release knob (B) and push it back into the unit:
  - Press the bar on the side of the knob [1] towards the centre of the knob. This releases the knob.
  - Press the knob downwards [2] while keeping the bar pressed in

Configure Speed Monitor

The settings are made via the rotary knob, as follows:

Press the knob

- Confirm selection/setting
- Switch to menu

Rotate knob

- Select menu level
- Set the parameter/numeric value

The speed with which you turn the knob affects the sequence of the menu and numeric values:

- Slowly: Units
- Quickly: Tens
- Very quickly:
  - Setting the numeric value: Hundreds
  - When switching the menu level: Jump to **ESCAPE**

Password protection

The configuration is protected through passwords. There is a master password and a customer password.

Factory setting for both passwords: 0000

The password levels contain different authorisations:

- **Master password**

  Display: All settings
  Edit: All settings

- **Customer password**

  Display: All settings
  Edit:

  – The customer password can be changed.
  – The language can be changed.
  – The settings can be reset to the factory settings.

- **No password**

  Edit:

  – The language can be changed.
  – The settings can be reset to the factory settings.

If the settings are reset to the factory settings, the passwords and the language will also be reset to the factory settings.

The passwords can be changed at any time in the menu.
Enter a password containing 4 characters.

Use chip card

The parameters that are set on a unit can be stored on the chip card. The data is stored along with a device identifier, the passwords, the name of the configuration and the check sum. We recommend that you **always** operate the unit with a chip card.

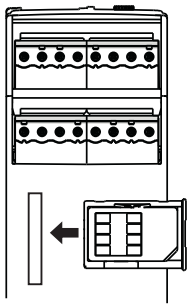
- If the parameters on a device have been changed due to an error, they can be restored using the backup copy on the chip card.
- If a unit requires maintenance or needs to be exchanged, the chip card can be used to download the parameters to another unit.

When the chip card is inside the unit:

- The chip card is checked to verify the device identifier, valid parameters, and ensure that the data is identical.
- Unit parameters are automatically saved to the chip card during operation. As a result, the chip card always contains a copy of the unit's current internal data. Exception: If you select **Write configuration to SIM: No**.

Insert chip card

Make sure that you do not bend the chip card as you insert it into the chip card slot.



Write data to chip card

If you are inserting a chip card which has not yet been written by a PNOZ s30, you have the option to:

	Insert chip card	1.		2.	Data is written to the chip card
Please insert SIM Card!	**Write configur-ation to SIM: No?**		**Write con-figuration to SIM: Yes?**		**Current menu**

Allow data to be written to the chip card

	Insert chip card	1.	Data is **not** written to the chip card
Please insert SIM Card!	**Write con-figuration to SIM: No?**		**Insert rewritable SIM Card!**

Do not allow data to be written to the chip card

Read data from chip card

If you are inserting a chip card which has not yet been written by a PNOZ s30, you have the option to:

	Insert chip card (data on chip card different from device)	1.		2.	Data is read into the device
Current menu	**SIM: Name of the configuration (8 characters)** **CRC: 12345 (0 .. 65535)** **Load SIM: No?**		**SIM: Name of the configuration (8 characters)** **CRC: 12345 (0 .. 65535)** **Load SIM: Yes?**		**Current menu**

Allow data to be read from the chip card

	Insert chip card (Data on chip card different from device)	1.	Data is **not** read into the device, data is written to the chip card
Current menu	**SIM: Name of the configuration (8 characters)** **CRC: 12345 (0 .. 65535)** **Load SIM: No?**		**Write configuration to SIM: No?** (for more details see "Write data to chip card)

Do not allow data to be read from the chip card

Transfer device parameters

You can transfer device parameters from one device to another using the chip card.

Proceed as follows:

- Remove chip card containg the data from device 1.
- Insert chip card in device 2.
- Confirm the message **Load SIM Yes?**.
  The data is transferred.

Duplicate chip card

You can also create copies of a chip card and its data.

Proceed as follows:

- Remove chip card containg the device data.
- Insert a new chip card into the device.
- Confirm the message **Write configuration to SIM Yes?**.
- The new chip card is written.

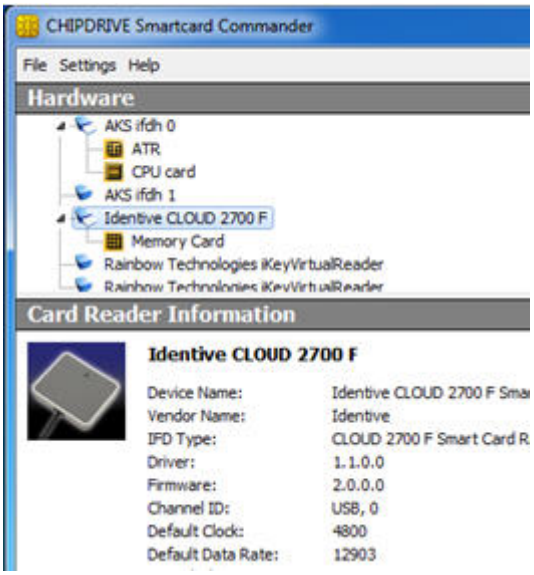
Save configuration with Software SmartCardCommander

You have the option to save a PNOZ s30 configuration from the chip card to your computer. The configuration can be saved on the computer and then downloaded to other chip cards.

To do this you will need the chip card reader **PNOZ Chip Card Reader** with the corresponding **SmartCardCommander** software. Both are available from Pilz as accessories, individually or as part of a set (see Accessories [📖 891]).

Save PNOZ s30 configuration on the computer

1. Make a note of the configuration's CRC in the PNOZ s30. It is shown on the display in the **Information/ Configuration CRC** menu. This will be needed later to check whether the correct configuration is saved on the device.
2. Remove the chip card from the PNOZ s30 and insert it into the holder for the chip card reader.
3. Start the **SmartCardCommander** software.
4. Insert the holder containing the chip card into the chip card reader.
5. The **Memory Card** directory is displayed in a list under **Hardware** on the software interface of the **SmartCardCommander**.



6. To read the data on the chip card, click on the **Memory Card** directory and then select **Read Data from Card**.
7. When **Data read successfully** is displayed on the software interface, the data can be saved as a hex file in any directory on the computer.
8. Make sure that the corresponding configuration CRC, which you noted down, is saved in the same directory.

Download configuration from the computer to the PNOZ s30

1. Insert a chip card into the holder for the chip card reader and insert this into the chip card reader.
2. Start the **SmartCardCommander** software.
3. To write the chip card, select **Write Data to Card** and confirm with **Yes**.
4. Insert the chip card in the PNOZ s30 and proceed as described under Read data from chip card [📖 846].
5. To ensure that the configuration has been transferred correctly, check that the CRC for the configuration in the PNOZ s30 matches the configuration CRC you noted down on the computer.

Menu overview

The tables provide an overview of the menu settings.

The Excel file provides a detailed view of the setting options:
PNOZ_s30_Menu_Overview.

Permanent display

If no settings are made, information regarding the configuration and current values are shown on the display.

You can change the permanent display on the display in the "Settings" menu.

Safety relays PNOZsigma
PNOZ s30

Basic settings Ini pnp pnp

Settings for basic configuration 1

Level	Designation on the display	Description	Settings
1	**Basic Parameter** **Ini pnp pnp** Default Load?	Select the default settings with which the basic configuration menu **Ini pnp pnp** is to be called: -Load : The basic parameters are loaded. Then it switches to the basic menu **Ini pnp pnp**. The basic parameters should always be loaded when commissioning for the first time. - Edit: The basic parameters are not loaded, i.e. all parameters are retained. The basic menu parameters can be changed within the permitted boundaries. - Escape: Exits the basic menu.	
2	**Standstill** **Rel.1 Out 1** Default 2.00 Hz	Enter standstill frequency	100 mHz ... 10.0 Hz
2	**v max** **Rel.2 Out 2** Default 500 Hz	Enter the max. permitted speed	10 mHz ... 3.00 kHz

Other, pre-defined settings:

- **Encoder type**

  2 pnp type proximity switches
- **Parameter set/select input**

  P0, select inputs are ignored (Select inputs mode: "None")
- **Hysteresis**

  Standstill and speed, 2 % each
- **Output assignment**
  - Standstill: Relay output Rel.1 and semiconductor output Out 1
  - Speed: Relay output Rel.2 and semiconductor output Out 2

Safety relays PNOZsigma
PNOZ s30

- **Start mode**
  - Rel.1 and semiconductor output Out 1, Rel.2 , Out 1, Out 2: Automatic start "Automatic"
- **Switch delay**

  None
- **Max. encoder frequency**

  3.5 kHz

Basic settings for the rotary encoder

Settings for basic configuration 2

Level	Designation on the display	Description	Settings
1	**Basic Parameter** **Encoder:** Default Load?	Select the default settings with which the basic configuration menu "**Rotary encoder:**" is to be called: - Load: The basic parameters are loaded. Then it switches to the basic menu "**Rotary encoder:**". The basic parameters should always be loaded when commissioning for the first time. - Edit: The basic parameters are not loaded, i.e. all parameters are retained. The basic menu parameters can be changed within the permitted boundaries. -Escape: Exits the basic menu.	
2	**Encoder** Default TTL differential	Select rotary encoder type	-TTL differential (A, /A, B, /B) -TTL single ended (A, B) -HTL differential (A, /A, B, /B) -HTL single ended (A, B) -sin/cos 1 Vss (A, /A, B, /B) -Hiperface (A, /A, B, /B)
2	**Standstill** **Rel.1 Out 1** Default 100 Hz	Enter standstill frequency	10 mHz to 1.00 kHz

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
2	**v max** **Rel.2 Out 2** Default 5.00 kHz	Enter the max. permitted speed	10 mHz to 1.00 MHz

Other, pre-defined settings:

- **Switch functions**
  - **Direction (F3)**

    Left direction
    Tolerance for wrong direction = 10 pulses
  - **Direction (F4)**

    Right direction
    Tolerance for wrong direction = 10 pulses
- **Parameter set/select input**

  P0, select inputs are ignored (Select inputs mode: "None ")
- **Hysteresis**

  Standstill and speed, 2 % each
- **Output assignment**
  - Standstill: Relay output Rel. 1 and semiconductor output Out 1
  - Speed: Relay output Rel. 2 and semiconductor output Out 2
  - Left direction: External output Ext. 1 and semiconductor output Out 3
  - Right direction: External output Ext. 2 and semiconductor output Out 4
- **Start mode**
  - All outputs: Automatic start ("Automatic")
- **Switch delay**

  None
- **Max. encoder frequency**

  1 MHz

Safety relays PNOZsigma
PNOZ s30

Settings

Level	Designation on the display	Description	Settings
1	**Permanent Display** Default H : Min : Sec (system time) v (current speed of track AB) Position	Permanent display Current values and information regarding configuration are displayed. You can change the permanent display on the display	**Display combinations:** -vz (current speed of track Z) -v (current speed of track AB) - Position - Switch functions F1...F9 - v (current speed of track AB) - Position - Line 1/2: F1/F2, F3/F2, F5/F4, F7/F6 or F9/F8 (parameters selected via select inputs). v (current speed of track AB) - H : Min : Sec (system time) - v (current speed of track AB) - Position
1	**Displ. Units** **Speed: Dist:** Default Hz Imp	Select unit of speed and distance (position).	**Speed:** (speed) **- Pos.** (distance/position) Hz Imp (pulse) Hz Edg (edge) m/s m m/min m m/h m rps rot rpm rot
1	**Conversion** Default 1 Hz= 1 Imp/s	Unit conversion. Enter ratio of unit to pulses.	Display 1 Hz= 1 Imp/s 1 Hz = 4 Edg/s 1 m = x Imp (x = 1 ... 10,000,000 pulses) 1 rot = x Imp (x = 1 ... 10,000,000 pulses)

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
1	**Encoder Settings**	Create encoder configuration for the tracks A, /A, B, /B, Z, /Z, S	
2	**Encoder** Default Undefined	Select pre-defined encoder types for the tracks A, B and Z: Proximity switch Encoder - with and without inverted signals - with or without Z-Index (0-Index) - with proximity switch at track Z Reference: If "Undefined" is selected, an error message is shown when you confirm the menu	**No encoder selected:** - Undefined **Proximity switch (Ini):** - Initiator A: pnp B: pnp - Initiator A: npn B: pnp - Initiator A: pnp B: npn - Initiator A: npn B: npn **Rotary encoder:** **TTL** - TTL differential (A, /A, B, /B) - TTL single ended (A, B) **TTL with Z-Index** -TTL diff. Z index (A, /A, B, /B, Z, /Z) - TTL single Z index (A, B, Z) **HTL** - HTL differential (A, /A, B, /B) - HTL single ended (A, B) **HTL with Z-Index** - HTL diff. Z index (A, /A, B, /B, Z, /Z) - HTL single Z index (A, B, Z) **Sin/Cos 1 Vss** - sin/cos 1 Vss (A, /A, B, /B) **Sin/Cos 1 Vss with Z-Index** - sin/cos 1 Vss Z Index (A, /A, B, /B, Z, /Z) **Hiperface** - Hiperface (A, /A, B, /B)

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
			Rotary encoder + pnp proximity switch **TTL + pnp proximity switch *** - TTL diff. (A, /A, B, /B), Z Freq Inipnp (Z) - TTL single (A, B), Z Freq Inipnp (Z) **HTL + pnp proximity switch *** - HTL diff. (A, /A, B, /B), Z Freq Inipnp (Z) - HTL single (A, B),Z Freq Inipnp (Z) **sin/cos 1 Vss + pnp proximity switch *** **-** sin/cos 1 Vss (A, /A, B, /B), Z Freq Inipnp (Z) **Hiperface + pnp proximity switch *** **-** Hiperface (A, /A, B, /B), Z Freq Inipnp (Z) * Alternatively, a track from an HTL encoder can also be used instead of a pnp proximity switch The configuration is the same as with the pnp proximity switch as Z-frequency monitoring.
2	**Track /A/B**	Settings for tracks A and B	
3	**Type AB**	For information only: Information on configured encoder type on tracks A and B	

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
3	**Track /A/B**	For information only: Information on the use of the inverted tracks /A and /B: No track /A /B or Inverted (inverted tracks /A and /B used) or Uref external (e.g. “Hiperface” encoder type)	
3	**AB Direction** Default Normal	Select direction for tracks A and B Information: This function is used to display a forward movement as positive linear/rotational speed, irrespective of the installation of the rotary encoder.	- Normal - Inverted
3	**Track AB fmax** Default 10 mHz	Enter max. frequency of the encoder on tracks A and B Important: The frequency must be less than or equal to the max. encoder frequency specified in the encoder's data sheet and less than the max. speed of the monitored drive.	10 mHz … 1.00 MHz
2	**Track Z**	Settings for track Z	
3	**Type Z**	For information only: Information on configured encoder type at track Z	
3	**Track /Z**	For information only: Information on the use of the inverted track /Z: No track /Z or Inverted (inverted track /Z used)	

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
3	**Track Z fmax** Default 10 mHz	Enter max. frequency of the encoder on track Z Important: The frequency must be less than the max. encoder frequency specified in the encoder's data sheet	10 mHz … 1.00 MHz
2	**fAB/fZ Ratio** Default 1.0000 : 1	Enter the ratio of the frequency on tracks AB "fAB" to the frequency on track Z "fZ". Used to check the Z-Index or for frequency monitoring on track Z **About** Calculating the frequency ratio: Enter permanent display: "vz: v: Position:" Switch on drive Read vz and v Divide v/vz Enter result as ratio fAB to fZ	0.0001 ... 400,000 : 1
2	**Track S**	Settings for track S (error track)	
3	**Track S** Default Not used	Use of track S: -Not used (track S is not used) -Evaluation (track S is used)	- Not used - Evaluation
3	**Track S Umax** Default 6.0 V	Enter max. voltage at track S. If the voltage is > Umax, an error is displayed and the outputs are switched off.	0.0 V ... 30.0 V
3	**Track S Umin** Default 2.0 V	Enter min. voltage at track S. If the voltage is < Umin, an error is displayed and the outputs are switched off.	0.0 V ... 30.0 V
1	**Delay Time Startup** Default 0.00 s	Select start-up delay (The start-up phase of the PNOZ s30 is extended by this time. The encoder signals are not evaluated until after the start-up phase.)	0 ... 600 s

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
1	**Function Parameter**	Select function parameter	
2	**Standstill** **-v max:** : Default 2.00 Hz	Select standstill frequency	10 mHz ... 1.00 MHz or the corresponding value in the selected unit
2	**(F1 ... F9)** **Parameter**	Enter parameter for the switch functions F1 ... F9	
3	**(F1 ... F9)** **(P0 ... P15)** **Parameter** Default 10 mHz	For each switch function F1 ... F9, 16 parameters P0 ... P15 can be configured.	
4	**(F1 ... F9)** **(P0 ... P15)** **Teach v max:** Display: Current linear/rotational speed	The current linear/rotational speed is displayed and can be adopted as a limit value.	
4	**(F1 ... F9)** **(P0 ... P15)** **-v max:** : **Standstill**	"**Standstill**" is displayed and can be adopted Info: The standstill frequency is selected globally in the menu "**Standstill v max:** " (see above)	
4	**(F1 ... F9)** **(P0 ... P15)** **-v max:** : **2.00 kHz**	Select linear/rotational speed limit	10 mHz ... 1.00 MHz or the corresponding value in the selected unit
4	**(F1 ... F9)** **(P0 ... P15)** **Function** Position **(1 … 4)**	Select position monitoring 1 ... 4	

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
4	**(F1 ... F9)** **(P0 ... P15)** **(Direct. Left, Direct. Right)**	Select left-hand or right-hand direction monitoring	
1	**Assign Outputs**	Assign functions to outputs	
2	**Output** **(Rel.1 ... Out 4)** Default Off	Each output can be assigned a switch function (F1...F9) or a range (F2-F3, F4-F5, F6-F7, F8-F9). Each output can also be used as an error output (error) or be switched off (Off). When used as an error output, the following applies: Fault: Output off No error: Output on For ranges, the following applies: The lower range limit is the switch function with the lower number (e.g. F2), The upper range limit is the switch function with the higher number (e.g. F3). Outputs: Rel.1: Relay output 1 Rel.2: Relay output 2 Ext. 1: External output 1 Ext. 2: External output 2 Out 1 ... Out 4: Semiconductor outputs 1 ... 4	-Off -F1...F9 -F2-F3 -F4-F5 -F6-F7 -F8-F9 -error
1	**Start mode**	Select start behaviour	

Safety relays PNOZsigma
PNOZ s30

Level	Designation on the display	Description	Settings
2	**Start mode** (**(Rel.1 ... Out 4)**) Default Monitored /	Select start mode for each output separately Automatic: Automatic start Monitored /: Monitored start with rising edge at S34 Monitored \: Monitored start with falling edge at S34	- Automatic - Monitored / -Monitored \

Advanced settings

Level	Menu designation	Description	Settings
1	**Positions Parameter**	Settings for position monitoring functions	
2	**Position (1 ... 4)** **Window width** Default 1 pulse	Enter width of position window for position monitoring functions 1 ... 4	1 ... 24,900,000 pulses or the corresponding value in the selected unit
1	**Direction Parameter**	Settings for direction monitoring	
2	**(Direct. Left max. right, Direct. Right max. left)** Default 0 pulse	Enter max. tolerated number of pulses (or Edg, m, rot) in the wrong direction.	1 ... 24,900,000 pulses or the corresponding value in the selected unit
1	**Mode** **Select Input** Default None	Setting for using the select inputs	-All 16 -1 from 4 -None
1	**Delay** **Select Input** Default tdl : 0 ms	Enter delay time of the select inputs Y10 – Y13 Info: The states of the select inputs are only adopted if they were unchanged during the set time.	0 ... 30.0 s
1	**Function Hysteresis**		

Safety relays PNOZsigma
PNOZ s30

Level	Menu designation	Description	Settings
2	**(F1 ... F9) Function Hysteresis** Default 1 %	Enter hysteresis for the switching functions F1 ... F9 (not effective with position and direction monitoring)	0 ... 50 %
1	**Output Delay**	Setting for the delay effect and delay time for the outputs	
2	**Delay Output** **(Rel.1 ... Out 4)** Default On 0 ms (display only)	Setting for the delay time effect and delay time for the respective output	
3	**Delay Effect** **(Rel.1 ... Out 4)** Default On delay	Enter whether the delay time is to be activated when switching on, switching off, or switching on and off.	- On - Off -OnOff
3	**Delay Time** **(Rel.1 ... Out 4)** Default tdO: 0 ms	Select delay time for the respective output	0 ... 30.0 s
1	**Output Out Logic**	Setting for the switching direction of the semiconductor outputs	
2	**output** **(Out 1 ... Out 4)** **Logic** Default N/O contact	Select the switching direction of the semiconductor outputs Out 1 ... Out 4: N/O contact (normally energised mode) N/C contact (normally de-energised mode)	- N/O contact - N/C contact
1	**Name of Configuration** Default Default	Enter name of the configuration The name may be a max. of 8 characters in length It is stored on the chip card	**.....**

Safety relays PNOZsigma
PNOZ s30

Level	Menu designation	Description	Settings
1	**Password Settings**	Change passwords Reference: In the "Default Settings" menu, the passwords are reset to the default setting: 00000.	
2	**Master PW**	Change master password	0000 ... 9999
2	**Customer PW**	Change customer password	0000 ... 9999
2	**Language** Default English	Select menu language	-English - German - French
1	**Default Settings**	Select whether the parameters are to be reset to the default settings Yes: All parameters are reset to the default values. The language is set to English and all passwords are set to 0000.	- Escape - Yes

Safety relays PNOZsigma
PNOZ s30

Information

Level	Menu designation	Description	Display/Settings
1	**System Time**	Time that the device is switched on	xxx.xxx h xx min xx s
1	**Max. Speed** **Track AB**	Max. measured linear/rotational speed at tracks A and B The value can be reset to 0	0 … 4.29 MHz or the corresponding value in the set unit Reset: Reset: - Yes ? - No
1	**Max. Speed** **Track Z**	Max. measured linear/rotational speed at track Z The value can be reset to 0	0 … 4.29 MHz or the corresponding value in the set unit Reset: Reset: - Yes? - No?
1	**Relay (Ctrl, 1, 2) Cycles**	Information: Total number of relay operations Relay Ctrl (Root relay, common 2nd shutdown route) Relay 1 (Relay output 1: 11-12, 13-14) Relay 2 (Relay output 2: 21-22, 23-24)	0 ... 6,000,000 x, > 6,000,000 x
1	**CRC of Configuration**	Check sum of configuration parameters	0 ... 65535

Safety relays PNOZsigma
PNOZ s30

Level	Menu designation	Description	Display/Settings
1	**Error Stack Entries**	Error stack entries Up to 20 error stack entries are displayed Repairable errors: Level 2, 3 and 4 (can be rectified by user) System errors: Level 2 and 3 (internal error, information for Pilz Service).	Repairable error: Level 2: 1st line: Seq. No. "**Err.:**", error number 2nd + 3rd line: Plain text to describe error for the user Level 3: 1st line: Seq. No. "**Repairable**" 2nd line: "**System time**" 3rd line: System time when the error occurred Level 4: Information for Pilz Service System errors: Level 2: 1st line: Seq. No. "**Err.:**", error number 2nd line: "**System Error**" 3rd line: System time when the error occurred Level 3: Information for Pilz Service
1	**Input Module SW Version** Va.b	For internal purposes only	
1	**Main Unit SW Version** Va.b	For internal purposes only	

Safety relays PNOZsigma
PNOZ s30

Level	Menu designation	Description	Display/Settings
-	**Actual Errors**	Up to 8 errors are displayed. Repairable errors: Level 2, 3 and 4 (can be rectified by user) System errors: Level 2 and 3 (internal error, information for Pilz Service). The error messages can be hidden with "Escape".	Repairable error: Level 2: 1st line: Seq. No. "**Err.:**", error number 2nd + 3rd line: Plain text to describe error for the user Level 3: 1st line: Seq. No. "**Repairable**" 2nd line: "**System time**" 3rd line: System time when the error occurred Level 4: Information for Pilz Service System errors: Level 2: 1st line: Seq. No. "**Err.:**", error number 2nd line: "**System Error**" 3rd line: System time when the error occurred Level 3: Information for Pilz Service
-	**Error Faulty Signal: A/A B/B Z/Z**	Error message: Incorrect signal at one or more tracks. The message - is continually updated. - can be ignored temporarily.	
-	**AB frequency deviation**	Error message: Frequency difference between the proximity switches on tracks A and B The message - is continually updated - can be ignored temporarily	
-	**Chip card messages**		

Safety relays PNOZsigma
PNOZ s30

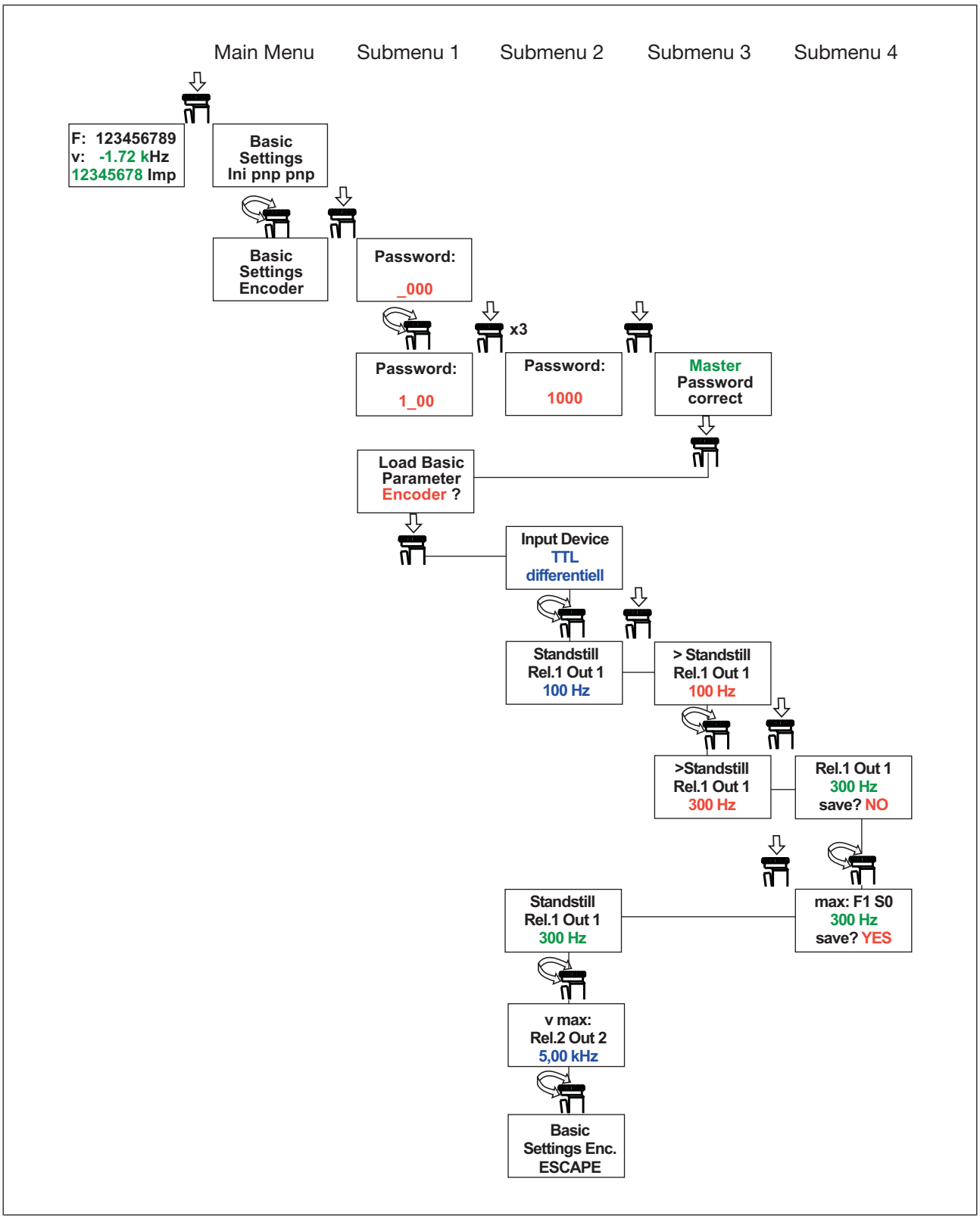
Level	Menu designation	Description	Display/Settings
-	**Please insert SIM Card!**	Appears when the device is operated without a chip card or when a defective chip card is inserted, appears again when parameters are changed. Info: The message disappears after 30 s or by pressing the rotary knob	
-	**Please insert writable SIM Card!**	Appears when the answer to "**Load SIM**" and "**Write Configuration to SIM:**" is "No"	
-	SIM: ..... CRC: ..... **Load SIM** Default No?	Appears when device detects a chip card with a valid configuration. -> Select whether the data on the chip card is to be transferred to the device.	- No? - Yes?
-	**Write Configuration to SIM:** Default No?	Appears - When a chip card has been used that does not yet contain data - When a chip card has been used that does not contain any valid data - When**Load SIM** No was selected -> Select whether the data on the chip card is to be saved.	- No? - Yes?
-	**Password messages**		
-	**Master PW** Default 0000	-> Enter master password **Password:**	0000 ... 9999

Safety relays PNOZsigma
PNOZ s30

Level	Menu designation	Description	Display/Settings
-	**Password:** Default 0000	-> Enter customer password	0000 ... 9999

Safety relays PNOZsigma
PNOZ s30

Example: Configure basic configuration 2



Safety relays PNOZsigma
PNOZ s30

Technical details

General	750330	751330
Approvals	CCC, CE, GOST, TÜV, cULus Listed	CCC, CE, GOST, TÜV, cULus Listed
Electrical data	**750330**	**751330**
Supply voltage		
Voltage	24 - 240 V	24 - 240 V
Kind	AC/DC	AC/DC
Voltage tolerance	-15 %/+10 %	-15 %/+10 %
Output of external power supply (AC)	9,0 VA	9,0 VA
Output of external power supply (DC)	5,5 W	5,5 W
Frequency range AC	50 - 60 Hz	50 - 60 Hz
Residual ripple DC	160 %	160 %
Duty cycle	100 %	100 %
External unit fuse protection F1 min.	1,00 A	1,00 A
External unit fuse protection F1 max.	Max. conductor cross section	Max. conductor cross section
Proximity switch input	**750330**	**751330**
Number of inputs	2	2
Input signal level		
Signal level at "1"	11 - 30 V	11 - 30 V
Signal level at "0"	-3 - 5 V	-3 - 5 V
Input resistance	22 kOhm	22 kOhm
Input's frequency range	0 - 1.000 kHz	0 - 1.000 kHz
Configurable monitoring frequency		
Without hysteresis	10 mHz - 1.000 kHz	10 mHz - 1.000 kHz
Incremental encoder input	**750330**	**751330**
Number of inputs	1	1
Connection type	RJ45 female connector, 8-pin	RJ45 female connector, 8-pin
Input signal level	0,5 - 30,0 Vss	0,5 - 30,0 Vss
Phase position for the differential signals A, /A and B,/B	90° ±30°	90° ±30°
Overload protection	-50 - 65 V	-50 - 65 V
Input resistance	20,0 kOhm	20,0 kOhm
Input's frequency range	0 - 1.000 kHz	0 - 1.000 kHz
Configurable monitoring frequency		
Without hysteresis	10 mHz - 1.000 kHz	10 mHz - 1.000 kHz

Safety relays PNOZsigma
PNOZ s30

Inputs	750330	751330
Voltage at		
Start circuit DC	**24,0 V**	**24,0 V**
Feedback loop DC	**24,0 V**	**24,0 V**
Current at		
Start circuit DC	**5,0 mA**	**5,0 mA**
Feedback loop DC	**5,0 mA**	**5,0 mA**
Max. inrush current impulse		
Current pulse, feedback loop	**0,06 A**	**0,06 A**
Current pulse, start circuit	**0,06 A**	**0,06 A**
Semiconductor outputs	**750330**	**751330**
Number	**4**	**4**
Voltage	**24,0 V**	**24,0 V**
Current	**50 mA**	**50 mA**
External supply voltage	**24,0 V**	**24,0 V**
Voltage tolerance	**-20% / +20%**	**-20% / +20%**
Relay outputs	**750330**	**751330**
Number of output contacts		
Safety contacts (N/O), instantaneous	**2**	**2**
Auxiliary contacts (N/C)	**2**	**2**
Utilisation category		
In accordance with the standard	**EN 60947-4-1**	**EN 60947-4-1**
Utilisation category of safety contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**4,0 A**	**4,0 A**
Max. power	**1000 VA**	**1000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**4,0 A**	**4,0 A**
Max. power	**100 W**	**100 W**

Safety relays PNOZsigma
PNOZ s30

Relay outputs	750330	751330
Utilisation category of auxiliary contacts		
AC1 at	**240 V**	**240 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**4,0 A**	**4,0 A**
Max. power	**1000 VA**	**1000 VA**
DC1 at	**24 V**	**24 V**
Min. current	**0,01 A**	**0,01 A**
Max. current	**4,0 A**	**4,0 A**
Max. power	**100 W**	**100 W**
Utilisation category		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Utilisation category of safety contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3,0 A**	**3,0 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4,0 A**	**4,0 A**
Utilisation category of auxiliary contacts		
AC15 at	**230 V**	**230 V**
Max. current	**3,0 A**	**3,0 A**
DC13 (6 cycles/min) at	**24 V**	**24 V**
Max. current	**4,0 A**	**4,0 A**
External contact fuse protection, safety contacts		
In accordance with the standard	**EN 60947-5-1**	**EN 60947-5-1**
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Circuit breaker 24V AC/DC, characteristic B/C	**4 A**	**4 A**
External contact fuse protection, auxiliary contacts		
Blow-out fuse, quick	**6 A**	**6 A**
Blow-out fuse, slow	**4 A**	**4 A**
Circuit breaker 24 V AC/DC, characteristic B/C	**4 A**	**4 A**
Conventional thermal current	**4,0 A**	**4,0 A**
Contact material	**AgCuNi + 0,2 µm Au**	**AgCuNi + 0,2 µm Au**

Safety relays PNOZsigma
PNOZ s30

Times	750330	751330
Switch-on delay		
With automatic start typ.	**15 ms**	**15 ms**
With automatic start max.	**50 ms**	**50 ms**
With automatic start after power on typ.	**3.920 ms**	**3.920 ms**
With automatic start after power on max.	**4 s**	**4 s**
With manual start typ.	**40 ms**	**40 ms**
With manual start max.	**100 ms**	**100 ms**
Delay-on de-energisation		
With power failure typ. UB 240 V	**100 ms**	**100 ms**
With power failure max. UB 240 V	**150 ms**	**150 ms**
After safety function is triggered typ.	**8 ms**	**8 ms**
After safety function is triggered max.	**15 ms**	**15 ms**
Recovery time at max. switching frequency 1/s		
After power failure	**4 s**	**4 s**
After safety function is triggered	**1 s**	**1 s**
Reaction time after limit value is exceeded	**1/f_ist + 16 ms**	**1/f_ist + 16 ms**
Waiting period with a monitored start		
With rising edge	**30 ms**	**30 ms**
With falling edge	**30 ms**	**30 ms**
Min. start pulse duration with a monitored start		
With rising edge	**30 ms**	**30 ms**
With falling edge	**30 ms**	**30 ms**
Supply interruption before de-energisation	**20 ms**	**20 ms**
Switch delay (selectable)	**0 - 30 s**	**0 - 30 s**
Delay on the select inputs (selectable)	**0 - 30 s**	**0 - 30 s**
Start-up delay (selectable)	**0 - 600 s**	**0 - 600 s**
Environmental data	**750330**	**751330**
Climatic suitability	**EN 60068-2-78**	**EN 60068-2-78**
Ambient temperature		
Temperature range	**-20 - 55 °C**	**-20 - 55 °C**
Storage temperature		
Temperature range	**-40 - 85 °C**	**-40 - 85 °C**

Safety relays PNOZsigma
PNOZ s30

Environmental data	750330	751330
EMC	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3**	**EN 60947-5-1, EN 61000-6-2, EN 61000-6-3**
Vibration		
In accordance with the standard	**EN 60068-2-6**	**EN 60068-2-6**
Frequency	**10,0 - 55,0 Hz**	**10,0 - 55,0 Hz**
Amplitude	**0,35 mm**	**0,35 mm**
Airgap creepage		
In accordance with the standard	**EN 60947-1**	**EN 60947-1**
Overvoltage category	**II**	**II**
Pollution degree	**2**	**2**
Rated insulation voltage	**250 V**	**250 V**
Rated impulse withstand voltage	**4,00 kV**	**4,00 kV**
Protection type		
Mounting area (e.g. control cabinet)	**IP54**	**IP54**
Housing	**IP30**	**IP30**
Terminals	**IP20**	**IP20**
Mechanical data	**750330**	**751330**
Mounting position	**Horizontal on top hat rail**	**Horizontal on top hat rail**
Mechanical life	**10,000,000 cycles**	**10,000,000 cycles**
Material		
Bottom	**PC**	**PC**
Front	**PC**	**PC**
Top	**PC**	**PC**
Connection type	**Screw terminal**	**Spring-loaded terminal**
Mounting type	**plug-in**	**plug-in**
Conductor cross section with screw terminals		
1 core flexible	**0,25 - 2,50 mm², 24 - 12 AWG**	–
2 core with the same cross section, flexible with crimp connectors, no plastic sleeve	**0,25 - 1,00 mm², 24 - 16 AWG**	–
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	**0,20 - 1,50 mm², 24 - 16 AWG**	–
Torque setting with screw terminals	**0,50 Nm**	–
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	–	**0,20 - 2,50 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	–	**2**

Safety relays PNOZsigma
PNOZ s30

Mechanical data	750330	751330
Stripping length with spring-loaded terminals	–	**9 mm**
Dimensions		
Height	**98,0 mm**	**100,0 mm**
Width	**45,0 mm**	**45,0 mm**
Depth	**120,0 mm**	**120,0 mm**
Weight	**410 g**	**410 g**

Where standards are undated, the 2009-06 latest editions shall apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Monitoring 1 encoder	**PL d**	**Cat. 2**	**SIL CL 2**	**2,34E-08**	**SIL 2**	**2,05E-03**	**20**
Monitoring 2 encoder	**PL e**	**Cat. 4**	**SIL CL 3**	**1,44E-09**	**SIL 3**	**1,21E-04**	**20**
Monitoring safe encoder	**PL e**	**Cat. 4**	**SIL CL 3**	**2,78E-09**	**SIL 3**	**2,40E-04**	**20**

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

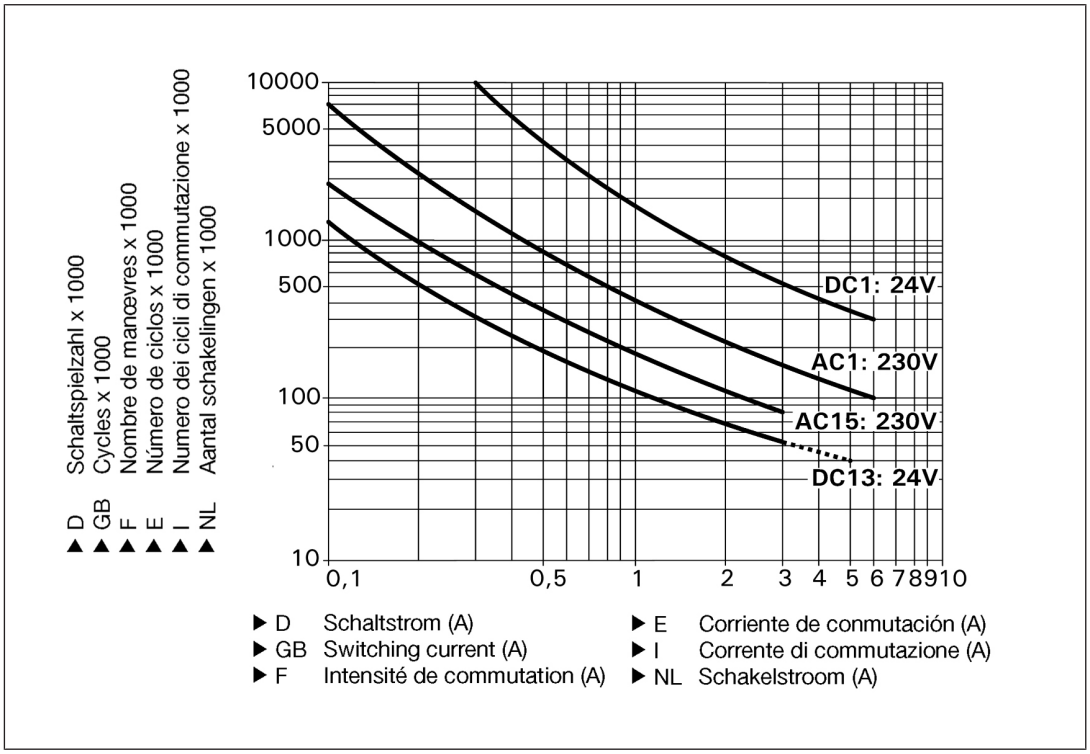
The PFH value depends on the switching frequency and the load on the relay output.
If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates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

Safety relays PNOZsigma
PNOZ s30

Supplementary data

Service life graph of output relays

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: 1 000 000 cycles

Provided the application to be implemented requires fewer than 1 000 000 cycles, the PFH value (see Technical details [868]) can be used in the calculation.

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

Safety relays PNOZsigma
PNOZ s30

Categories

Safety level

The maximum achievable safety level depends on the encoder, the wiring and the operating mode of the PNOZ s30.

Information on the safety-related characteristic data for the subsystems *Sensor* and *PNOZ s30*

Example:

Sensor subsystem			PNOZ s30 subsystem	
Category	**MTTFd**	**DC**	**Operating mode**	**PFH [1/h]**
2	Manufacturer-specific	90 %	Monitoring 1 encoder	3,28E-08

The values for *Category* and *DC* can be set for the sensor subsystem, bearing in mind the restrictions stated in the respective chapter. The MTTFd value must be stated by the device manufacturer.

Assuming that all faults are dangerous, MTTF = MTTFd can be set.
The characteristic value MTTF is a property of the sensor, which may only be stated by the manufacturer.

Forced dynamisation:
When monitoring sensors with square output signals (TTL, HTL) or safe sensors, the axis must be moved within 8 hours so that the signal changes on all the connected tracks.

Key:
SRP/CS = Safety-related part of a control system (EN 13849-1, Tab. 2)

Safety functions

The following safe monitoring functions are available:

- Standstill
- Position
- Speed
- Speed range
- Direction
- Monitoring for broken shearpins

The safety functions of the PNOZ s30 are monitoring functions, whereby a safe output signal is used to show if defined limit values are exceeded.

The reaction function that takes place (e.g. shutting down the drive, activating a mechanical brake) when exceeded limit values are detected during the normal operation of the safety function must be defined and implemented by the machine/plant developer and does not form part of the PNOZ s30.

Safety relays PNOZsigma
PNOZ s30

The monitoring function of the PNOZ s30 can be used to implement safety functions defined in the standard EN 61800-5-2 for Adjustable speed electrical power drive systems.

Safety functions in accordance with EN 61800-5-2	Implementation with PNOZ s30 safety function
Safe Operating Stop (SOS)	Standstill, position
Safely Limited Speed (SLS)	Speed
Safe Speed Range (SSR)	Speed range
Safe Direction (SDI)	Direction
Safe Speed Monitor (SSM)	Speed, speed range

Safety-related characteristic data for operation with non-safety-related rotary encoder without additional requirements

Permitted encoder types and output signals

Permitted encoder types:

- Rotary non-safety-related encoders
- Linear non-safety-related encoders

Permitted output signals:

- Square output signals TTL, single ended
- Square output signals TTL, differential
- Square output signals HTL, single ended
- Square output signals HTL, differential
- Sin/Cos output signals 1Vss, reference voltage
- Sin/Cos output signals 1Vss, differential

Safety-related architecture

To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
Category	**MTTFd**	**DC**	**Operating mode**	**PFH (1/h)**
1*	Manufacturer-specific	0 %	Monitoring 1 encoder	2,34-08

*In accordance with EN ISO 13849-1, Category 1 is only met if the sensor is a "well-tried component".

Safety relays PNOZsigma
PNOZ s30

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Speed Speed range Direction Standstill Position	PL c (Cat. 1)	-

Safety-related characteristic data for operation with non-safety-related rotary encoder with mechanical fault exclusion

In accordance with EN 61800-5-2 : 2007, Table D.16 (Motion and position feedback sensors), fault exclusions are permitted for faults in the mechanical connection between the sensor (encoder) and motor.

Permitted encoder types and output signals

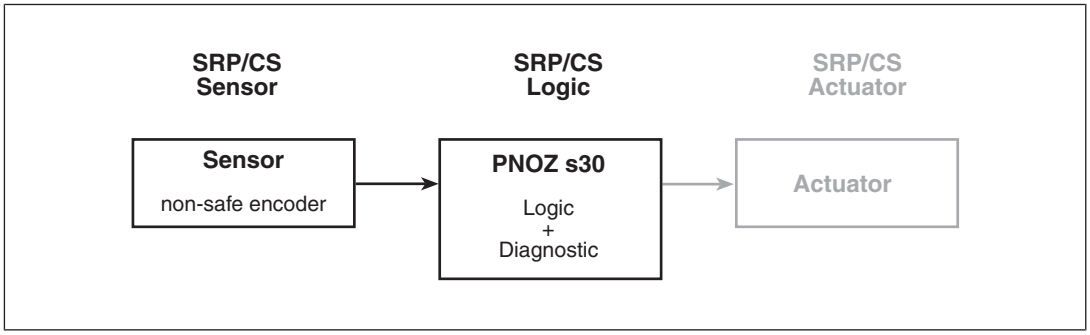
Permitted encoder types:

- Rotary non-safety-related encoders

Permitted output signals:

- Sin/Cos output signals 1Vss, reference voltage
- Sin/Cos output signals 1Vss, differential

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
Category	**MTTFd**	**DC**	**Operating mode**	**PFH (1/h)**
2	Manufacturer-specific	90 %	Monitoring 1 encoder	2,34E-08

Safety relays PNOZsigma
PNOZ s30

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Speed Speed range Direction Standstill Position	PL d (Cat. 2)	2

Safety-related characteristic data for operation with non-safety-related rotary encoder with diagnostics via the drive controller

The detection of encoder errors (diagnostics for the sensor subsystem via the evaluation device) can be supplemented with a drive controller.

Permitted encoder types and output signals

Permitted encoder types:

- Rotary non-safety-related encoders
- Linear non-safety-related encoders

Permitted output signals:

- Square output signals TTL, single ended
- Square output signals TTL, differential
- Square output signals HTL, single ended
- Square output signals HTL, differential
- Sin/Cos output signals 1Vss, reference voltage
- Sin/Cos output signals 1Vss, differential

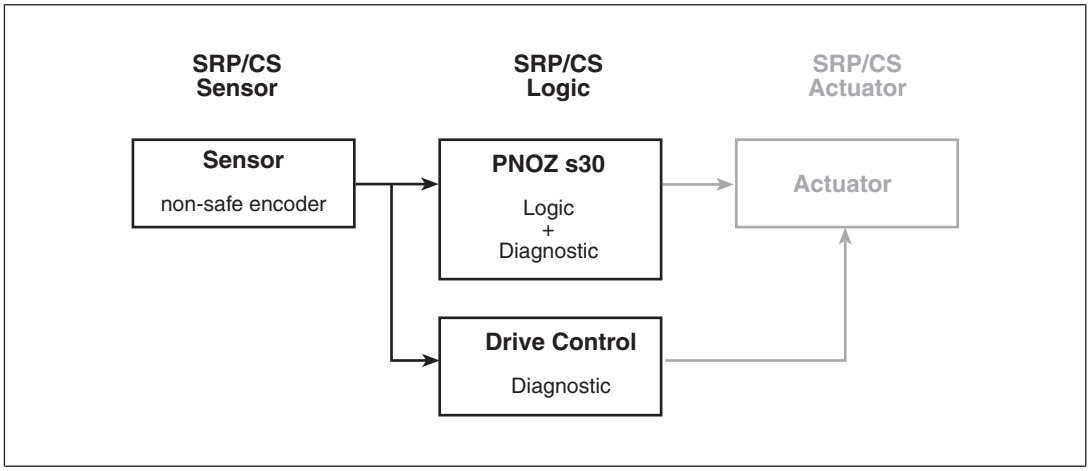
Requirements of the drive controller

- Parameters for the control loops and motor control must be set in such a way as to guarantee stabile operation.
  Drag error detection (see below) must be capable of operating in accordance with the requirements of the safety function.
- The motor must be operated with a current impressing control procedure, based on the rotor position (field-oriented control). If the analogue track signals are idle, field-oriented control will brake and/or stop the rotor.
- The drive controller must be in position control operating mode.
- If a maximum error variable is exceeded (set/true comparison) the drive controller must switch to a fault condition and stop the drive (drag error detection). The error reaction to drag error detection should be a controlled motor stop.

Safety relays PNOZsigma
PNOZ s30

- Fault detection via the error variable with subsequent shutdown must meet the requirements of the safety function, with regard to reaction times for example.
- The drive controller must evaluate the same incremental/sincos signals from the encoder for control as are processed by the safe evaluation device (important on encoders with combined analogue/digital interface).

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
Category	**MTTFd**	**DC**	**Operating mode**	**PFH (1/h)**
2	Manufacturer-specific	90 %	Monitoring 1 encoder	2,34E-08

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Speed Speed range Direction Standstill Position	PL d (Cat. 2)	2

Safety relays PNOZsigma
PNOZ s30

Safety-related characteristic data for operation with a safe rotary encoder

Safe encoders are certified in accordance with EN 61508, EN 13849 and EN 62061. In order to achieve the safety level stated by the encoder, the safe evaluation device (PNOZ s30) must normally detect designated errors. Details of the safe encoder's requirements of the evaluation device can be found in the user documentation for the safe encoder. The encoder and evaluation device must be compatible.

Permitted encoder types and output signals

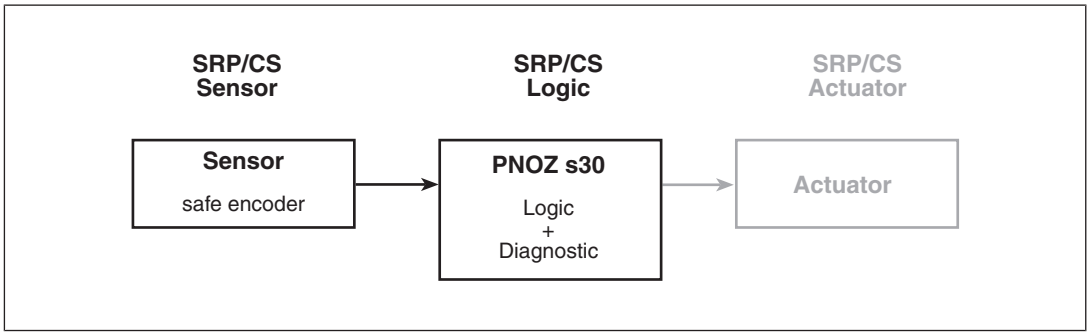
Permitted encoder types:

- Rotary safe encoder
- Linear safe encoder

Permitted output signals:

- Sin/Cos output signals 1Vss, reference voltage
- Sin/Cos output signals 1Vss, differential

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
PL	**SIL**	**PFH (1/h)**	**Operating mode**	**PFH (1/h)**
See manufacturer			Monitoring Safe encoder	2,78E-09

Safety relays PNOZsigma
PNOZ s30

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Speed Speed range Direction Standstill Position	PL e (Cat.4)	3

Safety-related characteristic data for operation with a safe rotary encoder with Z index

Safe encoders are certified in accordance with EN 61508, EN 13849 and EN 62061. In order to achieve the safety level stated by the encoder, the safe evaluation device (PNOZ s30) must normally detect designated errors. Details of the safe encoder's requirements of the evaluation device can be found in the user documentation for the safe encoder. The encoder and evaluation device must be compatible.

Permitted encoder types and output signals

Permitted encoder types:

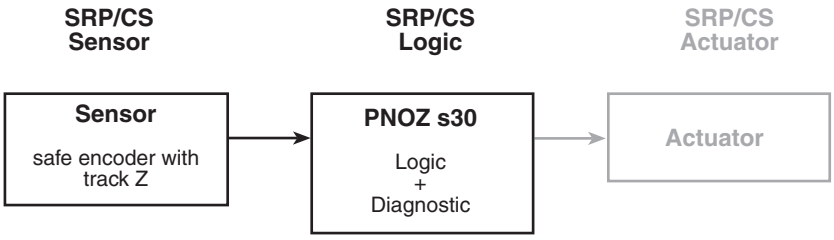
- Rotary safe encoder
- Linear safe encoder

Permitted output signals:

- Square output signals TTL, differential with Z index
- Square output signals HTL, differential with Z index
- Sin/Cos output signals 1Vss, reference voltage with Z index
- Sin/Cos output signals 1Vss, differential with Z index

Safety relays PNOZsigma
PNOZ s30

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
PL	**SIL**	**PFH (1/h)**	**Operating mode**	**PFH (1/h)**
See manufacturer			Monitoring 2 encoders	1,44E-09

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Speed Speed range Direction Standstill Position	PL e (Cat.4)	3

Safety-related characteristic data for operation with non-safety-related rotary encoder and proximity switch

The speed monitoring of the non-safety-related encoder can be verified via an additional reference sensor.

Permitted encoder types and output signals

Non-safety-related rotary encoder

Permitted encoder types:

- Rotary non-safety-related encoders
- Linear non-safety-related encoders

Safety relays PNOZsigma
PNOZ s30

Permitted output signals:

- Square output signals TTL, single ended
- Square output signals TTL, differential
- Square output signals HTL, single ended
- Square output signals HTL, differential
- Sin/Cos output signals 1Vss, reference voltage
- Sin/Cos output signals 1Vss, differential

Reference sensor

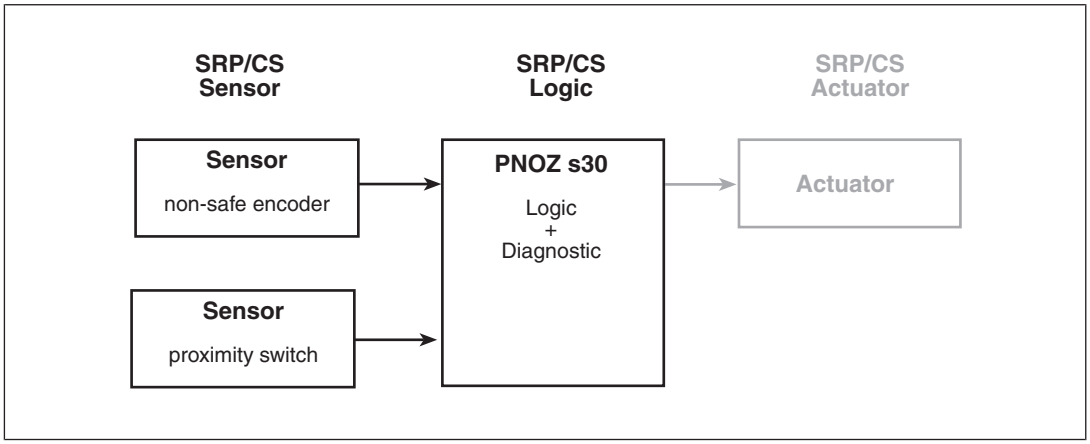
Permitted encoder types:

- Rotary non-safety-related encoders
- Linear non-safety-related encoders
- Inductive proximity switches

Permitted output signals:

- Square output signals HTL, single ended
- Square output signal 24 V, pnp

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
Category	**MTTFd**	**DC**	**Operating mode**	**PFH (1/h)**
4	Manufacturer-specific	90 %	Monitoring 2 encoders	1,44E-09

In a worst case scenario, the sensor subsystem's characteristic value MTTFd is calculated from the inferior (lower) value of the two sensors.

Safety relays PNOZsigma
PNOZ s30

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Direction Position	PL c (Cat. 1)	-
Speed Speed range Standstill	PL e (Cat.4)	3

Please note:

For the "sensor" subsystem, a minimum speed must be exceeded within forced dynamisation.

The minimum speed depends on the ratio of the frequency at tracks AB "f_{AB}" to the frequency at track Z "f_Z" in your configuration (***fAB/fZ Verh.*** setting in the menu) and is calculated as follows:

- when ***fAB/fZ Verh.*** ≥ 1.0
  f_Z = 70 mHz or f_{AB} = (f_{AB}/f_Z) *x* 70 mHz
- when f_{AB}/f_Z ***Verh.*** < 1.0
  f_{AB} = 70 mHz or f_Z = 70 mHz/(f_{AB}/f_z)

At the very latest, a feasibility error will be detected when a tolerance expires. The tolerance level depends on the ratio of the frequency at tracks AB "f_{AB}" to the frequency at track Z "f_Z" in your configuration (***fAB/fZ Verh.*** setting in the menu) and is calculated as follows:

- when ***fAB/fZ Verh.*** ≥ 1.0
  7.5 Z-pulses or 7.5 x *(f_{AB}/f_Z)* AB-pulses
- when ***fAB/fZ Verh.*** < 1.0
  4.5 AB-pulses or *4.5/(f_{AB}/f_Z)* Z-pulses

Safety-related characteristic data for operation with 2 proximity switches

Permitted encoder types and output signals

Non-safety-related rotary encoder

Permitted encoder types:

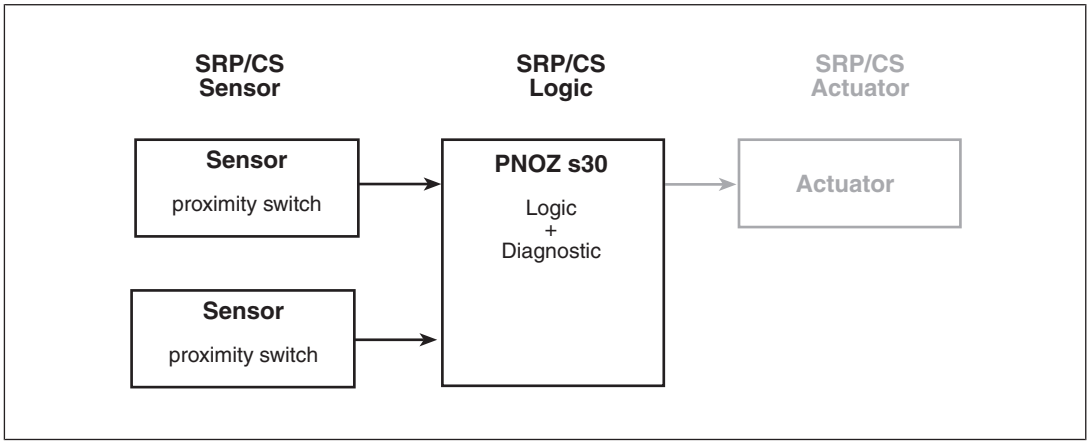
- Inductive proximity switches

Permitted output circuits:

- pnp
- npn

Safety relays PNOZsigma
PNOZ s30

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor			PNOZ s30 subsystem	
Category	**MTTFd**	**DC**	**Operating mode**	**PFH (1/h)**
4	Manufacturer-specific	90 %	Monitoring 2 encoders	1,44E-09

In a worst case scenario, the sensor subsystem's characteristic value MTTFd is calculated from the inferior (lower) value of the two sensors.

Achievable safety level

Safety function	PL in accordance with EN ISO 13849-1: 2015	SIL CL in accordance with EN IEC 62061
Direction Position	-	-
Speed Speed range Standstill	PL e (Cat.4)	3

Please note:
Common cause failures (CCF) are possible for the sensor subsystem. An appropriate analysis must be carried out.

To use proximity switches 1 and 2 we recommend that you:

- Use different technologies/design or physical principles (e.g. different manufacturers) and
- Evaluate the encoder supply via track S

Safety relays PNOZsigma
PNOZ s30

Examples

Connection of proximity switch

Features

PNOZ s30

- Standstill monitoring for enabling the safety gate via Rel. 1:
  Standstill is detected at <= 2 Hz, the output Rel. 1 switches on and the safety gate can be released with the pushbutton S3.
- Monitoring for overspeed via Rel. 2:
  Overspeed is detected at >= 500 Hz and the output Rel. 2 switches off.
- Feedback loop monitoring for Rel.1 via feedback loop input Y1,
  Feedback loop monitoring for Rel.2 via feedback loop input Y2
- Automatic reset

Encoder

The measured values are detected by two proximity switches (pnp).

PNOZ s4

- Safety gate monitoring

Configuration overview

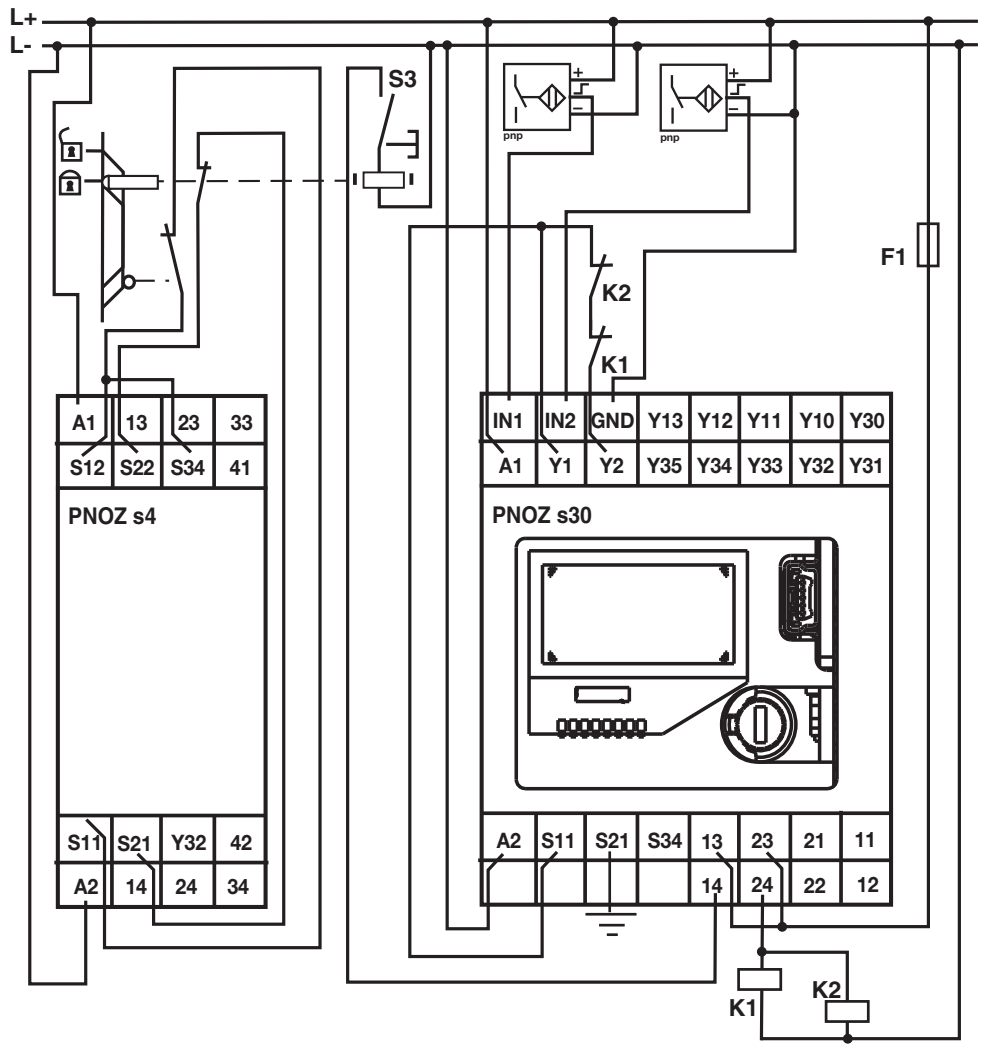
language	English			input device	A: pnp / B: pnp					global standstill (10 mHz - 1 MHz)	2 Hz
delay time start-up (0-600s)		Hysteresis (0-50%)								input device settings (10 mHz-1 MHz)	
			F1	F2	F3	F4	F5	F6	F7	F8	F9	f max (A/B)	3000 kHz
units		P0	Standstill	500 Hz								f max (Z)	
		P1											
conversion		P2										ratio (0,0001-400.000:1)	
		P3										f(A/B):f(Z)	
mode select input		P4										position window width (1-24.900.000 Imp)	
none		P5										Pos. 1	
		P6										Pos. 2	
Sel 1 (Y10)		P7										Pos. 3	
Sel 2 (Y11)		P8										Pos. 4	
Sel 3 (Y12)		P9										incorrect direction (max. wrong) direction (1-24.900.000 Imp)	
Sel 4 (Y13)		P10										direction left max. right	
		P11										direction right max. left	
delay time select input (0-30s)		P12											
		P13											
		P14											
		P15											

	Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)
assign outputs (functions)	F1	F2						
delay time effect (outputs)								
delay time 0 - 30s (outputs)								
reset mode	automatic	automatic						
output out logic								

name of configuration
Example 1
CRC of configuration

Safety relays PNOZsigma
PNOZ s30

Connection



Safety relays PNOZsigma
PNOZ s30

Incremental encoder connection

Features

PNOZ s30

- Speed monitoring:
  Monitoring for overspeed for the operating modes "Setup" and "Automatic", which are selected with the switch S1.
  - The operating mode "Setup" is selected if the select input SEL1 is activated. Overspeed is detected during setup at >= 50 Hz and the output Rel. 2 switches off.
  - The operating mode "Automatic" is selected if the select input SEL2 is activated. Overspeed is detected during automatic mode at >= 3000 Hz and the output Rel. 2 switches off.
  - If a speed of 2800 Hz is exceeded, the semiconductor output Out1 switches in automatic mode and a message (advance warning) is output via the PLC.
- Standstill monitoring:
  Standstill is detected at <= 2 Hz for both operating modes and the output Rel. 1 switches on.
- Feedback loop monitoring via feedback inputs Y1 and Y2

Encoder:

The measured values are detected by an incremental encoder (sin/cos)

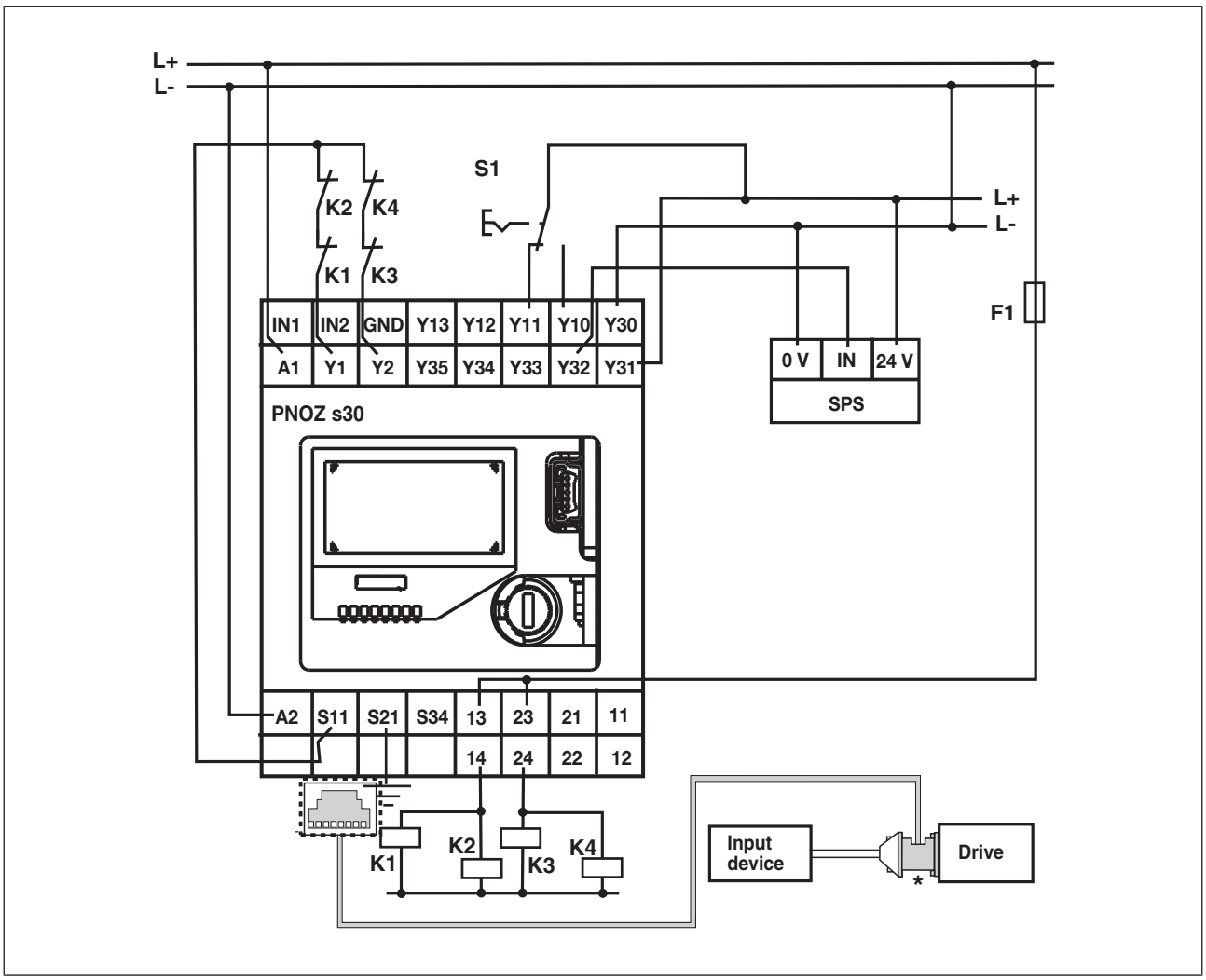
Safety relays PNOZsigma
PNOZ s30

Configuration overview

language	English			input device	Sin/cos 1Vss					global standstill (10 mHz - 1 MHz)	2 Hz
delay time start-up (0-600s)		Hysteresis (0-50%)								input device settings (10 mHz-1 MHz)	
			F1	F2	F3	F4	F5	F6	F7	F8	F9	f max (A/B)	20 kHz
units		P0										f max (Z)	
		P1	Standstill	50 Hz	50 Hz							ratio (0,0001-400.000:1)	
conversion		P2	Standstill	3000 Hz	2800 Hz							f(A/B):f(Z)	
		P3										position window width (1-24.900.000 Imp)	
mode select input		P4										Pos. 1	
1 of 4		P5										Pos. 2	
		P6										Pos. 3	
Sel 1 (Y10)		P7										Pos. 4	
Sel 2 (Y11)		P8										incorrect direction (max. wrong) direction (1-24.900.000 Imp)	
Sel 3 (Y12)		P9										direction left max. right	
Sel 4 (Y13)		P10										direction right max. left	
		P11											
		P12										name of configuration	
		P13										Example 2	
		P14											
		P15										CRC of configuration	
delay time select input (0-30s)													
20 ms													
			Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)			
assign outputs (functions)			F1	F2			F3						
delay time effect (outputs)													
delay time 0 - 30s (outputs)													
reset mode			automatic	automatic			automatic						
output out logic							normally off						

Safety relays PNOZsigma
PNOZ s30

Connection



* The PNOZ msi adapters are available from Pilz as accessories

Safety relays PNOZsigma
PNOZ s30

Order reference

Product

Product type	Features	Terminals	Order No.
PNOZ s30	24 - 240 VAC/DC	With screw terminals	750 330
PNOZ s30 C	24 - 240 VAC/DC	With spring-loaded terminals	751 330

Accessories

Product type	Features	Order No.
PNOZ s terminator plug	Terminator, x10	750 010
PNOZmulti Chipcard	Chip card, 8 kB	779 201
PNOZmulti Chipcard Set	Chip card, 8 kB, x10	779 200
PNOZmulti Chipcard	Chip card, 32 kB	779 211
PNOZmulti Chipcard Set	Chip card, 32 kB, x10	779 212
Chipcard Holder	Chip card holder	779 240
PNOZmulti Seal	Chip card seal, x10	779 250
PNOZ s Set3 Screw Loaded Terminals	Set of plug-in screw terminals, x1	750 014
PNOZ s Set3 Spring Loaded Terminals	Set of plug-in spring terminals, x1	751 014
PNOZ msi1Ap	Adapter and cable 25-pin, 2.5 m	773 840
PNOZ msi1Ap	Adapter and cable 25-pin, 5.0 m	773 844
PNOZ msi1Bp	Adapter and cable 25-pin, 2.5 m	773 841
PNOZ msi1Bp	25-pin, 5.0 m	773 839
PNOZ msi3Ap	Adapter and cable 15-pin, 2.5 m	773 842
PNOZ msi3Bp	Adapter and cable 15-pin, 2.5 m	773 843
PNOZ msi5p	Adapter and cable Bos/Rex 15-pin, 2.5 m	773 857
PNOZ msi5p	Adapter and cable Bos/Rex 15-pin, 1.5 m	773 858
PNOZ msi6p	Adapter and cable Elau 9-pin, 7.5 m	773 859
PNOZ msi6p	Adapter and cable Elau 9-pin, 2.5 m	773 860
PNOZ msi6p	Adapter and cable Elau 9-pin, 1.5 m	773 861
PNOZ msi7p	Adapter and cable SEW 15-pin, 2.5 m	773 864
PNOZ msi7p	Adapter and cable SEW 15-pin, 1.5 m	773 865
PNOZ msi8p	Adapter and cable Lenze 9-pin, 2.5 m	773 862
PNOZ msi8p	Adapter and cable Lenze 9-pin, 1.5 m	773 863
PNOZ msi9p	Adapter cable 5.0 m	773 856

Safety relays PNOZsigma
PNOZ s30

Product type	Features	Order No.
PNOZ msi10p	Adapter cable 2.5 m	773 854
PNOZ msi11p	Adapter cable 1.5 m	773 855
PNOZ msi19p	Connection cable, 1.5 m	773 846
PNOZ msi19p	Connection cable, 2.5 m	773 847
PNOZ msi S09	9-pin adapter, connector set	773 870
PNOZ msi S15	15-pin adapter, connector set	773 871
PNOZ msi S25	25-pin adapter, connector set	773 872
PNOZ Chip Card Reader	Chip card reader for saving the configuration on the computer	779 230
SmartCardCommander with SIM card adapter	Software for the chip card reader 779 230, for saving the configuration on the computer	750 031
PNOZsigma Chip Card manager set	Set consisting of the PNOZ Chip Card Reader and SmartCardCommander with SIM card adapter (779 230 and 750 030)	750 030

Safety relays PNOZsigma
PNOZ s50

Overview

Unit structure

Scope of supply

- PWM relay PNOZ s50
- Connection terminals (spring-loaded terminals)
- Chip card
- Chip card holder
- Documentation on data medium

Unit features

Using the product PNOZ s50:

PWM relay for the safe activation of inductive loads, e.g. valves, mechanical holding brakes.

The product has the following features:

- Semiconductor outputs
  - 2 dual-pole failsafe power outputs, rated voltages 24 V or 48 VDC, e.g. for mechanical holding brakes, valves
  - Output voltage can be reduced through pulse width modulation (PWM)
  - Potential of the power outputs connected to the supply voltage B1/B2
  - 1 single-pole failsafe output for error
  - 2 single-pole failsafe outputs for status of the power circuits
  - 2 test pulse outputs
  - Potential of the single-pole outputs connected to supply voltage A1/A2
- Semiconductor inputs
  - 4 failsafe inputs for activating the power outputs (fast shutdown of power circuits)
  - 2 single-pole standard inputs for activating the power outputs (slow shutdown of power circuits)

Safety relays PNOZsigma
PNOZ s50

  - 2 single-pole standard inputs for feedback loops

  Potential of the semiconductor inputs connected to supply voltage A1/A2
- Supply voltage
  - 24 VDC for device
  - For power circuits, rated voltage 24 V, 48 VDC

  Supply voltage for device and power circuit are isolated from each other
- Voltage output 24 VDC

  Potential connected to supply voltage A1/A2
- Can be configured via the display on the device
- Configuration is stored on a chip card
- Display
  - Number of operations
  - System information
  - Status of the inputs and outputs
  - Warning and error messages
- Status and fault LEDs
- Plug-in connection terminals (spring-loaded terminals)

Safety relays PNOZsigma
PNOZ s50

Front/side view

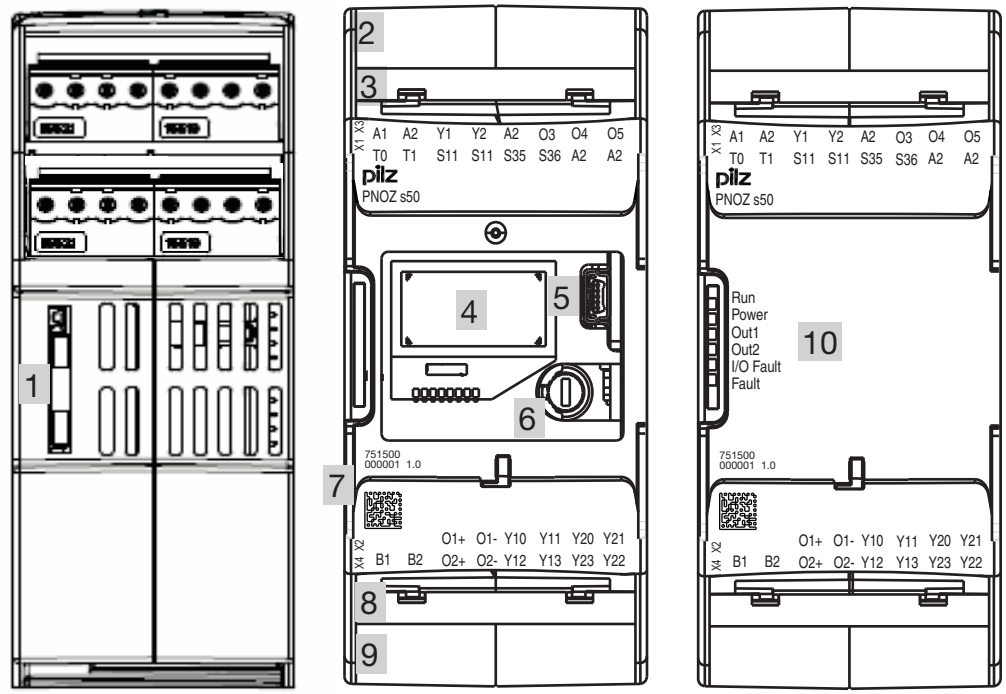


Fig.: Left: Side view, centre: Front view without cover, right: Front view with cover

Legend:

- 1: Chip card
- 2: Connection terminal X3
- 3: Connection terminal X1
- 4: Display
- 5: 4-pin socket (service only)
- 6: Rotary knob
- 7: Labelling strip with:
  - Order number
  - Serial number
  - Hardware version number
  - 2D code
- 8: Connection terminal X2
- 9: Connection terminal X4
- 10: LEDs

Safety relays PNOZsigma
PNOZ s50

Function description

Introduction

The PWM relay PNOZ s50 is used for the safety-related shutdown of inductive loads.

It has two power outputs to activate two independent, inductive loads. Each power circuit is switched independently by two inputs. Two feedback loops monitor the switch status of the inductive loads. Two failsafe outputs signal the switch status of the inductive loads to the higher level safety control system. A failsafe fault signal output signals any fault to a higher level safety control system.

The device is configurable. All the parameters can be set via a rotary knob with pushbutton. The state of the inputs and outputs, the configuration and any faults are shown on a display. The configuration is stored on a chip card.

There is an integrated counter, which records the number of operations for each power circuit.

Block diagram

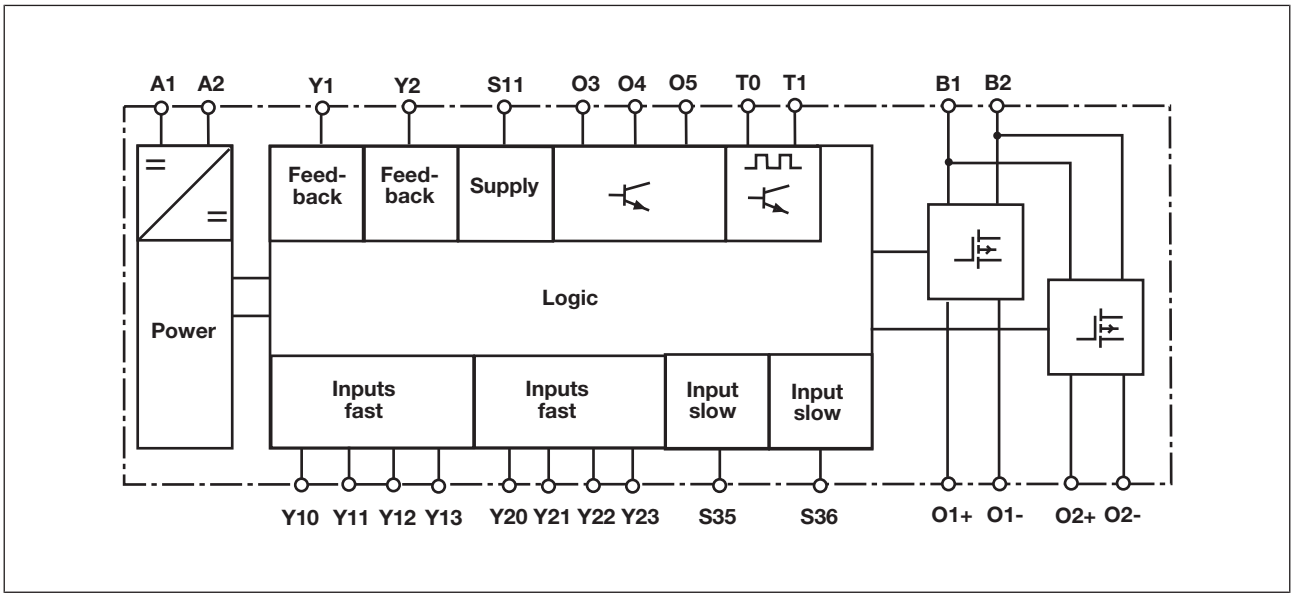


Fig.: Block diagram

Potential isolation, potential connection:

- Potential isolation between the supply voltages A1/A2 and B1/B2.
- Potential connection between the power outputs O1+/O1-, O2+/O2- and the supply voltage B1/B2.
- Potential connection between the semiconductor inputs and single-pole outputs, voltage output and supply voltage A1/A2.

Safety relays PNOZsigma
PNOZ s50

Functions

Switching the power circuits on and off (fast shutdown)

The device has two safe dual-pole outputs O1+/O1- (power circuit 1) and O2+/O2-(power circuit 2), which can be switched using inputs Y10/Y11 (power circuit 1) and Y20/Y21 (power circuit 2):

- Switch-on (brake is ventilated):
  - O1+/O1- is switched on when there is a "1" signal (24 VDC) at Y10 **and** Y11.
  - O2+/O2- is switched on when there is a "1" signal (24 VDC) at Y20 **and** Y21.
  - Partial operation is not time-monitored. An output will not switch until both the corresponding inputs are "1".
- Switch-off (brake is applied):
  - O1+/O1- is switched off safely when there is a "0" signal (0 VDC) at Y10 **and/or** Y11.
  - O2+/O2- is switched off safely when there is a "0" signal (0 VDC) at Y20 **and/or** Y21.

Power circuit 1	**Y10**	**Y11**	**O1+, O1-**	
	1	1	1	Load under current (power circuit 1 switched on)
	1	0	0	Load without current (power circuit 1 switched off)
	0	1	0	
	0	0	0	
Power circuit 2	**Y20**	**Y21**	**O2+, O2-**	
	1	1	1	Load under current (power circuit 2 switched on)
	1	0	0	Load without current (power circuit 2 switched off)
	0	1	0	
	0	0	0	

The power circuits are supplied via the terminals B1/B2 with the voltage U_{B1B2} (voltage range: rated voltage 24 V, 48 VDC).

Both poles are switched (e.g. O1+, O1-).

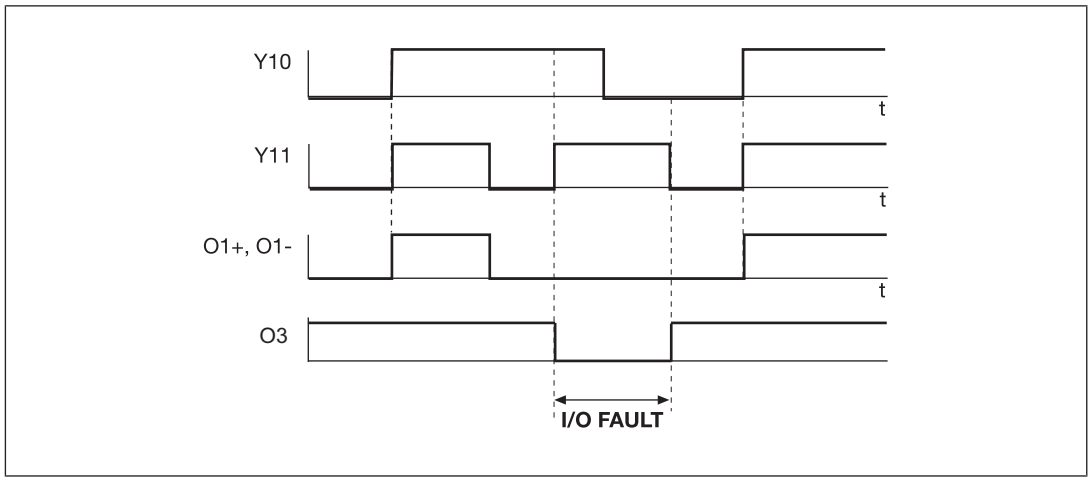


Fig.: Start-up condition for inputs Y10/Y11

After the output O1+/O1- and/or O2+/O2- is switched on, the voltage U_{B1B2} is available for a configurable overexcitation time U_{over}. Once the overexcitation time t_{over} has elapsed, the voltage is reduced through pulse width modulation (PWM). The overexcitation time t_{over} and the reduced voltage U_{Avg} are configured via the display.

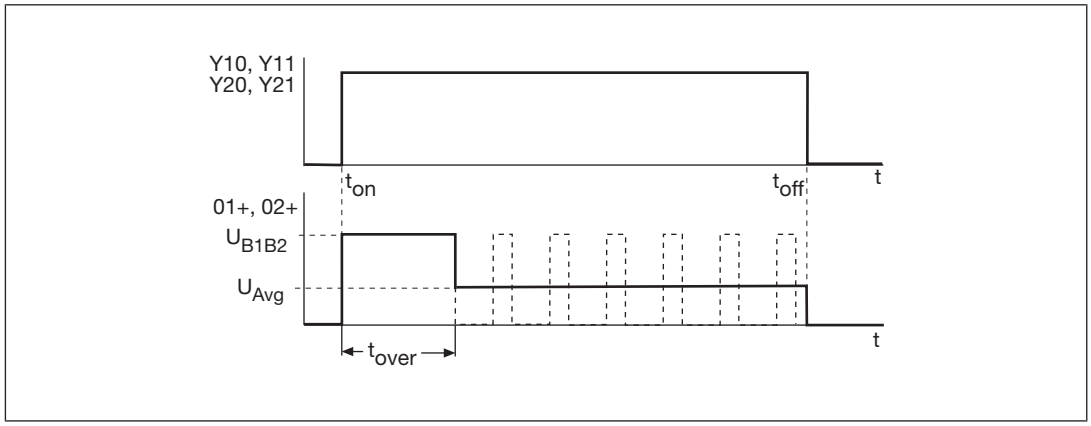


Fig.: Switching the power circuits on and off

Legend:

- Y10, Y11, Y20, Y21: Safe inputs to switch the outputs O1+, O2+
- O1+, O2+: Safe outputs, power circuit 1 and 2
- U_{B1B2}: Supply voltage to the power circuits
- t_{on}: Switch on power circuit
- t_{over}: Configured overexcitation time
- t_{off}: Switch off power circuit
- U_{Avg}: Configured reduced voltage (arithmetic mean of the voltage at the outputs once the overexcitation time has elapsed)

Inputs Y10, Y11 (or Y20, Y21) can be activated via single-pole or dual-pole safe outputs.

Safety relays PNOZsigma
PNOZ s50

Switching the power circuits on and off (slow shutdown S35, S36)

If the switching times are not critical, the loads at the power circuits can also be shut down slowly. A connected brake is permitted to have longer application times, for example. The brake switches with lower noise and is lower wearing.

A 1/0 pulse edge at one of the slow shutdown inputs (S35 or S36) switches off the corresponding power circuit (O1+, O2+) in single-pole mode. A flywheel diode means that the current only dissipates the magnetic field slowly.

Power circuit 1	**S35**	**O1+, O1-**
	1/0 pulse edge	Switches off power circuit 1
Power circuit 2	**S36**	**O2+, O2-**
	1/0 pulse edge	Switches off power circuit 2

Conditions for fast and slow shutdown

To shut down the power circuits, the following conditions must be met:

Shutdown	**Y10/Y11**	**S35**	**O1+/O1-**
Fast	1/0 pulse edge	1	-> 0
Slow	1	1/0 pulse edge	-> 0

Shutdown	**Y20/Y21**	**S36**	**O2+/O2-**
Fast	1/0 pulse edge	1	-> 0
Slow	1	1/0 pulse edge	-> 0

Safety relays PNOZsigma
PNOZ s50

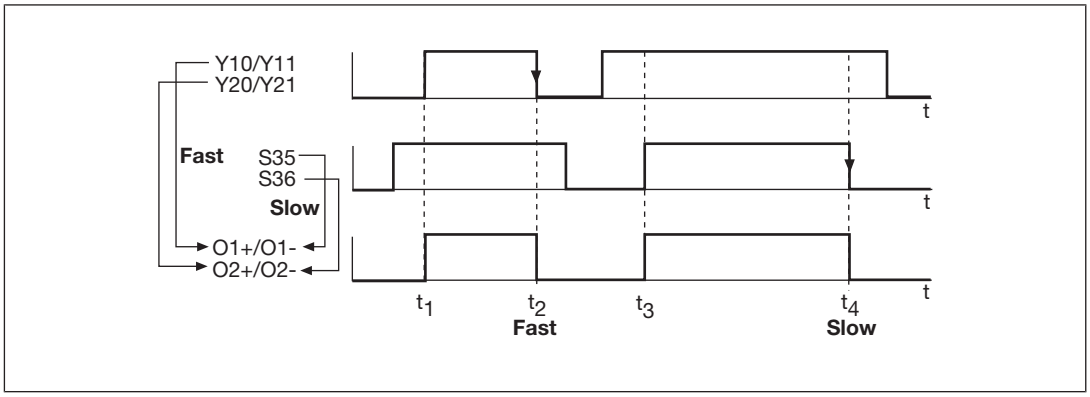


Fig.: Conditions for fast and slow shutdown

Legend:

- Fast: Fast shutdown
- Slow: Slow shutdown
- t_1:and t_3 Switch-on: Y10, Y11, S35 = 1, O1+/O1- switches on; Y20, Y21, S36 = 1, O2+/O2- switches on
- t_2: Fast shutdown via 1/0 pulse edge from Y10/Y11 or Y20/Y21
- t_4: Slow shutdown via 1/0 pulse edge from S35 or S36

Feedback loop Y1, Y2

The operating state of the inductive load can be uploaded, for example, via

- Micro switches
- Proximity switches
- Hall sensors

The feedback loop can be configured for N/C or N/O contacts.

The 24 V voltage outputs S11 of the PNOZ s50 can be used to provide the 24 V DC supply to the equipment in the feedback loop. This is only permitted if test pulses are not used. Otherwise a wiring error will be registered.

The feedback loop will only be evaluated after a max. ventilation and application time, which is to be configured. Contact bounce during application or ventilation of the equipment is ignored.

- Max. ventilation time: Period within which the load must be ventilated once the power circuit is switched on.
- Max. application time: Period within which the load must be applied once the power circuit is switched off.

The max. ventilation and application time, plus the switch-on behaviour (N/C / N/O) are configured via the display. The max. application time is configured separately for slow and fast shutdown. The max. ventilation time is configured jointly for slow and fast shutdown.

Safety relays PNOZsigma
PNOZ s50

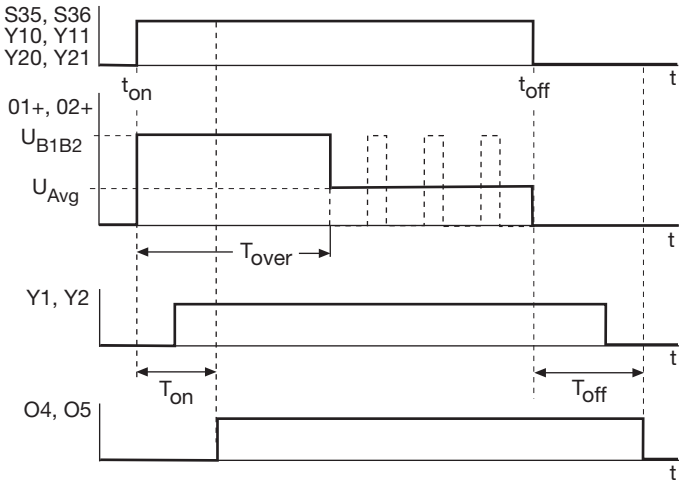


Fig.: Ventilation and application time

Legend:

- Y10, Y11, Y20, Y21: Safe inputs to switch the outputs O1+/O1-, O2+/O2-
- O1+, O2+: Safe outputs, power circuit 1 and 2
- U_{B1B2}: Supply voltage to the power circuits
- t_{on}: Switch on power circuit
- t_{over}: Configured overexcitation time
- t_{off}: Switch off power circuit
- U_{Avg}: Configured reduced voltage (arithmetic mean of the voltage at the outputs once the overexcitation time has elapsed)
- Y1, Y2: Feedback loops
- T_{on}: Configured duration of max. ventilation time
- T_{off}: Configured duration of max. application time
- O4, O5: Failsafe outputs for status of the load, change in state after T_{on} and T_{off} have elapsed

Safety relays PNOZsigma
PNOZ s50

Test pulse outputs T0, T1

Feedback loops Y1 and Y2 can be assigned test pulses. The PNOZ s50 has 2 test pulse outputs, T0 and T1.

Please note the fixed allocation of test pulses to the following inputs:

- T0 pulses the feedback loop Y1
- T1 pulses the feedback loop Y2

The test pulse outputs T0/T1 are switched on (24 V) in

- "RUN" operating status.
- "I/O Fault" operating status (fault on inputs and outputs).

The test pulse outputs T0/T1 are switched off (0 V) in

- "Fault" operating status (internal fault).

The test pulses can be switched on and off via the display.

- The default setting is for test pulses to be switched on.
- Test pulses will not be active in the event of a fault (I/O Fault and Fault).

Signal and status outputs O3, O4, O5

Single-pole failsafe semiconductor outputs signal the operating status of the load and indicate a fault.

Fault signal output	**O3**	
	1	No fault, LED "I/O Fault" and "Fault" is off
	0	Fault, LED "I/O Fault" or "Fault" is lit
Status outputs They signal the status of the load only after the ventilation or application time has elapsed.	**O4**	
	1	Load at O1+/O1- ventilated
	0	Load at O1+/O1- applied
	O5	
	1	Load at O2+/O2- ventilated
	0	Load at O2+/O2- applied

Output test

Outputs that are switched on are checked via regular off tests.

- Test pulses for outputs that are switched on: see technical details
- Outputs that are switched on are switched off for the duration of the test pulse.
- The load must not switch off because of the test.
- The switch-off tests cannot be turned off.

Dual-pole outputs that are switched off are checked via regular on tests.

- The test pulses switch the positive pole of the output. The load must not switch on because of the test.

Testing for shorts

- A test is regularly carried out to check for shorts between the outputs.

Status display, configuration and messages

Overview

The configuration is set using the device's rotary knob with pushbutton and is then displayed. Access to the configuration menu is password-protected.

The following device properties can be configured:

- Supply voltage to the power circuits
- Signals to the outputs of the power circuits:
  - Overexcitation time
  - Reduced voltage
- Feedback loop:
  - Max. ventilation and application time
  - High or low logic (N/O or N/C)
  - Evaluation of test pulses
- Offset (start value) for the number of operations

Additional information on the display:

- Status display
- Number of operations
- States of inputs and outputs
- Information on the device
- Software versions
- Error messages

Chip card

The set parameters, the device ID and the check sum for device configuration are stored on the chip card (for further information see chapter entitled "Commissioning", under "Use chip card [📖 913]").

Reaction time

The reaction time (see Technical details [📖 934]) of the PNOZ s50 is the time between a signal changing at the inputs for fast (Y10/Y11, Y20/Y21) or slow shutdown (S35, S36) and the signal changing at the outputs of the power circuit (O1+/O1-, O2+/O2-). The reaction time takes into account the input filter time, temperature drift and spread of components.

To determine the plant's overall reaction times, the corresponding internal processing times of the higher level safety control system and connected load must also be considered.

Installation

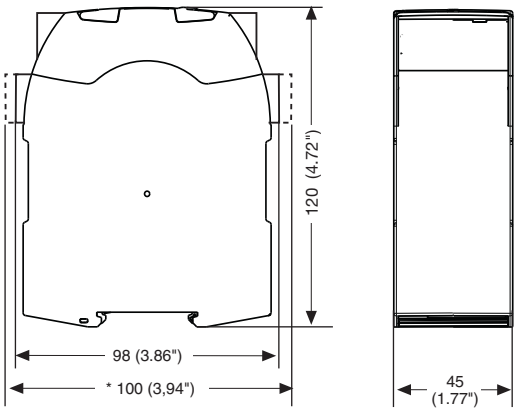
General installation guidelines

Control cabinet installation

- The unit should be installed in a control cabinet with a protection type of at least IP54.
- Fit the device to a horizontal DIN rail. The venting slots must face upwards and downwards. Other mounting positions could destroy the device.
- Use the locking element on the rear of the device to attach it to the DIN rail.
- Push the device upwards or downwards before lifting it from the DIN rail.

Dimensions

*with spring-loaded terminals



Mounting distances

Depending on the ambient temperature, with control cabinet installation it may be necessary to maintain a certain distance from the top and bottom, as well as to other heat-producing devices (see diagram).

The values stated for the mounting distances are minimum specifications. Details of whether a distance needs to be maintained can be found in the section entitled "Supplementary data [📖 938]".

Air conditioning may otherwise be required.

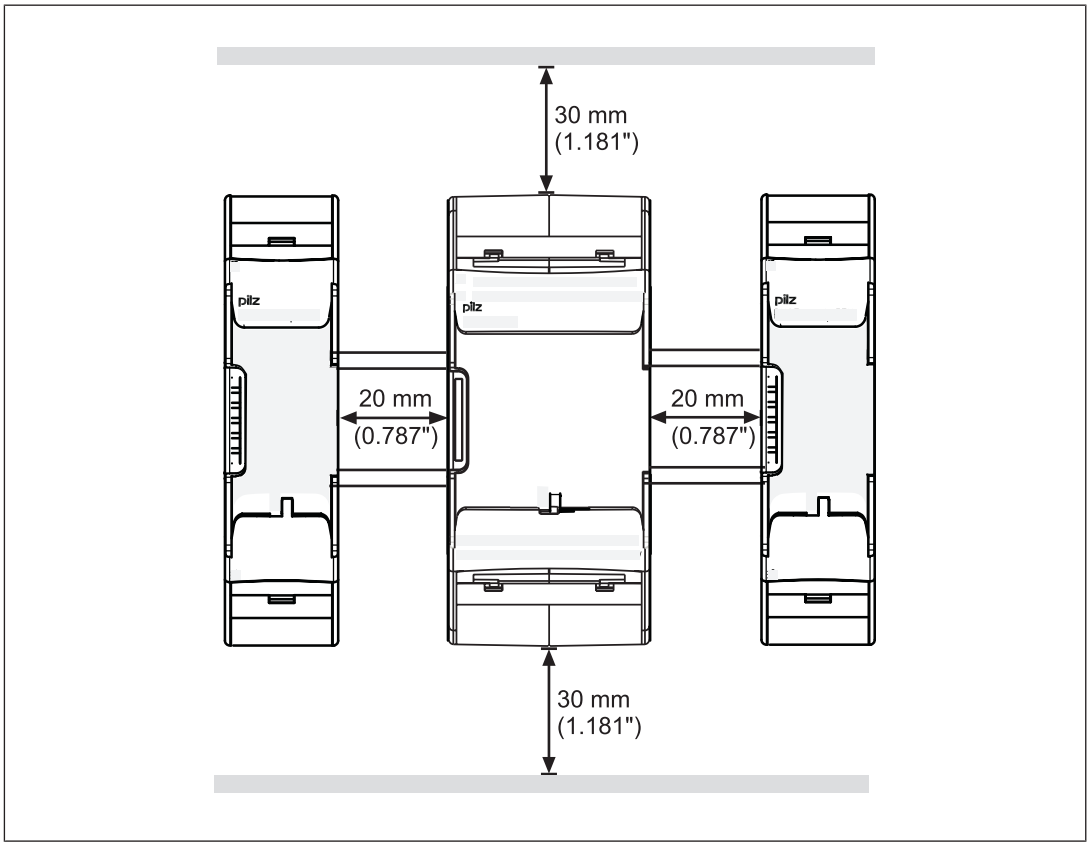


Fig.: Mounting distances for the PNOZ s50

Safety relays PNOZsigma
PNOZ s50

Commissioning

Wiring

General wiring guidelines

Note:

- Information given in the "Technical details" must be followed.
- Use copper wire that can withstand 75 °C.
- The wiring must be designed to achieve sufficient noise immunity and protection against noise emissions in terms of EMC. Please also refer to DIN EN 60204-1 (Electrical equipment of machines).

Inputs

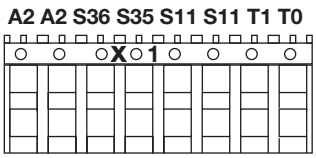
- Appropriate wiring must be used to exclude short circuits between the inputs or to a supply line!

Outputs

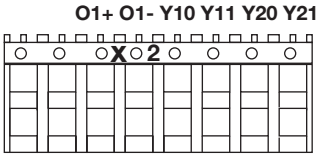
- If short circuits occur between the cable from the output to the load and a supply line, it will no longer be possible to switch off the load.

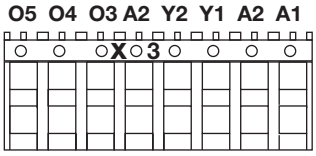
  Possible remedy: Exclude the error by using separate multicore cable for supply voltages
- Use appropriate wiring to exclude short circuits between the outputs!

Pin assignment

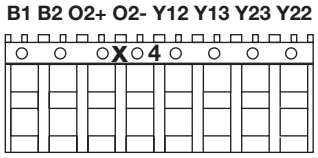
Female connector X1	Terminal	Description
	A2	Reference potential for - Device's supply voltage - Inputs - Fault signal and status outputs
	S36	Standard input for slow shutdown, power circuit 2
	S35	Standard input for slow shutdown, power circuit 1
	S11	Voltage output 24 VDC
	S11	Voltage output 24 VDC
	T1	Test pulse output 1
	T0	Test pulse output 0

Safety relays PNOZsigma
PNOZ s50

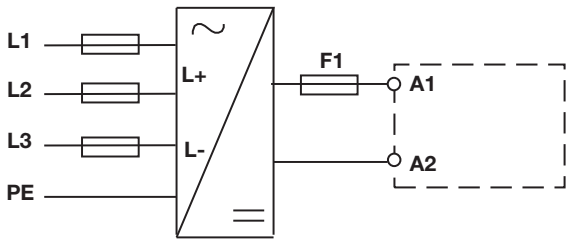
Female connector X2	Terminal	Description
	O1+	Failsafe output for power circuit 1, positive
	O1-	Failsafe output for power circuit 1, negative
	Y10	Failsafe input for fast shutdown, power circuit 1
	Y11	Failsafe input for fast shutdown, power circuit 1
	Y20	Failsafe input for fast shutdown, power circuit 2
	Y21	Failsafe input for fast shutdown, power circuit 2

Female connector X3	Terminal	Description
	O5	Failsafe output for status, power circuit 2
	O4	Failsafe output for status, power circuit 1
	O3	Failsafe output for fault signal
	A2	0 V supply voltage for device
	Y2	Standard input for feedback loop 2
	Y1	Standard input for feedback loop 1
	A2	0 V supply voltage for device
	A1	24 VDC supply voltage for device

Safety relays PNOZsigma
PNOZ s50

Female connector X4	Terminal	Description
	B1	Supply voltage of power circuits
	B2	Reference potential of the supply voltage to the power circuits
	O2+	Failsafe output for power circuit 2, positive
	O2-	Failsafe output for power circuit 2, negative
	Y12	Reference potential for failsafe inputs for fast shutdown, power circuit 1
	Y13	Reference potential for failsafe inputs for fast shutdown, power circuit 1
	Y23	Reference potential for failsafe inputs for fast shutdown, power circuit 2
	Y22	Reference potential for failsafe inputs for fast shutdown, power circuit 2

Supply voltage for device

Supply voltage to the device	
Please note: The supply voltage must be protected with a fuse. Fuse F1: Circuit breaker, 24 VDC, 4 A, characteristic B/C	

Requirements:

- When selecting the power supply, please refer to the requirements stated under Technical details [📖 934].

  Make sure that the supply voltage for the device (A1/A2) complies with the specified tolerance of -15/+20 %. If the voltage is outside this tolerance, then

  – the device will change to a fault condition, if the outputs are switched on.

  – a message will be entered in the error stack if the outputs are switched off.

Safety relays PNOZsigma
PNOZ s50

Supply voltage for power circuits

Requirements:

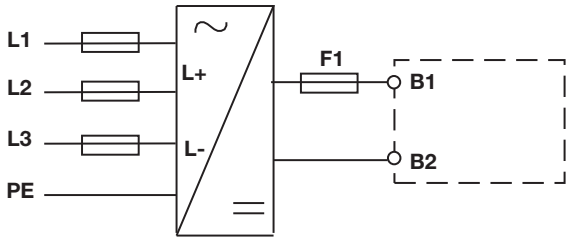
- When selecting the power supply, please refer to the requirements stated under Technical details [934].

  Make sure that the supply voltage for the power circuits (B1/B2) complies with the specified tolerance of +/-10 %. If the voltage is outside this tolerance, then

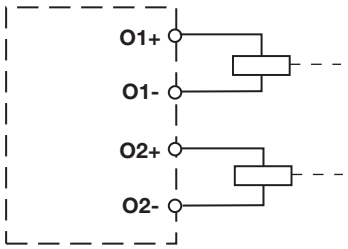
  – the device will change to a fault condition, if the outputs are switched on.

  – a message will be entered in the error stack if the outputs are switched off.

- The power supply must be able to bridge a power outage of 20 ms.

Supply voltage for power circuits	
Please note: The supply voltage must be protected with a fuse. Fuse F1: Circuit breaker 24 V, 48 VDC, 10 A, characteristic B/C	

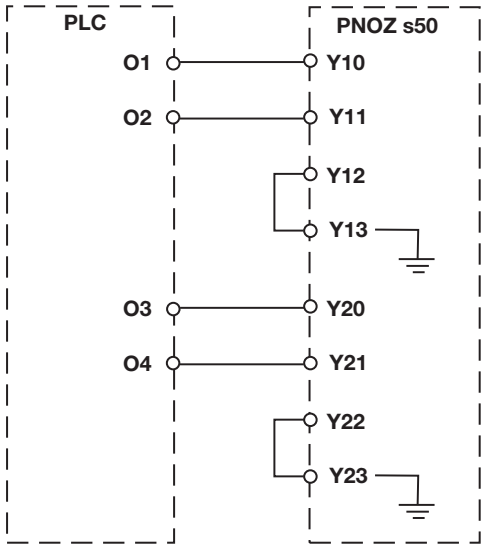
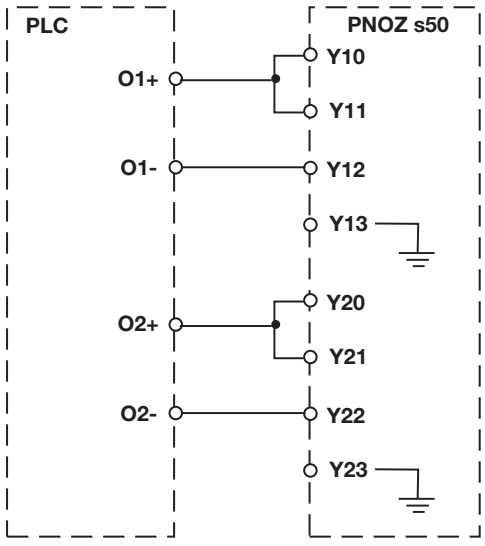
Power circuit

Power circuit	
Dual-pole outputs	

Safety relays PNOZsigma
PNOZ s50

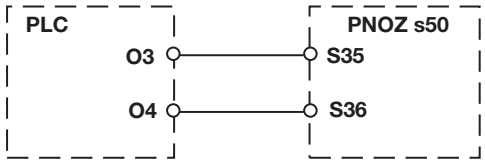
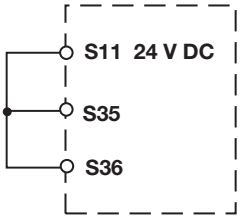
Inputs

Fast shutdown

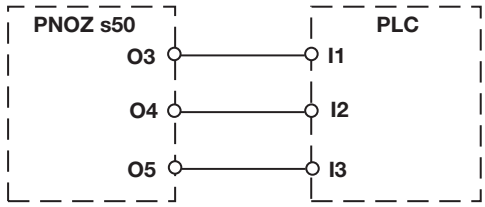
Activation via safe single-pole outputs	
Link Y12 – Y13 Link Y22 – Y23 PLC: Safety control system	
Activation via safe dual-pole outputs	
Link Y10 – Y11 Link Y20 – Y21 PLC: Safety control system	

Safety relays PNOZsigma
PNOZ s50

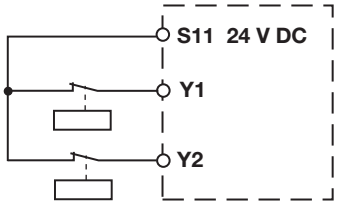
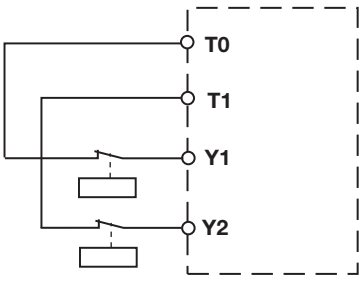
Slow shutdown

Activation via single-pole outputs	
PLC: Safety control system	
Connect the inputs to 24 VDC if slow shutdown is not being used. S11: Voltage output 24 VDC	

Outputs

Status outputs	
PLC: Safety control system	

Feedback loop

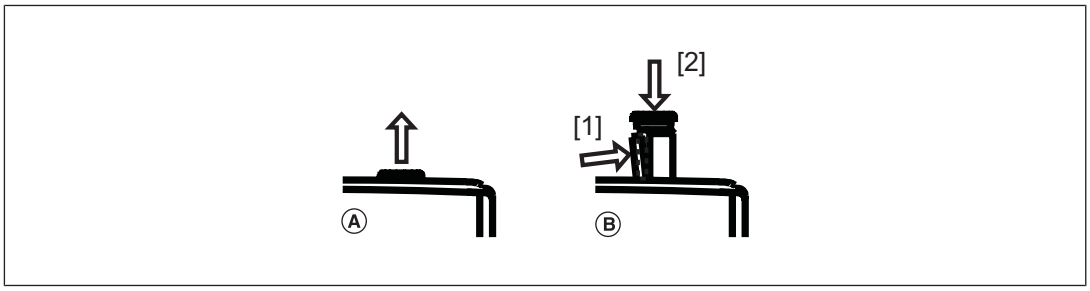
Feedback loop	
A N/C contact is shown in the connection diagram. A N/O contact can also be configured.	
Feedback loop with test pulses	
Please note the allocation of the test pulses and feedback loops: T0 <-> Y1 T1 <-> Y2	

Safety relays PNOZsigma
PNOZ s50

Display menu and configuration

The menu settings are made on the unit's display via a rotary knob. You have the option to make the settings on the knob by hand or with a screwdriver. If you make the settings with a screwdriver, the knob can remain within the unit.

Operate rotary knob



Pull out knob (A):

- until it locks into position
- Release knob (B) and push it back into the unit:
  - Press the bar on the side of the knob [1] towards the centre of the knob. This releases the knob.
  - Press the knob downwards [2] while keeping the bar pressed in

Configure device

The settings are made via the rotary knob, as follows:

Press the knob

- Confirm selection/setting
- Switch to menu

Rotate knob

- Select menu level
- Set the parameter/numeric value

The display is backlit. It is

- switched on by turning or pressing the rotary knob.
- switched off if the rotary knob has not been operated for 30 seconds.

Password protection

The configuration is password-protected.

- Parameters can only be changed once a password has been entered.
- Factory setting for the password: 000000
- The pasword consists of 6 figures in the range 000000 … 999999.
- The password can be changed at any time in the menu.

Use chip card

The parameters that are set on a device are stored on the chip card. The data is stored along with a device identifier and check sum. We recommend that you always operate the unit with a chip card.

When the chip card is inside the unit,

- The chip card is checked to verify the device identifier, valid parameters, and ensure that the data is identical.
- Device parameters are automatically saved to the chip card during configuration. As a result, the chip card always contains a copy of the unit's current internal data.

When the device is switched on in the Power On operating state (all LEDs illuminate briefly) a test is carried out to check whether

- a chip card is inserted or just an empty chip card holder.
- data on the chip card matches the data in the device.
- data on the chip card is valid.

In the Configuration operating state ("Run" LED flashes):

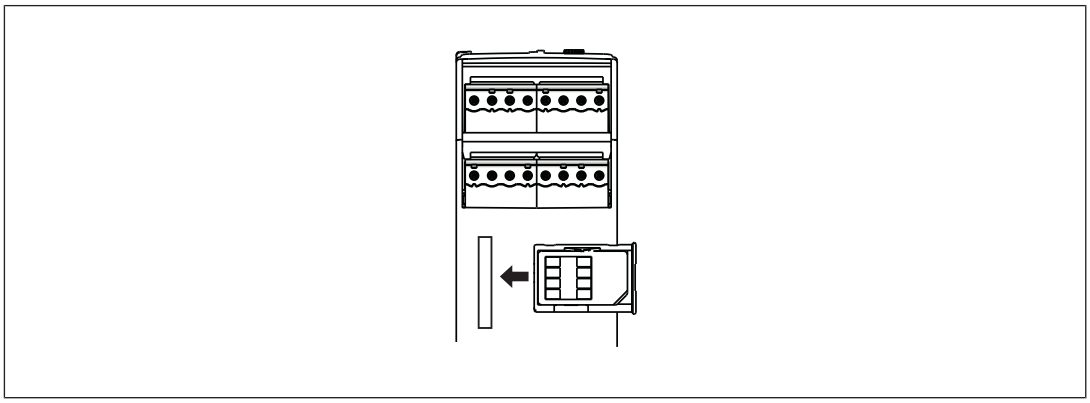
- The data is written to the chip card during configuration.

In the RUN operating state ("Run" LED is lit):

- The chip card containing a valid configuration must be inserted.
- The chip card must not be removed during operation.

Insert chip card

Make sure that you do not bend the chip card as you insert it into the chip card slot.



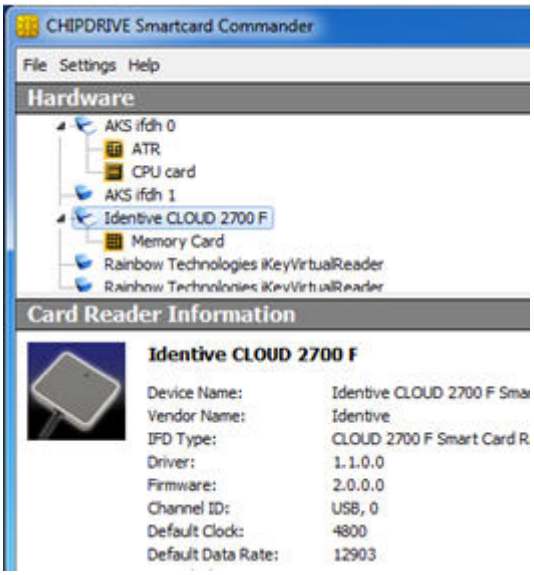
Save configuration with Software SmartCardCommander

You have the option to save a PNOZ s50 configuration from the chip card to your computer. The configuration can be saved on the computer and then downloaded to other chip cards.

To do this you will need the chip card reader **PNOZ Chip Card Reader** with the corresponding **SmartCardCommander** software. Both are available from Pilz as accessories, individually or as part of a set (see Order references Accessories [📖 939]).

Save PNOZ s50 configuration on the computer

1. Make a note of the configuration's CRC in the PNOZ s50. It is shown on the display in the **Information/ Configuration CRC** menu. This will be needed later to check whether the correct configuration is saved on the device.
2. Remove the chip card from the PNOZ s50 and insert it into the holder for the chip card reader.
3. Start the **SmartCardCommander** software.
4. Insert the holder containing the chip card into the chip card reader.
5. The **Memory Card** directory is displayed in a list under **Hardware** on the software interface of the **SmartCardCommander**.



6. To read the data on the chip card, click on the **Memory Card** directory and then select **Read Data from Card**.
7. When **Data read successfully** is displayed on the software interface, the data can be saved as a hex file in any directory on the computer.
8. Make sure that the corresponding configuration CRC, which you noted down, is saved in the same directory.

Download configuration from the computer to the PNOZ s50

1. Insert a chip card into the holder for the chip card reader and insert this into the chip card reader.
2. Start the **SmartCardCommander** software.
3. To write the chip card, select **Write Data to Card** and confirm with **Yes**.
4. Insert the chip card in the PNOZ s50.

5. To ensure that the configuration has been transferred correctly, check that the CRC for the configuration in the PNOZ s50 matches the configuration CRC you noted down on the computer.

Display and configuration

Menu overview

The following diagrams illustrate the principle structure of the configuration menu on the display.

The menu consists of

- Messages at cold start, if there are problems with the chip card.
- Level 1: Status indicators, error stack
- Level 2: Password entry
- Level 3: Configuration

The displayed symbols illustrate the operation of the rotary knob.

	Rotate knob
	Press knob

Level 1 and 2: Status indicators and password entry

Status information is displayed when the device is switched on. This level is not password-protected.

The state of the signals is displayed as follows:

Icon	Description
⛶	Signal inactive
☒	Signal active

The password is entered in Level 2. It authorises configuration of the device in Level 3.

Safety relays PNOZsigma
PNOZ s50

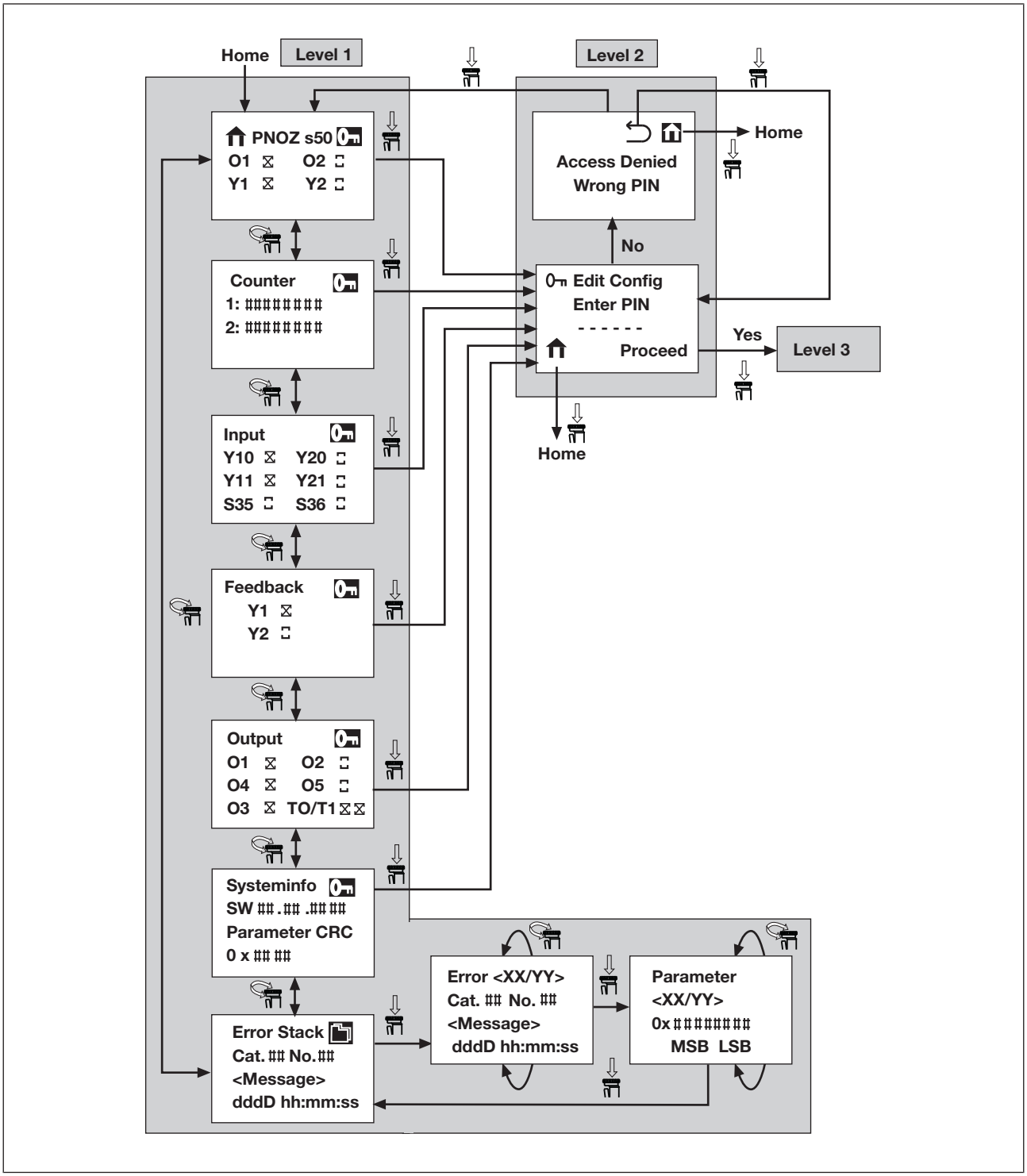


Fig.: Menu overview of Levels 1 and 2

Level 3: Configuration

The device is configured in Level 3.

Safety relays PNOZsigma
PNOZ s50

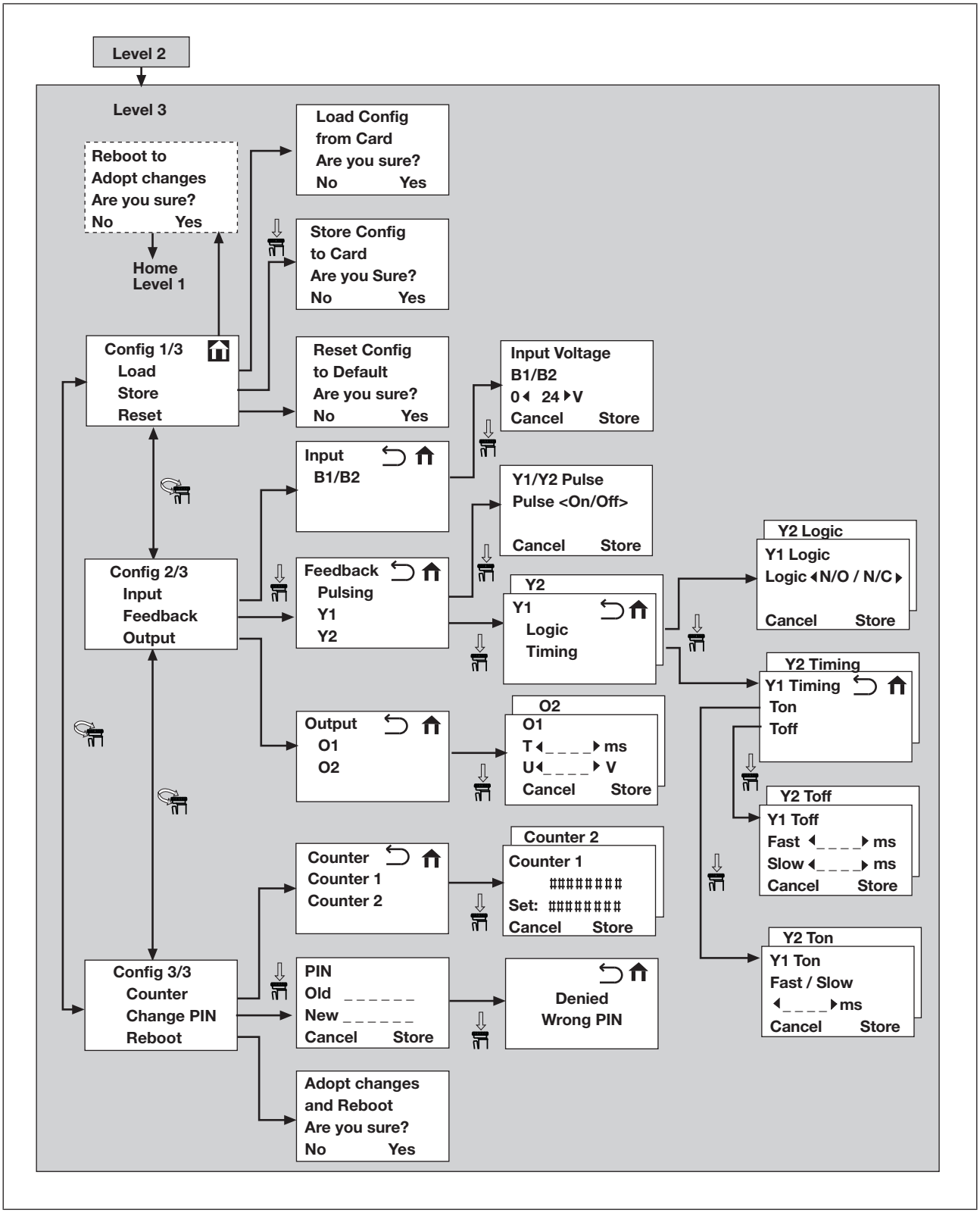


Fig.: Menu overview of Level 3

Safety relays PNOZsigma
PNOZ s50

Operate menus and enter values

Various navigational aids are available on the display:

- Tags
- Text fields

Tags

Display	Description
	Returns to the previous menu
	Exits the configuration menu (Level 3) and switches to the home menu (Level 1)
	Switches from the current error in the error stack
	Switches to the password menu (Level 2)

Text fields

Text field	Description
Cancel or **No**	Rejects all the changes and returns to the previous menu
Proceed	Confirms the password entry and jumps to the configuration menu (Level 3)
Store or **Yes**	Saves all the changes and returns to the previous menu

To move within a menu and switch to another menu, proceed as follows:

1. Turn the rotary knob to jump from line to line.

   The position within the menu is highlighted.
2. Press the rotary knob to move to the next menu or to the previous menu.

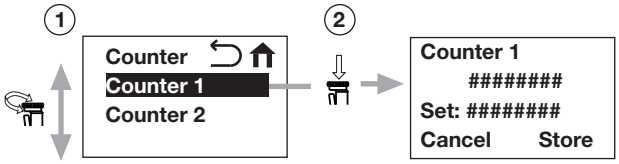


Fig.: Moving from line to line

To change values in a menu, follow the instructions below:

1. Turn the rotary knob to jump from line to line.
2. Press the rotary knob. Only then is it possible to change a numeric value.

   The selected area flashes. Values can now be changed.
3. Turn the rotary knob to switch between numeric values.
4. Press the rotary knob to complete the entry.

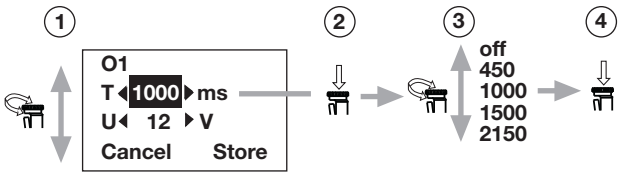
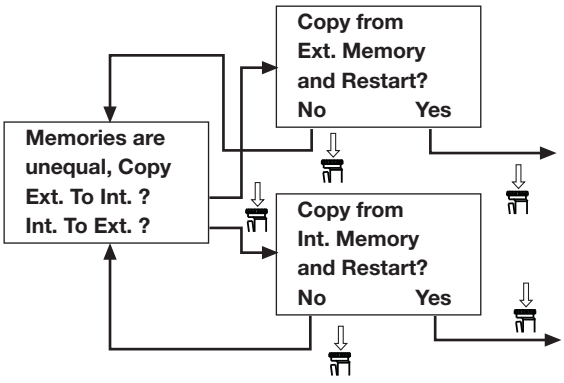


Fig.: Changing numeric values

Display menu at cold start

When the device is switched on in the Power On operating state (cold start), the memory contents of the device and the chip card are read and compared. If there are any deviations, messages will appear.

Overview	Display	Description
No Chipcard detected No chip card and no chip card holder in the device.	No Cipcard detected Proceed? No Yes	**No** – Insert chip card or only chip card holder **Yes** – Switch to RUN operating state, without a chip card inserted
Chipcard is Defect The chip card is defective or Only the chip card holder is inserted.	Cipcard is defect, remove Or replace Proceed	**Proceed** – 1. Use a valid chip card or insert chip card holder only. 2. Restart device with **Proceed**.
Memories are unequal The parameters on the chip card and in the device memory are not identical.		

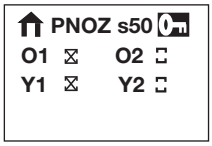
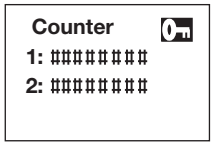
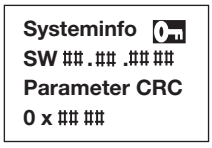
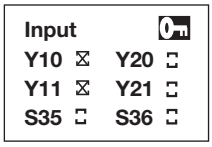
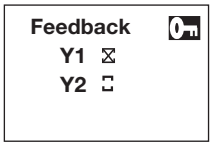
Safety relays PNOZsigma
PNOZ s50

Overview	Display	Description
	Memories are unequal, Copy Ext. To Int. ? Int. To Ext. ?	**Ext. To Int.** – Switch to the next menu to download parameters from the chip card to the device memory **Int. To Ext.** – Switch to the next menu to upload parameters from the device memory to the chip card
	Copy from Ext. Memory and Restart? No Yes	**No** – Return to the previous menu **Yes** – Download parameters from the chip card to the device memory
	Copy from Int. Memory and Restart? No Yes	**No** – Return to the previous menu **Yes** – Upload parameters from the device memory to the chip card
Chipcard is Invalid The parameters on the chip card are invalid.	**Cipcard is Invalid, Copy Int. to Ext.? No Yes**	**No** – 1. Use a valid chip card or insert chip card holder only. 2. Restart device with **No**. **Yes** – Upload parameters from the device memory to the chip card

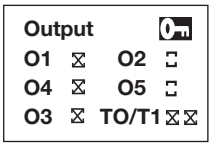
Safety relays PNOZsigma
PNOZ s50

Status display and configuration

Level 1: Status indicators

Overview	Display	Description
PNOZ s50 C Start-up display		**PNOZ s50** – Device name **O1**, **O2** – Outputs of the power circuits O1 and O2 **Y1**, **Y2** – Standard inputs of feedback loops 1 and 2.
Counter Number of operations		**1:** Counter for output O1+/ O1- **2:** Counter for output O2+/ O2-
Systeminfo		**SW:** Software version of device, e.g. 01.01.0001 **Parameter CRC:** Check sum covering the device configuration
Input States of the inputs are displayed		**Y10** – Failsafe input 0 for fast shutdown, power circuit 1 **Y11** – Failsafe input 1 for fast shutdown, power circuit 1 **Y20** – Failsafe input 0 for fast shutdown, power circuit 2 **Y20** – Failsafe input 1 for fast shutdown, power circuit 2 **S35** – Standard input for slow shutdown, power circuit 1 **S36** – Standard input for slow shutdown, power circuit 2
Feedback States of the feedback loops are displayed		**Y1** – Standard input for feedback loop 1 **Y2** – Standard input for feedback loop 2

Safety relays PNOZsigma
PNOZ s50

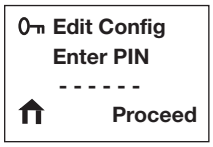
Overview	Display	Description
Output States of the outputs are displayed		**O1** – Failsafe output for power circuit 1 **O2** – Failsafe output for power circuit 2 **O3** – Failsafe output for fault signal **O4** – Failsafe output for status of power circuit 1 **O5** – Failsafe output for status of power circuit 1 **TO/T1** – Test pulse output 0/1

Safety relays PNOZsigma
PNOZ s50

Overview	Display	Description
Error Stack Error messages are displayed	**Error Stack** **Cat. ## No.##** **<Message>** **dddD hh:mm:ss**	Current error stack entry **Cat.** – Error class (hexadecimal) **No.** – Error number (hexadecimal) **<Message>** – Error text **dddD hh:mm:ss** – Power-on time since Power On: Days, hours, minutes, seconds
	Error <XX/YY> **Cat. ## No. ##** **<Message>** **dddD hh:mm:ss**	Error stack entries **<XX/YY>** – Entry number/number of entries (decimal) **Cat.** – Error class (hexadecimal) **No.** – Error number (hexadecimal) **<Message>** – Error text **dddD hh:mm:ss** – Power-on time since error occurred: Days, hours, minutes, seconds
	Parameter **<XX/YY>** **0x########** **MSB LSB**	Parameters of a selected entry in the error stack **<XX/YY>** – Current parameter/number of available parameters (decimal) **0x########** – Parameters (hexadecimal), grouped by MSB and LSB

Safety relays PNOZsigma
PNOZ s50

Level 2: Password entry

Overview	Display	Description
PIN Password entry		_ _ _ _ _ _ – Field for entering the password **Proceed** – Confirm entry and jump to Level 3 **Home** – To start menu, without confirming entry
		You entered an incorrect password. **Back** – Back to password entry **Home** – Back to start menu

Level 3: Configuration

The device is supplied with the following parameters:

Function	Terminal	Description	Parameter	Value	In display menu
Supply voltage, power circuits 1 and 2	B1/B2	Supply voltage	Input Voltage	24 V	**Input -> Input Voltage**
Test pulses	Y1/Y2	Test pulses on feedback loops	Pulsing	On	**Feedback -> Pulsing -> Y1/Y2 Pulse**
Power circuit 1	O1+/O1-	Reduced voltage	U	6 V	**Output -> O1**
		Overexcitation time	T	100 ms	**Output -> O1**
	Y1	Maximum ventilation time	Ton	30 ms	**Feedback -> Y1 -> Y1 Timing -> Y1 Ton**
		Maximum application time, fast shutdown	Toff fast	30 ms	**Feedback -> Y1 -> Y1 Timing -> Y1 Toff**
		Maximum application time, slow shutdown	Toff slow	30 ms	**Feedback -> Y1 -> Y1 Timing -> Y1 Toff**
		Logic of feedback loop 1	Logic	N/C	**Feedback -> Y1 -> Logic -> Y1 Logic**

Safety relays PNOZsigma
PNOZ s50

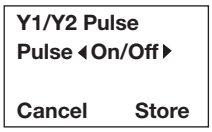
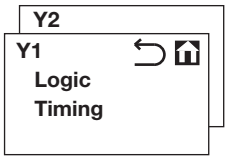
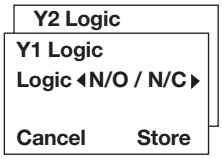
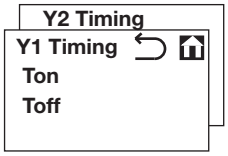
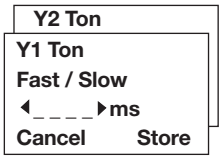
Function	Terminal	Description	Parameter	Value	In display menu
Power circuit 2	O2+/O2-	Reduced voltage	U	6 V	**Output -> O2**
		Overexcitation time	T	100 ms	**Output -> O2**
	Y2	Maximum ventilation time	Ton	30 ms	**Feedback -> Y2 -> Y1 Timing -> Y2 Ton**
		Maximum application time, fast shutdown	Toff fast	30 ms	**Feedback -> Y2 -> Y1 Timing -> Y2 Toff**
		Maximum application time, slow shutdown	Toff slow	30 ms	**Feedback -> Y2 -> Y1 Timing -> Y2 Toff**
		Logic of feedback loop 2	Logic	NC	**Feedback -> Y2 -> Logic -> Y2 Logic**

Overview	Display	Description
Switch to submenus		
Config 1/3	**Config 1/3** **Load** **Store** **Reset**	**Load** – Switches to the **Load** menu to download the configuration from the chip card **Store –** Switches to the **Store** menu to save the configuration to the chip card **Reset –** Switches to the **Reset** menu to reset the configuration to the default settings
Config 2/3	**Config 2/3** **Input** **Feedback** **Output**	**Input –** Switches to the **Input** menu to configure the supply voltage for the power element **Feedback –** Switches to the **Feedback** menu to configure the feedback loops **Output** – Switches to the **Output** menu to configure the properties of the power outputs O1+/O1- and O2+/O2-
Config 3/3	**Config 3/3** **Counter** **Change PIN** **Reboot**	**Counter** – Switches to the **Counter** menu to enter a start value for the counter **Change PIN –** Switches to the **Change PIN** menu to change the password **Reboot –** Switches to the **Reboot** menu to restart the device

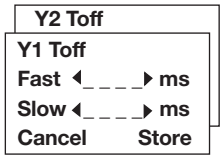
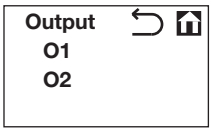
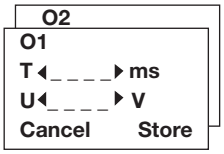
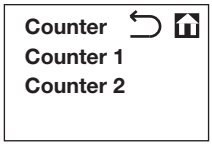
Safety relays PNOZsigma
PNOZ s50

Overview	Display	Description
Load configuration from chip card		
Load Config from Card Download parameters from the chip card to the device	Load Config from Card Are you sure? No Yes	**Are you sure?** – Security prompt **No** – Do not download parameters from chip card **Yes** – Download parameters from chip card
Save configuration to chip card		
Store Config to Card Download parameters from the device to the chip card	Store Config to Card Are you Sure? No Yes	**Are you sure?** - Security prompt **No** – Do not save parameters to chip card **Yes** – Save parameters to chip card
Restore default settings		
Reset Config to Default Reset configuration to default settings	Reset Config to Default Are you sure? No Yes	**Are you sure?** – Security prompt **No** – Do not load default settings **Yes** – Load default settings
Configure supply voltage B1/B2 to the power circuits		
Input Switch to the menu for the supply voltage to the power circuits	Input B1/B2	**B1/B2** – Switch to the **Input Voltage** menu to configure the inputs B1/B2
Input Voltage Configure the supply voltage to the power circuits	Input Voltage B1/B2 U ◂ 24 ▸ V Cancel Store	**U < 24 > V** – Select supply voltage for power circuit, values: 24 V, 48 V **Cancel** – Exit menu without confirming the entry **Store** – Confirm entry
Configure feedback loops Y1 and Y2		
Feedback Configure feedback loops	Feedback Pulsing Y1 Y2	**Pulsing** – Configure test pulses **Y1** – Switch to the **Y1** menu to configure feedback loop Y1 **Y2** – Switch to the **Y2** menu to configure feedback loop Y2

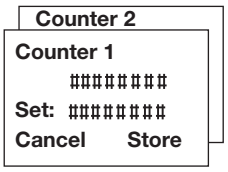
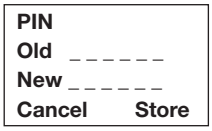
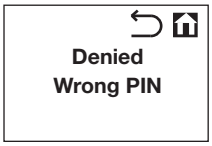
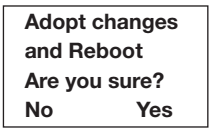
Safety relays PNOZsigma
PNOZ s50

Overview	Display	Description
Y1/Y2 Pulse Activate test pulse		**Pulse On**: Test pulse on **Pulse Off**: Test pulse off **Cancel** – Exit menu without confirming the entry **Store** – Confirm entry Please note: The test pulses can only be activated simultaneously for both feedback loops Y1 and Y2.
Y1 or Y2 Switch to sub-menus for configuration of the feedback loops		**Logic** – Switch to **Logic Y1** or **Logic Y2** menu **Timing** – Switch to **Timing Y1** or **Timing Y2** menu
Y1 Logic or **Y2 Logic** Define N/C or N/O contact in the feedback loop		**Logic < N/O /N/C> -** Input logic for feedback loop Y1 or Y2: **N/O**: N/O contact **N/C**: N/C contact **Cancel** – Exit menu without confirming the entry **Store** – Confirm entry
Y1 Timing or Y2 Timing		**Ton** – Switch to submenu for configuration of the max. ventilation time **Toff** – Switch to submenu for configuration of the max. application time
Y1 Ton or Y2 Ton Configure max. ventilation time for fast and slow shutdown		**Slow / Fast < 500 > ms –** Max. ventilation time Values: 30 … 4000 ms configurable in steps The max. ventilation times are the same for fast and slow shutdown. **Cancel** – Exit menu without confirming the entry **Store** – Confirm entry

Safety relays PNOZsigma
PNOZ s50

Overview	Display	Description
Y1 Toff or Y2 Toff Configure max. application time for fast and slow shutdown		**Fast < 500 > ms** – Max. application time for fast shutdown **Slow < 500 > ms** – Max. application time for slow shutdown Values: 30 … 4000 ms configurable in steps **Cancel** – Exit menu without confirming the entry **Store** – Confirm entry
Configure power circuits O1+/O1- and O2+/O2-		
Output Configure power circuits		**O1** – Switch to the **O1** menu to configure power circuit 1 **O2** – Switch to the **O2** menu to configure power circuit 2
O1 or **O2** Configure overexcitation time and reduced voltage		**O1** or **O2** **T < 1000 > ms** – Configure overexcitation time, values: off, 100 … 2500 ms configurable in steps. If "off" is configured, the voltage at B1/B2 is connected directly to outputs O1 or O2 without reduction. Any value entered for the reduced voltage will not be evaluated. **U < 12 > V** – Configure reduced voltage, values: 6, 8, 12, 16, 24 V **Store** – Confirm entry **Cancel** – Exit menu without confirming the entry
Configure counter		
Counter Specify offset for number of operations		**Counter 1** – Event counter 1 - Switch to the **Counter 1** menu to configure the number of operations for power circuit O1+/O1- **Counter 2** – Event counter 2 - Switch to the **Counter 2** menu to configure the number of operations for power circuit O2+/O2-

Safety relays PNOZsigma
PNOZ s50

Overview	Display	Description
Counter 1 or **Counter 2** Switch to menu to set the counter for the number of operations for power circuits O1+/O1- or O2+/O2-		**Counter 1** – Event counter 1 - Configure number of operations for load at power circuit O1+/O1- **Counter 2** – Event counter 2 - Configure number of operations for load at power circuit O2+/O2- **########** – Old counter status **Set:** – Enter new counter status, e.g. when a used load is applied Value range: 0 … 99999999 **Store** – Confirm entry **Cancel** – Exit menu without confirming the entry
Change password		
PIN Change password		**Old** – Enter the old password **New** – Enter the new password **Cancel** – Exit menu without confirming the entry **Store** – Adopt new password
Denied Wrong PIN Error message		You entered an incorrect password
Restart after changing configuration		
Adopt changes and Reboot Restart and adopt configuration		**No** – Do not restart **Yes** – Restart

Restart device

Restart the device if you have changed the configuration. The changed configuration is adopted during a restart.

There are two options for restarting the device once the configuration is complete.

Option one:

1. Switch off the device's supply voltage (terminals A1 and A2).
2. Switch the device's supply voltage back on.

   The configuration is adopted.

Option two:

1. Select **Reboot** in menu level 3.
2. Select **Yes** and press the rotary knob.

   The device is restarted and the configuration is adopted.

Examples

Overview

This chapter provides information on how to connect the PNOZ s50 to a safety control system. The connections illustrated are independent of any specific control system.

Mechanical holding brake

Properties

PNOZ s50

- Safe activation of two independent mechanical holding brakes
- Ventilation and application times are monitored
- Fast and slow shutdown of both brakes
- Feedback loop for brake B1 is monitored via input Y1
- Feedback loop for brake B2 is monitored via input Y2
- Fuses
  - F1: 24 V DC, 4 A, characteristic B/C
  - F2: 24 V DC, 10 A, characteristic B/C

Safety control system

- Inputs:
  - Fault signal O3
  - State of brakes O4, O5 (applied, ventilated) is monitored
- Outputs
  - Activation of fast and slow shutdown of brake

Brake

- Micro switch S1 to signal the state of brake B1
- Micro switch S2 to signal the state of brake B2

Safety relays PNOZsigma
PNOZ s50

Configuration overview

The following parameters must be set in the display menu:

Function	Terminal	Description	Parameter	Value	In display menu
Supply voltage, power circuits 1 and 2	B1/B2	Supply voltage	Input Voltage	24 V	**Input -> Input Voltage**
Test pulse	Y1/Y2	Test pulses on feedback loops	Pulsing	On	**Feedback -> Pulsing -> Y1/Y2 Pulse**
Power circuit 1	O1+/O1-	Reduced voltage	U	12 V	**Output -> O1**
		Overexcitation time	T	450 ms	**Output -> O1**
	Y1	Maximum ventilation time	Ton	60 ms	**Feedback -> Y1 -> Y1 Timing -> Y1 Ton**
		Maximum application time, fast shutdown	Toff fast	30 ms	**Feedback -> Y1 -> Y1 Timing -> Y1 Toff**
		Maximum application time, slow shutdown	Toff slow	150 ms	**Feedback -> Y1 -> Y1 Timing -> Y1 Toff**
		Logic of feedback loop 1	Logic	N/C	**Feedback -> Y1 -> Logic -> Y1 Logic**
Power circuit 2	O2+/O2-	Reduced voltage	U	12 V	**Output -> O2**
		Overexcitation time	T	450 ms	**Output -> O2**
	Y2	Maximum ventilation time	Ton	60 ms	**Feedback -> Y2 -> Y1 Timing -> Y2 Ton**
		Maximum application time, fast shutdown	Toff fast	30 ms	**Feedback -> Y2 -> Y1 Timing -> Y2 Toff**
		Maximum application time, slow shutdown	Toff slow	150 ms	**Feedback -> Y2 -> Y1 Timing -> Y2 Toff**
		Logic of feedback loop 2	Logic	NC	**Feedback -> Y2 -> Logic -> Y2 Logic**

Safety relays PNOZsigma
PNOZ s50

Connection

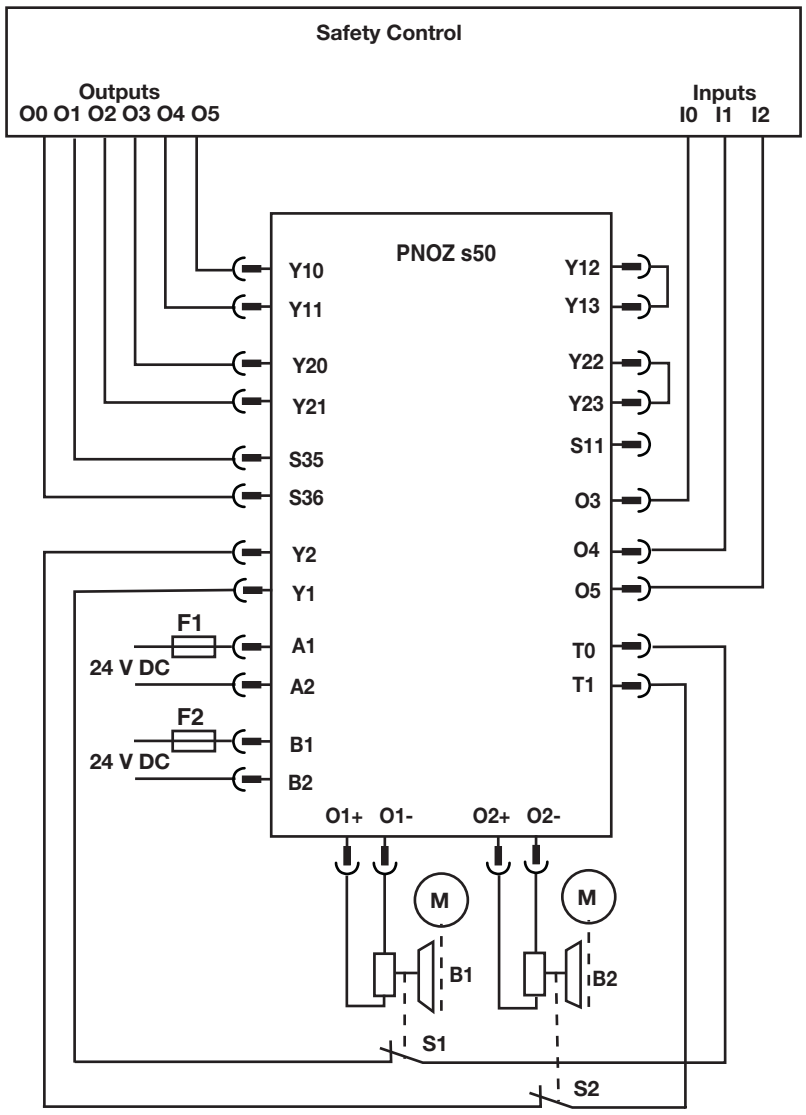


Fig.: Connection example: Two mechanical holding brakes

Safety relays PNOZsigma
PNOZ s50

Technical details

General	
Approvals	**CE, EAC (Eurasian), TÜV, cULus Listed**
Electrical data	
Supply voltage	
for	**Supply to the system**
Voltage	**24 V**
Kind	**DC**
Voltage tolerance	**-15 %/+20 %**
Output of external power supply (DC)	**18 W**
Output of external power supply (DC) at no load	**3 W**
Residual ripple DC	**5 %**
External unit fuse protection F1	**4 A, circuit breaker 24 V DC, characteristic B/C**
Potential isolation	**No**
Supply voltage	
for	**Supply to 2-pole SC outputs**
Voltage	**24 V, 48 V**
Kind	**DC**
Voltage tolerance	**-10 %/+10 %**
Output of external power supply (DC)	**240 W**
External unit fuse protection F1	**10 A, circuit breaker 48 V DC, characteristic B/C**
Potential isolation	**yes**
Inputs	
Number	**8**
Number of safe inputs	**4**
Number of standard inputs	**4**
Input current, safe inputs	**3 - 10 mA**
Input current, standard inputs	**3 - 10 mA**
Min. threshold voltage when signal changes from "1" to "0", safe inputs	**7 V**
Max. threshold voltage when signal changes from "0" to "1", safe inputs	**10 V**
Min. threshold voltage when signal changes from "1" to "0", standard inputs	**7 V**
Max. threshold voltage when signal changes from "0" to "1", standard inputs	**10 V**
Pulse suppression	**1 ms**
Voltage at	
Input circuit DC	**24 V**
Feedback loop DC	**24 V**
Potential isolation	**No**

Safety relays PNOZsigma
PNOZ s50

Semiconductor outputs	
Number of positive-switching single-pole semiconductor outputs	**3**
Switching capability	
Voltage	**24 V**
Current	**0,1 A**
Max. duration of off time during self test	**300 µs**
Short circuit-proof	**yes**
Potential isolation	**No**
Permitted loads	**inductive, capacitive, resistive**
Semiconductor outputs, 2-pole	
Number of dual-pole semiconductor outputs	**2**
Maximum output power during continuous duty	**84 W**
Maximum output power during overexcitation	**156 W**
Reduced voltages	**6 V, 8 V, 12 V, 16 V, 24 V**
Voltage tolerance of reduced voltages	**-10 %/+10 %**
Max. output current at "1" signal, 24 V, continuous duty	**3,5 A**
Max. output current at "1" signal, 48 V, continuous duty	**1,75 A**
Max. output current at "1" signal, 24 V, overexcitation	**6,5 A**
Max. output current at "1" signal, 48 V, overexcitation	**3,25 A**
Min. current at 2-pole output at "1" signal	**100 mA**
Short circuit-proof	**yes**
Permitted loads	**Inductive**
Max. duration of off time during self test	**500 µs**
Voltage outputs	
Number	**1**
Voltage	**24 V DC**
Max. current	**0,1 A**
Short circuit-proof	**yes**
Potential isolation	**No**
Test pulse outputs	
Number of test pulse outputs	**2**
Voltage, test pulse outputs	**24 V DC**
Max. duration of off time during self test	**6 ms**
Short circuit-proof	**yes**
Max. output current at "1" signal	**0,1 A**
Potential isolation	**No**
Times	
Supply interruption before de-energisation	**20 ms**
Max. reaction time when the input signal changes	**7 ms**

Safety relays PNOZsigma
PNOZ s50

Times	
Ventilation time configurable in steps	**30 ms ... 4000 ms**
Application time during fast shutdown configurable in steps	**30 ms ... 4000 ms**
Application time during slow shutdown configurable in steps	**30 ms ... 4000 ms**
Overexcitation time configurable in steps	**100 ms ... 2500 ms**
Environmental data	
Climatic suitability	**EN 60068-2-1, EN 60068-2-14, EN 60068-2-2, EN 60068-2-78**
Ambient temperature	
Temperature range	**0 - 55 °C**
Storage temperature	
Temperature range	**-40 - 85 °C**
Climatic suitability	
Humidity	**93 % r. h. at 40 °C**
Condensation during operation	**Not permitted**
EMC	**EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61326-3-1**
Vibration	
In accordance with the standard	**EN 60068-2-6**
Frequency	**10 - 55 Hz**
Amplitude	**0,35 mm**
Max. operating height above sea level	**2000 m**
Airgap creepage	
In accordance with the standard	**EN 60664-1**
Overvoltage category	**III**
Protection type	
Mounting area (e.g. control cabinet)	**IP54**
Housing	**IP20**
Terminals	**IP20**
Potential isolation	
Potential isolation between	**2-pole semiconductor outputs and system voltage**
Type of potential isolation	**Basic insulation**
Mechanical data	
Mounting position	**Horizontal on top hat rail**
Material	
Bottom	**PC**
Front	**PC**
Top	**PC**
Connection type	**Spring-loaded terminal**

Safety relays PNOZsigma
PNOZ s50

Mechanical data	
Mounting type	**plug-in**
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	**0,2 - 2,5 mm², 24 - 12 AWG**
Spring-loaded terminals: Terminal points per connection	**2**
Stripping length with spring-loaded terminals	**9 mm**
Dimensions	
Height	**100 mm**
Width	**45 mm**
Depth	**120 mm**
Weight	**255 g**

The standards current on 2013-03 apply.

Safety characteristic data

Operating Mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN 62061 SIL CL	EN 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
All	**PL e**	**Cat. 4**	**SIL CL 3**	**7,83E-10**	**SIL 3**	**6,81E-05**	**20**

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

The safety-related characteristic data (PFH, PFD) are mean values. They have been calculated at an average ambient component temperature of 40 °C and apply for the ambient temperature range stated in the technical details.

Safety relays PNOZsigma
PNOZ s50

Supplementary data

The max. permitted load current at the power circuits O1+/O1- and O2+/O2- depends on the

- Ambient temperature.
- Distance between the PNOZ s50 and adjacent devices.
- Number of power circuits connected (one or two).
- Size of the supply voltage to the power circuits at B1/B2.

Distance required between adjacent devices	Ambient temperature	Number of power circuits	Max. permitted output current at $U_{B1/B2}$ = 24 V	Max. permitted output current at $U_{B1/B2}$ = 48 V
Yes	45°C	1	6.5 A	3.25 A
Yes	55°C	1	5.5 A	2.75 A
Yes	45°C	2	4.5 A	2.25 A
Yes	55°C	2	4.0 A	2.0 A
No	45°C	1	6.0 A	3.0 A
No	55°C	1	5.0 A	2.5 A
No	45°C	2	4.0 A	2.0 A
No	55°C	2	3.5 A	1.75 A

Use of the devices in accordance with UL

Ambient temperature	Number of power circuits	Max. permitted output current at $U_{B1/B2}$ = 24 V	Max. permitted output current at $U_{B1/B2}$ = 48 V	Utilisation category
45°C	1	6.5 A	3.25 A	Pilot Duty
55°C	1	5.5 A	2.75 A	
45°C	2	4.5 A	2.25 A	
55°C	2	4.0 A	2.0 A	

When using the devices in accordance with UL, please note the following:

- The ambient temperature is understood to be the *Surrounding Air Temperature*.
- Appropriate measures e.g (tempering of the control cabinet) should be used to ensure that the stated values are maintained when devices are installed without a distance.

Safety relays PNOZsigma
PNOZ s50

Order reference

Order references Module

Product type	Terminals	Order no.
PNOZ s50 C	Spring-loaded terminals	751 500

Order references Accessories

Chip cards and chip card reader

Product type	Features			Order No.
PNOZmulti Chipcard	Chip card	32 kB		779 211
PNOZmulti Chipcard Set	Chip card	32 kB	10 pieces	779 212
Chipcard Holder	Chip card holder			779 240
PNOZmulti Seal	Chip card seal		10 pieces	779 250
PNOZ Chip Card Reader	Chip card reader for saving the configuration on the computer			779 230
SmartCardCommander with SIM card adapter	Software for the chip card reader 779 230, for saving the configuration on the computer			750 031
PNOZsigma Chip Card manager set	Set consisting of the PNOZ Chip Card Reader and SmartCardCommander with SIM card adapter (779 230 and 750 030)			750 030

Terminals

Product type	Features			Order No.
PNOZ s Set1 Spring Loaded Terminals 45 mm	Set of plug-in spring-loaded terminals		1 piece	751 008